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POSTER SESSION
BIOLOGICAL; EDUCATION;
MEDICAL; SOCIAL SCIENCES
9:00 – 10:00 AM

TOLERTON & HOOD HALL OF SCIENCE

Board 01 DEVELOPMENT OF A WEB-SITE FOR EDUCATIONAL PURPOSES. Frederick J. Kluth, fjk@fjkluth.com, 1060 DeLeone Dr., Kent OH 44240-2026. The value of the Internet has been widely touted with demands made for computer equipment for the classroom. Much emphasis has been placed on the development of physical infrastructure for the classroom with less on the content to be presented. The purpose of this paper is to focus on the development of content. The hypothesis was that if a number of different web pages on different subject areas were combined into one web site then those pages of interest would receive attention and response while the others would be ignored. The idea was to build on the pages of interest to develop the site. Forty-two content pages were developed in three general areas: Computers, Visual Arts, and the Environment. The requirements of the various search engines were studied. The pages were modified to suit them and descriptive material was submitted so the pages could be found on the search engine. The result was that for more than a year the web site received less than 10 hits per day. In November of 1999, some students found one of the art pages, and they requested help in that area. I was able to help them only after I set up a system where I could receive their questions anonymously. That system was applied to all 42 content pages. Now, the art page of interest to the students receives more than 500 hits a day while hits on the other pages increased only slightly.

Board 02 LIVING-LEARNING COMMUNITY FOR SCIENCE AND MATHEMATICS MAJORS – EFFECTS ON RETENTION. Lisa M. Unico, LUNICO@edinboro.edu, Edinboro University of Pennsylvania, Ph.D. Chemistry Department, Cooper Hall, Edinboro PA 16444.

In an effort to increase the retention of undergraduates enrolled in majors within the School of Science, Management and Technologies, a Living-Learning Community was established for these students in August, 1998 in Rose Hall. The goals for this community include: a) fostering a community environment in which the students are able to work together towards academic success; b) increasing the retention of these students not only at the University, but also within the School of Science, Management and Technologies; and c) recruiting even higher caliber science students to Edinboro University of Pennsylvania. Rose is the residence hall closest to Cooper and Hendricks Halls where most science courses are taught. Rose was also the first residence hall to be completely renovated and wired into the campus network. A small computer laboratory and a Living-Learning Community library were added. Several trips are planned throughout the academic year, the most notable of which is the annual retreat weekend to Allegheny National Forest. These trips include academic forums and provide students with extensive access to faculty. In addition to the Resident Assistants, each floor in the Living-Learning Community has a Scholar-in-Residence: an upperclassman who acts as an academic resource for the others. We are in the third year of this "experiment" and the assessment of the Living-Learning Community is continuing. Retention rates for the first two years were higher, not only than those for residential students at large, but also than those for the other Living-Learning Communities on campus (i. e. Education, Criminal Justice, General Studies).

Board 03 LOW SAT-MATH SCORES AND PERFORMANCE IN SCIENCE COURSES. Harry E. Spencer¹, harry.spencer@oberlin.edu, Yolanda P. Cruz², yolanda.p.cruz@oberlin.edu, Oberlin College, Department of Chemistry¹, Department of Biology², Oberlin OH 44074.

To discover if the generalizations made in the 1998 book, *The Shape of the River* (R. Bowen and D. Bok, Princeton University Press) concerning the academic performance of black and white students applied to an individual institution, we examined 1989-1998 Oberlin enrollment data. Our results confirm two findings reported in this book: 1) on average, SAT-Math scores of black are significantly lower than those of white students and 2) approximately equal proportions of black as white students earned majors in biology or chemistry. We report here a third finding, not examined in *The Shape of the River*. While 56% of white science or math majors have SAT-Math scores in the top third of the range for all graduates, only 13% of black majors do (N = 972 and 73, respectively). The percentage of high grades in introductory biology and chemistry courses increased, failing grades decreased, as SAT-Math scores increased. These relationships are reflected in the percentages of students who failed introductory biology (47% of black and 9% of white students) and chemistry (30% and 7%, respectively). We conclude that the academic difficulties of black students in science are grounded not in race but in inadequate preparation as reflected by their SAT-Math scores. Our results point to the need for special institutional accommodations regarding difficulties faced by all science students with

relatively low SAT-Math scores. Such accommodations, while upholding academic standards and admissions policies, would include frank and early advising of at-risk students and early and continuous remedial assistance.

Board 04 PROJECT TEAMS (TEACHER EDUCATION AT AKRON FOR MATHEMATICS AND SCIENCE). Annabelle Foos¹, afoos@uakron.edu, Katharine Owens², kowens@uakron.edu, David McConnell¹, damm6@uakron.edu, Sandy Coyner², scoyner@uakron.edu, Francis Broadway², fsb@uakron.edu, The University of Akron, ¹Department of Geology, ²College of Education, Akron OH 44325-4101.

Project TEAMS addressed the need at The University of Akron for focused dialogue on national standards for science and mathematics teaching, science and mathematics content course development, and incorporation of inquiry-based methods in undergraduate science and mathematics courses. Faculty from institutions of higher education in the local area, science and mathematics teachers from grades 6-12 schools, and UA faculty members came together for focused discussions on these topics. Initially, a series of "brown bag" luncheon seminars were held. These seminars were followed by an in-depth three-day workshop at which faculty members' definitions of 'inquiry', 'inquiry learning', and 'inquiry teaching' were probed. Subsequently, UA faculty members developed or modified science and mathematics courses taught to preservice teacher education students and have made progress in changing large lecture classes into learning communities. Emerging from these discussions and activities, project directors developed an instrument to assess college faculty members' attitudes toward inquiry. In 2001 UA's model for ongoing collaborative activities and conversations across colleges is being disseminated to two-year colleges across northeast Ohio through an extension of Project TEAMS.

Board 05 THE INVESTIGATION OF VARIABLES AFFECTING COLLEGIATE PRECISION SKATERS' BODY IMAGE PERCEPTIONS. Melissa S. Troy, troyms@muohio.edu, Sarah M. Buck, bucks@muohio.edu, Diana M. Spillman, spillmdm@muohio.edu, Miami University, Department of Physical Education, Health and Sport Studies, Phillips Hall, Oxford OH 45056.

The purpose of this investigation was to identify the variables that affect college-aged precision ice skaters' perceptions of their body image. It was hypothesized that the subscales of the Eating Disorder Inventory – 2 (EDI-2) would have an influence on body image perception. Twenty-two volunteers from two world-class precision skating teams participated. The measurements used in this study were the EDI-2 and The Nutrition & Health Survey. The results showed that those skaters who perceived themselves as endomorphic (i. e., possessing a larger body structure) scored progressively higher on the EDI-2 subscales of drive for thinness, body dissatisfaction, and social insecurity. A set of variables from the EDI-2 (drive for thinness, bulimia, body dissatisfaction, and ineffectiveness) was found to have a multiple regression with self-image perception. An independent t-test for high and low EDI-2 scores showed that most variables were not statistically significant. In conclusion, high scores on certain EDI-2 subscales were found to have a significant influence on precision skaters' perceptions of their body image.

Board 06 ASSOCIATIONS BETWEEN FOOD QUANTITY AND BEHAVIOR: OBSERVATIONS OF A LOWLAND GORILLA FAMILY. Kate E. Rosenberg, Kater@musingum.edu, (James L. Dooley Jr., jdooley@musingum.edu) Muskingum College, New Concord OH 43762.

Advancing strategies for successful management of captive specimens in zoos and other facilities is an important area of concern within the fields of conservation, zoo science, and conservation medicine. Within the broad domain of issues attendant to captive management, one particularly important challenge is to further understand about the linkages between diet and behavior. To date, there has been little study of such linkages in primates. Further, the few existing investigations have been largely conducted without appropriate consideration of potentially confounding variables, such as the amount or quantity of food received. The objective of this research was to observe changes in behavioral patterns (particularly changes in the frequency of aggression, playfulness, grooming and communication) among captive gorillas as a function of the amount of food received. Between May and August 2000 a family group of lowland gorillas (*Gorilla gorilla gorilla*) were observed for 100 hours at the Columbus Zoo. Dietary data and behavioral observations were recorded. Initial results suggest increases in aggression and time spent napping may be associated with decreases in food quantity. Analyses of other potential associations between food quantity and behavior continue.

Board 07 NMDARS AND VDCCS MAY ACT SYNERGISTICALLY IN THE ACQUISITION OF A CONDITIONED TASTE AVERSION. Amy L. Zmarowski¹, ZmarowskiAL@hiram.edu, Brian Woodside², Kimberley A. Phillips¹, Timothy J. Teyler², ¹Hiram College, P.O. Box 506, Hiram OH 44234, ²NEUCOM.

An enduring, enhanced neuronal response, long-term potentiation (LTP), is one possible mechanism underlying memory. Two forms of LTP have been identified in the rat brain. NmdalLTP, mediated by the N-methyl-D-aspartate receptor (NMDAR), decays over hours to days. VdclLTP, initiated by voltage-dependent calcium channels (VDCCs), may represent long-lasting changes in synaptic strength. While much is known about their cellular mechanisms, it is unclear what distinct behavioral roles

they play. Here we hypothesize that blocking the NMDARs will impair short-term retention (24 hours), while blocking the VDCCs will impair long-term retention (21 days) for a conditioned taste aversion. Long Evans rats were water deprived and allowed 20 minutes access to water each day on training and retention days. Thirty minutes before each drinking session we systemically injected rats with either saline, (2 control groups, $n=10$ each), MK-801 (.10 mg/kg) to block NMDARs ($n=10$), verapamil (10 mg/kg) to block VDCCs ($n=10$), or both drugs ($n=10$). One of the control groups and the three experimental groups were given LiCl ½-hour after drinking the novel stimulus, sweetened milk at conditioning. The second control group was given saline. All groups given the LiCl exhibited robust conditioned taste aversion compared to the saline controls at the 24-hour test, indicating that NMDARs do not mediate short-term retention in this task. At the 21-day retention test, the double drug group showed significant memory loss compared to the saline/LiCl control group. The MK-801 and verapamil drug groups also showed more forgetting than controls, but the results were not significant.

Board 08 DEHYDROEPIANDROSTERONE (DHEA) INCREASES SERUM SODIUM CONCENTRATION IN MICE. Donald Troike, don_troike@wilmington.edu, Lavone Bradfield, Jensen Buhiru, Virginia Hogan, Tammy Venema, Rachel Nance, Wilmington College, Dept. of Biology, 251 Ludovic St., Wilmington OH 45177.

DHEA, a precursor of the sex steroids, is secreted by the adrenal cortex, but its function in the body is uncertain. Because its secretion declines with age, DHEA supplements have become popular as an anti-aging treatment. Since many steroids exhibit mineralocorticoid activity, the possibility that hypertensive individuals might self-administer DHEA warranted a study of its effect on serum sodium (Na) levels. In our first experiment 5 male ICR mice were injected intraperitoneally with 1 mg of DHEA-acetate in vegetable oil, while 5 controls received only vegetable oil. Serum was separated from tail vein blood collected at 0 and 48 hours, diluted appropriately with deionized water, and its Na concentration determined with a Perkin Elmer Atomic Absorption Spectrometer following directions in its procedures manual. Controls showed no difference (352 vs 358 mg% Na, $P=.34$), while the DHEA group showed a significant elevation (334 vs 439 mg% sodium, $P<.02$). In our second experiment 9 mice were administered 1 mg of DHEA-acetate in vegetable oil by gavage, while 9 controls received vegetable oil. Tail vein blood was collected at 0, 6, 12 and 24 hours. Controls showed no change. The DHEA group (342 mg% at 0 hrs) showed a rise in serum Na at 6 hrs (384 mg%, $P<.001$) and 12 hrs (410 mg%, $P<.001$) with a return to control values by 24 hrs (340 mg%, $P<.8$). These results show that DHEA at the dose administered significantly elevates serum Na concentration in male mice, suggesting that self-administration of DHEA may not be wise for people with hypertension.

Board 09 VOCAL RESPONSE OF MALE REDWING BLACKBIRDS (*AGELAIUS PHOENICEUS*) DURING SIMULTANEOUS EXPOSURES TO DIGITALLY REMASTERED SPECIFIC SONG PLAYBACK AND MOUNTS. Aaron Lopez, Cyrusx75@Velocity.net, Edinboro University of Pennsylvania, Department of Psychology, Bioacoustic Research Program, Edinboro PA 16444.

This experiment was conducted to determine the effects of song playback (an auditory stimulus) and an artificial mount (a visual stimulus) exposures on the defensive vocal and behavioral patterns of male redwing blackbirds in the wild. One of our goals was to determine if auditory and visual stimuli would elicit behavioral responses in the redwing that differ in magnitude. We anticipated that auditory song stimuli would elicit behavioral responses greater in magnitude than the visual mount stimulation. In this study, a convenience sample of 20 male redwings were observed in wetland habitats located in southern Erie County, Pennsylvania through the months of May and June. In this within-subjects ABA experimental protocol, the birds (5 birds per group) were assigned to one of four possible exposure groups. These groups included a 5 min behavioral criterion period, a 5 min pre-exposure period (A), a 5 min exposure period (B), and a final 5 min post-exposure period (A). The dependent measures recorded in this study included the vocalizations of each male and the time spent within an established perimeter. The results indicate auditory stimuli alone elicit a different pattern of behavioral responses than visual stimuli alone. Finally, the results indicate combined auditory and visual stimulus presentations elicit behavioral response patterns similar to those of the solitary auditory exposures.

Board 10 THREE ANGIOSPERM SEASONAL STUDIES USED TO ENHANCE THINKING SKILLS. John L. Frola, JLFrola@uakron.edu, David J. Stroup, The University of Akron, Dept. of Biology, Akron OH 44325-3908.

Seasonal studies of three plant species *Podophyllum peltatum*, *Arisaema triphyllum* and *Tipularia discolor* were carried out. Observations of the shoot apices are described based on an analysis of the theories on shoot apical organization. Measurements and descriptions of apical dome height and width of the species were obtained to serve as a basis for classroom discussions concerning the changes in apical organization over a one-year period. The mean height of the apical dome is 28.45 μ m and the mean width of the apical dome is 125.05 μ m. Results from these three studies were used to prepare a multi-media presentation which allowed students to make observations and generate hypotheses about shoot development. During

classroom discussion, fundamental anatomical and morphological questions were generated to be used as the basis for student laboratory projects. This project was designed to improve identified thinking skills, and our current understanding of underground shoot apical development.

Board 11 LITTER ARANEAE AS A FUNCTION OF VARYING AMOUNTS OF DECIDUOUS LITTERFALL. Douglas M. Jenison, Jenisodm@muc.edu, 2649 Tallmadge Rd., Ravenna OH 44266.

This study investigated litter Araneae populations in varying amounts of deciduous litterfall in both climax and successional forests before and after litterfall. I hypothesized that increased litter mass would harbor increased diversity of Araneae. This study was conducted in Stark County, Ohio. Plots were chosen in climax beech-maple and successional red maple forests. Three treatments were studied in each forest under both pre- and post-litterfall conditions: 1. Removal plot- all litter was removed in December and transferred to, 2. Double litter plot, and 3. Control plot. Litter removals and transfers were done annually for a 5-year period. Average litter transfers were 539 $\text{g m}^{-2}\text{yr}^{-1}$ in the maple stand and 839 $\text{g m}^{-2}\text{yr}^{-1}$ in the beech stand, each plot 10m in diameter. Araneae were sampled in 3-0.1m² subplots in each treatment. All 36 samples were extracted in Berlese funnels for seven days. Araneae were separated into families and analyzed for density, dominance, frequency and importance value. The intra-forest Araneae communities were compared by forest type and by season. Populations were highest in the pre-litter fall double litter treatment (240 m²). Diversity (Shannon Wiener = H) was highest in the September climax forest normal litter treatment (H= 0.80) with seven families, and lowest in the September successional forest double litter treatment (H= 0.22) with two families. Two of the three dominant families were similar in both forests and represented mobile hunting spiders. The third dominant family differed between the two forests representing less mobile Araneae. The data suggest amounts of litterfall, and forest type affect litter Araneae populations and community composition.

Board 12 THE EVOLUTIONARY IMPLICATIONS OF CAPILLARY AND ERYTHROCYTE SIZE IN URODELE AMPHIBIANS. Justin William Walley, wallejw@muc.edu, (Brandon Sheafor, Sheafobr@muc.edu), Mount Union College, 1972 Clark Ave., Alliance OH 44601.

Urodele amphibians have the largest erythrocytes of all vertebrates, however it is unclear what physiological purpose large erythrocytes might serve. One explanation centers around the anatomy of the amphibian circulatory system. Amphibian hearts have a single ventricle and, therefore, cannot differentiate blood pressures between pulmonary and systemic circuits. If ventricular pressure is too high, pulmonary edema can result. If pressure is too low, distribution to the systemic circuit may be compromised. Therefore, Urodele's may have evolved large capillaries in order to maintain low systemic resistance, which would provide sufficient flow without a need for high blood pressure. It has been suggested that erythrocytes must be slightly larger than the capillaries through which they pass to ensure efficient gas exchange. Therefore, an organism with large capillaries would also require large erythrocytes. Lungless salamanders (Plethodontidae) are ideal organisms for testing the hypothesis that Urodele's have large capillaries in order to reduce resistance in the cardiovascular system. Because Plethodontids do not have a pulmonary system and are not susceptible to pulmonary edema, they should have smaller capillaries and erythrocytes than do closely related Urodele's. Smaller capillaries are beneficial due to more effective blood distribution, which allows for better oxygen delivery to tissues and, therefore, increases metabolic capacity. Erythrocyte diameter, capillary diameter, and blood pressure will be determined by digital analysis of perfused tissues from Plethodontids and closely related Urodele amphibians. Initial results indicate that erythrocyte and capillary size is significantly smaller in Plethodontids when compared to closely related families of lunged Urodele's.

Board 13 DEVELOPMENT OF A FISH SPECIES-AT-RISK DATABASE FOR THE GREAT LAKES. Joshua J. Noble, josh.noble@iname.com, and Nicholas E. Mandrak, nmandrak@cc.ysu.edu, Youngstown State University, Department of Biological Sciences, Youngstown OH 44555.

Many fish species are considered to be at risk in the Great Lakes basin. The conservation status for these species is determined by each state, provincial, and federal government agency in the basin. As a result, the conservation status for each species may vary greatly between jurisdictions. A single database containing the conservation and distribution data for all species for all jurisdictions would greatly assist in identifying the extent and distribution of, and causes for, fish species at risk. We are currently compiling such a database in three phases. The first phase is the development of a list of species at risk by jurisdiction. The second phase is the compilation of georeferenced distribution data using records from government agencies, museums and existing literature. The third phase will tabulate the factors documented to cause fish species declines across the basin. The database will then be used to complete a "hotspot analysis" to identify areas with high numbers of species at risk, and the reasons for these numbers. We have completed the first phase. Eighty-four species have been designated a conservation status by at least one jurisdiction. Ontario has the greatest number of species listed (47); whereas, Pennsylvania has the fewest number of species listed (10). The lake sturgeon (*Acipenser fulvescens*) is listed by the most jurisdictions (10); whereas, 35 species are listed by only one jurisdiction.

BOARD 14 CHANGES IN FISH HEALTH AND COMMUNITIES IN THE MAHONING RIVER BETWEEN 1989 AND 2000. Elizabeth A. Testa, lobsterlegs@yahoo.com, (Nicholas E. Mandrak, nmandrak@cc.ysu.edu, and Lauren A. Schroeder), Youngstown State University, Department of Biological Sciences, Youngstown OH 44555.

The Mahoning River is ranked as one of the most severely polluted rivers in the United States. The effect of pollution on fish health and community structure was studied in 1988 following the decline of steel industry. The purpose of the current study is to replicate this earlier study to test the hypothesis that fish health and communities have improved following the cessation of industrial pollution. In Fall 2000, fishes were sampled using an electrofishing boat and hoop nets. For each fish sampled, deformity, lesion and tumor (DELT) anomalies were recorded using the index used in the earlier study. In the earlier study, nine species were caught and the brown bullhead (*Ameiurus nebulosus*) was most abundant. The brown bullhead (n=125) had a mean barbel deformity score of 1.33, mean lesion score of 0.13, and mean tumor score of 0.04. In the current study, 17 species were caught and the common carp (*Cyprinus carpio*) was most abundant. As no brown bullhead were caught, the DELT index was applied to the carp. The carp (n=58) had a mean barbel deformity score of 1.02, mean lesion score of 0.72, and mean tumor score of 0.05. Changes in fish community composition indicate that the communities are recovering; whereas, the lack of change in the DELT index in benthic species suggests that the toxic sediments are still a health issue.

Board 15 DIGITAL RECORDING AND ANALYSIS OF FEMALE REDWING BLACKBIRD (*AGELAIUS PHOENICEUS*) VOCALIZATIONS COLLECTED IN THE FIELD. John Teti, jteti17@hotmail.com, Mark Borland, Aaron Lopez, and Grant McLaren, gmclaren7@hotmail.com, Edinboro University of Pennsylvania, The Bioacoustic Research Training Program, Department of Psychology, Edinboro PA 16444.

Investigations concerning the significance of birdsong have traditionally focused on the vocalizations of male passerines. Few investigations have addressed the potential significance of female vocalizations. To the best of our knowledge, a collection of the female redwing's repertoire does not exist. One goal of this study was to record and catalogue the vocalizations produced by female redwings. The calls of six free-living female redwings were recorded on their habitats in northwestern Pennsylvania from May through June. Recordings were completed from 1700 to 2000. Prior to recording, each female was observed producing vocalizations within the territory of a male conspecific. Next, each female was recorded for one hour. Recordings were completed with a parabolic dish, a microphone, and a digital analog tape. Once vocalizations were captured, the digital samples were transferred to a Macintosh computer, equipped with *Canary* sound processing software, for analysis. The results indicate an individual female redwing can produce at least four acoustically different vocalizations. The mean (M) duration of vocalizations was $M = 1.40$ ($SD = 0.91$) secs. These vocalizations ranged between the mean frequencies of $M = 1.36$ ($SD = 0.42$) and 7.313 ($SD = 0.88$) kHz. These results suggest female redwings, like their male counterparts, may use different vocalizations to transmit information in the habitat.

Board 16 VOCAL RESPONSES OF MALE AND FEMALE REDWING BLACKBIRDS TO DIGITAL FEMALE CONSPECIFIC PLAYBACK STIMULI IN THE FIELD. Mark Borland, m604620b@edinboro.edu, John Teti, Aaron Lopez, and Grant McLaren, gmclaren7@hotmail.com, Edinboro University of Pennsylvania, The Bioacoustic Research Training Program, Department of Psychology, Edinboro PA 16444.

Most studies, concerning the behavioral significance of birdsong, have focused on the vocalization of male passerines. Investigations rarely address the potential significance of female vocalizations. The goal of this study was to elicit vocal responses from male and female redwings with calls of a female conspecific. Vocal responses of six (two males and four females) redwings were recorded in this study. Playback and recording sessions were completed on habitats located in southwestern Pennsylvania during May and June. These sessions were completed between the hours of 1700 and 2000. The female stimulus was broadcast into a habitat using a speaker and a digital analog tape (D.A.T) recorder positioned adjacent to the primary perch of a male redwing. During playback sessions, an individual bird was exposed to a five min pre-playback, a five min playback, and a five min post-playback period, respectively. During the playback period, the bird was exposed to repeated presentations of the female vocal stimulus. Observers used a microphone, a parabolic dish, and a DAT machine to record vocal responses elicited by the vocal stimulus. Results indicate the female playback stimulus elicited vocal and approach responses from the male and female redwing. Thus, further investigations into the use of female vocalizations as playback stimuli may be warranted.

Board 17 SURVEY OF THE COLEOPTERA AT THE RAVENNA TRAINING AND LOGISTICS SITE. Roger Williams and Diane Hartzler, The Ohio State University, OARDC, Department of Entomology, Wooster OH 44691.

Our goal was to collect and identify the maximum number of beetle species present within the ranging habitats of the Ravenna Arsenal in NE Ohio. This was the second year of this study in which we are looking at the biodiversity of the Coleoptera inhabiting the Ravenna Training and Logistics site. This 21,000-acre area is under the

jurisdiction of the Ohio Army National Guard and it is located east of the city of Ravenna. Collecting began in early April and continued until there was little or no beetle activity in November 2000. Sampling methods utilized various types of insect traps, terrestrial and aquatic nets, beating sheets, and hand collecting in various habitats. Collections were quantified and recorded along with their longitude and latitude coordinates. Specimens were labeled with all pertinent collection data along with a separate label indicating their taxonomic nomenclature. In most cases, determinations were to species. Abundance ratings were used to describe a particular species population. The most abundant species of beetle collected within the fenced arsenal was the colorful picnic beetle, *Glischrochilus quadrisignatus*. Overall, we recorded 365 species in 29 families with more than 11,498 specimens represented. Many of the specimens are still being identified by specialists. Thus, the total number of species is expected to be much higher.

Board 18 ECONOMICALLY IMPORTANT NITIDULIDS OF NORTHERN EGYPT WITH EMPHASIS ON THEIR PHEROMONES. Ayman M. Mostafa, mostafa.5@osu.edu, The Ohio State University, Department of Entomology, OARDC, Wooster OH 44691.

Nitidulid beetles occupy a wide range of habitats throughout the world. Some species are cosmopolitan, while others are well known as pests of ripening and dried fruits, grains and many stored products. In Northern Egypt there are four main species attacking citrus, date palm, guava and many of other fresh and dried or stored fruits. These species are, *Carpophilus hemipterus*, *C. dimidiatus*, *Urophorus humiralis* and *Epuraea luteolus*. Also we observed "the small hive beetle" *Aethina tumida* for the first time in Egypt last summer. Beside what we know about attraction of these beetles to some volatiles and fermented dough, aggregation pheromones of many nitidulid species were discovered and synthesized during the last few years. Our work focused on studying the combination effects of both pheromones and whole wheat bread dough (WWBD) on these insects. The following combinations were applied by using the PVC trap in both citrus and date palm orchards in Rosetta in Northern Egypt (1998-2000): 1) WWBD only, 2) *C. hemipterus* pheromone only, 3) *C. dimidiatus* pheromone only, 4) *C. hemipterus* pheromone + WWBD and 5) *C. dimidiatus* pheromone + WWBD. Results showed that date palm was more attractive to the four species of nitidulids than citrus. Combination of dough and pheromone of *C. dimidiatus* was the most attractive lure of these insects, followed by a combination of dough and pheromone of *C. hemipterus*. Less attractive was dough by itself and finally least attractive were individual pheromones by themselves. Insects were most abundant during period from March to June (1815, 1731, 1355 and 348, respectively).

Board 19 SYNCHRONIZATION OF ESTRUS AND REPRODUCTIVE EFFICIENCY OF DAIRY HEIFERS USING TWO DIFFERENT HORMONE BREEDING PROTOCOLS. Marcia E. Braun and Nancy Woodley, Ohio Northern University, Ada OH 45810.

Reproductive efficiency is an essential factor to consider when striving to achieve successful dairy management. Reproductive efficiency is defined as the breeding rate divided by the number of artificial insemination (AI) services, and the breeding rate is determined by confirmed pregnancies in the test animals. Therefore, this study tested the breeding success rate in 30 Holstein heifers that were either treated with one of two different hormone therapies used to synchronize estrus against that of animals that were not treated and bred when estrus was visually detected (control, n=9). Not all heifers conceived after the first AI service, so a total of 50 services were required. The PG group (n=15) received two doses of Prostaglandin F2-alpha (PG), which is the most common method used to synchronize estrus in many dairy herds. The GnRH group (n=6) received a relatively novel hormone therapy involving a sequence of treatments of Gonadotropin Releasing Hormone (GnRH), PG and GnRH. The cattle were examined to determine estrus synchronization and then bred. It was determined that reproductive efficiency in the cattle subjected to PG (87%) and heat detection (83%) methods were higher than the GnRH protocol (55%). In conclusion, the heat detection and the PG techniques were both successful, but timed breeding would be more cost effective on larger farms, and heat detection would be better utilized with smaller herds.

Board 20 IMMUNE EFFICIENCY IN *MUS MUSCULUS* FOLLOWING TREATMENT OF LEAD-INDUCED TOXICITY WITH MESO-2,3-DIMERCAPTOSUCCINIC ACID (DMSA) DURING GESTATION. Erin E. Wallace, e-wallace@onu.edu, (Linda Young, lyoung@onu.edu), Ohio Northern University, 402 W. College Ave. Unit 2297, Ada OH 45810.

This research was an evaluation of the efficiency of meso-2,3-dimercaptosuccinic acid (DMSA) in inhibiting the effects of lead-induced toxicity. The ten female *Mus musculus* were weighed daily to determine time of pregnancy and monitor their health. Lead acetate (250ppm) was administered in the morning, via gavage to female mice, starting on their sixth day of determined gestation. DMSA (30 mg/kg or 60 mg/kg) was also dispensed in double distilled water starting on the sixth day of determined gestation for the designated groups in the evening. The newborns and mothers were not subjected to further lead exposure or DMSA after three full days of administration during the mother's pregnancy. Blood was withdrawn from the offspring, via tail bleeds, twenty-four days after birth to determine lead levels, to perform differential counts, to observe lead-induced red blood cell basophilic stippling, to

monitor microcytic anemia, and to quantify total plasma protein levels. Complications prevented accurate blood lead level determination. Examination of blood smears failed to show red blood cell basophilic stippling or lead-induced microcytic anemia. Lead treatment resulted in a significant elevation of lymphocytes and eosinophils relative to controls and a significant decline in neutrophil number. DMSA treatments yielded no significant changes in number for these three cell types. Lead and DMSA treatments appear to have a toxic effect on monocytes. Analysis of plasma protein levels, indicate that a lead-induced decrease cannot be counteracted via DMSA treatment. Comparison of lymphocyte number with total plasma protein values, suggest that the lead-mediated decline is not the result of a decreased immunoglobulin fraction.

Board 21 THE EFFECTS OF ULTRAVIOLET RADIATION ON DEVELOPMENTAL STAGES, SURVIVORSHIP, AND GROWTH OF THE AFRICAN CLAWED FROG (*XENOPUS LAEVIS*). Andrea C. Walther, a-walther@onu.edu, (Nelson Moore, n-moore@onu.edu), Ohio Northern University, 402 W. College Ave., Ada OH 45810.

Within the past decade, reports of malformed amphibians have increased in areas of North America. A possible causative agent of these deformities is the higher intensity of ultraviolet radiation due to the depletion of the ozone layer. The objective of my study is to test this hypothesis. Because they can be maintained easily and bred successfully in most laboratory settings, South African clawed frogs (*Xenopus laevis*) were chosen as the experimental subjects. By breeding two adults, over 500 eggs were obtained for observation. The eggs were separated into 6 different groups of 75 eggs each to be exposed to ultraviolet radiation at different stages of development, including: early cell division (one-cell to blastula), dorsal lip to neural groove, neural tube, hatching, and two weeks after hatching. Each of the 6 groups was further subdivided into 3 subgroups, each containing 25 eggs, so that each subgroup, except for the control, would be irradiated at either 20%, 40%, or 80% UV light intensity (8000mW/cm²=312 nm) at the appropriate stage. As the eggs developed into tadpoles, the number and condition of the frogs were closely monitored and recorded. With only one tadpole remaining out of 125 that were exposed to 80% UV light intensity, findings indicate that higher concentrations of UV light exposure have more fatal or adverse effects in the development of the tadpoles. Also, individuals exposed at the neural tube stage and two weeks after hatching had a survival rate of 0.0 at all UV intensities.

Board 22 QUALITATIVE ANALYSIS OF SPOTTED TURTLE (*CLEMMYS GUTTATA*) HABITATS IN OHIO. Joseph M. Ullmer, Ozz11@aol.com, Jennifer L. Grieger, and Timothy L. Lewis, tlewis@wittenberg.edu, Wittenberg University, Dept. of Biology, Springfield OH 45501.

The number of spotted turtles (*Clemmys guttata*) has declined in Ohio, mainly as a result of habitat loss, predation, and collection. This study involved the identification and qualitative analysis of known and historic spotted turtle habitats in Ohio. Between February 1999 and October 2000 we checked for presence of invasive plant species such as honeysuckle (*Lonicera* spp.), buckthorn (*Rhamnus* spp.), and cattails (*Typha latifolia*), as well as local and regional habitat fragmentation in these areas. We also noted whenever a site had been developed or otherwise changed, which would result in the local extirpation of the turtles. We visited 47 of 50 statewide sites, of which 9 had been developed and were no longer habitable. Of the 38 remaining sites, 70% had significant invasive plant species, 79% were isolated, and 57% showed signs of intrasite fragmentation. Thus, most Ohio habitats are marginal for spotted turtle populations. Population isolation also threatens turtle populations. These populations are widely separated within three main regions in the state, in southwestern Ohio by approximately 20 kilometers, 5 kilometers in northwestern Ohio, and 30 kilometers in northeastern Ohio. Given the current population isolation, presence of invasive plant species, fragmentation in most habitats, and the reported increase in predator populations (especially raccoons, *Procyon lotor*), we conclude that spotted turtle populations are at risk in Ohio.

Board 23 EFFECTS OF SURFACE CLIMATE ON USAGE OF CAVES AS A REFUGIUM FOR PLETHODON GLUTINOSUS (GREEN) AND EURYCEA LONGICAUDA (GREEN) IN CARTER COUNTY, KENTUCKY. Matthew C. Hazelton, s02.mhazelton@wittenberg.edu, (Horton H. Hobbs III, hobbs@wittenberg.edu) Wittenberg University, Department of Biology, P.O. Box 720, Springfield OH 45501-0720.

The purpose of the study is to correlate changes in surface climate with those in population densities of two species of salamanders, *Plethodon glutinosus* and *Eurycea longicauda*, in Coon-in-the-Crack Cave I, Carter County, KY. Both *P. glutinosus* and *E. longicauda* are lungless salamanders and need high humidity to respire through their skin. They are nocturnal and are active only during times of high humidity and mild temperatures. Once a month, beginning February 2000, Coon-in-the-Crack Cave I was searched systematically for salamanders. For each salamander, location within the cave, snout to vent length, weight, and sex were recorded. HOBO® Data Loggers were placed throughout the cave, recording temperature and humidity. Data loggers also collected surface temperature and humidity data to facilitate the comparison of surface and subsurface climatic conditions to

the distribution and abundances of each species in the cave. Results of this study may help explain the seasonal distribution and specific climatic preferences of *P. glutinosus* and *E. longicauda* within and outside the cave environment. Eight months of the proposed twelve-month study have been completed. The salamanders were absent from the cave until surface temperatures reached 27°C during the day and dropping to 15°C at night. At the same time surface humidity fluctuated from saturation level to 12% relative humidity in a single day. We hypothesize that *P. glutinosus* and *E. longicauda* use Coon-in-the-Crack Cave I as a refugium from high temperatures and low humidity.

Board 24 POINT-QUARTER SURVEY OF A CLARK COUNTY OHIO WOODLOT. Kristin C. Young, kcwhy@hotmail.com, (Timothy L. Lewis, tlewis@wittenberg.edu), Wittenberg University, Department of Biology, 225 N. Fountain Ave., Springfield OH 45501.

This is a point-quarter survey of a small, 2.5 ha woodlot in Clark County, Ohio. Historically, the study area was covered by forest, but now only a small, isolated forest tract remains. Often decreased forest diversity is a result of forest fragmentation. The purpose of this study is to analyze the density, dominance, and frequency of the tree species present in the woodlot to test if a small number of species will dominate the area with high frequency. Small woodlots are not generally characterized by high frequency or diversity. Using the point-quarter survey method, 30 points were sampled at 30 m intervals using nine transects. The location of the point (ie. transect number and distance from the edge of the forest), distance from the point, dbh, and species were recorded for each tree surveyed. Initial observations indicate that this woodlot is dominated by slippery elm (*Ulmus rubra*), black cherry (*Prunus serotina*), and white ash (*Fraxinus americana*). These data imply that the diversity of the woodlot is, in fact, less than the diversity of a larger, continuous forest that existed previously. These data are important for forest conservation issues in Ohio, as small woodlots predominate.

Board 25 ROLE OF THE *NifM* IN MATURATION OF Fe-PROTEIN OF THE NITROGENASE. N. Gavini and L. Pulakat, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Nitrogenase, the enzyme that catalyzes the reduction of dinitrogen to ammonia, consists of two proteins, the MoFe- and the Fe- proteins. Maturation and assembly of these complex metalloproteins require *nif*-accessory proteins encoded by at least 15 genes. We have investigated the role for *nifM* in the maturation of the Fe-protein. Deletion of *nifM* from the *Azotobacter vinelandii* chromosome resulted in synthesis of inactive and aggregated form of the Fe-protein. Further analysis showed that this Fe-protein is devoid of its Fe₂S₄ metal center. Comparison of amino acid sequence of NifM with several protein databases revealed a high homology with *E. coli* parvulin, a peptidylprolyl cis-trans isomerase (PPIase). The complete NifM protein and the NifM peptide of 100 amino acids corresponding to *E. coli* PpiC were purified to homogeneity. It was found that both these proteins have PPIase activity when tested on artificial chromogenic substrate succinyl-Ala-Phe-Pro-Phe-4-nitroanilide. However, neither *E. coli* PpiC nor the NifM peptide of 100 amino acids could complement the *nifM* strains of *Azotobacter*, indicating that just the PPIase activity in the cells is not enough to complement the *nifM* function. Furthermore, we have also demonstrated by using the 'Matchmaker Two-Hybrid' protein-protein interaction assay that the amino terminus of the NifM is needed to interact with the Fe-protein of nitrogenase. Studies on chimeric NifM-PpiC, showed that the PPIase-like domain and the Fe-protein-interaction domain of the NifM are essential for the ability of the NifM to participate in the nitrogen fixation.

Board 26 CHARACTERIZATION OF *NifM* INDEPENDENT MATURATION OF THE Fe-PROTEIN OF NITROGENASE. S. Nash, snash@bqnet.bgsu.edu, N. Affara, F. Kobeissy, M. Narasimhan, D. Knowle, L. Pulakat and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

The role of the *nifM* gene product in the maturation of the Fe-protein component of nitrogenase was obscure. Thus far, the *nifM* gene has been cloned from *Klebsiella pneumoniae*, *Azotobacter vinelandii* and *A. chroococcum*. A comparison of the amino acid sequences deduced from the nucleotide sequences of these genes clearly demonstrates the existence of a low level of interspecies sequence identity at the amino acid level. Previous results suggested that the *nifM* gene product plays an important role in conferring activity and some stability to the Fe-protein. Since isolated Fe-protein does not contain any NifM protein, it is unlikely that the NifM is a subunit of the Fe-protein complex. Therefore, the role of the NifM protein could be to impart activity and stability to the Fe-protein. Based on this reasoning, we have been able to isolate an *A. vinelandii* strain in which the NifM-protein is no longer required for nitrogenase activity. Further analysis showed that the *nifH* gene from this mutant strain contained multiple mutations spanning four easily recognizable regions in the Fe-protein. We have constructed mutations in all four regions, one region at a time, and performed genetic complementation experiments. These analyses showed that the region spanning amino acids 145 to 160 is involved in the NifM-mediated folding of the Fe-protein of nitrogenase.

Board 27 STUDIES ON THE EXPRESSION AND INTERACTION BETWEEN THE NHE6 AND THE ANGIOTENSIN II RECEPTOR SUBTYPE AT2. S. Bruhl, sbruhl@bgnnet.bgsu.edu, S. Cooper, D. Knowle, N. Gavini, and L. Pulakat, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

To elucidate the physiological role of the Angiotensin II Receptor AT2, we used yeast two-hybrid assay to identify cellular proteins that may directly interact with the AT2 and mediate its signaling. Screening of a 17-day fetal mouse MATCHMAKER cDNA library with the AT2 as "bait," lead to the identification of an interacting fetal mouse peptide which shares 94% similarity with the human Na⁺/H⁺ exchanger NHE6 and 74% similarity with the *C. elegans* Na⁺/H⁺ exchanger. To determine the expression pattern of this new NHE isoform in rodents, we used the rat model. Tissues from different developmental stages were analyzed for the expression of this new NHE by isolating mRNA and performing RT-PCR experiments. Our studies showed that, this new NHE isoform is expressed in rat during early stages of embryonic development and the region of the rat NHE peptide amplified by RT-PCR technique shared 94% and 92% similarity respectively with the corresponding region of the mouse and human NHEs. The NHE6 isoform was expressed in heart, kidney, brain and muscle. Ang II is known to stimulate NHEs in vascular smooth muscle cells and cardiac myocytes and this regulation may play an important role in cardiac ischemia and hypertrophy. However the exact cellular mechanisms that are involved in the regulation of NHEs by Ang II are yet to be worked out in detail. Our results indicate that one possible mechanism by which the Ang II may regulate the function of the NHEs is through direct protein-protein interaction between the AT2 and NHE.

Board 28 ROLE OF ILE249 [LOCATED IN THE THIRD INTRACELLULAR LOOP OF THE AT2 RECEPTOR] IN LIGAND-RECEPTOR INTERACTION. V. Kumar, vikasvk@bgnnet.bgsu.edu, D. Knowle, L. Pulakat, and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Angiotensin II receptor subtypes AT1 and AT2 show the lowest homology in the 3rd intracellular loop (ICL). In order to elucidate the differences between the functions of the 3rd intracellular loop of AT1 and AT2, we have previously constructed a chimeric mutant by replacing the 3rd ICL of AT2 with that of AT1. The chimeric mutant could not bind the AT2 specific high affinity ligand CGP42112A and Sarile, though it could activate PLC in a similar manner to that of the AT1. These results implied that the 3rd ICL of AT2 plays a major role in ligand binding and activation. Our aim was to further elucidate which amino acids of the 3rd ICL are involved in the ligand binding of AT2. Site directed mutagenesis was carried out and isoleucine at position 249 in the 3rd ICL was replaced with proline, the corresponding amino acid in the AT1. The ligand binding property of this mutant was assessed using a *Xenopus laevis* oocytes expression system. Our results indicate that Ile249Pro mutant exhibited reduced affinity to both ¹²⁵I-CGP42112A and ¹²⁵I-Angiotensin II. This suggests that the Ile249 located in the mid-region of the 3rd ICL of AT2 is one of the amino acids that contributes to high-affinity ligand binding of the AT2.

POSTER SESSION

BIOLOGICAL; MEDICAL SCIENCES

10:00 – 11:00 AM

TOLERTON & HOOD HALL OF SCIENCE

Board 01 A METHOD OF ASSESSING A POSSIBLE COMMUNITY CANCER CLUSTER. Jere M. Boyer¹, boyerj@summa-health.org, William Franks², Don Benson³, Vishvas Hegde³, Susan Johnson and Bryan Kozinski³, ¹Summa Health System, Akron OH 44304, ²Stark County Health Department, ³North-eastern Ohio University.

The concern that generated this project was the large number of inquiries that were forthcoming to the Stark County Health Department from persons in the area of the Excess Industrial Landfill in Uniontown, OH. There are a number of published procedures for response to such inquiries but none appeared to be useful in this situation. The study consisted of looking at the needs of the community in question, reviewing available response procedures, developing a protocol for response and piloting the protocol in the community. A questionnaire was developed that is used to screen the initial call to the health department. A training program was developed and implemented for initial contacts. Approximately 90% of all calls, thus screened over a two-year period (N=43) were shown to be resolved at this point. If, after the initial contact is made, the screener believes that a cancer cluster may be present, the second phase of the plan is initiated. This phase is four-pronged. It includes establishing good public relations, data gathering involving not only trained persons but community people interested in the program, defining the exact population to be studied and education of the community as a whole. The statistical analysis of data gathered and the mapping of this data is the next step. The preferred method is a Standard Incidence Ratio (SIR). Using this method, >1 indicates possible clustering. If <1, the SIR would suggest no clustering. To date, all cases reported to the health

department have had SIR <1, indicating no rationale to proceed. If we were to obtain data where the SIR >1, steps are presented in the protocol that would continue the process. This procedure may be useful to others for such studies.

Board 02 DETERMINATION OF PHENOTYPIC CHARACTERISTICS FOR STRAIN DIFFERENTIATION AND EPIDEMIOLOGICAL STUDIES OF PSEUDOMONAS AERUGINOSA. Eric Proudfoot, Roudabeh J. Jamasbi, Bowling Green State University, Department of Biological Sciences and Medical Technology, Bowling Green OH 43403.

Five-hundred thirty clinical isolates of *Pseudomonas aeruginosa* were collected from four Northwestern Ohio hospitals over a five-year period using standard microbiological techniques. The strains were serotyped by ELISA and/or slide agglutination techniques using specific monoclonal or polyclonal antibodies produced against the 17 International Antigenic Typing System (IATS) serotypes of *P. aeruginosa*. Serotype O:11 predominated in frequency followed by O:6, O:3, and O:2. Antibiotic susceptibility testing and beta-galactosidase production were determined to further differentiate the isolates in each serogroup. No consistent susceptibility patterns among the isolates were observed. However, increased antibiotic resistance was noted in patients with recurrence of infection. More than 60% of the O:11 serotype possessed beta-galactosidase enzyme capable of cleaving orthonitrophenol beta galactoside (ONPG) substrate. Ten percent of the O:15 serotype also possessed beta-galactosidase enzyme, consistent with our previous findings, but unreported elsewhere. A combination of several phenotyping methods is an effective first step in strain differentiation of *P. aeruginosa*. Genotypic studies for differentiation of strains with similar phenotypic characteristics are currently underway.

Board 03 EFFECTS OF ECCENTRIC EXERCISE ON GLUCOSE KINETICS AND INSULIN CONCENTRATIONS IN RESISTANCE-TRAINED ATHLETES. Traci A. Sexton, tsexton@kent.edu, (Lonnie M. Lowery, lowery@kent.edu), Kent State University, Department of Nutrition, Rm. 100 Nixson Hall, Kent OH 44242

Downhill running induces temporary muscle damage that interferes with bodily use of dietary carbohydrate (Sherman, W., et al. *Int J Sport Nutr*, 1992). The purpose of this research was to determine the effects of combined upper and lower body eccentric exercise on blood glucose and serum insulin concentrations in ten male resistance-trained athletes (18-35 y). The hypothesis was that eccentric bench pressing and squatting (six sets of six repetitions at 80% of 1 RM) would increase blood glucose and insulin response to an oral glucose tolerance test (OGTT), 24 hours later. In a repeated measures design, subjects drank 75 g of a glucose beverage (296 ml) on two different mornings, one while fully recovered from exercise (UNSORE) and the other while experiencing muscle damage and soreness (SORE) induced in the lab. Blood samples were taken every 30 minutes for two hours after glucose ingestion. Blood glucose was measured with a glucometer at each time point, after which remaining blood was centrifuged and the pipetted serum frozen at -120°C until insulin analysis (ELISA results pending). Preliminary findings reveal increased perception of soreness (0-10 scale) after exercise (SORE: 5.6 ± 1.8 vs. UNSORE: 1.0 ± 0.1, p=0.0005), indicating muscle trauma. Dependent t-test revealed a non-significant increase (p=0.24) between SORE and UNSORE glucose concentrations at 30 minutes (148 ± 22 vs. 130 ± 22 mg/dl). Soreness correlated with peak blood glucose (r=0.65, p=0.04). These observations suggest that damaging exercise does not significantly increase resistance athletes' peak glucose concentrations in response to an OGTT but a relationship may exist between muscle trauma and serum glucose.

Board 04 THE ROLE OF CALCIUM INFLUX THROUGH VDCC'S AND NMDA CHANNELS IN THE FORMATION OF LONG-TERM AND SHORT-TERM MEMORIES. L.J. Petrak, lara.petrak@oberlin.edu, B.R. Fletcher, brf3@po.cwru.edu, K.K. Dalal, kunal.dalal@oberlin.edu, (Albert Borroni), Oberlin College, Dept of Neuroscience, Oberlin OH 44074.

The hippocampus is a structure in the brain that is crucial to the formation and storage of memories. Within this structure, there is a model for synaptic modifications that occur during learning termed long-term potentiation (LTP). Synaptic modifications induced by repetitive stimulation of selected excitatory afferents in the hippocampus have been shown to be dependent on the entry of calcium into the post-synaptic cell. Two points at which calcium can enter the cell during repetitive stimulation include the activation of N-methyl-D-aspartate receptors (nmdaLTP) and/or voltage dependent calcium channels (vdccLTP). VdclLTP can be blocked with tyrosine kinase inhibitors, while nmdaLTP is completely blocked by serine/threonine kinase inhibitors (Cavus and Teyler, 1996). While a 1999 study by Morgan and Teyler showed evidence for both vdccLTP and nmdaLTP in intact anesthetized rats, it is still uncertain if the phenomenon exists in awake, freely moving rats. We decided to determine if vdccLTP did in fact exist in the conscious animal. Stimulus parameters that induce both types of LTP in slices were used to induce LTP in animals with chronically implanted hippocampal electrodes. Both forms of LTP were independently assayed through pharmacological manipulations that included injecting IP either the VDCC antagonist verapamil and/or the NMDA antagonist MK-801. We found induction of LTP in awake animals to be an extremely difficult procedure. While the results are currently inconclusive the process is extremely enlightening and will be explained in the poster.

Board 05 THE REGENERATIVE CAPACITIES OF CULTURED EMBRYONIC AND ADULT RAT SKELETAL MUSCLE TISSUE. Jaimee L. Novak, jnovak@onu.edu, (Nancy Woodley, nwoodley@onu.edu), Ohio Northern University, 402 West College Avenue, Ada OH 45810.

Skeletal muscle cells have the ability to participate in tissue repair and regeneration. This project will focus on comparing the capacities with which embryonic and adult muscle cells regenerate after being damaged physically by mechanical scraping. Removal of the muscle cells from their *in vivo* site and their subsequent expansion *in vitro* essentially mimics the damage (removal), repair and regeneration (*in vitro* expansion) processes of muscle growth. Due to the high mitotic capacity present in embryonic tissue, it is hypothesized that the embryonic cells will be more capable of withstanding physical damage. Rat skeletal muscle cells were cultured and allowed to expand (undergo mitosis) in a controlled *in vitro* environment. Both embryonic and adult tissue were cultured to provide a comparison between the two tissue sources as to whether the level of regeneration varies with the mitotic capacity of the tissue source. Initial findings indicate the presence of primary cultures (n=8) from embryonic rat skeletal muscle. Although the purity of the cultures is to be assessed by immunolabeling with muscle specific vimentin, the passaged dishes of cells (n=8) from adult male skeletal muscle cells have shown successful regrowth and repair following the initial mechanical scraping.

Board 06 BREEDING SELECTION FOR LOW BLOOD PRESSURE. Colin M. Everhart, colin2@uakron.edu, University of Akron, Dept. of Biology, Akron OH 44325-3908.

The hypothesis tested was that low blood pressure (LBP) has a genetic origin and is sex-related. Normotensive Wistar-Kyoto (WKY) rats were selected for LBP and then mated. All rats were > 10 weeks of age, so the BP was reliable. All pressures were recorded under the same conditions. Of the parents, males (n=2) and females (n=6) had pressures of 124 ± 1 mmHg and 120 ± 8 mmHg, respectively. The parents exhibited normal BP for this strain of rats. These rats (P₁) were placed in 2 breeding cages (1M x 3F). F₁ males (n=3) and females (n=3) had pressures of 114 ± 3 mmHg and 116 ± 1 mmHg, respectively. F₁ rats were selected for LBP and bred (1M x 1F). F₂ males (n=2) and females (n=2) had pressures of 115 ± 1 mmHg and 112 ± 1 mmHg, respectively. F₃ rats were selected for LBP and bred (1M x 1F). F₃ males (n=2) and females (n=2) had pressures of 109 ± 2 mmHg and 115 ± 0 mmHg, respectively. After 3 generations, male BP decreased 15 mmHg. This significant finding suggests that LBP may be sex-related. It is known that there are loci on the Y chromosome that contribute to high blood pressure; perhaps there are also loci on the Y chromosome that contribute to LBP. Future intentions will be to establish a LBP strain to conclusively show that there is a genetic origin. This eventual strain will allow for the elucidation of the locus(t) using various molecular techniques.

Board 07 AN EXAMINATION OF DENTAL CARIES FORMATION AND BIOFILM DEVELOPMENT ON MAMMALIAN TEETH USING SCANNING ELECTRON MICROSCOPY. Krista A. Shasteen, kashaste@cc.owu.edu, (Laura Tuhela-Reuning, ltuhela@cc.owu.edu), Ohio Wesleyan University, HWCC Box # 1129, Delaware OH 43015.

An understanding of the formative mechanisms of cavity development and its relation to biofilm formation should allow for improved dental care and a decrease in the development of new caries. To study this phenomenon four trials of dog, human, deer, and cow teeth were exposed to a bacterial culture, and both the resulting biofilm and degree of decay of the teeth were documented. Teeth in varied stages of wear and previous caries development were exposed to a pure culture of bacteria obtained from a bacterial enrichment culture from the human mouth. Teeth were first washed in a 2.62% solution of sodium hypochlorite to remove organic material then incubated for 15 days in the pure bacterial culture. The teeth were then examined using the SEM to determine the amount of tooth decay and the extent of biofilm formation. To preserve the biofilm structure for SEM observation, samples were cryo prepared in slush/liquid N₂. To observe the development of new caries and tooth degradation, biofilm was removed from tooth surfaces, and the cleaned, dried samples were gold coated prior to SEM examination. Initial observations indicate increased biofilm development consistent with additional damage to the teeth, especially those teeth with previous caries formation.

Board 08 NATURAL PASSIVE IMMUNITY AGAINST CANDIDA ALBICANS. Annalee S. Lucena, lucenaas@muohio.edu, Marcia R. Lee, leemr@muohio.edu, Miami University, Department of Microbiology, Oxford OH 45056.

Candida albicans is an opportunistic yeast, which can cause severe disease of the oral cavity. An essential virulence factor is its ability to change from a budding yeast to a filamentous, invasive growth form called a germ tube. Inhibition of germ tube formation was detected in the presence of whole breast milk. A 10-fold dilution scheme of the breast milk in physiologic saline, based on the National Committee for Clinical Laboratory Standards (NCCLS) M27-A protocol, was used with *C. albicans* ATCC 90028 strain. Results showed that breast milk diluted 1:100 was sufficient to prevent germ tube formation, indicating that this dilution is the breast milk's minimal inhibitory concentration (MIC). Furthermore, morphologic aberrations, represented by shortened and reduced germ tubes, were evident at the 1:1000 dilution of breast

milk. The positive control, non-exposed *C. albicans*, formed abundant germ tubes, whereas the negative control, milk alone, remained visually unchanged. Furthermore, fluorescent staining with Alexa-Fluor labeled anti-sheep secretory IgA showed an even distribution of fluorescence both on the germ tubes and the parental cell of *C. albicans*. These results provide evidence that natural passive immunity plays a role in the defense against germination. Additionally, no significant difference was found between breast milk samples that were immediately used and samples that were frozen at -70°C and then thawed. In conclusion, this study suggests that breast milk, even diluted 1:100, possesses antifungal properties, which may offer protection against *C. albicans*' pathogenesis.

Board 09 THE ROLE OF VOLTAGE-DEPENDENT CALCIUM CHANNELS (VDCC'S) IN CONSOLIDATION OF MEMORY. B.R. Fletcher, brf3@po.cwru.edu, W.C. Clapp, B.L. Woodside, T.J. Teyler, A.M. Borroni, Case Western Reserve University, SOM E563, 2119 Abington Rd., Cleveland OH 44106.

Long-term potentiation (LTP) is an activity dependent increase in synaptic efficacy that is induced by increases in intracellular calcium and is thought to be a model for memory formation. Recent data suggests that influxes of calcium through N-Methyl-D-Aspartate receptor (NMDA) mediated channels and voltage-dependent calcium channels (VDCCs) can independently lead to the induction of LTP. Furthermore, LTP formed through these separate mechanisms seems to have different characteristics. Using the radial arm maze Woodside et al. (2001) and Borroni et al. (2000) have shown that animals in which VDCCs have been antagonized increase the number of reference memory errors (RMEs) they make after a 7-10 day period in which they have not been in the maze - animals treated with saline or the NMDA antagonist, MK801, do not increase their errors. In these studies the antagonists were injected before running the animal in the maze. In this study, we used a similar procedure except animals were injected immediately after completing a given trial. RESULTS: Compared to the animals injected with MK801 or saline, the animals injected with verapamil took much longer to reach criterion (saline - 23 days; MK801 - 22 days; verapamil - 34 days, verapamil & MK801 - 34 days). Further comparisons of RMEs made before and after the break in training show that only the groups injected with verapamil significantly increased their number of errors (saline: 1.07 ± 0.21 vs 1.18 ± 0.22 ; MK801: 1.22 ± 0.25 vs 1.37 ± 0.27 ; verapamil: 1.26 ± 0.20 vs 1.89 ± 0.21 ; MK801 + verapamil: 1.26 ± 0.21 vs 1.70 ± 0.24). These results suggest that activation of VDCCs is important in the consolidation of information necessary to navigate the radial arm maze.

Board 10 THE EFFECTS OF CRYOTHERAPY ON DELAYED-ONSET MUSCLE SORENESS. Jill D. Schmalhurst, j-schmalhurst@onu.edu, (Rema Suniga r_suniga@onu.edu), Ohio Northern University, Department of Biological Sciences, Ada OH 45810.

Previous studies have produced mixed results concerning the effects of cryotherapy, or ice treatment, on muscle soreness occurring 24 to 48 hours after exercise. Some studies have indicated that ice relieves pain and prevents further tissue damage, allowing exercise to resume more quickly. Others have demonstrated that ice diminishes the inflammatory response, therefore delaying the healing process. I hypothesized that cryotherapeutic treatment would not be beneficial in the rehabilitation of muscles. Initial measurements of biceps girth—to measure swelling, range of motion, and strength were taken for comparison and were then recorded before and after treatment daily. Strength was measured using a pull scale. Measurements in pounds were then converted to torque. Muscle soreness was induced in two groups of males, collegiate varsity athletes (n=7) and recreational athletes (n=9), by directing them through an extensive series of biceps curls employing the use of a spotter. The following day, daily ice treatments lasting 20 minutes were initiated on a randomly selected arm until the pain subsided and normal functioning returned (duration 3-5 days). The other arm served as the control, receiving no treatment. Each individual completed a daily pain log and a final evaluation of the treatment. Evaluation responses regarding pain, function, recovery, and preference are mixed with individuals suggesting that ice severely inhibited recovery and increased pain (n=6), facilitated recovery (n=5), or provided no difference compared to the control arm (n=5).

Board 11 EFFECTS OF AROCLOR 12540 ON ENDOCRINE, AND BEHAVIORAL MEASURES IN 30-DAY-OLD RATS BRED FROM PARENTS EXPOSED TO AROCLOR 12540 FOR ONE YEAR. Douglas A. Donahue, dougdon@bgsu.edu, Kori Anne Bagrowski, Brent Drouillard, Terri L. Provost, Christa L. Bowen, Lee A. Meserve, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Polychlorinated biphenyls (PCB) are environmental contaminants that have been a problem since the 1960s. PCB are a serious concern because they are widespread, lipophilic, and bioaccumulate through food webs by concentrating in adipose tissue. These contaminants are a threat to both wildlife and humans because they cause metabolic and endocrine disruptions. Some of the problems associated with PCB include hypothyroxinemia, spatial learning and memory deficits, neurochemical and neurobehavioral alterations, and reproductive problems. We obtained animals that had been exposed to Aroclor 12540 in 1.25ppm and 25ppm dosage for one year and proceeded to breed these animals. When the pups reach 20 days of age they will

undergo several tests in the Morris water maze assessing behavior and learning. At thirty days of age, the animals will be sacrificed, body weights and organ weights determined, serum collected for later analysis of T3 and T4, Brain ChAT activity will be determined in the basal forebrain and the hippocampus to estimate the ability to generate acetylcholine. We expect the female rats to conceive with lower frequency and that the rats will have more miscarriages than control females. This study is important because it may show the mechanism by which PCB administered for a year affects physiological functions especially with regard to reproductive success. Additionally, it is anticipated that there will be a considerable impact on learning and memory (decrease with increasing PCB exposure), ChAT activity (decrease with increasing PCB exposure), and thyroid status (decrease with increasing PCB exposure) in the offspring of animals chronically exposed to PCB.

Board 12 EFFECTS OF THE TOBACCO-SPECIFIC CARCINOGEN 4-(METHYLNITROSAMINO)-1-(3-PYRIDYL)-1-BUTANONE (NNK) ON CULTURED MAMMALIAN TRACHEAL EPITHELIUM. Alison E. Oakley, a-oakley@onu.edu, (Nancy Woodley, n-woodley@onu.edu), Ohio Northern University, Ada OH 45810.

The tobacco-specific nitrosamine, 4-(methyl nitrosamino)-1-(3-pyridyl)-1-butanone (NNK), is a potent lung carcinogen formed solely from nicotine. This study will test the effects of NNK on cultured mammalian tracheal epithelial cells using both acute and chronic testing protocols. In acute tests (48 hours), dishes of cultured cells were subjected to NNK at one of 5 different concentrations (10^{-7} to 10^{-3} M; n = 2 for each); and 2 additional dishes, receiving vehicle only (DMSO), served as controls. Doses of 10^{-5} to 10^{-3} M showed increased numbers of cells as compared to controls, indicating a stimulatory rather than a toxic effect. Since no acute toxicity of NNK was determined, chronic tests will be used to determine if a sustained high dose (10^{-4} M) can induce toxic effects and a sustained low dose (10^{-7} M) can induce proliferative effects. Cultured cells will receive one of the two doses or vehicle (n = 2 for each) added into the media over a 5-week period. At the end of each test, cells will be analyzed with a trypan blue exclusion assay and counted to determine total cell number and viability. Acute and chronic tests will determine whether NNK can induce toxic effects (cell death) and/or removal of contact inhibition followed by proliferation (indicating uncontrolled cell growth) in cultured tracheal epithelium.

Board 13 A SYSTEMATIC METHOD FOR CONSTRUCTING RESTRICTION MAPS FROM GEL DATA. Stephen M. Hoeprich¹, smh@vet.purdue.edu, Tom Freeland², tfreeland@walsh.edu, ¹Purdue University, Department of Veterinary Pathobiology, West Lafayette IN 47907 and ²Walsh University, 2020 Easton St. NW, N. Canton OH 44720.

Restriction mapping is a necessary part of DNA cloning. In attempting to locate the sites of restriction endonuclease (RE) cutting on a piece of DNA, one must obtain data from electrophoresis gels. Unfortunately, the gels provide only size data. The location and order of the RE sites along the DNA molecule must be reconstructed from the fragment size data. For constructing a restriction map of this type, the trial-and-error method works, but we devised a more systematic approach, especially useful when teaching this concept in the classroom. The method described in this work is an unambiguous and systematic approach to constructing restriction maps of DNA molecules, by properly ordering the smaller fragments which result when DNA is cleaved by a combination of two RE's. We can demonstrate a method to construct restriction maps by hand that eliminates trial-and-error. It involves an electrophoresis gel photo (or facsimile thereof) containing a DNA fragment of interest cut by two different RE's, separately and together. The first step is to identify fragments from one RE digestion, which were further reduced in size by cutting with the second RE. Our method introduces a new labeling procedure in which the fragments are identified by a set of connecting arrows, based only on which fragments are cut by the other RE, and which are not cut. By following the directions of the arrows, one can unambiguously establish the order of RE cut sites on the DNA fragment.

Board 14 LONG TERM STORAGE OF CYANOBACTERIAL CULTURES. Jonathan T. Hlivko, jonhlivko@hotmail.com, and Susan R. Barnum, barnumsr@muohio.edu, Miami University, Department of Botany, Oxford OH 45056.

Long-term storage of cyanobacteria is accomplished through a process known as cryopreservation. Cryopreservation is the process of using ultra-low temperatures to store living organisms. Storage at ultra-low temperatures will help prevent genetic mutations that occur from serial cultivation, as well as make it possible to culture the original culture when needed. The objective of this research was to find a method that effectively cryopreserves a variety of cyanobacteria. Experiments utilized the two known cryopreservants 8% DMSO and 5% Methanol. The cryopreservant was added to a cryo-vial containing cyanobacteria. Then the cryo-vials were precooled at -80°C for two hours. The cryo-vials were then quickly plunged into liquid nitrogen and placed in a -80°C freezer to test storage over one, three, and six months. The methods for freezing and recovery were all carried out in almost complete darkness due to the negative affect light has on cyanobacteria treated with a cryopreservant. To date all 25 strains from the 11 genera of cyanobacteria were recovered and successfully cultured for both the one- and three- month experiments using the 8% DMSO and 5% Methanol.

Board 15 AUDITORY PROCESSING AND MIDDLE TEMPORAL GYRUS VOLUME IN WOMEN WITH POSTTRAUMATIC STRESS DISORDER SECONDARY TO CHILD ABUSE. Megan A. Hoffmann, s02.mhoffmann@wittenberg.edu, Kelly A. Zander (Cathy L. Pederson, cpederson@wittenberg.edu), Wittenberg University, Department of Biology, P.O. Box 720, Springfield OH 45501.

Abuse during childhood is increasingly linked to Posttraumatic Stress Disorder (PTSD), a mental affliction which continues into adulthood in abuse survivors. Twenty-four right-handed women (ages of 20 and 40) were categorized into three groups. Group 1 had a history of child abuse and was diagnosed with PTSD. Group 2 also had a history of child abuse, but no diagnosis of PTSD. Group 3 had no history of abuse. Each subject was screened for trauma history and personality disorders, clinically interviewed to confirm group assignment, and given the *Weschler Memory Scales* and a magnetic resonance imaging (MRI) brain scan. Based on group assignment, subjects were placed in triads based on age, education, alcohol intake, illicit drug use, and smoking habits. There were no significant differences between groups demographically (MANOVA; $p > .140$ for each demographic), indicating strong matches. While preliminary results (n=4 in each group, total n=12) suggested a significant decrease in auditory immediate memory (MANOVA; $p=0.010$), increasing the n (8 per group, total n=24) produced non-significant results for both auditory immediate (MANOVA; $p=0.247$) and delayed memory (MANOVA; $p=0.105$). Preliminary MRI tracings (n=4) of the middle temporal gyrus indicate no difference between groups (t-test; $t=-1.247$, $p=0.350$). Therefore, in women with PTSD secondary to child abuse, there is no significant deficit in auditory processing, nor would a decrease in middle temporal gyrus volume be expected.

Board 16 THE EFFECTS OF GARLIC EXTRACT ON PORCINE RENAL ARTERY TONE IN VITRO. Amanda L. Gause, a-gause@onu.edu, N. Woodley, n-woodley@onu.edu, Ohio Northern University, Department of Biological Sciences, Ada OH 45810.

Garlic, or *Allium sativum*, is a proposed vasodilator that has been shown to lower blood pressure (Adler, 1997; Etherton, 1997). Furthermore, this vasodilation may be endothelium-dependent (Boudoulas, 1998). To test the effect of garlic on the vasculature, Endothelium-denuded (EC; n=4) and endothelium-intact (EC'; n=4) porcine renal arterial rings were contracted in vitro with 1.0 mM phenylephrine. A dose-response to garlic extract (10^{-9} to 10^{-3} M) was conducted on half of the rings, and the remainder received saline only (controls). All rings were then subjected to 1.0 mM acetylcholine and 1.0 mM sodium nitroprusside. Preliminary results indicate all rings contracted to Phe (EC' = 13.0g; EC = 7.3g). Acetylcholine relaxed the EC' rings (15%), sodium nitroprusside relaxed all rings (20% EC'; 32% EC). However, response of the rings to garlic extract was not different from the controls.

BOARD 17 THE EFFECTS OF HYPERICUM PERFORATUM ON CHONDROCYTE GROWTH. Elizabeth A. Baracz, E-baracz@Onu.edu, and Amy L. Aulthouse, Ohio Northern University, Department Of Biological Sciences, Ada OH 45810.

This study was conducted to observe the effects of the herbal drug, *Hypericum perforatum* (Saint John's Wort) on chondrocyte growth. Saint John's Wort is being increasingly utilized for neurotic depression in pregnant women; however, it is not known how this drug will affect the developing fetus. *Hypericum perforatum* was tested, to evaluate its effects on chondrogenesis in a tissue culture model using human chondrocytes. Chondrocytes cultured at 5×10^5 cells/mL were untreated (Dulbecco's Modification of Eagle's Medium (DMEM)) or were exposed to St. John's Wort 25 mg/mL DMEM, or vehicle control 20% ethanol/mL DMEM. Two treatment protocols were used. In one set, cultures were treated twice weekly (DMEM (N=6); St. John's Wort (N=15); vehicle (N=9)). In the other set vehicle treatment was eliminated and cultures were treated biweekly (DMEM (N=8) and St. John's Wort (N=8)) or daily (St. John's Wort (N=7) and DMEM (N=8)). Culture period for all groups was three weeks. Single cells and cell clusters (indicating mitosis) were counted, and the presence of Alcian Blue staining matrix (indicating proteoglycan synthesis) was noted. Cells were viable with the Trypan Blue exclusion assay. Mitosis appeared to be reduced both in cultures treated daily and twice weekly with St. John's Wort, whereas, matrix production appeared to be reduced only in cultures treated daily with St. John's Wort. However, statistical analysis with ANOVA and post hoc Scheffe conducted at a 95% confidence level did not indicate any significance for any treatment among groups.

Board 18 THE ACQUISITION OF SPECIFIC CUES USED IN A CONDITIONED FEAR TASK MAY BE MEDIATED DIFFERENTIALLY BY NMDARS AND VDCCS. Jennifer Stanke¹, duo2jens@juno.com, Brian Woodside², William B. McVaugh¹, ¹Malone College, 525 Tremont Ave. S.W., Massillon OH 44647, ²NEUCOM.

Long-term potentiation (LTP), an enduring, enhanced neuronal response, is one possible mechanism underlying memory. Two forms of LTP have been identified in the rat brain. NmdaLTP, which decays over hours to days, is mediated by the N-methyl-D-aspartate receptor (NMDAR). VdclLTP, initiated by activation of voltage-dependent calcium channels (VDCCs), may represent long-lasting changes at the synapse. Much is known about the cellular mechanisms of these forms, but it is unclear what distinct behavioral roles they play. Here we hypothesized that blocking the NMDARs would impair short-term retention (24 hours), and blocking the VDCCs

would impair long-term retention (10 days) in a fear conditioning paradigm where context and tone are paired with mild footshock. Forty-five minutes before each training or testing session we systemically injected rats with either saline (n=6), MK-801 (.10 mg/kg) to block NMDARs (n=6), or verapamil (10 mg/kg) to block VDCCs (n=6). Each rat received 4 training trials in a footshock chamber with distinctive contextual cues. Each trial consisted of 2 minutes exposure to only the context, then a 30-second tone, with coincident mild footshock for the last 2 seconds. At the 24-hour and 10-day retention tests, each rat was placed in the chamber once under the same conditions as training, but without footshock. Freezing behavior was recorded for the session, and was compared to the last training trial. Rats given MK-801 were impaired in memory for context and tone at both retention intervals. Rats injected with verapamil were impaired significantly for context only at the 10-day retention test.

Board 19 AN MRI COMPARISON OF THE LEFT AND RIGHT HEMISPHERIC VOLUMES. Emily J. Rogalski, erogalski@hotmail.com, Kelly A. Zander, s01.kzander@wittenberg.edu (Cathy L. Pederson, cpederson@wittenberg.edu), Wittenberg University, Biology Department, Springfield OH 45501-0720.

Using brain magnetic resonance imaging (MRI) from 6 right-handed women ages 20 to 40, a comparison of the left and right hemisphere volumes was conducted. MRI's were transferred onto 3D Brain Station (a computer program) whereby the volumes of the left and right hemispheres could be measured. Tracings taken every 2mm from axial slices were used to calculate the volume of each hemisphere. Cerebral hemispheres were either hand-traced twice and averaged for accuracy or automatically traced once (with the electronic wizard provided by 3D Brain Station). The goal is to determine whether there is a significant difference in volume between the left hemisphere when compared with the right hemisphere. Preliminary observations have shown the left hemisphere to be significantly larger than the right hemisphere (paired t-test; $t = 2.427$, $p = 0.010$). Thus, a correlation between the volumes of the brain and the ability to perform certain functions may be identified. The left hemisphere is known to function in processing language, and is sequential, analytic and time-dependent, experiencing events as a sequence of units. The right hemisphere plays a role in interpreting and displaying emotion and is holistic in its processing. These results indicate that right-handed women have a significantly larger left cerebral hemisphere than right cerebral hemisphere, which may indicate left cerebral dominance.

Board 20 A HISTOLOGICAL EVALUATION OF HUMAN HORMONE-SECRETING TUMORS BY MEANS OF HIGH-RESOLUTION LIGHT MICROSCOPY, IMMUNOMICROSCOPY, AND ELECTRON MICROSCOPY. Melissa C. Stewart, s03.mstewart@wittenberg.edu, David L. Mason, Wittenberg University, Dept. of Biology, Springfield OH 45501.

The goal of this project was to evaluate hormone-secreting tumors for unique cellular and histological features that can help with their identification. Tissues from over thirty patients with hormone tumors evaluated at Community Hospital, Springfield, Ohio, were fixed for light and electron microscopy, embedded in plastic, sectioned, stained, and viewed with both light and electron microscopes. For light microscopy selected cellular markers helpful for specific hormone identification were immunostained by the application of primary antibodies conjugated to peroxidase. For electron microscopy, subcellular identification was made by the application of a specific primary antibody followed by colloidal gold conjugated to protein A that has an affinity to bind with the Fc sector of an antibody. The following types of hormone tumors were identified by these methods: papillary, follicular, and medullary carcinomas of the thyroid, gastrinoma, insulinoma, glucagonoma, merkel cell tumor, several carcinoids, small cell anaplastic carcinoma, prolactinoma, and growth hormone tumors. Micrographs highlight specific features found for identifying each type of hormone tumor. These include antibody detection in each case for specific hormones and membrane bound neurosecretory granules at the subcellular level. The antibodies employed include: antineuron specific enolase, antichromogranin, antiprolactin, anticalcitonin, antithyoglobulin, antigastrin, antinsulin, antiglucagon, and antiserotonin.

Board 21 EVALUATION OF EXINE COAT OF HERBACEOUS POLLEN GRAINS BY MEANS OF SCANNING ELECTRON MICROSCOPY. Erin R. Athy, s00.eathy@wittenberg.edu, David L. Mason, Wittenberg University, Springfield OH 45501.

During sexual reproduction in most herbaceous plants, the "female" ovary is stationary while the "male" pollen is dispersed by various means to different plants. I hypothesize that the morphological features of the exine coat vary among species and are adapted for a specific dispersal method. Anthers were harvested from 25 species of the Springfield area during the 2000 growing season and allowed to desiccate in collecting vials. Grains were mounted on

holding stubs, sputter-coated with platinum gold, and viewed under the scanning electron microscope. Species did display varying pollen morphology. They were classified according to relative size and divided into four categories: 1) Smooth, 2) Spinous, 3) Bulbous, 4) Cavernous. Documented correlation between morphology and dispersal is rare. However, observational speculations can be made. While all pollen has the potential to become airborne, it is most probable that the smallest and cavernous grains, assumedly being the lightest, depend primarily on this dispersal method. Often, animals and insects are associated with pollen dispersal. This may explain spinous pollen grains, developed to attach to the body or hairs. Shafts created between lobes in bulbous pollen could serve the same purpose when hair or bristles become wedged between. This project provides mainly a pictorial reference for pollen of various herbaceous plants; future research should be directed toward the function of morphological features of the exine coat.

BOARD 22 AN INVESTIGATION OF PHYSICO-CHEMICAL CHARACTERISTICS AND MACROINVERTEBRATE ASSEMBLAGES IN WEB SPRING, JOHN BRYAN STATE PARK, GREENE COUNTY, OHIO. Laurie J. Bauer, s01.lbauer@wittenberg.edu, Wittenberg University, Department of Biology, Box 1272, Springfield OH 45501.

An investigation of a small hardwater spring was conducted in the summer/fall of 2000 to examine the differences between spring pool and run physicochemistry and macroinvertebrate constitution. Web Spring emerges from a dolomite bluff on the south side of the Little Miami River in John Bryan State Park, Greene County, Ohio, and following impoundment at the head of the spring, flows north into the river. The physicochemical characteristics and macroinvertebrate assemblages and patterns in the pool at the spring effluent and several successive points along the stream run and the Little Miami River were studied. The primary organisms inhabiting the spring are the isopod, *Lirceus fontinalis* and the amphipod, *Synurella dentata*. The pool was characterized by high isopod densities, while the spring run had greater species richness but progressively lower numbers of organisms per meter. Temperature (spring effluent mean (SEM): 11.5°C, range: 11.0-11.8°C; spring run lowest site mean (SRLSM): 11.7°C, range: 4.8-12.8°C), dissolved oxygen (SEM: 8.3 mg/l, range: 7.8-9.8 mg/l; SRLSM: 10.3 mg/l, range: 4.4-11.2 mg/l), and pH (SEM: 7.30, range: 6.41-7.73; SRLSM: 7.86, range: 6.85-8.25) increased moving downstream, but there was no significant variation in hardness and the concentration of dissolved substances at different points in the spring pool and run. The Little Miami River differed from the spring chemically (higher temperature (mean= 17.2°C), pH (mean= 8.05), sulfates (mean= 72.8 mg/l), turbidity (mean= 6.49 NTU); lower dissolved oxygen (mean= 8.1 mg/l), nitrates (mean= 3.9 mg/l) and experienced greater seasonal variation. The river macroinvertebrate community consisted primarily of aquatic insects (Ephemeroptera, Trichoptera, Diptera).

Board 24 CHARACTERIZATION OF *nifM* PHENOTYPE OF *KLEBSIELLA PNEUMONIAE* UN1798. M-H. Suh, man-heesuh@hotmail.com, M. F. Wallner, O. Dissertori, L. Pulakat and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Klebsiella pneumoniae, a free living soil bacterium, is able to fix nitrogen under anaerobic conditions. In that context 20 different *nif* genes required for diazotrophic growth have been characterized. It has been shown in previous publications that active NifM is required for the biosynthesis of an active Fe-protein of the nitrogenase complex. This study is based on a *K. pneumoniae* UN1798, a *nif* strain created by chemical mutagenesis. Further investigations on this strain by cloning of the defective *nifM* gene and nucleotide sequence analysis showed that the NifM ORF carried two codon substitutions at positions 80 and 81. The residue at position 80, Glu, was replaced by Lys and the residue at position 81, Arg, was replaced by Cys. Therefore, it seemed that these mutations in the NifM are responsible for the inability of this strain to perform diazotrophic growth. To further determine the role of each of these mutations in the functions of NifM, the homologous amino acids in *Azotobacter vinelandii* NifM were identified as Met99 and Arg100 by ClustalW sequence alignment. A series of mutated the *A. vinelandii nifM* genes were generated by site directed mutagenesis and integrated into the chromosome of a *nifM* *A. vinelandii* strain BG98. This strain carries a kanamycin resistance marker inserted into the *nifM* ORF. As a consequence, this gene is inactivated and *A. vinelandii* strain BG98 cannot grow on BN⁻ nutrition media plates. After transformation of the altered *nifM* genes into *A. vinelandii* strain BG98, functional NifM mutants were detected by selection on BN⁻, BN⁻Kan and BN⁻ nutrition media plates. These investigations revealed that Glu80 and Arg81 of *K. pneumoniae* NifM and the corresponding homologous amino acids, Met99 and Arg100 of the *A. vinelandii* NifM play important roles in the ability of NifM to participate in the biosynthesis of active Fe-protein.

Board 25 ANALYSIS OF THE ROLE OF THIRD INTRACELLULAR LOOP IN THE LIGAND BINDING PROPERTIES OF THE AT2. G. Sarikonda, ghana@bqnet.bgsu.edu, D. Knowle, J. Bostelman, L. Pulakat, and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

AT1 and AT2, the two-receptor subtypes of Angiotensin II (Ang II) have a seven transmembrane domain topology and share 34% identity. A comparison of the three intracellular loops (ICL) of AT1 and AT2 show the lowest identity to be in the 3rd ICL. In order to determine the differences in the functions of AT1 and AT2 of the 3rd ICL we had previously constructed a chimeric receptor by replacing the entire 3rd ICL of the AT2 with that of the AT1. This chimeric receptor lost affinity to CGP42112A and Sarll. However the chimeric receptor could activate PLC similar to that of AT1. To further elucidate what aminoacids of the 3rd ICL are involved in determining the ligand binding properties of the AT2, we generated AT2 mutants by replacing amino acids of the 3rd ICL that were significantly different from that of the AT1 with the corresponding amino acids of the AT1. These include M2 (Leu255Phe, Lys256Arg), M3 (M2+Thr250Arg, Arg251Leu) and M4 (Thr241Ala, sn242Tyr, Ser243Glu, Tyr244Ile). Our studies using *Xenopus* oocyte expression system indicate that the mutants M2 and M3 could bind ¹²⁵I-CGP42112A and ¹²⁵I-Angitensin II with affinity similar to that of the wildtype AT2. However, the mutant M4 showed slightly reduced affinity to both ligands. These results imply that replacing amino acids in the c-terminal and mid-region of the 3rd ICL of AT2 with that of the AT1 does not abolish the ligand binding properties of the AT2.

Board 26 CHARACTERIZATION OF THE *nifM* FROM *KLEBSIELLA PNEUMONIAE* UN1787. N. Warier, navindw@bqnet.bgsu.edu, L. Pulakat and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Previous studies on the *nifM* indicate that it is involved in biosynthesis of active Fe-protein of nitrogenase, the enzyme that catalyzes the reduction of dinitrogen to ammonia. In order to gain insight regarding the regions of *NifM* required for its participation in nitrogen fixation, we have made use of a previously isolated mutant *K. pneumoniae* UN1787. This *nif* strain was isolated by NTG mutagenesis and mutation was mapped to the *nifM* allele. The *nifM* gene from this strain was cloned and subjected to nucleotide sequence analysis. During this analysis we found that the leucine codon at position 191 was changed to phenylalanine codon. Apart from this change, the rest of the sequence was found to be identical to the published *nifM* sequence of *K. pneumoniae*. Our homology search revealed that this leucine is conserved among *NifM* sequences from a variety of other nitrogen fixing bacteria. To further determine if the functional role of this leucine is conserved among *NifM* proteins of other bacteria, we analyzed the role of corresponding leucine residue, Leu213, in the *Azotobacter vinelandii* *NifM*. Leu213Phe mutant of *Azotobacter vinelandii* *NifM* was generated by site-directed mutagenesis and introduced into the chromosome of *nifM* *A. vinelandii* BG98. The Leu213Phe mutant of *A. vinelandii* *NifM* could not complement the *nif* phenotype in *A. vinelandii* BG98, confirming the fact that the amino acids important in *K. pneumoniae* *NifM* are also important in *A. vinelandii*.

Board 27 A COMPARISON OF MICROVIDEOGRAPHY AND FECAL SAC ANALYSIS FOR ANALYZING THE ARTHROPOD DIET OF ACADIAN FLY-CATCHER NESTLINGS. Lashale D. Pugh, lashalep@excite.com, Courtenay N. Willis, cnwillis@cc.ysu.edu, Patricia L. Gundrum, Youngstown State University, Department of Biological Sciences, 1 University Plaza, Youngstown OH 44555-3601.

Microvideography and fecal sac analysis were compared for their effectiveness in quantifying the composition of arthropod prey in Acadian Flycatcher (*Empidonax vireescens*) nestling diets. A greater number of prey recorded on video could be identified to family level and a greater proportion of the total number of items brought over time could be identified. Video allowed the identification of prey from three classes of arthropods and 20 families of insects from 10 orders whereas only two classes of arthropods and two families of insects from four orders were identified using fecal sac analysis. The most common prey identified from videotaped feedings were Diptera (33%), Lepidoptera (21%), and Arachnida (13%), whereas the most common prey identified in nestling fecal sacs were Arachnida (31%), Coleoptera (22%), and Diptera (11%). Compared with fecal sac analysis, microvideography was considered to be the most effective and complete method of determining the diet of nestlings. In addition, microvideography can provide information on other aspects of the birds' biology, such as feeding rates, size of prey loads delivered by adults, parental sex differences, and information on preferences for prey at particular times or nestling age.

Board 28 THE EFFECTS OF MSH PROHORMONE ON MELANOPHORE DARKENING IN *ANOLIS CAROLINENSIS*. Joseph A. Kallai, jkallai@lycosmail.com, (L. Epp, epplg@muc.edu), Mount Union College, Box #831, 1972 Clark Ave., Alliance OH 44601.

This experiment is being conducted to further understand the relationship between MSH, MSH pro-hormone, i.e. pro-opiomelanocortin (POMC), and the melanophore darkening effect in *Anolis*. It is known that in addition to MSH, related compounds derived from POMC, such as ACTH, LPH, B-endorphin and others, may stimulate the darkening of melanophores. It has been hypothesized that MSH is the major hormone involved in melanophore darkening, while the others are less effective, or only work in combination with MSH. However, the actual extent of the effect of each of these other compounds alone or in combination with MSH is not known, making previous work on melanophores and pituitary extracts unclear. Therefore, the hypothesis is being tested by treating isolated skin samples of *Anolis*, held in Ringer's solution, with MSH or one of the other POMC-derived molecules, individually or in combination. The skin is illuminated during treatment and any changes in melanophore activity are detected and recorded by a reflected-light sensor mounted directly above skin. Preliminary results have confirmed the potent melanophore stimulation activity of MSH and have indicated that B-endorphin may act as an antagonist to MSH. These studies may be extended to the skin of *Rana pipiens*.

Board 29 EXPERIMENTAL ERROR: ACCURACY AND PRECISION. 1. MYCORRHIZAL FUNGAL INFECTION 2. PLANT HEIGHT. Morteza Javadi, mjavadi@csc.edu, Daniel C. Johnson, Tara M. Jordan, and Angela M. McClain, Columbus State Community College, Biological and Physical Sciences Department, 550 E. Spring St., Columbus OH 43216.

The precision of an experiment can be affected by the number of replications, the selection of treatments, the selection of experimental unit and material, and the quality of technique. An increase in the number of operators may result in a greater variability and error, which may reduce precision. Thus, significant differences among treatment means may be observed. Three undergraduate students at Columbus State Community College conducted field and laboratory experiments in order to test the foregoing hypothesis. A randomized complete block design was chosen for the experiment. The experiment contained four blocks or replications. Students served as the treatments for this experiment. In each block two stems of a dandelion plant (*Taraxacum officinale*) were marked and measured to the nearest tenth of one millimeter. In addition from each block, root samples of crabgrass plants (*Digitaria sanguinalis*) were taken and analyzed by modified Phillips and Hayman staining procedures for mycorrhizal infection of the root cortex. Significant differences were observed for the recorded plant heights and the mycorrhizal fungal infections. The data indicates that the level of precision and the operator's ability affect the results of the experiment.

POSTER SESSION

PRE-COLLEGE STUDENTS

1:30 – 3:00 PM

TOLERTON & HOOD HALL OF SCIENCE

Board 01 THE DETECTION OF LISTERIA MONOCYTOGENES IN COMMON HOUSEHOLD ITEMS. Jonathan. R. Brouse, brouse@clover.net, 875 Kensington Rd., Coshocton OH. (Coshocton High School)

Listeria monocytogenes is a pathogen linked to a life threatening disease, listeriosis, that crossed to humans from animals in 1981. The food industry has a zero tolerance level for *Listeria* since it grows quickly to harmful levels within an hour and a half. Normal growth takes place in 1 to 91 days. *Listeria* is dangerous because it has the unique trait to grow in refrigeration (4C) or highly salted foods (pH 4.4 to 9.6), will survive freezing, and is more heat resistant than *Escherichia*. *Listeria* is aerobic, gram positive, and a non-spore forming bacillus. Tested were conducted specifically for *Listeria monocytogenes*. Method used was catalase, gram staining, and tumbling mobility. Tested items were cow & r'squo's milk, spaghetti, money, fresh water fish tank water, cooked and uncooked food (hot dogs, pheasant, liver, pork, chicken, and beef). Samples were developed through the use of commercial agars of an infusion base of 5% sheep blood agar. The project included 15 trails each repeated three times so that 45 agars were developed, 33 grew colonies, 9 identified as possible *Listeria*. Using the Catalase test, hydrogen peroxide identified gas bubbles (strep Positive) on five trails. Gram staining techniques resulted in two positive trails under magnification. Using the thioglycollate medium and tumbling motility in overnight incubation *Listeria monocytogenes* was identified in spaghetti and milk. Positive trials were repeated three additional times with same results.

Board 02 THE EFFECT OF LEG EXTENSION ON EN FACE TIME DURING A FOUETTE' TURN. Brooke E. Musat, Skibunny3516@aol.com, 3516 Darlington NW, Canton OH 44708. (GlenOak High School)

A *pirouette* is a complete turn of the body on one foot. A *fouette'* turn is repeated *pirouettes* that begin as a normal *pirouette*, but extend the leg to slow down the lower body so the upper body can remain stationary *en face*. *En Face* is simply facing front, or toward the audience. Understanding the effect leg extension has on *en face* time will help to maximize the *en face* portion of the turn and thus increase the drama of the move. It was hypothesized that the percentage of time *en face* during a *fouette'* turn sequence will be greater when the leg is extended the farthest from the axis of rotation during the *en face* portion of the turn. Ninety *fouette'* turns were video taped from overhead. The percent *en face* time was determined using a stopwatch during slow motion playback of the tape. Leg extension was measured by capturing images from the videotape and scaling the photographs. Eighty three percent of the trials supported the hypothesis, the ten percent that did not support the hypothesis were affected by other factors that require further investigation and has errors in measurement that can be reduced by identified improvements in experimental technique. Seven percent of the data was inconclusive. Overall the results support the use of ballet technique that maximizes leg extension to increase the *en face* portion of the *fouette* turn.

Board 03 TOTAL PLATE COUNT OF HETEROTROPHIC MESOPHILIC BACTERIA FOUND IN GROUND BEEF HAMBURGER IN COMMERCIAL OUTLETS IN COSHOCTON, OHIO: A CONTINUATION OF BURGER BUGS. Amy C. Schlegel, dschlegel@coshocton.com, 1900 Atwood Terrace, Coshocton OH 43812. (Coshocton High School)

The objective of this study was to see if there was an elevated total plate count (in colony-forming-units or CFU's) of heterotrophic mesophilic bacteria from seven different beef sources over the course of one year. Four cooked hamburgers from Coshocton, Ohio, fast food restaurants were tested (Burger King, Hardee's, McDonald's and Wendy's). Ground beef sources of Oscar Meyer all beef bologna, Food Club all beef franks, and fresh raw ground beef chuck from Big Bear grocery store were used as well. Samples were maintained at approximately 23 degrees Celsius prior to inoculation on agar plates. Each sample of 11 grams was diluted to a 1:1000 ratio with distilled water on trypticase soy agar plates once a month for one year. The total plate counts were read at 24, 48, 72 and 96 hours. Results indicated that all samples had considerable bacterial growth. For example, Burger King had 30,000 CFU's in January 1999. This number continues throughout the year and in January, 2000 there were 100,000 CFU's. The highest months for all samples were June, July, and October, while the lowest months for all samples were January and February. Out of all of the samples, both hot and cold, Burger King had the highest amount of bacterial growth, and Wendy's had the least amount of bacterial growth. One month of Coshocton County Memorial Hospital test results represented gram negative bacterial growth in all samples including some with *Escherichia coli*.

Board 04 THE EFFECT OF CLINICALLY RELEVANT TEMPERATURE ON THE STIFFNESS OF THERMAL-ACTIVATED SUPERELASTIC NICKEL TITANIUM ARCHWIRES. David B. Pryor, Davidua2003@hotmail.com, 1476 Ardwick Road, Upper Arlington OH 43220-3902. (Upper Arlington High School)

When cold, thermal-activated nickel titanium (NiTi) orthodontic archwires are in the martensitic phase they have less stiffness; whereas, when heated, they change into the austenitic phase and have more stiffness. The effect of the temperatures of cold and hot beverages on the stiffness of thermal NiTi and regular NiTi orthodontic archwires was studied. The hypothesis was that cold temperatures would cause less stiffness and that hot temperatures would cause more stiffness in both wires. Also, that after 30 and 60 minutes at intraoral temperature the initially tested cooled wires would become stiffer and the heated wires would become less stiff. The force to deflect both archwires from 0.0635 mm to 0.8255 mm in 13 intervals of 0.0635 mm each was measured for several conditions and temperatures. The sample size was 36 resulting in a total of 7,488 measurements. The thermal NiTi had less stiffness ($\text{Alpha}=0.05$) over the entire deflection range at 0.57 degrees C than at 37 degrees C and therefore cooling would allow bending to severely malpositioned teeth. Regular NiTi had less stiffness only over a range of 0.2540 mm to 0.8255 mm. Both archwires were also subjected to both 0.57 degrees C and 68.89 degrees C and then tested in a 37 degrees C air chamber (intraoral temperature) initially, after 30, and after 60 minutes. There was no significant difference ($\text{Alpha}=0.05$) in stiffness in either archwire between initial, 30, and 60 minutes and therefore beverage temperature would not effect the archwires= stiffness during orthodontic treatment.

Board 05 THE BIOMECHANICS OF CHORDAL RUPTURE IN THE MITRAL VALVE. Kyra L. Sedransk, kyra298@aol.com, 15830 South Park Blvd., Shaker Heights OH 44120. (Hathaway Brown School)

Rupture of chordae tendineae is a main cause of mitral valve insufficiency, requiring corrective surgery. However the precise mechanisms of chordal rupture are unknown. Normal porcine mitral valves were studied to provide a basis of comparison for the rupture of diseased mitral valve chordae tendineae. Chordae from porcine mitral valves were obtained at slaughter, and the chordae were identified as anterior marginal (n=37), anterior basal (n=22), posterior marginal (n=24), and posterior basal

(n=22). Tissues were weighed, measured, and mechanically tested to failure under uniaxial loading conditions in an Instron. Characteristics of the ruptured ends were assessed under dissecting and polarized light microscopy. Marginal chordae were thinner and less strong than basal chordae. Marginal chordae tended to rupture close to but below the leaflet insertion as did basal chordae that also tore frequently at the leaflet. The tear often extended halfway down the chordae; the torn collagen fibers gave the edge a frayed appearance. In normal mitral valves, pressure across the closed valve is balanced between numerous thin marginal chordae and relatively fewer thick basal chordae. The observed weakness in these posterior marginal chordae may be associated with the high incidence of ruptures in this location in diseased mitral valves.

Board 06 GENDER EQUITY IN THE CLASSROOM. Katerina S. Papacosma, epapacos@kent.edu, 142 Lake Terrace Dr., Munroe Falls OH 44262. (Western Reserve Academy)

This study was designed to examine gender equity in the classroom. Extensive literature review indicated that teachers pay more attention to boys by calling on, praising, or reprimanding them more often than girls. The latter, consistently underrepresented in teacher-student interactions, become underachievers. Based on this research, the hypothesis to be tested was that at Old Trail School in Bath, Ohio, 8th grade boys would receive more attention than girls, thus dominating the classroom activities/interactions and that gender preference/division would occur within those activities. Data for this study were collected through opinion questionnaires and on-site observations from a sample of five teachers, 39 girls, and 32 boys participating in the 8th grade classes of language arts, science, geometry, history and French for a total of 4 weeks in September 1999. The study looked at whether teachers (1) called on, praised, and reprimanded boys more often than girls; (2) expected different standards of work from students; and (3) assigned gender-specific tasks to them. In-depth statistical analysis of the data using the two-tailed t-test indicated that (1) in three of the five classes boys and girls were called on at equal rates regardless of whether they had their hand up or not; (2) in the same three classes, girls received more praise whereas in the other two, boys received more praise; and (3) boys received considerably more reprimands than girls. The questionnaire results supported these findings and revealed that the majority of students and teachers think that boys and girls are equally represented in teacher-student interactions. Finally, no gender preference/division was observed. Based on the above, the hypothesis that boys dominate classroom activities/interactions had to be rejected for three of the classes and accepted only for two of them. On the whole, the 8th grade Old Trail female students should not fear that they are being "shortchanged": by getting opportunities and encouragement equal to those of the boys, the girls are given the tools necessary for whatever achievement and career options they may choose.

Board 07 EFFECTS OF COMMERCIAL DE-ICER PRODUCTS ON VEGETATION AND SOIL. Tricia M. Yerardi, ty2002@excite.com, 124 Rinkliff Lane, Chillicothe OH 45601. (Unioto High School)

Ice removal is difficult, thus leading to the use of de-icers. However, there may be adverse effects on vegetation and soil. This study explored the effects of repetitive de-icer usage on seed germination, plant growth, root formation, and soil nutrients. Concentrations of 10% and 25% solutions of 4 different commercial de-icers were used for 10 days. Tap water was a control. Hypotheses were: (1) Seeds receiving water and 10% solutions would germinate; (2) Plants receiving water and 10% solutions would increase in height and number of leaves; (3) Ivy sprigs placed in water and 10% solutions would develop root growth, and (4) Soil nutrients in all solutions would decrease compared to control sample of topsoil. Solutions were tap water, Prestone Windshield De-Icer Washer Fluid (PWDWF), Prestone Driveway Heat (PDH), Scotwood Industries Road Runner Ice Melt (SWIRRIM), and Diamond Crystal Salt (DCS). Soil composition was measured as cation exchange capacity (CEC). Higher CEC levels indicate increased soil nutrient sources. Results were: (1) Seeds germinated in water and 10% and 25% PWDWF solutions; (2) Water and 10% PDH retained the same number of leaves; all other solutions decreased the number of leaves. All treatments caused a decrease in height except water and 10% PWDWF which increased height; (3) All solutions allowed sprouting of roots, and (4) The CEC decreased with water, 10% and 25% PWDWF, and 10% and 25% DCS. The CEC increased with 10% and 25% PDH, and 10% and 25% SWIRRIM. This project found the least damaging product was also the most economical, SWIRRIM. De-icers should be used in the smallest amounts possible for the smallest periods of time. Plants that are tolerant of de-icers should be planted in areas of de-icer usage.

Board 08 AN EXPLORATION OF ELECTROMAGNETIC MASS ACCELERATION. Mathew J. Beck, wsjb@msn.com, 6726 Shull Road, Huber Heights OH 45424. (Wayne High School)

Can electromagnetic energy in a coil be transferred to a metallic projectile with enough force to propel the projectile from the core? How will the addition of a second electromagnet affect the velocity of the projectile? An electromagnetic accelerator was designed to be strong enough to propel a metallic projectile. The addition of a second electromagnet is expected to increase the velocity of the projectile. The electromagnetic accelerator that was discussed has 300 wraps of 32 gauge wire over a length of 1/2 inch and a 1/4 inch diameter. The power source is two lantern (6 volt)

batteries which charge the circuit from a disposable camera. Although small, the high voltage capacitor in the circuit provides the energy necessary to fire the projectile (a small ball bearing). The "barrel" of the accelerator is a drinking straw. The electromagnetic accelerator is built upon a stable, level base and has a timing device with a remote switch. Carbon paper was used over graph paper as the target. The electromagnetic accelerator was strong enough to propel the projectile. Velocities were determined by the travel time of the projectile over a constant distance. The first coil produced velocities ranging from 8-13 m/s during the course of 1,000 plus trials. The addition of a second coil increased the velocity of the projectile. The second coil produced velocities that were 7-9 m/s faster than the velocities with just one coil. There were 500 plus trials conducted with the second coil.

Board 09 HOW LAUNCH SITE WIND AFFECTS THE DYNAMIC CENTER OF PRESSURE OF A MODEL ROCKET. Jennifer A. Cornett, jil_cornett@hotmail.com, 4790 Carters Corner Road, Sunbury OH 43074. (Big Walnut High School)

The purpose of this project was to determine how wind speed affects the stability of a model rocket, specifically the dynamic Center of Pressure (CP). The hypothesis was that the CP moves forward as the speed of the crosswind increases (as the angle of attack increases). It was also expected that the stable designed rocket would have a higher angular stability margin thus making it more stable at higher wind speeds than the neutral and unstable designed rockets. The approach was to use a wind tunnel to determine the angle of attack where the rocket would become unstable, at various pivot points representing the dynamic CP as it moved forward. Three trials were run for each of the three rockets. The angle of attack values were plotted against the dynamic CP position in relation to the predicted CP and the real Center of Gravity (CG). For the stable designed rocket the average angle of attack ranged from 20 to 55 degrees, while the neutral design ranged 10 to 46 degrees and the unstable design ranged 15 to 40 degrees. The angle of attack when the CG and dynamic CP become equal represents the maximum angular stability or the angle of attack where the rocket becomes unstable in free flight. The maximum angular stability was found to be 43.3 degrees for the stable design, 10.2 degrees for the neutral design, and no value obtained for the unstable design as expected. With the maximum angular stability known, the maximum allowable wind speed can be calculated for a given rocket velocity for each rocket design. Both parts of the hypothesis were correct. The dynamic CP moves forward as the angle of attack increases, which increases as the wind speed increases for a given rocket velocity. As expected, the stable designed rocket had a much larger angular stability margin than the neutral and unstable designed rockets.

Board 10 A COMPARISON OF THE CENTRAL PROCESSING SPEEDS IN SENIOR CITIZENS AND HIGH SCHOOL STUDENTS. Kathryn A. Lawton, Lawtonerk@aol.com, 2745 Wickliffe Rd., Columbus OH 43221. (Upper Arlington High School)

The popular myth that the performance of senior citizens automatically deteriorates with age is questionable. Other variables beside age may be involved, such as the Central Processing Speed of the brain. This myth was tested using sixty high school students and fifty-two senior citizens to determine if a significant difference could be seen between two different age groups regarding Central Processing Speed. The Trail-Making Test was used to measure a subject's Central Processing Speed. It was hypothesized that high school subjects would have a significantly better Trail-Making score than senior citizens. Each subject was asked to perform parts A and B of the Trail-Making Test and were then asked to answer a questionnaire about other factors that may have influenced their score. T-test results showed high school students performed significantly better on parts A and B of the Trail-Making Test than senior citizens did. The actual T-test scores showed the groups to be statistically different using a 0.05 test criteria. Calculated probability values for the T-tests indicated the probability of the T-score occurring by chance to be less than 0.0001. Chi-Square test results showed other factors, such as gender, stress, and eating, were not related to a subject's Trail-Making score. Thus, the Trail-Making Test can be considered a good test because it was not influenced by outside factors. The test results suggest that Central Processing Speed declines with age. However, it does not say that accuracy declines with age as all subjects in the experiment, high school students and senior citizens, were required to be completely accurate in the line drawing they completed for the Trail-Making Test.

Board 11 IS THE RIGHT WAY LEFT? A STUDY OF AUDITORY PROCESSING AND HANDEDNESS. Christine A. Lewis, 03Clewis@BeaumontSchool.org, 7451 Briar Hill Dr., Kirtland OH 44094. (Beaumont School)

The goal of this project was to determine if right and left-handers differ in processing auditory information. The hypothesis was that both right and left-handed people would show a right ear advantage when processing verbal information because most individuals show a left cerebral hemisphere dominance for language. However, left-handers would not demonstrate as strong a right ear advantage, because left-handers may not be as strongly lateralized for language as right-handers. Nineteen right handed subjects and ten left handed subjects, ages 12 to 50 years of age (median age 15), were administered a handedness survey to verify the subjects preferred hand. All subjects had normal hearing bilaterally. A dichotic listening test

was employed to determine ear advantage. A different word was presented to each ear at the exact same time. The word heard first and most clearly was reported by the subject. Results showed that although both right and left handed subjects showed a right ear advantage, right-handed subjects showed a stronger right ear advantage with 57.7% of the words reported in the right ear and 29% in the left ear. Left-handed participants did not demonstrate as strong a right ear advantage with 44.8% of words report in the right ear and 40.9% in the left ear. These results suggest that left and right-handed individuals may differ in how language is processed. Such differences may have implications for working with stroke patients who have lost language or with learning disabled students.

Board 12 IT'S ESSENTIAL: DISSOLVED OXYGEN IN WATER. Stephanie Louise Brouse, brouse@clover.net, 875 Kensington Rd., Coshocton OH 43812. (Coshocton High School)

The hydrologic cycle shows water is vital to keep nature in balance. The water that runs off of farmlands or water from treatment plants will enter the river. Bacteria can enter the water system through pollutants, which contain contaminants from solid waste. Dissolved Oxygen (DO) affects the growth of bacteria and is an essential part in the renewal process of water. The purpose of this study was to see how effective the local water treatment plant was at removing bacteria from the treated water. Recycled sewage water was tested using the Biological Oxygen Demand test. The project examined the efficiency of the wastewater treatment process by testing wastewater before and after treatment. The testing period was 180 days. Time of year will effect the DO level. July test results range from 5.7 to 5.9. December DO test results ranged from 8.0 to 8.7. It was observations that water temperature, water pH and bacteria count can affect the amount of Dissolved Oxygen present in the water. It was concluded the local waste water treatment plant had between a 93 to 98 percent efficiency rate. The calculation used for the biological oxygen demand was BOD, (mg/l) = D1-D2 / P where D1 represents dissolved oxygen before, D2 represents the dissolved oxygen after testing and P = decimal fraction of sample used.

Board 13 THE PURIFICATION OF VASOPRESSIN V1 RECEPTOR FRAGMENTS. Aurélie F. Thibonnier, Aelia628@hotmail.com, 160 Valencia Circle, Chagrin Falls OH 44022-1562. (Hathaway Brown School)

Arginine vasopressin (AVP) is an antidiuretic hormone involved in numerous physiological functions including the regulation of body fluid osmolality, blood volume, vascular tone, blood pressure, cell proliferation, and adrenocorticotropic hormone (ACTH) release. There are many disorders associated with excessive Vasopressin secretion or lack thereof. Examples include hyponatraemia, syndrome of inappropriate secretion of AVP (SIADH), blood pressure elevation, congestive heart failure (CHF) and liver cirrhosis. The treatments currently available for these disorders, however, are nonspecific and inefficient. Molecular models allow researchers to study the interaction between Vasopressin receptors and their antagonists. This increased knowledge will lead to the engineering of more efficient and potent medications designed to cure specific Vasopressin disorders. In addition, newer and more precise medications might reduce the unwanted and potentially harmful side effects that accompany current drugs. In this experiment, one of the three subtypes of AVP receptors, V1 vascular AVP receptor (V1R), was studied. The main function of this receptor is vasoconstriction and cell proliferation. The goal of this experiment was to purify the BamH1 V_{6H} fragment of V1R. The experiment began with the digesting and purifying of the cDNA, which contained the AVP receptor insert. The cDNA BamH1 V_{6H} fragment was then inserted into a pMAL c2x expression vector, which had already been digested with the same restriction site enzyme and then purified. Next, E. coli cells were electroporated with the pMAL c2x expression vectors and then microgram amounts of plasmid DNA BamH1 V_{6H} pMAL c2x vectors were purified. The vectors were then induced on a large-scale with the enzyme IPTG. Finally, the AVP receptor with the 6H antibody was immunoblotted and photographed. The purification was successfully completed establishing an integral step in achieving the ultimate goal, molecular modeling of vasopressin receptors.

Board 14 A COMPARATIVE STUDY OF THREE BRANDS OF MASTITIS PREVENTION PRODUCTS. Joshua M. Penhorwood, Pwood02@yahoo.com, 27900 Newton Perkins Rd., West Mansfield OH 43358. (Benjamin Logan High School)

Mastitis cost the United States dairy farmers \$2 to \$4 billion dollars each year, which is why it is important to have a good, sound mastitis management program. The purpose of this project was to determine which of the three brands of mastitis prevention products (Bio-Dry, Dry-Clox and Quartermaster) most effectively prevented mastitis. Dry-Clox was expected to work the best. At time of drying off each bovine was milked as normal being sure to take out all milk. Each teat was then cleaned with an alcohol pad. The contents of the prepackaged syringe containing Bio-Dry, Dry-Clox or Quartermaster were injected into each quarter. The teat duct was then sealed with stronghold teat sealant by dipping each teat into cup filled with sealant. Seventy bovine were treated and 54 bovine freshened and began lactating 55-60 days after drying them off. After bovines began lactation the somatic cell count was taken by the certified milk tester and recorded. The somatic cell counts of each bovine were then looked at for the first three months of the following lactation for a somatic cell count that indicated mastitis (a somatic cell count over 750,000 indicated mastitis). Results show Bio-Dry with a 23% rate of mastitis among the bovine it was used to treat, Dry-Clox with a 21% rate of mastitis and Quartermaster with a 12.5% rate of mastitis, indicating that Quartermaster was the best treatment.

Board 15 THE EFFECT OF PERFLUOROCARBONS ON *DAPHNIA MAGNA*. Kirsten E. Hansen, smiles2u@gurmail.com, 3698 Glencairn Road, Shaker Heights OH 44122. (Beaumont High School)

What is the oxygen capacity of perfluorocarbons in water solutions at a constant temperature? How are stressed *Daphnia magna* affected by perfluorocarbons? The purpose of answering these questions is to find a correlation between the reduction of physical stress for humans and *Daphnia magna* when using perfluorocarbons. It is expected that the *Daphnia magna* in perfluorocarbons will withstand stressors better than those without a readily available oxygen supply. To research this, two single variable experiments were designed. In the first experiment, six tubes of varying percentages of perfluorocarbons were tested for oxygen concentration levels. The results showed that as the percentage of perfluorocarbon in the solution increased, the solution's ability to retain oxygen increased. In the second experiment, sixteen *Daphnia magna* were assigned to four different groups in petri dishes. Each *Daphnia magna*'s heart rate was recorded. Then, the first control group was exposed to room air while in culture jar water, and the second control group was exposed to room air while in a perfluorocarbon solution. The first experimental group was exposed to an inhalant, nail polish remover, while in water and the second experimental group was exposed to the same inhalant while in a perfluorocarbon solution. Heart rates were recorded. Three-fourths of the *Daphnia magna* exposed to the inhalant while in water died. Not one from the other three groups died. Maximum heart rate deviation and percent change showed that the presence of perfluorocarbons around a *Daphnia magna* increases its longevity ($p=0.014$). However, it does not minimize the stress from the inhalants.

Board 16 COMPUTER MODEL TO PREDICT PUCK VELOCITY OF A HOCKEY SLAP SHOT. William C. Musat, Rider3516@aol.com, 3516 Darlington NW, Canton OH 44708. (Pleasant View School for the Arts)

A hockey slap shot consists of a long fast swing and hitting the playing surface behind the puck, which makes the stick snap and gives the puck additional velocity. The hockey slap shot is most often used to create high puck velocity. This investigation created a computer model to predict puck velocity so the optimum combination of variables to obtain the maximum puck velocity could be found. A gravity-powered machine was designed and built to shoot the slap shots. The machine could vary stick flexibility, swing momentum, puck position, and stick path. Over one thousand tests were run where a radar gun measured the puck velocity. Puck velocity's ranged from thirty-one to forty-two km/h. The data were analyzed using graphical analysis and a computer model was built based on the experimental data. The model predicts puck velocity with a four percent average error for combinations of puck placement and stick path. There is an ideal puck placement between fifty and one hundred and thirty millimeters behind the axis of rotation for each particular stick path. Varying from the ideal puck placement can result in as much of a seven-km/h decrease in puck velocity. Results show that the stick hitting the surface between fifty and one hundred millimeters behind the axis of rotation results in the highest puck velocity and greater amounts result in as much as an eight-km/h decrease in the puck velocity.

Board 17 HOW DOES BRAND OF FILM AND FILM SPEED AFFECT THE GRAIN IN PICTURES? Katrina A. Nicholl, soccerjock9@hotmail.com, 315 S. Detroit St., Bellefontaine OH 43311. (Bellefontaine High School)

Kodak Gold, Kodak Royal Gold, Fuji Super G Plus & Polaroid films were used in 100, 200, 400 ISO's, Kodak Gold 800 ISO, Fuji 800 ISO, Kodak Royal Gold 1000 ISO and Fuji 1600 ISO were used to test faster speed Still life's of soccer equipment and Looney Tune cartoon models were set up using fabric for the background. Pictures were taken of each display at different exposures. The film was developed at a professional lab and the pictures were labeled so it would be known what brand and speed of film was used for the particular picture. The best example was chosen from each speed and brand to print a 5x7 or 8x10 at a professional lab. Then from the same negative an 8x10 section was printed from a 20x24 enlargement, to make the grain more visible. Again, they were labeled as printed so they wouldn't be mixed up. All pictures were then put into file pages and compared by looking at them with a loupe, to choose the smallest to the largest grain. It was also determined which brand had the largest or smallest grain overall. Kodak Royal Gold 100 had the smallest grain. Kodak Royal Gold was 1st in eight of 10 tests. Fuji Super G Plus was 2nd in 7 of the 10 test, while Kodak Gold was 3rd and Polaroid 4th overall.

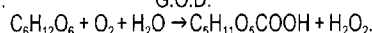
Board 18 ANTIMICROBIAL EFFECT OF LYSOZYME *IN VITRO*. Eric S. Steichen, steichene@aol.com, 2735 Baker Place, Cincinnati OH 45206-1820. (Seven Hills School)

Healthy lungs are remarkably sterile despite multitudinous microbial particles in inhaled air. This is due to a number of lung and airway antimicrobial factors, lysozyme being one of the most abundant. Mice genetically altered to overexpress airway lysozyme have enhanced bacterial clearance following acute intratracheal infection. The question is whether increased lysozyme levels in airway and lung fluids exert antibacterial activity (ABA) independent of cellular factors present in the lungs *in vivo*.

The hypothesis was that bronchoalveolar and airway lavage fluid (BALF) lysozyme would exert direct ABA. To this effect, the change in chemiluminescence was measured from *E. coli* with pCGLS1 plasmid (gene for spontaneous chemiluminescence: emission of UV light) following incubation with BALF as an indicator of ABA of BALF from lysozyme overexpressing mice and wild-type mice. Test samples using chicken eggwhite lysozyme and vehicle (potassium phosphate buffer) were also run. Chemiluminescence was consistently lower (i.e. ABA higher) in overexpressing BALF vs. wild-type BALF, in both undiluted (1X) BALF and BALF diluted ten times (10X). Chemiluminescence in 1X wild-type BALF versus 1X overexpressing BALF was 45.829 vs. 40.296 respectively ($p= .062$). Chemiluminescence in 10X wild-type BALF vs. 10X overexpressing BALF was 36.629 vs. 22.555 ($p= .070$). In conclusion, lysozyme exerts direct ABA *in vitro* (although not statistically significant difference); thus, the increased ABA observed in the lungs of lysozyme overexpressing mice is partly due to a direct lysozyme effect independent of other cellular factors. This research may lead to using lysozyme therapeutically to boost airway ABA in diseased or infected lungs.

Board 19 DEVELOPING A MICROSENSOR ARRAY FOR THE MONITORING OF GLUCOSE AND KETONE LEVELS IN DIABETICS. Kristin L. Butler, cmco@aol.com, 19333 Van Aken Blvd. #108, Shaker Heights OH 44122. (Hathaway Brown School)

This research focused on the development of an array of microsensors to aid diabetics in the strife they face in caring for themselves. For diabetic management it is desirable to monitor both blood glucose and ketone levels (found in Type 1 diabetes). Three phases were planned, each of which focused on a different aspect of diabetic management. The first phase involved the fabrication and testing of a cost-effective and accurate glucose sensor, followed by a ketone sensor in the second phase, and concluded by an insulin infusion system as the third phase. The first phase was in progress at the time of submission, and it was based on the hypothesis that an enzyme catalyst sensor can be used to measure the amount of glucose by detecting the production of hydrogen peroxide. This sensor was fabricated using thick film printing technology. The sensor was designed using AutoCAD and was printed onto an alumina substrate by the silk-screening printing method. The sensor contained three electrodes; an anode, a cathode, and a reference electrode. Both anode and cathode were platinum and the reference electrode was silver-silver chloride. Glucose oxidase was immobilized onto the surface of the sensor using protein cross-linking with glutaraldehyde. This enzyme catalyst sensor can be used to measure the amount of glucose by detecting the production of hydrogen peroxide, according to the following reaction:



Testing has affirmed that the methods of detection do work. Glucose was detected in three different solutions of de-ionized water with varied concentrations of 50 mg/dl, 150 mg/dl, and 250 mg/dl. The relationship observed between the data was linear, and correlation coefficients were between .94 and .99. Testing will now continue to observe how various atmospheric changes such as temperature change results.

Board 20 THE EFFECTS OF *IN VITRO* STRESS ON THE MORPHOLOGY OF *CANDIDA ALBICANS*. Timothy A. Cook, TCook2002@aol.com, 8671 St. Rt. 7, Proctorville OH 45669. (Fairland High School)

Many organisms are known to exhibit morphological changes when subjected to stress. *Candida albicans*, a deuteromycete, is known to have two forms. The first of these, the blastospore, is prevalent in temperatures below 37° C. The second, the hyphal form, is usually seen only above 37° C. The main goal of this study was to determine morphological changes brought about from changes in pH and povidone iodine (PVP-I) stressors on *C. albicans*. Cells were incubated at pH levels 6.3, 7.3, and 8.3 in both 25° C and 37° C. A minimal salts broth (MSB) was used to subject the microorganisms to starvation. Weekly plate counts were made to determine how cell numbers changed over time. Weekly minimal lethal concentration (MLC) tests were performed using 5% PVP-I. Cells from the tube representing the highest tolerated concentration of PVP-I were stained with FUN-1 Yeast Viability Stain and Calcofluor White M2R, then viewed using laser scanning confocal microscopy. Data from the viable plate count tests concurred with the viability data from the FUN-1 stain. Morphology analysis showed total germination at 37° C and some germination at 25° C under slightly acidic conditions in PVP-I. In slightly alkaline conditions in PVP-I, the organism exhibited much lower colony numbers and tended to favor a hyphal state only when above 37° C. The effect of PVP-I at different pH and temperature levels on protein profiles is currently being investigated with the use of SDS gel electrophoresis to determine the activation of heat-shock proteins in *C. albicans*.

Board 21 DEGRADATION OF PROCESSED PAPER BY SWINE MANURE. Jared B. Steed, stoneyfarm@msn.com, 5979 Radnor Rd., Radnor OH 43066. (Buckeye Valley Middle School)

Discarded paper and paper products are a major problem in our modern society. Seventy-five million tons of paper is produced each year. Of this, 22,500,000 tons (30%) cannot be recycled because it has a thin layer of clay covering it. This type of paper is better known as glossy or processed paper. The layer of clay allows for sharper colored images in the printing process. This coating causes the paper to produce more clay than paper fibers when it is depulped. The use of recycled paper

as an alternative bedding material for farm animals is becoming widely accepted. Newsprint absorbs more water than peanut shells, straw or sawdust. The object of this study was to determine if swine manure aids in the decomposition of processed paper. Glossy, processed paper was cut into 2" x 2" squares and weighed. Each treatment was placed in a 250 ml sterile Erlenmeyer flask. Each flask received one of the following treatments along with 30 ml. of sterile water: paper, sterile manure, manure, sterile manure with paper and manure with paper. These were incubated at 28 C at 100rpm on a rotating shaker table for 48 hours. Each solution was run through 1/2" 1/4" 1/8" mesh to determine the degree of degradation. The dried residues on each mesh and filtrate were expressed as percent of weight of ingredients added. The water degraded the paper by 8% as compared to 77% degradation with the autoclaved manure. The greatest amount of degradation was 86% by the untreated manure. The conclusion from this study is that processed paper will be degraded when mixed with swine manure.

Board 22 WILL YEAR LONG WATER SAMPLING OF A DENTAL CAST GRINDING DEVICE ALLOW FOR INCREASED QUANTITIES OF BIOFILM BUILDUP AS EVIDENCED BY HETEROTROPHIC MESOPHILIC BACTERIA THROUGHOUT DIFFERENT POINTS OF DISTRIBUTION. Erin F. Schlegel, dschlegel@coshocton.com, 1900 Atwood Terrace, Coshocton OH 43812. (Coshocton High School)

Different points of water distribution in a dental cast grinding appliance (including control, output, aerosol, plaster trap) were sampled at monthly intervals throughout the course of one year. Millipore HPC samplers served as the media on which heterotrophic mesophilic bacteria (in colony-forming-units per milliliter) were identified. Additionally, tuberculocidal Lysol I. C. was released into the lines 2 to 3 minutes before and after operation of the appliance. The aerosol tests yielded increasing quantities of microorganisms. For example, 200 CFU's for aerosol were found in the first month of testing. This number dropped to 2 CFU's after a month of disinfecting with gluteraldehyde. Eventually the number of microorganisms went to 600 CFU's within 6 months. This suggests progressive resistance to the disinfecting agent. The possibility for dormancy periods in the debris-laden plaster trap and the capacity for retrograding (between input and output settings) were also discussed. The compilation of these seasonal trends supports the probability of biofilms serving as vectors in the infectious-disease causing process.

Board 23 ENHANCING SOYBEAN RESISTANCE TO THE MEXICAN BEAN BEETLE. Aaron L. Iverson, aaroniverson@yahoo.com, 2740 Buttermilk Hill Rd., Radnor OH 43066. (Buckeye Valley High School)

In response to a stress, a plant establishes a defensive resistance characterized by the accumulation of several defensive proteins. This experiment incorporated a general bioassay testing this induced resistance in soybean plants. Under chemical induction, the effects of salicylic acid (SA) and jasmonic acid (JA) on the defensive pathway of soybeans were studied. Under physical induction, the effects of plants stressed with previous herbivory and the establishment of a systemic acquired resistance (SAR) were studied. A preference test and a larval antibiosis screening technique (LAST) were performed to monitor the effects of defensive resistance in soybeans. The preference test, quantified by percent consumption, used adult Mexican bean beetles (MBB) while the LAST assessment used MBB larvae. Results from the LAST assessment showed evidence of both physical and chemical induction. JA, the end product of the defensive pathway and the signal of a plant which stimulates a defensive response to a stress, apparently increased the defensive mechanisms of plants when applied exogenously and larval damage was less than that of the controls (larval mortality: 96% JA, 48% controls). In contrast, plants treated with SA had less resistance to the larvae (larval mortality: 44% SA, 48% controls), as SA blocks a critical enzyme in the defense pathway, indirectly blocking the production of JA. SAR was apparently established in previously-eaten plants and they, consequently, had a greater defense towards the larvae than did the controls (larval mortality: 96% prev. eaten, 56% controls). The use of induced resistance may provide a means to enhance the natural resistance of soybeans to pests.

Board 24 THE DESIGN AND DEVELOPMENT OF A MICRO-ELECTROCHEMICAL SENSOR AND PLATING SYSTEM TO DETECT AND REMOVE CADMIUM, COPPER, LEAD, NICKEL, IRON, AND ZINC FROM WATER. Elina Onitskansky, Elina514@yahoo.com, Haverford Dr., Lyndhurst OH 44124-2712. (Hathaway Brown High School)

Research was done to create a micro-electrochemical sensor usable as an efficient, cost-effective and real-time method for monitoring and removing cadmium, copper, iron, lead, nickel, and zinc, which are toxic and common ions, from streams and effluents. The sensor, designed with different electrode shapes and areas in AutoCAD, was printed using thick-film technology onto alumina (Al₂O₃). Electrode materials were platinum, silver and carbon. Sensors were evaluated using cyclic voltammetry on a CH-660A Electrochemical Workstation. Based on the Gibbs free energy principle, electrochemical oxidation and reduction of the metal ions occurred at specific potentials. Metal ion concentrations exhibited a linear relationship to current output at specific voltage potentials. The best sensor configuration, one whose experimental data gave the most linear results coupled with the largest slope value in a linear regression treatment, was chosen. A circular design with internal working-

electrodes is optimal. Potential interference between metal ions was investigated, mathematically determined, and the ion evaluation order for final testing was decided. The temperature effect on sensor performance was assessed. Experimentation and design changes yielded a sensor that could detect as low as 0.05 ppm of each ion, which encompasses the EPA detection values for most of the ions. The voltage range for detection is between -1.6 to 0.4 V. A constant current, determined using the Faraday equation, was applied to electrodes with reversed polarities, to electroplate the metal ions from the solution. The plating system's effectiveness was determined by evaluating the concentration changes of metal ions before and after the electroplating.

Board 25 A STUDY OF THE BEHAVIOR IN CAPTIVITY OF THE SAGUINUS OEDIPUS GEOFFROYI. Rachael A. Petro, 01rpetro@beaumontschool.org, 9425 Airlane Dr., Macedonia OH 44056. (Beaumont High School)

The tamarin, a small, arboreal creature of which there are approximately 21 known species, originates in northern South America. Tamarins can often be found in captive situations of all kinds. The purpose of this project was to determine if there would be a distinct difference between the tamarins' behaviors in two captive environments: a traditional primate house, and a more naturalistic rainforest environment. It was hypothesized that although there would be a difference, neither environment would truly be conducive to natural behavior. Procedures necessitated a zoo facility where *Saguinus oedipus geoffroyi*, a popular species of tamarin, could be observed in two different captive environments. An ethogram that identified studied behaviors was prepared; these behaviors included feeding, locomotion, and visual and social behaviors. One-hour observation sessions were repeated four times for each environment; every minute during each observation hour, the individuals' behaviors were visually scanned and the proper behavioral code from my ethogram was manually recorded. Detailed environmental descriptions were noted. From the data collected, the significant differences in the Geoffroy's tamarins' behaviors in the two environments (primate house and rainforest) were obvious, both numerically and graphically. A chi-square statistical test produced a statistical value high above the critical value (p value < .01, critical value = 26.22, value obtained = 647149.35). Consequently, the tamarins' behavioral differences were deemed significant. In conclusion, both initial hypotheses were supported. The differences observed in this project, as well as the behavioral variance from nature in both environments, emphasize the importance of the study of animal behavior in order to determine what is most beneficial to animals in captivity.

Board 26 ISOLATION AND CHARACTERIZATION OF NITROGEN-FIXING BACTERIA. Tian Zhang, tianzhang@hotmail.com, 1547 Conneaut Ave., Bowling Green OH 43402. (Bowling Green High School)

Nitrogen fixation is of fundamental importance in the biosphere. In nature, this occurs via the biological nitrogen fixation reaction. A small but diverse group of diazotrophic microorganisms is able to fix atmospheric nitrogen. The main goal of this study is to characterize diazotrophic microorganisms from aquatic samples isolated from ponds around Bowling Green State University, Wood County, Ohio. It was hypothesized that the water would be proficient in diazotrophic organisms. Water samples of about 5mL were collected from 4 different locations and incubated for 7 days in nutrient media lacking a nitrogen source. Nine single colonies, effective in N₂-fixation, were isolated on Burk's nitrogen-free agar plates. As an initial identification process, the morphology of these isolated microorganisms was then investigated using scanning electron microscopy. Because most N₂-fixing microorganisms have the enzyme system of nitrogenase encoded by the *nifH* gene, this DNA sequence has been examined. To do this, PCR amplification of corresponding DNA using highly conserved oligonucleotide primers has been utilized and the resulting segments subjected to partial sequence analysis. The microorganisms' *nifH* sequence was verified against that of *Azotobacter vinelandii*, matching 99.3%, from the 140th base pair to the 280th base pair. However, possible mutations are still being investigated.

Board 27 THE EFFECTS OF GIBBERELIC ACID ON THE PEROXIDASE ACTIVITY OF THE ARABIDOPSIS THALIANA. Marianne K. Torontali, Mtorontali@hotmail.com, 2199 Barrington Rd., University Heights OH 44118. (Beaumont School)

How does gibberellic acid affect the peroxidase activity of the *Arabidopsis thaliana*. This experiment hypothesized that gibberellic acid will cause a decrease in the peroxidase activity of the *Arabidopsis thaliana*. *Arabidopsis* is a type of mustard plant that completes its life cycle within approximately 45 days. Gibberellic is a growth hormone that has a large regulatory role in plant growth. Peroxidase activity is more commonly known as the plant's defense system. The beginning of the experiment included the controls: distilled water, a constant source of fluorescent light, and four quads of the *Arabidopsis* plants. After three weeks of growth, gibberellic acid was applied daily for one week, using three different concentrations (100.0%, 90%, and 80%). Afterward, they were left to continue growth for one week. The peroxidase activity was analyzed by dot blots, which are constructed by using liquid plant extracts, nitrocellulose membrane, and different peroxidase protein standards. To further analyze this, a gel test was run by inserting the liquid plant extracts and the peroxidase protein standards into an agarose gel. This isolated the peroxidase isoenzymes present. Results prove that gibberellic acid, when applied, does cause a decrease in peroxidase in the *Arabidopsis thaliana*.

**POSTER SESSION
BIOLOGICAL SCIENCES**

3:00 – 4:00 PM

TOLERTON & HOOD HALL OF SCIENCE

Board 01 A STUDY OF THE DIET AND GROWTH RATE OF SILVER CHUB, *MACRHYBOPSIS STORERIANA*, IN THE WESTERN BASIN OF LAKE ERIE. Sheri D. Klingensmith, jewel2378@yahoo.com, (Nicholas E. Mandrak, nmandrak@cc.ysu.edu), Youngstown State University, One University Plaza, Youngstown OH 44555.

The once abundant Lake Erie population of Silver Chub, *Macrhybopsis storeriana*, suddenly began to disappear in the 1960's, almost to the point of extirpation. However, the abundance of Silver Chub in the western basin of Lake Erie has recently increased. Preliminary data suggest that their reemergence may be related to the increased numbers of *Hexagenia* mayflies. It is believed that *Hexagenia* has returned to the western basin as a result of cleaner, well-oxygenated water and sediments. We hypothesize that the reemergence of Silver Chub is a result of the increased numbers of *Hexagenia* in Lake Erie. To test this hypothesis, the growth rates and diets of Silver Chub netted in the western basin of Lake Erie in 2000 are being compared to those Silver Chub studied by Edward Coyle Kinney in the 1950's before their disappearance. According to Kinney's data, *Hexagenia* comprised 51.1% of the adult diets in the months of August and September. To determine if the diet of the Silver Chub has changed since the 1950's gut content analysis is being performed on specimens collected in August and September of 2000. Initial observations indicate that Silver Chub are consuming higher amounts of zebra mussel, *Dreissena polymorpha*, than *Hexagenia*.

Board 02 PRESENT STATUS OF THE UPPER LITTLE MIAMI RIVER FISH FAUNA. Ted M. Cavender, cavender.1@osu.edu, Matt J. Greene, Marc R. Kibbey, The Ohio State University, Museum of Biological Diversity, 1315 Kinnear Rd., Columbus OH 43212-1192.

One of Ohio's finest rivers, the Little Miami, drains a 1755 sq. mi. (4500 sq. km.) area in southwestern Ohio. It is Ohio's first designated state and federal Wild and Scenic River that holds about 70% of the native fish species found living in state waters. The upper portion of the drainage (17% of the total drainage area) lies in Greene and Clark Counties and extends north of a line formed by southern Xenia Township. Massies Creek and Beaver Creek are included in this headwater system. A total of 58 fish collections were made within the upper drainage with the purpose of determining the present status of the fish populations. Funding was provided by the Division of Wildlife Ohio Wildlife Diversity Program. ODNR-DOW District 5 cooperated with personnel and equipment to assist in collecting many of the sites. All sites where fish were previously collected (historical sites) were sampled during this project. Of the nearly 80 species previously recorded for the upper drainage, only 50 were located, or about 63% of the original fauna. The threatened tonguebit minnow was among the missing species. The upper watershed is largely agricultural with very few municipalities that discharge into the river. Intensive row crop agriculture with accompanying surface runoff has impacted the headwater system. Most changes to the fish fauna occurred over a period of about forty years following a survey completed in 1957. New additions to the Little Miami fauna made by this study consisted of introduced species rather than native forms. For example, the northern sturgeon, *Fundulus catenatus*, was found at 12 collection sites in the Little Miami River and its tributaries of Xenia Township. This species has now firmly established itself in the drainage and is currently expanding its range.

Board 03 CONTROL MECHANISMS OF SYLLEPTIC BRANCHING IN *POPULUS*. Dong-II Kim, kim.950@osu.edu, (Morris G. Cline, cline.5@osu.edu), The Ohio State University Plant Biology Department, 1735 Neil Ave., Columbus OH 43210.

The axillary buds of woody plants do not grow out during the season in which they are formed. They flush in the following spring. However, in *Populus* and in many tropical species, some axillary buds grow out sylleptically, i.e., they grow out during the same season in which they are formed. This type of branching enhances photosynthetic leaf area and total tree growth. The cause of sylleptic branching is unknown. The long-range goal of this study is to elucidate the control mechanisms of sylleptic branching. Presently, attempts are being made to determine the cause and effect relationship between the growth of the parent shoot and the amount of sylleptic branching. Three hybrid clones (11-11, 47-174, and 49-177) of *P. trichocarpa* (Black cottonwood) x *P. deltoides* (Eastern cottonwood) with contrasting degrees of sylleptic branching are being studied. The rate of growth of the parent shoot and amount of sylleptic branching are measured periodically. Preliminary data shows that the fastest growing clone (47-174) has a low amount of sylleptic branching and the slowest growing clone (11-11) has a greater amount of sylleptic branching. This result indicates that an inverse relationship exists between the growth rate of parent shoot and the degree of sylleptic branching. Hormonal and nutritional factors which probably play a role in this response will be investigated.

Board 04 FOOD LIMITATION AS AN INFLUENCE ON THE POPULATION DYNAMICS AND DEMOGRAPHY OF *MICROTUS PENNSYLVANICUS* POPULATIONS LIVING IN A HIGHLY DISTURBED HABITAT. John W. Doudna, jdoudna@muskingum.edu, Christopher D. Bodnar, Christina R. Wampler, (James L. Dooley Jr., jdooley@muskingum.edu), Muskingum College, 163 Stormont St., New Concord OH 43762.

We are comparing population dynamics and demography of meadow vole (*Microtus pennsylvanicus*) populations distributed across a series of habitats that were sequentially disturbed through the 1970s and 1980s by strip-mining activities. Preliminary data suggested that population sizes and recruitment rates were lower than would have been anticipated within less disturbed habitats. We are testing the hypothesis that *Microtus* populations living in formerly strip-mined habitats are food limited. We established four 40 by 40 meter plots at each of two locations within our study site. On each plot we established a 5 x 5 array of live-trapping stations. In addition, at each site food supplementation stations were established on two randomly selected plots. We have used standard mark-recapture protocol for either three or four days each month since June in order to compare population performance of *Microtus* within and between sites. Results thus far suggest that both sites are able to support *Microtus* populations. However, population size and demography vary greatly among different study sites. Nonetheless, we have seen little difference in population size and demography between food supplemented and non-supplemented plots within sites, suggesting that population performance is unlikely solely limited by food availability.

Board 05 THE EFFECT OF BIRD FEEDER HEIGHT AND DISTANCE FROM A FOREST EDGE ON THE FORAGING PREFERENCES OF WINTER BIRDS IN SOUTHEASTERN OHIO. Jeremy M. Alberts, jalberts@muskingum.edu, (Danny J. Ingold, ingold@muskingum.edu), Muskingum College, New Concord OH 43762.

A variety of studies have addressed winter bird foraging preferences at human-made feeders but relatively few have examined two or more factors concomitantly that might influence foraging frequency and the amount of food consumed. The objective of this research will be to address how feeder height and distance of the feeder from the nearest forest edge will influence foraging frequency by various winter passerine and woodpecker species at feeders in southeastern Ohio. My hypothesis is that birds will prefer to forage at the higher feeders situated closest to the forest edge. This study will be conducted from early January through early February 2001 on a reclaimed stripmine (The Wilds) in Muskingum Co., Ohio. Three units of observation each consisting of 3 pairs of feeders, will be employed in this study. Each feeder in a given pair at a particular unit of observation will be placed at one of two heights (2 and 4 meters), and at one of three distances from the forest edge (5, 10 and 20 meters). Each of the three units of observation (consisting of 6 feeders) will be a minimum of 100 m apart along the forest edge. Each unit of observation will be observed for a minimum of 5 hours/week between 0700 and 1000 to determine which bird species attend the feeders, and all feeders will be filled twice daily so that the amount of black oil sunflower seeds consumed may be quantified. Temperature, precipitation and wind speed will be recorded during each day in the field.

Board 06 NEST BOX SELECTION AND REPRODUCTIVE SUCCESS IN EASTERN BLUEBIRDS, TREE SWALLOWS AND HOUSE WRENS AT THREE HABITAT SCALES: LOCAL, LANDSCAPE AND REGIONAL. Alison M. Stahlheber, aliscum13@yahoo.com, (Danny J. Ingold, ingold@muskingum.edu), Muskingum College, New Concord OH 43762.

Relatively few nest box studies have examined how habitat features at the landscape and regional levels potentially influence bluebird and tree swallow nest-box use. From late-April through mid-August 2000, I monitored 36 nest boxes on a reclaimed stripmine (the Wilds) and 24 nest boxes in a residential area and on unmined farmland. At each box I measured 10 local habitat features (in a circle with a 3 m radius around the box), 8 landscape features (in a circle with a 50 m radius around the box), and noted whether the box was situated on a reclaimed stripmine or not (regional level). Logistic regression analyses revealed that the presence of water and forest edge at the landscape level were significant predictors of nest box occupancy of bluebirds ($P < 0.05$), and that the percentage of grass and herbaceous growth around the nest box (local level) also significantly predicted the presence of bluebirds ($P < 0.05$). The reproductive success of eastern bluebirds (numbers of nestlings fledged) on the reclaimed stripmine was significantly less than those which nested on unmined areas ($P < 0.001$). Logistic regression analyses revealed a significant positive association between tree swallows and box type at the local level ($P < 0.05$), and tree swallows and the presence of a fence at the landscape level ($P < 0.05$). These data suggest that certain landscape and regional features most likely influence bluebird and swallow nest use and reproductive success.

Board 07 SIMPLIFYING CLASSIFICATION CHARACTERISTICS FOR SPASMONEME BEARING, CONTRACTILE, COLONIAL PERITRICHIA. Jennifer A. Tieche, tjieche@captal.edu, (Kerry Cheeseman), Capital University, 4285 S. St. Rte. 605 Galena OH 43021.

For several years this author has worked under the assumption that there was no simple field method to perform lab and field classifications, differentiating the general species of the spasmoneme bearing contractile, colonial members of Peritrichia,

specifically of the ciliates – *Carchesium* and *Zoothamnium*. After more than four years of research in which attempts to identify what appeared to be different members of these contractile colonial ciliates, which appeared year-round and at different periods during the year in a stream in central Ohio a serious re-evaluation was performed of previously accumulated data from available reference sources and personal research notes and microphotographs. There are obvious differences in the structure, appearance, and mobility of the colonies, which are representative of differences in their species and/or genera. In this current year's research, a matrix of simplified lab and field characteristics for initial classification of the ciliate colonies was developed. An expansion of previously developed minute characteristics was undertaken. Together these two schemes have furthered the ability to identify the spasmoneme bearing, contractile, colonial ciliates appearing in central Ohio.

Board 08 GENETIC ANALYSIS OF *AMBYSTOMA MACULATUM* AND *AMBYSTOMA TEXANUM* POPULATIONS IN STRATFORD NATURE PRESERVE USING RAPD MARKERS. Joshua J. Obar, jjobar@cc.owu.edu, (Marten J. Edwards, mjedward@cc.owu.edu, and Sally M. Waterhouse, smwaterh@cc.owu.edu), Ohio Wesleyan University, HWCC Box 822, Delaware OH 43015.

Over the past 40 years amphibian populations worldwide have been in a gradual decline. This decline in populations and population sizes could have considerable effects on the genetic structure of amphibian populations, such as decreased genetic diversity or restricted intraspecies genetic flow. Within Stratford Nature Preserve (Delaware, Ohio) there are two wetland ponds, 0.4824 ha and 0.2425 ha respectively, which support *Ambystoma maculatum* and *Ambystoma texanum* populations. Intraspecies genetic flow between the ponds has not been demonstrated. Restricted intraspecies genetic flow could be a result of breeding site fidelity or construction in surrounding areas. If intraspecies genetic flow is restricted, the genetic diversity of the two-wetland ponds should differ because they support breeding populations of different sizes. To investigate the genetic structure of these populations, RAPD-PCR methodology is being used on DNA isolated from toe clippings from both species of salamanders.

Board 09 ASSESSING THE UTILITY OF A MITOCHONDRIAL MARKER FOR STUDIES OF SPECIFIC AND INTRASPECIFIC RELATIONSHIPS WITHIN THE BATRACHOSPERMALES (RHODOPHYTA). Nicholas J. Machesky, nm357097@ohio.edu, and Morgan L. Viss, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

Recently primers have been developed for a mitochondrial spacer region between the COX2 and COX3 genes that has shown promise for intraspecific studies of marine red algae. The purpose of the present study was to investigate the utility of this region for phylogenetic and population level studies within the freshwater red algal order Batrachospermales. Sequence data were obtained from *Sirodotia huillensis*, *Tuomeya americana*, *Batrachospermum boryanum*, *B. macrosporum* and *B. helminthosum* to assess genetic variation among taxa. Ten populations (3 Ohio and 1 each from Tennessee, North Carolina, Louisiana, Connecticut, Rhode Island, Massachusetts and Michigan) of *Batrachospermum helminthosum* were sequenced to evaluate intraspecific genetic variation. The length of the spacer region varied greatly among taxa but appears to be invariant within a species. Alignment among taxa was easily distinguishable for the first third of the spacer, but was unobtainable in the last two-thirds near the COX3 gene, making the utility of this region for phylogenetic studies of distantly related taxa questionable. Analysis showed the sequence length for all *B. helminthosum* individuals was 370 base pairs, of which numerous sites were variable but only few changes were parsimoniously informative. There were at least six different haplotypes among the populations, yet no geographic trends were evident from the analysis.

Board 10 BIOMASS OF HYDROPONICALLY GROWN TREE SEEDLINGS TREATED WITH COPPER. Tamekia L. Taylor, (Cadance Lowell, clowell@csu.edu), Central State University, Dept. Natural Sciences and Mathematics, P.O. Box 1004, Wilberforce OH 45384-1004.

Heavy metals such as copper, cobalt, nickel and zinc can be major industrial pollutants of soil. With that in mind, the objective for this study was to establish Threshold Limit Values (TLV) for the micronutrient copper in four tree species, green ash, white ash, red oak, and sycamore. These are typical tree species grown on coal reclamation sites suggesting that they survive under harsh growing conditions and might be candidates for phytoremediation. A flood and drain hydroponic system was set up in the Central State University greenhouse. Deionized water was added/drain weekly and a complete nutrient solution with increasing concentrations of copper was added biweekly, after the first month of deionized water only. The system consisted of 20 large Rubbermaid containers filled with perlite. Thirty-three green ash, 33 red oak, 27 sycamore, and 27 white ash one-year seedlings were randomly planted with six trees per container. The trees were allowed to grow for five months in the hydroponic system. To evaluate growth and survival, tree height, basal diameter, leaf chlorophyll content, and aboveground biomass were taken. From the data gathered, we have concluded that copper tolerance decreased in order for the tree species from red oak, green ash, white ash, to sycamore. Currently, we are evaluating the concentration of copper found in the seedling leaves.

Board 11 A GENETIC COMPARISON OF *LYTHRUM SALICARIA* AND *LYTHRUM VIGRATUM*. Sara F. Walker, walker.16@wright.edu, James Amon, james.amon@wright.edu, Dan E. Krane, dan.krane@wright.edu, Wright State University, Biological Sciences Department, Dayton OH 45435.

Purple Loosestrife (*Lythrum salicaria*) is an emergent plant of European origin. *L. salicaria* arrived with European settlers along the northeastern coast in the early 19th century and has spread across mid-latitude North America wetlands. The bisexual flowers of purple loosestrife are insect-pollinated and are capable of self-pollination. The plants can produce more than two million seeds per growing season and seed dispersal is largely by drift in moving waters. Erratic spread can also be possible by introduction as a forage plant or by accidental escape from horticultural planting. The impact of purple loosestrife on vegetation has been substantial and has caused numerous states (including Ohio) to ban its cultivation. Affected areas also experience serious reductions in waterfowl diversity and aquatic productivity. A newly introduced species (*Lythrum vigratum*) that has many similarities to that of *L. salicaria* is currently being propagated and sold commercially, despite bans regarding *L. salicaria*. We employ tissue extraction and RAPD PCR to address the question of relatedness and gene flow between *L. salicaria* and *L. vigratum*. A total of 29 *L. salicaria* and 4 *L. salicaria* specimens have been obtained from throughout the state of Ohio. High quality genomic DNA has been isolated from each of these samples and analyzed with two primers in RAPD PCR. Of the 33 samples obtained, 12 profiles have been compared to this point. Whole sufficient genetic variation exists to allow unique identification of each individual, distinguishing differences can be seen between *L. salicaria* and *L. vigratum* populations.

Board 12 INTERACTION BETWEEN *MONILINIA VACCINII-CORYMBOSI* CONIDIA AND BLUEBERRY POLLEN. Heather A. Richard, htharchr@otterbein.edu, Carl G. Gelfius, and Jeffrey S. Lehman, jlehman@otterbein.edu, Otterbein College, Department of Life Science, Westerville OH 43081.

Spores of many floral-infecting fungi are transmitted by pollinators and deposited on the stigma, where they germinate and grow along with pollen. As a result of their proximity, fungal spores may interact with pollen and greatly influence host ecology and evolution. This study addresses the interaction between asexual spores (conidia) of *Monilinia vaccinii-corymbosi* and blueberry pollen. Germination of pollen and conidia was measured on the surface of agar plugs and on the stigma of detached flowers. Surfaces were seeded with a pollen/conidia mixture ranging from 0% pollen and 100% conidia to 100% pollen and 0% conidia. Pollen and conidia were allowed to germinate, and growth was recorded under brightfield or UV-fluorescence microscopy. Polystyrene spheres (25 and 45 mm) were used in additional germination studies to mimic conidia and pollen. The relationship between pollen germination and amount of conidia deposited was significant ($P=0.002$); germination of pollen was negatively correlated with percentage conidia ($r=0.13$). Conversely, pollen germination was not influenced by increasing percentage of 25 mm polystyrene spheres ($P=0.17$). The relationship between conidia germination and pollen concentration was significant ($P=0.001$); conidia germination was negatively correlated with percentage pollen ($r=0.17$). Germination of conidia was not influenced by the increasing percentage of 40 mm polystyrene spheres ($P=0.17$). The results show that blueberry pollen and *M. vaccinii-corymbosi* conidia compete with each other during germination and that the amount of pollen and conidia may greatly influence subsequent seed set and disease development.

Board 13 NATURAL ESTABLISHMENT OF CONIFER SEEDLINGS ON THE MUDDY RIVER MUDFLOW, MOUNT ST. HELENS, WASHINGTON. Jessica R. Miesel¹, JSSRMSL@otterbein.edu, Jeffrey S. Lehman¹, and Peter M. Frenzen², ¹Otterbein College, Department of Life and Earth Sciences, Westerville OH 43081 and ²USDA Forest Service.

The eruption of Mount St. Helens in 1980 drastically altered the surrounding environment. Mudflows, fed by melting glaciers, obliterated a one km wide strip of forest in the Muddy River valley on the mountain's southern slopes. The objective of this study is to record natural establishment of conifer seedlings on a mudflow deposit over a 10-year period following the eruption. Tree height, diameter, and species were recorded for individually tagged seedlings in two 50' x 50' m plots in 1990, 1991, 1994, and 1999. Data for tree height, diameter, frequency, and density were analyzed using ANOVA. *Abies procera* was the most abundant species in all years except 1994, when *Pseudotsuga menziesii* was most abundant. Stem density decreased as distance from the adjacent, undisturbed forest increased. Total stem density increased between all years except between 1994 and 1999, when a significant decrease was observed. *Pinus monticola* seedlings exhibited the greatest growth rates per year, with mean \pm s.d. values of 6.10 \pm 2.5 and 2.53 \pm 1.6 for height (cm) and diameter (mm) respectively. *Pseudotsuga menziesii*, *Tsuga heterophylla*, and *Abies procera* exhibited smaller relative growth rates, with mean \pm s.d. of 3.89 \pm 4.9, 2.90 \pm 1.1, and 2.00 \pm 2.4 for height and 1.52 \pm 0.9, 1.13 \pm 0.4, and 1.05 \pm 0.3 for diameter. Results illustrate the dynamics of seedling establishment and growth in early development of a sub-alpine forest following a mudflow disturbance.

Board 14 EFFECT OF MOWING ON PHOTOSYNTHETIC RATES OF AN HERBACEOUS COMMUNITY. Lisa A. Bucci, bucci_l@denison.edu, and Fardad Firouznia, firouznia@denison.edu, Denison University, Department of Biology, Granville OH 43023.

Altering the source:sink ratio by shading leaves or removing sinks can lead to changes in photosynthetic rates due to physiological changes. Indiscriminate mowing or grazing can remove both sources and sinks, and it is not apparent how either may affect photosynthetic rates. This study aimed to determine the effect of mowing on photosynthetic rates of an herbaceous community. We hypothesized that mowing leads to increased photosynthetic rates per unit leaf area but not per unit land area. Two adjacent plots of equal size were chosen. The first was mowed in fall 1999 while the second was mowed in spring 2000. Photosynthetic rates per unit leaf area were measured using a Li-6200 photosynthesis meter during the summer 2000. Solar radiation, leaf area index (LAI), soil water content (θ_v), and leaf water potential (ψ_{leaf}) were also measured. Our results show that photosynthetic rates in the second plot were significantly higher than those in the first by 26% ($p < 0.0001$). This was not significantly affected by solar radiation, time of day, or sampling day. There were no significant differences in ψ_{leaf} or θ_v . The first plot had a greater LAI as expected (39%). The greater photosynthetic rates observed are due to physiological changes in the remaining leaves of the mowed plants. However, the overall photosynthetic rate per unit land area might be greater in the older plot. Therefore, indiscriminate mowing or grazing may increase photosynthetic rate per unit leaf area but decrease photosynthetic rate per unit land area.

Board 15 HOME RANGES OF *NERITA PELORONTA* AND *NERITA VESSICOLOR* ON SAN SALVADOR, THE BAHAMAS. Abbie L. Watson, s02.awatson@wittenberg.edu, (Timothy L. Lewis, tlewis@wittenberg.edu), Wittenberg University, Biology Department, P.O. Box 720, Springfield OH 45501.

Bleeding tooth (*Nerita peloronta*) and four-toothed nerites (*Nerita versicolor*) snails inhabit surf zones of rocky shores of southeast Florida and the West Indies, both feeding on alga growing on the substrate. There are no apparent differences in movement patterns nor habitats occupied between either species of snail. To test for species variations, we marked approximately 50 snails each year (30 *N. versicolor* and 20 *N. peloronta*) in 1994, 1996, 1998, and 2000 and recorded their locations over 2-week intervals several times daily. The study site was a vertical, north-facing rock wall. Variables such as tide, weather, sun exposure, and human traffic were considered. Data were analyzed using CALHOME home range software, calculating 95% and 50% minimum convex polygons and 95% and 50% adaptive kernels. Our results indicated that the bleeding tooth nerites had significantly larger home ranges in all categories than the four-toothed nerites. Spring tides and harsh weather caused all snails to move upward to less exposed positions. The snails differed in home range size and therefore likely feed differentially.

Board 16 VARIATIONS OF BEACH TRASH ACCUMULATION ALONG THE COASTLINE OF SAN SALVADOR, THE BAHAMAS. Jen Davis, s01.jdavis@wittenberg.edu, Betsy Beymer, Courtney Paul (Tim Lewis tlewis@wittenberg.edu), Wittenberg University, Department of Biology, P.O. Box 720, Springfield OH 45501.

Accumulation of anthropogenic marine trash on beaches around the world has many adverse organismal effects including starvation, infection, and strangulation. In order to help assess potential negative effects and predict human impacts on these areas, studies recording the amount and type of trash present are necessary. We studied marine trash accumulation on two San Salvador beaches in 1994, 1998 and 2000. The research site consisted of one or two 300-meter by 30-meter areas on beaches facing the Antilles Current. We visually searched for trash and tarballs, and categorized the trash according to size and material. The beach trash accumulation was 101.1 pieces/km/day in 1994, 86.8 pieces/km/day in 1998, and 582.9 pieces/km/day in 2000 (212,000 pieces/km annually). We found that the rate of trash accumulation on San Salvador is high and is increasing. This accumulated trash could potentially cause a rapid decrease in the quality of ecological habitats and the biodiversity of organisms that inhabit those areas.

Board 17 CHANGES IN THE CORAL-ALGAE EQUILIBRIUM ON PATCH REEFS, SAN SALVADOR ISLAND, THE BAHAMAS. K. A. Zander, s01.kzander@wittenberg.edu, M. K. Mann, s01.mmann@wittenberg.edu, and T. L. Lewis, Wittenberg University, Biology Department, Springfield OH 45501.

The coral reef community is a complex ecosystem in which algae and coral are the codominant organisms. However, environmental factors and stochastic events can contribute to changes in the balance between algal and coral species on the reef. Observation of the reef ecosystem of the coast of San Salvador Island, The Bahamas, indicated a disturbance in the coral-algae balance which favored algal dominance on the reefs; therefore, data were collected in alternating years between 1980 and 2000 recording the number of algae, coral, and other species living on representative portions of the shallow water patch reefs. The data was collected by placing a line intercept transect on various sections of the reefs and counting every organism. A Shannon-Weaver Diversity Index value was calculated for each year in addition to the percentage of coral and algae found on each reef. The diversity at Sand Dollar

increased overall from 1.80 to 2.38 with large fluctuations between years, and the percentage of algae increased by 2.49% and coral decreased by 0.6%. The diversity at Barkers Point increased steadily from 2.10 to 2.50. Also at this reef the percentage of algae decreased 4.59% and coral rose 7.63%. Algae were the dominant organisms on both reefs throughout the twenty years of data collection, while increasing and decreasing trends seem to be reef specific.

Board 18 VARIATIONS IN QUANTITIES AND TYPES OF TRASH ACCUMULATION ON TWO BEACHES ON SAN SALVADOR, THE BAHAMAS. Carlton F. Studlar, (Timothy L. Lewis, tlewis@wittenberg.edu), Wittenberg University, Department of Biology, Springfield OH 45501.

Anthropogenic trash has adverse effects on marine organisms including entanglement, inhibition of digestive functions, and strangulation. Studies recording the amount and type of trash present help assess potential negative impacts, and allow for projections of the human impacts on these areas. From 28 May to 10 June 2000 we compared both the initial and newly-accumulated marine trash on the south and east sides of San Salvador, The Bahamas, using 300 meter survey areas. The southern beach exhibited a higher initial count of garbage (5287 pieces/km) than the east facing beach (3967 pieces/km). The rate of accumulation for the southern beach was 216 pieces/km/day, compared to 131 pieces/km/day on the eastern one. We attributed the greater accumulation at the southern study site to the Antilles Current, which sweeps northward at San Salvador. The similar composition of the garbage on the study areas, including the discovery of similar intravenous bags at both locations, strongly suggests that the beaches are accruing their refuse from the same sources. The totals were extremely high compared to those from The Center For Marine Conservation's 1998 U.S. Coastal Cleanup, which had 479 pieces/km.

Board 19 THE EFFECTS OF TIDE CHANGES ON PHYLUM DIVERSITY IN BAHAMIAN INTERTIDAL POOLS. Kelly A. Riedinger, s02.kriedinger@wittenberg.edu, and Elizabeth R. Miller, s02.emiller@wittenberg.edu, Wittenberg University, Biology Department, PO Box 720, Springfield OH 45501-0702.

Marine intertidal pool organisms endure wide environmental fluctuations in salinity, temperature, moisture, and predation. As the tide varies throughout the day, the organisms should show patterns of movement related to environmental parameters and stresses. We studied the diversity of Mollusca, Chordata, and Arthropoda that populated 9 tide pools on 3 beaches in correlation with the changing of high and low tides on the island of San Salvador, The Bahamas. We calculated the Shannon-Weaver Index for species diversity (H') over a three-week period. Within the three phyla observed, we found average high tide H' value = 0.351 ($n=27$), and the low tide $H' = 0.425$ ($n=30$). Additionally, mollusks high tide $H' = 1.183$ ($n=27$), and the low tide $H' = 1.270$ ($n=30$). From these data, we concluded that slight, non-significant changes in species diversity existed within the phyla between low and high tide. This indicates that factors other than tide change, such as reproductive habits, feeding patterns, and pool size, may be the cause of diversity fluctuation within the tide pools at certain times.

Board 20 EFFICACY OF SEARCH TECHNIQUES USED IN TURTLE RESEARCH. Erin M. Shockey, eshockey@wittenberg.edu, (Timothy L. Lewis, tlewis@wittenberg.edu), Wittenberg University, Department of Biology, Springfield OH 45501.

Methods of estimating turtle population size are dependent upon the efficacy of capture techniques. Researchers often debate these estimation methods but virtually ignore the capture techniques behind them. Two capture techniques that are common to this field are random and systematic sweep searches. We evaluated these search techniques using a known population of spotted turtles (*Clemmys guttata*) in a fen, including several with radio transmitters for a comparison index. Search teams of 1 to 14 individuals then used the search techniques to locate turtles. Observations made thus far indicate that individual search quality shows a marked improvement after an individual's first encounter with the recovery of a turtle and continues to improve with experience. Random searches are somewhat more productive than sweep searches, with an average of 1.3 turtles recovered per individual search hour as compared to 0.9 turtles for the sweep search. Smaller search groups (1-2 individuals) are more productive than on a per-person basis than large search groups (up to 14 individuals), with turtles recovered per individual search hour averaging 1.75 and 0.3, respectively, for the random search and 1.3 and 0.007, respectively, for the sweep search technique. Preliminary results indicate that random searches conducted by small search groups are most efficient for turtle capture.

Board 21 GENETIC CHARACTERIZATION OF *NifM* POINT MUTATION PRESENT IN THE *KLEBSIELLA PNEUMONIA* UN1654. N. Affara, affara@yahoo.com, L. Pulakat and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

The role of *nifM* gene product in the maturation of the nitrogenase system is not yet clearly understood. Our homology search analysis indicated that the C-terminal domain of the *NifMs* from different nitrogen fixing bacteria share high homology with the peptidyl-prolyl *cis-trans* isomerases (PPIases). *Klebsiella pneumonia* strain UN1654 was previously isolated by chemical mutagenesis and it was found to be

defective in nitrogen fixation. Genetic mapping analysis combined with 2-D gel electrophoretic analysis of the total proteins from this strain showed that the defect is located in the *nifM* locus on *K. pneumoniae* chromosome. To identify the specific location of this defect, we isolated the *nifM* gene from this strain. Nucleotide sequence analysis revealed a substitution of Ser173 of the NifM ORF by an asparagine. To determine if the corresponding amino acid in the *Azotobacter vinelandii* NifM, Thr195, is essential for the functions of that protein, we replaced it with an asparagine by site directed mutagenesis and integrated the resulting mutated *nifM* into a *nifM* *A. vinelandii* strain, BG98. Failure of this mutated *nifM* to complement the Nif phenotype of *A. vinelandii* BG98 suggested that the replacing the conserved amino acid (at position in 173 *K. pneumoniae* and at position in 195 in *A. vinelandii*) with asparagine, in the region of the protein that is highly homologous to PPLases, abolishes the functions of both NifM proteins.

Board 22 ISOLATION AND CHARACTERIZATION OF A SECOND SITE COMPENSATORY MUTATION IN AZOTOBACTER VINELANDII UW97. F. Kobeissy, fkasko@bgnnet.bgsu.edu, B. Wex, S. Nash, N. Affara, L. Pulakat and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Azotobacter vinelandii UW97 is incapable of diazotrophic growth due to a specific mutation in the *nifH*. This mutation replaces serine by phenylalanine rendering the protein incapable of its functions. The loss of function is possibly due to a conformational disruption of the second conserved domain. In theory this disruption impairs the ability of the protein to attain the proper conformation to interact with the MoFe protein and other accessory proteins. We have isolated a genetic mutant of *A. vinelandii* UW97, designated *A. vinelandii* strain BG1402, which regained the property of diazotrophic growth. Further analyses by nucleotide sequencing and genetic complementation showed that the *A. vinelandii* strain BG1402 retained the original mutation at Ser44Phe, however, acquired a suppressor mutation at residue 68, where a glutamic acid was replaced by lysine. This resulted in an alteration of the size as well as polarity of the side chain of the residue at this position. The amino acid 68 is located at the very verge of the dinitrogenase reductase docking-site to the MoFe protein and therefore implicated in the stabilization of the interaction between these two proteins. Further investigation revealed that the single mutation Glu68Lys on wild type dinitrogenase reductase rendered the protein functional, however slightly impaired. The purification and characterization of these altered proteins revealed the mechanism of the suppressor mutation involving conformational changes during the nitrogenase complex formation.

Board 23 ROLE OF C-TERMINAL CYTOPLASMIC DOMAIN OF THE ANGIOTENSIN II RECEPTOR AT2 IN ITS FUNCTIONS. A. Gray, grayman@bgnnet.bgsu.edu, J. Johnson, (N. Gavini, L. Pulakat), Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

Angiotensin II (Ang II) has long been recognized as an important component of the neuroendocrine control of cardiovascular function. The two-receptor subtypes of Ang II, AT1 and AT2, share structural similarity (both are proteins with seven transmembrane topology) and 34% identity at amino acid level. Our attempts to identify cellular proteins that directly interact with the AT2 and mediate its signaling lead us to discover two new protein-protein interactions, the first between the AT2 and the ErbB2/ErbB3 receptors and the second between the AT2 and an NHE isoform. A region of the AT2 that spans the 3rd intracellular loop and the C-terminal cytoplasmic region was shown to be needed for these interactions. To determine the exact role of C-terminal cytoplasmic domain in the functions of the AT2, we constructed a truncated AT2 in which a stop codon was introduced at position 328 by PCR mutagenesis. This resulted in generating a receptor that has lost the C-terminal cytoplasmic domain. The ligand-binding properties of this receptor were analyzed by expressing in *Xenopus* oocytes. Our results show that the truncated AT2 receptor could bind both CGP42112A and Angiotensin II with affinity similar to that of the wild type. Experiments are now in progress to determine if the truncated receptor can retain the ability to interact with the ErbB2/ErbB3 receptors and NHE isoform in yeast two-hybrid protein-protein interaction assay.

Board 24 INVESTIGATIONS ON THE ROLE OF *nifM* IN NITROGENASE ACTIVITY BY UTILIZING MUTANT *KLEBSIELLA PNEUMONIAE* (UN1851). N.M. Daniels, nycole@bgnnet.bgsu.edu, L. Pulakat and N. Gavini, Bowling Green State University, Department of Biological Sciences, Bowling Green OH 43403.

It was proposed that the NifM may be involved in generating an active Fe-protein of the nitrogenase system. To understand the exact role played by the NifM and to identify the essential region on the NifM for its activity, we have made use of the mutant *Klebsiella pneumoniae* UN1851, which was generated by chemical mutagenesis. In this strain, the mutation was genetically mapped to *nifM* allele and the strain is defective in nitrogen fixation. We have cloned the *nifM* gene from *K. pneumoniae* strain UN1851 and subjected to nucleotide sequence analysis. We found a single change in the glycine codon 213, which is converted to a serine codon. ClustalW alignment of the deduced amino acid sequence of NifM from various nitrogen fixing organisms revealed the presence of a conserved corresponding glycine at position

235 in *Azotobacter vinelandii* NifM sequence. Site directed mutagenesis was employed to change glycine 235 to serine and this was confirmed by DNA sequencing. The plasmid carrying mutated *A. vinelandii* *nifM* was introduced into *A. vinelandii* cells that contain a kanamycin resistance marker gene in the *nifM* coding sequence on the chromosome. The cells were grown on Burk's Nitrogen-Free plates and exhibited no growth. This result indicated that the mutation is located in a functionally important region of the NifM. Moreover, taken together, these results also suggested that the conserved glycine in the c-terminal regions of *A. vinelandii* NifM and *K. pneumoniae* NifM is essential for the enzyme activity of the NifM to generate active Fe protein.

Board 25 EFFECTS OF CHROMIUM PICCOLINATE (CP) ON INSULIN LEVELS AND MORRIS WATER MAZE PERFORMANCE IN RATS. Andrea M. Dvorak, andi51080@yahoo.com, (Beth B. Pritts, prittsbb@mail.lemoyne.edu), LeMoyne College, Department of Biology, Syracuse NY 13214.

Chromium Piccolinate (CP) is a dietary supplement that is reported to increase energy, promote weight loss, and build muscle mass. This experiment was designed to test the effect of CP on the performance of rats in the Morris water maze (MWM). The experiment will be completed by orally administering CP to Sprague Dawley rats from Charles River Laboratories; these will be divided into two treatment groups, the control and experimental swimmers. The MWM will be used to assess the effect of this supplement on behavior. This maze consists of a molded plastic pool with a podium, filled with opaque water (colored by white non-toxic poster paint) so that the podium cannot be seen. Rats will be placed at the far end of the pool and time will also be measured until the rat reaches the podium; the behavior of the rat in the pool will be observed. Since the supplement is reported to enhance energy levels, the expected outcome of this part of the experiment is to see faster times in the experimental rats compared to controls. The insulin levels will be tested by radioimmunoassay, which measures specific hormone binding. A gamma counter (Titertek) will be utilized to perform the radioimmunoassay. In addition the serum glucose levels will be measured and analyzed by an enzymatic chromagen method and spectrometry. The final part of the experiment is to measure the liver, kidney and muscle protein levels by a Lowry assay and to record an organ mass.

Board 26 THE PRODUCTIVITY OF CORN-LEGUME INTERCROPPING IN NORTHEAST OHIO. Aaron R. Harnar HarnarAR@hiram.edu, (Prudy Hall HallPJ@hiram.edu, Matt Hils HilsMH@hiram.edu) Hiram College, Hiram OH 44234.

The practice of intercropping two crop species has the potential to increase farmland productivity. In this study, the dried biomass of *Zea mays* plants when interseeded by a hand seeder with the supplementary nitrogen-fertilizing legume *Trifolium hybridum*, was compared with the dried biomass of maize plants from monocrop cultivation. Monocrop and intercrop treatments were randomly assigned within an experimental plot containing Ellsworth silt loam of less than 6% slope. Under monocrop and intercrop conditions, *Z. mays* was planted in either 18 inch (46 cm) or 36 inch (91 cm) rows at 45000, 50200, and 63500 kernels per hectare. The above ground maize biomass from these six planting arrangements was measured from the six replicate monocrop and intercrop maize sites 75 days after planting. Each replicate plot contained 500 m² with the maize planted in 20 m rows. The dried *Z. mays* biomass of all planting arrangements for both cropping practices was compared statistically using a univariate analysis of variance. The results from this study show a depression in intercrop *Z. mays* biomass significant at $p = .01$ when compared to monocrop *Z. mays* biomass. The cause of decreased intercropped *Z. mays* biomass may have resulted from competition between the *Z. mays* and *T. hybridum* for limiting resources, such as water.

Board 27 THE INFLUENCE OF GROUP SIZE ON GROWTH RATES IN THE THERAPHOSID SPIDER *HYSTEROCRATES GIGAS* (ARANEAE, THERAPHOSIDAE). Melissa M. Varrecchia, varrecchiamm@hiram.edu, Vanessa A. Gorley, gorleyva@hiram.edu, and Samuel D. Marshall, marshallsd@hiram.edu, J. H. Barrow Field Station, 11305 Wheeler Rd, Garrettsville OH 44231.

Spiderlings of the theraphosid spider *H. gigas* were reared in groups of 1, 2, and 4 to examine the influence of social interactions on growth rates. This taxon was selected because observations made on captive populations indicate that *Hysteroocrates* spp. tarantulas have an unusually high level of mutual tolerance and captive juveniles have been observed to feed cooperatively on large prey until several months old. Spiderlings from two different captive-produced clutches were used. The spiderlings were fed once a week on pre-killed crickets of a large enough size to ensure a superabundance of prey for all members of the group. No clear effect of group size on growth rates was found after examining growth rates for 12 weeks (through two successive molts). There was, however, a tendency for a greater asymmetry in growth rates for the dyads than in the tetrads. Cannibalism was only observed in one instance, in a tetrad. Feeding behavior and agonistic interactions were examined. No difference was found in the amount of time spent feeding between the different group sizes. A Pearson's r displayed a positive correlation between percent weight gain and hourly intervals observed feeding (singletons $r = 0.498$, $p < 0.01$; dyads $r = 0.459$, $p < 0.01$; tetrads $r = 0.341$, $p < 0.01$).

Board 28 LEADERSHIP BEHAVIOR IN WILD WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS*) IN OHIO. I. C. Scott, iscott@gw.odh.state.oh.us, Ohio Department of Health, Bureau of Environmental Health and Toxicology, 8th Floor, 246 N. High St., Columbus OH 43266-0118.

The behavior of wild white-tailed deer in the area within one mile of the Alum Creek Dam, north of Columbus, Ohio, was studied. These deer ranged in a rural agricultural area and experienced seasonal hunting. Deer activities were studied during the September – November 2000 period, when doe, fawns, and antlered bucks were easily distinguishable. VHS recordings of forty groups of deer entering agricultural fields from wooded areas during their evening feeding periods were analyzed. Group size ranged from one to eight deer. Activities that were examined included the communication deer use in social situations such as sounds, snorting, foot stomping, flashing of the white hair on the rump, fighting, mating, gait, and noticing, orientating, or advancing toward a human presence. Leadership behavior was categorized by determining which deer was in the front position during the evening entry into the feeding area, which deer determined the direction taken by the group, which deer first noticed an observer, and which deer oriented toward the observer and stomped, snorted, or flashed its white rump hair. Antlered males were seen during 40 % of the observations. Leadership behavior could be clearly observed in thirty-one groups including twelve groups, which contained both females and antlered males. Doe deer exhibited a significantly greater frequency of leadership behavior than did antlered buck or young deer in both those groups where behavior could be clearly observed and in those groups, which contained both doe and antlered buck deer.

POSTER SESSION

AGRICULTURE; BIOLOGY; EARTH; ENGINEERING; ENVIRONMENTAL; PHYSICS 4:00 – 5:00 PM TOLERTON & HOOD HALL OF SCIENCE

Board 01 FRACTURED GLACIAL TILL SITES AND SOILS IN CENTRAL OHIO. Ann D. Christy, christy.14@osu.edu, Julie Weatherington-Rice, weathringtr.1@osu.edu, The Ohio State University, Dept of Food, Agricultural, and Biological Engineering, 590 Woody Hayes Drive, Columbus OH 43210-1057. As a part of the continuing educational outreach activities of the Fracture Flow Working Group, a field trip was held on May 10, 2000 in conjunction with the Water Management Association of Ohio's Spring Conference on Fractured Glacial Till. The objectives of the field trip were to introduce new and returning participants to the natural glacial deposits in central Ohio, to familiarize them with local soils and their relationship to glacial till parent materials, to observe fractures in glacial tills in a variety of settings, and to provide a forum for discussion regarding the origin of these fractures and the potential role that they may play in the environment. Three sites were visited: the Martin Marietta Aggregates' Marble Cliff Quarry on the west side of Columbus where fresh backhoe cuts were made into the glacial overburden; the Graessle Road natural streamcut on the Battelle-Darby Creek Metro Park property in southwestern Franklin County; and the Bill Moose Run natural stream corridor in northern Columbus at the Ohio Schools for the Deaf and Blind. There were multiple stations at each site exploring topics such as geomorphology, soils, glacial geology, geotechnical engineering, hydrologic properties of the exposed units, and fracture flow in these units confirmed by dye testing. The field guide for the trip can be viewed at <http://www.ohiowater.org/wmao/publications.html>. Photographs from several of the sites are available on the Fracture Flow Working Group web page at <http://www.oardc.ohio-state.edu/fractures>.

Board 02 CHEMICAL CHARACTERISTICS OF AN ARTIFICIAL WETLAND, WESTERN INDIANA. Kathryn A. Lenzer, lenzer.1@osu.edu, (Lawrence A. Kriesek, kriesek.1@osu.edu, Vickie L. Poole, vickie@fnr.purdue.edu, George R. Parker, grp@fnr.purdue.edu), Ohio State University, Dept. of Geological Sciences, Columbus OH 43210.

An artificial wetland system has been created near West Lafayette, Indiana to study the efficacy of two types of cell construction in treating agricultural runoff for the removal of non-point source nutrients. Sources of water to the wetland system are predominantly from an agricultural drainage ditch and an aquaculture facility. Proportions of each input vary depending on precipitation and the aquaculture center-pumping schedule. The extent and direction of exchange with the groundwater system are presently unknown. The wetland system is constructed of six separate cells, which are connected in two parallel systems of three cells each. The major difference between the two parallel systems is the fill of the end basins; one is a free-surface cell and the other is a subsurface (gravel) cell. Surface water samples were collected in late summer, 2000, from the upgradient and downgradient ends of the six cells, and were analyzed for a variety of dissolved inorganic and organic components. We assume that chloride is conservative within the wetland, so the relatively constant values of Na⁺/Cl⁻, Mg²⁺/Cl⁻, Ca²⁺/Cl⁻, and K⁺/Cl⁻ in all samples indicate the predomi-

nance of "ditch water" throughout the system. "Aquaculture water" appears to have lower Cl⁻ contents than "ditch water", but dilution effects are relatively limited. Ion ratios are similar in the end basins of the two parallel cell systems, suggesting that the difference in basin construction has no major impact on inorganic water chemistry.

Board 03 A COMPARATIVE LOOK AT VITRINITE REFLECTANCE VALUES OBTAINED FROM MODELS AND MEASUREMENTS IN A STRATIGRAPHIC COLUMN NEAR THE JUAN DE FUCA RIDGE. Amanda C. Cavin, cavin.13@osu.edu, The Ohio State University, 3031 Neil Ave. Apt. D, Columbus OH 43202.

Organic samples collected during Ocean Drilling Program Leg 168 from a column of sediment deposited on a section of the ocean floor near the Juan de Fuca Ridge were analyzed and vitrinite reflectance values predicted using mathematical and computer models. The intention of this study was to determine the best model for predicting vitrinite reflectance and thus organic maturity. Two main types of models were used. Time independent models constructed by Barker (1983) and Barker and Pawlewicz (1986, 1994) assumed the maturity of vitrinite was dependent only on the maximum temperature of the sediment. Time dependent models, such as EASY %R_o (Sweeney and Burnham, 1990), take heating time into consideration, and temperature through geologic time must be estimated to use these models. Both types of models were manipulated to predict values of vitrinite reflectance in order to compare the results to actual values that were measured using an EITZ MPV microscope photometer. The values of vitrinite reflectance did not increase with depth, indicating that the samples were not heated to a high enough temperature, or not heated long enough to achieve organic maturation. Reflectance values were organized into histograms that indicated two populations of vitrinite were present. It was difficult to determine the best model for predicting vitrinite reflectance from temperatures because vitrinite reflectance in the column did not demonstrate a trend that increased with depth. Sweeney and Burnham's EASY %R_o model predicted the lowest vitrinite reflectance gradient of those tested, estimating the least amount of change in organic matter. However, the Sediment Burial model presented by Barker and Pawlewicz showed predicted values closer to actual measured reflectance values than any other models studied.

Board 04 DO "IMITATION" AND "BENT" BRASSFIELD AND DIACHRONOUS DAYTON INDICATE OHIO'S LOWER SILURIAN "LAYER-CAKE" STRATIGRAPHY IS HALF-BAKED? Mark A. Kleffner, kleffner.1@osu.edu, The Ohio State University at Lima, Department of Geological Sciences, 4240 Campus Dr., Lima OH 45804-3576.

Previous studies of Lower Silurian strata of western Ohio recognize the age of the uppermost Brassfield as no younger than middle Aeronian in the southern outcrop area (SOA: Adams and Highland counties) and as early to middle Telychian in age in the northern outcrop area (NOA: Greene, Montgomery, Preble, Clark, and Miami counties), concluding that the Brassfield is time transgressive from south to north. Previous studies tentatively consider the suprajacent Dayton Formation as isochronous throughout western Ohio, and to be of early to middle Telychian in age in the SOA. The Brassfield-Dayton (B-D) contact in the NOA is generally considered an obvious unconformity, with local truncation of Brassfield bedding. Previous studies fail to explain not only why it took so long for the sea to transgress such a short distance, but also how the B-D contact in the NOA can be such an obvious unconformity. Preliminary results of a new study in western Ohio offer some insights. The Brassfield is no younger than middle Aeronian in age (*kentuckyensis* Biozone) at most exposures in western Ohio. Near West Milton in Miami County (NOA) there is a 0.3-m thick crinoid packstone/grainstone of apparent early or middle Telychian age (probable *celloni* Biozone) unconformably overlying Brassfield beds of virtually identical lithology, but no younger than middle Aeronian in age. The Dayton is likely early to middle Telychian in age (probable *celloni* Biozone) throughout the SOA. In the NOA, the Dayton is early Wenlock in age (upper *amorphognathoides*, *ranuliformis*, and/or lower *sagitta rhenana* Biozones). The B-D contact is thereby an unconformity of differing magnitude in the NOA. The diachronous nature of the relatively thin Dayton suggests the possibility that two different formations in western Ohio are presently recognized as a single formation because of their similar stratigraphic position and no previous solid evidence to the contrary. Along the road to the sewage treatment plant in West Milton (NOA) there is a southeast-northwest trending anticline in the Brassfield with a nearly vertical southwest limb and a steeply dipping northeast limb which gradually decreases in dip to the northeast. If it is not a "pop-up" anticline, but one which formed due to tectonic activity during the Silurian in the NOA, then past difficulty in correlating the "layer-cake" Lower Silurian stratigraphy of Ohio becomes understandable.

Board 05 ALLIANCE EARTHQUAKE: EFFECTS OF LOCAL GEOLOGY AND LOCATION OF THE EPICENTER. Jill M. Dodson, dodsonjm@muc.edu, Brian T. Webb, (Lee Gray, graylm@muc.edu, Mark McNaught mcnaughtm@muc.edu), Mount Union College, 1972 Clark Ave., Alliance OH 44601.

On August 6, 2000 at 10:02 p.m., an earthquake with a magnitude of about 3.0 (mbLg) (according to the Ohio Geological Survey) occurred in Alliance, Ohio. This earthquake provides an excellent opportunity to study the effects of local geology on the surface intensity of the tremor. This study also enables the possible epicenter of the earthquake to be confirmed. Another goal of this study is to promote public safety

through better understanding of earthquakes in this area. A map of earthquake intensity is being constructed using surveys filled out by residents of the affected area and the Modified Mercalli Intensity Scale. This map is being compared with local geologic maps to determine the effect of the geology. The location of the highest felt intensity as determined by the survey is compared with the computed epicenter of the tremor. Initial reports suggest a Modified Mercalli Intensity of at least III for this tremor and that it was felt within a 15-kilometer radius of the computed epicenter.

Board 06 SURFICIAL GEOLOGY OF THE UPPER SCIOTO RIVER WATERSHED. Douglas L. Shrake, doug.shrake@dnr.state.oh.us, C. Scott Brockman, E. Mac Swinford, and Kim E. Vorbau, Ohio Department of Natural Resources, Division of Geological Survey, 4383 Fountain Square Dr., Columbus OH 43224-1362.

The 1:100,000-scale map, "Surficial geology of the upper Scioto River watershed," depicts the thickness and stratigraphic sequence of unconsolidated materials from the land surface to and including the uppermost underlying bedrock unit. Data for the map came mainly from county soil surveys, ODOT, Ohio EPA, engineering boring logs, water-well logs, and theses. Mapping was partially funded by an Ohio EPA 319 grant. The London, Powell, Broadway, and St. Johns Moraines influenced the surficial deposits of the map. The Powell Moraine significantly altered the trend of the Big Darby Creek valley. Prior to emplacement of this moraine, the valley paralleled the Scioto and Olentangy River valleys. The buried valley trends directly north of the point where the present creek turns south. The floors of the Scioto and Olentangy River valleys are bedrock. It is proposed that these valleys were active sub-ice meltwater channels. Three tills are identified in the map area: till A, a loamy till south of the Powell Moraine; till B, a silty till between the Powell and St. Johns Moraines; and till C, a very clayey till northeast of Bellefontaine. Till C's clayey nature may reflect localized incorporation of promorainic lacustrine material into till B. Significant deposits of sand and gravel are present at the confluence of the Scioto and Olentangy Rivers, along Big Darby Creek from Plain City to its confluence with Little Darby Creek, and in the interlobate area.

Board 07 FACTORS INFLUENCING SOIL ACCUMULATION OF MICROBIAL CELL WALL PRODUCTS IN NO TILLAGE VERSUS CONVENTIONAL TILLAGE AGRO-ECOSYSTEMS. Tonia White-Burford, white.820@osu.edu, Serita Frey, frey.77@osu.edu, Johan Six, Johan@nrel.colostate.edu, ¹The Ohio State University, School of Natural Resources, 2021 Coffey Rd., 210 Kottman Hall, Columbus OH 43210 and ²Colorado State University, Natural Resources Ecology Lab.

Glucosamine and muramic acid concentrations can be used to establish cumulative fungal and bacterial (respectively) cell wall product concentrations in soil. This is of interest because microbial-derived organic matter may contribute to the sequestration of carbon in agricultural soils. The purpose of this study was to determine factors influencing the accumulation of microbial cell wall products within two tillage treatments (no-tillage versus conventional tillage) at 14 long-term tillage comparison sites across the North America. Glucosamine and muramic acid were measured using a chemical extraction technique on archived soil samples previously collected from 14 long-term tillage comparison experiments within the North American Site Network. Samples were collected at a depth of 0-20 cm and were analyzed previously for soils moisture, texture, bulk density, pH, total organic carbon and nitrogen, and mineralizable carbon and nitrogen. Mean annual temperatures at the sites ranged from 5.5-16.5 degrees C and mean annual precipitation from 384-1246 mm. Multiple regression analysis determined the relationship between soil physical and chemical characteristics and amino sugar concentrations. The tillage treatment regime had a significant effect on the ratio of glucosamine to muramic acid, with the no-tillage treatments exhibiting higher ratios compared to the conventional tillage treatments. Texture played a significant role in determining the amino sugar ratio, but did not outweigh the significance of tillage treatment. As the percentage of clay and silt increased in the soil, the ratio of glucosamine to muramic acid increased. These observed correlations provide useful information for generating hypotheses regarding potential factors controlling the accumulation of microbial products in no-tillage compared to conventional tillage agro-ecosystems.

Board 08 EVALUATION OF CHICORY AS A POTENTIAL SUGAR CROP IN NORTHWEST OHIO. Edwin M. Lentz, lentz.38@osu.edu, NWDO-OSUE, 952 Lima Ave., Findlay OH 45840.

In Europe, chicory (*Cichorium intybus* L.) has been used as a root crop producing high fructose syrup and inulin. Little is known about its adaptation to Ohio, although Northwest Ohio has historically adapted to other root crops such as sugarbeets (*Beta vulgaris* L.). The objective of this study was to evaluate the adaptation of chicory to Northwest Ohio by measuring yields and carbohydrates at different harvest dates. Field plots of two varieties ('Cassel' and 'Orchies') were established in 1997 on a Kibbie fine sandy-loam at the Vegetable Branch of Ohio Agricultural Research and Development Center near Fremont, Ohio. Experimental design was a completely randomized block with four replications. Four rows, ten feet long of each variety were randomly selected in mid September, October, and November to determine root tonnage yield and carbohydrate analysis. Root yields were four tons larger for the October and November harvest compared to September for both varieties; the

average October and November yield was about 18 tons per acre. The variety 'Cassel' had larger yields than 'Orchies' for each harvest, averaging 4% more yield than 'Orchies'. Carbohydrate content was the highest (17.4%) at the October harvest for 'Orchies' and the November harvest for 'Cassel' and inulin levels followed a similar pattern. Chicory may be grown as a sugar crop in Northwest Ohio with yields expected to be less than 20 tons per acre. Harvest date is variety dependent for the most tonnage and highest percent carbohydrate level.

Board 09 MODIFIED RELAY INTERCROPPING. S. C. Prochaska, prochaska.1@osu.edu, Ohio State University Extension, 117 E. Mansfield St., Bucyrus OH 44820.

The effect on soybean and wheat yield of growing both crops at the same time in the same field was examined in a series of replicated field trials over the last six years in a Modified Relay Intercropping (MRI) system. Soybeans in the MRI system are generally sown into 10 to 12 inch row wheat around the pollination time period, with a grain drill or tool bar planter. The wheat has a tramline to facilitate soybean planting. Light or the lack of it has a profound effect on the growth of intercropped soybeans. Soybeans planted too early into wheat with many tillers often become spindly and result in weak soybean plants that do not yield well. The wheat plant, by virtue of its wide adaptability, is able to tolerate slightly wider row spacing and the stress of soybean planting with minimal yield loss. Six years of replicated field trials on the MRI system have resulted in favorable average soybean and wheat yields. In Crawford County, MRI plot wheat and soybeans have yielded 73 and 30 bushels/acre respectively, versus county average yields in conventional production systems of 67 and 44 bushels/acre respectively.

Board 10 RAPD-PCR ASSESSMENT OF THE GENETIC DIVERSITY WITHIN ALLIARIA PETIOLATA. Sarah Schmidt, schmidt.12@wright.edu, (Don Cipollini, Don.Cipollini@wright.edu, Dan E. Krane Dan.Krane@wright.edu), Wright State University, 3640 Colonel Glenn Highway, Dayton OH 45435-0001.

Alliaria petiolata, more commonly known as garlic mustard, is an obligate biennial herb of the mustard family that was introduced into North America from Europe in the late 1800s. This herbaceous species is extremely successful in the midwestern and northeastern United States, where it has no natural enemies, is self-fertile, and is difficult to eradicate once established. Garlic mustard lowers species diversity by outcompeting other plants in a wide variety of habitats, ranging from dry to moist forests and even riparian systems. No effective management strategy has been discovered to date, beyond the use of indiscriminate herbicides. Preliminary studies have suggested that this self-fertile invasive species is unusually genetically homogeneous in at least one portion of its range (southwestern Ohio). In this study, we expand the breadth of this preliminary work to examine genetic variation in this species among populations (N=3 or 4) from five sites in Ohio, Pennsylvania, and West Virginia, and plan to collect at several more sites from Indiana, Kentucky, and Michigan. High quality genomic DNA from these individuals has been analyzed with RAPD-PCR to generate reproducible and distinctive DNA profiles containing a minimum of ten potentially polymorphic bands each. Pairwise comparisons of the DNA profiles of all the samples collected from throughout the current range of this species should allow a useful measure of its naturally-occurring variation that may aid viable control strategies, including the introduction of biocontrol organisms.

Board 11 CHEMOTAXIS BY AN AQUATIC ISOLATE OF CITROBACTER FREUNDII IN KRAUS WILDERNESS PRESERVE. Jill M. Schnipke, jmschnip@cc.owu.edu, Laura M. Tuhela-Reuning, lmuhela@cc.owu.edu, Ohio Wesleyan University, HWCC Box 426, Delaware OH 43015.

Bacterial motility and chemotaxis have important ecological impacts on aquatic environments. Some motile bacteria can sense elements and compounds such as carbon, nitrogen, or iron sources in their environment and exhibit a chemotactic response by swimming towards or away from these chemicals. Motile bacteria may also attach to surfaces via their flagella, thus providing the initial layer of a biofilm. To study these phenomena, weekly water samples were collected (19 May 2000 to 14 July 2000) from two ponds in Ohio Wesleyan University's Kraus Wilderness Preserve. Biochemical tests were performed on the water samples to monitor dissolved oxygen, nitrogen, chlorine, phosphate, temperature, and pH. These tests indicated that the pond water was oligotrophic and very low in nitrogen. Various media were used to enrich for bacteria. The cultured organisms were screened for motility using phase contrast microscopy. Motile organisms were then maintained on R2A agar. One isolate, identified as *Citrobacter freundii* based on results from carbohydrate media, BBL Enterotubes, and BIOLOG, was chosen for chemotaxis assays due to its high degree of motility. Lactose, galactose, serine, glutamine, ferric chloride, ferrous sulfate, dextrose, aspartic acid, threonine, arginine, asparagine, methionine, leucine, citrate, sucrose, soluble starch, and casamino acids were used as potential chemoattractants. *C. freundii* exhibited positive responses to lactose, serine, asparagine, aspartic acid, and casamino acids. This is the first report of chemotaxis by an aquatic isolate of *C. freundii*. This research was funded by the Howard Hughes Medical Institute Undergraduate Biological Sciences Education Program grant to Ohio Wesleyan University.

Board 12 SOIL DEVELOPMENT AND WOODY PLANT DIVERSITY OF ABANDONED COAL MINE SITES IN THE BEAR CREEK RUN WATERSHED, STARK COUNTY OHIO. Annabelle Foos, af00s@uakron.edu, Forrest Smith, forrestsmith@uakron.edu, M. Castro, D. Flenner, T. Lundy, D. Moore, M. Shultz, K. Spencer, C. Vanco, C. Wellert, S. Yeaman; University of Akron, Center for Environmental Studies, Akron OH 44325-4102.

The soils and plants of two abandoned coal mine sites in southern Stark County Ohio were investigated. Soil profiles were measured and plant surveys were conducted at the crest and base of the slopes at both sites. The first site (Site A) was disturbed between 1971 and 1982. Soils on the crest of the slope had poorly developed horizons and were leached to a depth of 3 inches. No soil horizons were observed at the base of the slope. The woody plant diversity index was 0.46 at the crest of the slope and 0.0 at the base of the slope. The second site (Site B) was disturbed prior to 1957. Soils at the crest of the slope had well developed horizons and the depth of leaching was greater than 16 inches. The soil was only 3 inches thick at the base of the slope. The woody plant diversity index was 0.92 at the crest of the slope and 0.74 at the base of the slope. At both sites the soil development and woody plant diversity were higher at crest than at the base of the slopes suggesting that the crest is more stable relative to the base of the slope. The older site B had a higher woody plant diversity and better soil development than site A, indicating that soil formation and reestablishment of a woody plant community at abandoned coal mine sites can occur in a relatively short period of time (<50 years).

Board 13 WATER QUALITY STUDY OF BLACKLICK CREEK FOCUSING ON BLACKLICK ESTATES WASTE WATER TREATMENT PLANT. Shannon E Jordan, sejordan_152@msn.com, (Terry Lahm, tlahm@capital.edu), Capital University, 2199 E. Main St., Columbus OH 43209.

The water quality in Blacklick Creek has been a concern of the local residents and state officials because of the southeastern expansion of the Columbus metropolitan area into its watershed. The watershed drains approximately 63 square miles of urban, agricultural, and wooded land in Franklin and Fairfield counties. The purpose of this research is to determine the longitudinal and temporal impact of Blacklick Estates wastewater treatment plant (WWTP) on the water quality of Blacklick Creek. Field data were collected in October 2000 at locations upstream and downstream of the effluent discharge and includes pH, temperature, conductivity, dissolved oxygen, field tests for nitrate, nitrite, ammonia, and phosphate. Hydrologic discharge was also measured at specific sites in order to determine nitrate loads prior to and post effluent discharge. Water samples were analyzed in the laboratory for total phosphorus and nitrate concentrations using standard analytical methods (ultraviolet spectrophotometric methods). Our field and laboratory data are used in conjunction and compared with Ohio EPA biological and chemical surveys completed along this reach of the stream in 1986 and 1996.

Board 14 ANALYSES OF LOCAL SURFACE AND GROUNDWATER ENVIRONMENTAL IMPACTS FROM A HOG WASTE LAGOON IN DARKE COUNTY, OHIO. Jeneen S Tackett, RJTackett@dayton-online.net, (Timothy L Lewis, tlewis@wittenberg.edu), Wittenberg University, Biology Department, PO Box 720, Springfield OH 45501-0720.

Metal contamination, excess nutrients, pathogen occurrence, and low levels of dissolved oxygen in streams and domestic wells are frequently correlated with excess waste from livestock. Confinement farming is growing in popularity, and the associated waste accumulation has led to local ground and surface water quality degradation. This research will provide new data and subsequent conclusions concerning the effects of swine waste-holding ponds on surrounding water resources. Research commenced in June 2000 and will terminate June 2001. Domestic wells in the area of the hog farm were utilized for groundwater analyses. The headwaters of three area streams were chosen for surface water contamination monitoring. Stream samples were taken 1-2 times per month and analyzed for phosphates, sulfates, nitrates, ammonia, copper, zinc, pH, specific conductance, salinity, temperature, dissolved oxygen, and algae indicative of nutrient loading. Well samples were taken once a month and tested for sulfates, nitrates, phosphates, and presence or absence of coliform bacteria. Data were categorized by type (surface or groundwater), location, test parameter, and season. Statistical analyses will be performed to determine any significant difference between seasonal concentrations, surface and groundwater, or water quality of surface and groundwater with respect to distance from the waste lagoon. Initial observations suggest an impact on surface water quality immediately downstream from a site adjacent to the hog waste lagoon, particularly with reference to orthophosphate, nitrate-nitrogen, ammonia-nitrogen, and copper.

Board 15 A COMPARISON OF PLANT NUTRIENT STORAGE A CROSSED RECLAIMED SITES RECOVERED FROM STRIP-MINING. Lisa M. Horvath, lisalynn@clover.net, (Rebecca Bilek, rbilek@muskingum.edu, Jim Dooley, jdooley@muskingum.edu), Muskingum College, 163 Stormont Street, New Concord OH 43762.

The Wilds, a wildlife conservation facility is located on land that was strip-mined and reclaimed from north to south over a period of approximately fifteen years. Assessing habitat restoration in three distinct sites on this property, mined in 1973, 1976, and 1981, will give us information about how successful the reclamation

process has been. It is hypothesized that nutrient levels will vary depending on the time elapsed since mining and reclamation occurred. Samples of the grass, fescue (*Festuca spp.*), from each of the three designated sites are being analyzed for non-structural carbohydrates, total phenolic compounds, and nitrogen. Nutrient levels from site to site will be compared with those in plant samples from non-mined areas. Because non-structural carbohydrates are the primary storage unit for reserved energy, quantifying differences between sites may allow us to determine how available these compounds are for growth and reproduction. Total phenolic compounds are being analyzed to determine, for example, how well plants are able to metabolize glucose and sucrose. Nitrogen levels are vital for examining how well nitrogen from the soil has been assimilated. Plant samples are being analyzed for these compounds using acid digestion and colorimetric methods. These results will be correlated to observations of small mammal populations to assess the habitat recovery success.

Board 16 ENGINEERING ECONOMIC ANALYSIS OF JUMBO JET PRICE COMPETITION. Theodore J. Sheskin, tsheskin@popmail.csuohio.edu, Cleveland State University, Industrial Engineering Department, Cleveland OH 44115.

The Boeing Company is America's largest exporter based on dollars. Since 1970 the Boeing 747 airplane has given Boeing a monopoly in the market for jumbo jets. In December 2000, this monopoly ended when Airbus of Europe authorized production of a new, larger, super jumbo jet, the A380, after receiving 50 orders at about \$220 million per plane. The development cost is estimated to be \$11 billion. Boeing is considering an investment of \$4 billion to develop a stretched version of the 747. The goal of this research is to identify price reductions that Boeing may offer to preserve its dominance of the jumbo jet market. An engineering economic analysis was conducted. It was hypothesized that if Boeing will sacrifice short-term profit for long-term market share, then most customers will choose Boeing jumbo jets over the A380. With over 1,300 747's currently in service, Boeing has recovered the \$1 billion development cost of the 747. The New York Times reports that the 747 has been Boeing's "cash cow," contributing roughly half its profits in good years. Boeing can reduce the \$184 million price of the 747 by 50%. To obtain orders for 50 stretched 747's, Boeing can advertise a pre-production price of \$120 million, allowing Boeing to recover its development cost and payments to suppliers for engines and other components. In conclusion, Boeing can reduce the price of the 747, and sell the stretched version for less than the price of the A380. Airbus must maintain high prices to recover the huge development cost of the A380.

Board 17 PHYSICAL AND STRUCTURAL ANALYSIS OF HEMOCYANIN SUBUNIT II. Brian J. Hnatkovich, Hnatko98@hotmail.com, and Russell O. Robinson, (Lisa M. Unico, LUNICO@edinboro.edu), Edinboro University of Pennsylvania, Chemistry Department, Cooper Hall, Edinboro PA 16444.

Hemocyanin, the oxygen-transport protein found in *Limulus polyphemus* (horseshoe crabs), is similar to hemoglobin in that it is a multi-subunit molecule in which each subunit binds oxygen. Both hemocyanin and hemoglobin display positive cooperativity and allostery in oxygen binding. Allosteric effectors are small molecules, or ions that can also bind specifically to the transport protein. Binding of an allosteric effector changes the ability of the transport protein to bind oxygen by altering the structure of the protein. However, whereas hemoglobin is a tetramer, hemocyanin is an octahexamer. The mechanism of oxygen binding must also be different since the oxygen molecule binds to two copper ions that interact directly with amino acid residues in the absence of a porphyrin. Thus, hemocyanin is more complex and less well understood. We are studying the 628 amino acid Subunit II from hemocyanin. This subunit aggregates into hexamers that are able to model the functions of the complete octahexamer. Oxygen binding changes the absorbance spectrum of Subunit II substantially. This makes reliable quantification by spectral methods difficult. We are currently establishing spectral parameters for quantifying Subunit II. Additionally, we are interested in the structural changes associated with the binding of oxygen and the negative allosteric effector chloride. Concomitant spectral changes in the protein should be evident in UV, IR and fluorescence spectra. These spectrophotometric analyses will be performed after first isolating and purifying the protein by centrifugation and ion-exchange chromatography.

Board 18 A COMPARISON OF SOIL NUTRIENTS ACROSS RECLAIMED SITES RECOVERING FROM STRIP MINING. Kristen J. Vejsicky, kristenv@muskingum.edu, (Rebecca Bilek, rbilek@muskingum.edu and Jim Dooley, jdooley@muskingum.edu), Muskingum College, 163 Stormont St., New Concord OH 43762.

The Wilds, a wildlife conservation facility, is located on property that was strip-mined and reclaimed from north to south along a temporal gradient. Several researchers are engaged in assessing how effective reclamation efforts have been to habitat restoration. This study will examine the soil nutrients across three sample sites that were mined and reclaimed in approximately 1973, 1976, and 1981, and compare nutrient levels with those in samples from two areas that have not been strip-mined to assess how effective reclamation efforts have been. Soil pH and the nutrients nitrogen, organic carbon, phosphorus and iron have been selected for analysis due to their importance to soil chemistry and plant life. Soil samples will be digested and nitrogen

concentration will be determined using a colorimetric method with ammonium sulfate standards. Organic carbon will be measured using the Walkley-Black method. Soil organic matter is oxidized and the excess oxidizing agent is then titrated allowing the total organic carbon originally present to be determined. Phosphorus levels in soils will be measured using a spectrophotometric method after samples have been oxidized with sodium hypobromite followed by sodium hydroxide. Iron will be determined by atomic absorption in a solution of sodium citrate and dithionite. A glass electrode will be used to measure the pH of soil as a suspension in water. Results will be correlated to observations of small mammal populations and plant nutrient levels to assess the status of habitat recovery.

Board 19 DESIGNING INQUIRY-BASED COURSES IN MATHEMATICS AND PHYSICS. Brian W. McEnnis¹, mcennis.1@osu.edu, Gordon J. Aubrecht II², aubrecht@mps.ohio-state.edu, The Ohio State University, ¹Dept. of Mathematics and ²Dept. of Physics, Marion OH 43302-5695.

Many elementary and secondary school teachers teach as they have been taught, which in many cases means slavishly following a book. Furthermore, many teachers, especially at the elementary level, are science/technology shy, and avoid dealing with these topics as much as possible. Research has shown that active student involvement leads to greater retention of the material to be learned, but most students do not have the opportunity to learn this way. The authors have been working on a pilot project that targets preparation of preservice teachers. The goal is to develop curricula in mathematics and physics that will expose prospective teachers in their preservice training to the concepts of inquiry-based instruction. The project builds on successful physics and mathematical initiatives nationally and statewide, respectively, with curricula being designed using the results of pretests. This pretesting has identified some preconceptions and misperceptions not already documented in the literature, and has helped define topics for inclusion. Course materials that have already been developed have been pilot tested in a Columbus-area high school and at The Ohio State University in teacher education programs and in a summer program for talented high school students. The pilot testing has identified parts of the original modules that are in need of modification, and has identified preconceptions and misperceptions that did not come out in the pretesting. These ideas will be incorporated into revisions of the modules when full development of the project is implemented. This project is supported by NSF grant #9950528.

Board 20 ANTLER-CHEWING BY WILD WHITE-TAILED DEER AT THE WILDS, MUSKINGUM COUNTY, OHIO. Jack Kovach, jkovach@muskingum.edu, Muskingum College, Geology Dept., New Concord OH 43762.

Evidence of antler-chewing by wild, free-ranging white-tailed deer (*Odocoileus virginianus*) on the acreage comprising the Wilds wildlife preserve (formerly known as the International Center for the Preservation of Wild Animals) in Muskingum County, Ohio, is reported. Two cast (shed), 4-point, right antlers of white-tailed deer collected at the Wilds in 1997 by Dr. Mark Atkinson, Director of Animal Health at the Wilds, and donated to the author, show the distinctive shape and pattern of tooth marks resulting from chewing by ungulates (Sutcliffe, 1977). Such chewing is evident on all tines except the brow line of one of the antlers and on at least one tine of the other antler. (Three tines (including the brow line) of the second antler are so extensively chewed by rodents as to have obliterated any evidence of chewing by ungulates.) Both antlers were collected outside the confines of the perimeter fences constructed around the fenced pastures occupied by the exotic ungulates residing at the Wilds and, hence, could not have been chewed by the exotics. The chewing, therefore, can only be attributed to the native white-tailed deer, which occur in high numbers year round at the Wilds. To my knowledge, this is the first reported occurrence of antler-chewing by white-tailed deer in Ohio. Presumably, this behavior serves a nutritive function, providing some essential element(s). The age and sex of the deer engaging in the chewing of antlers at this site, the timing of this behavior during the course of the year and its prevalence are not known at present as no observations of deer chewing antlers have yet been made here.

SOCIAL SCIENCE

9:00 AM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 013

JOHN TORNES-PRESIDING

99:00 THE CULLISON SITE (33-Cs-64): A WINDOW INTO THE LATE PROTOHISTORIC PERIOD IN OHIO. Nigel R. Brush, nbrush@Ashland.edu, Ashland University, Dept. of Geology, Ashland OH 44805.

Native American peoples occupied the region we now call Ohio for more than 11,000 years. The continuity of their occupation was apparently unbroken until the latter half of the 17th Century. By 1680 the Beaver Wars were reaching their climax, and indigenous peoples had largely abandoned Ohio because of the incessant raids of the Iroquois. This protohistoric period is a "dark age" in Ohio prehistory, and sites dating near its end are rare. In the summer of 1995 the Interdepartmental Program in

Archaeology at the College of Wooster conducted a six-week archaeological field school at the Cullison Site – a late protohistoric village along the Walhonding River in central Coshocton County, Ohio. Based on an analysis of artifacts recovered from the surface of this site, it seemed likely that the village might provide critical insights into this little understood period. In order to determine if undisturbed features lay below the plow zone, 11,700 square feet of the site were shovel-shaved and/or shovel tested. This work resulted in the discovery and excavation of fourteen large, subsurface features. These features included refuse pits, fire pits, and an earth oven. Four radiocarbon samples taken from these features gave dates ranging in age from 1610 to 1660. The diversity of projectile point and pottery types recovered from these features, as well as a defaced petroglyph of an Iroquois warrior, suggests that native cultures in Ohio at this time were indeed being severely disrupted by incursions of the Iroquois.

09:15 DEVELOPING A PROTOCOL FOR THE APPLICATION OF REMOTE SENSING TECHNIQUES IN ARCHAEOLOGICAL CONTEXTS: A CASE STUDY FROM HOPEWELL MOUND GROUP, ROSS COUNTY, OHIO. Jarrod Burks, burks.22@osu.edu, Jennifer Pederson, jennifer_pederson@nps.gov, Hopewell Culture National Historical Park, 16062 State Route 104, Chillicothe OH 45601.

Archaeologists use a wide range of methods to illuminate the past, most of which are destructive. Recent applications across Ohio of geophysical remote sensing techniques which detect historically significant features without excavation have produced mixed results. Because the use of remote sensing devices by archaeologists in the Midwest has yet to be widely accepted, rigorous protocols and objectives for the use of this equipment in archaeological contexts have not been established. If remote sensing data are to ever stand alone, rather than serve as a means for locating archaeological features for excavation, then remote sensing surveys must be standardized: develop a set of expectations or hypotheses, derive a means to gather independent data, and test and interpret the results in the context of the survey. We have successfully applied this technique to an archaeological case study in Ross County, Ohio using Geoscan's FM36 fluxgate gradiometer to measure near surface deviations in the earth's magnetic field. Expectations of the archaeological record were developed based on prior archaeological investigations in the area of Hopewell Mound Group's Mound 1 (which has been "lost" since the late 1800s). A spatially intensive data collection procedure was designed and employed so as to specifically pinpoint small target anomalies. The survey successfully detected regularly spaced, magnetic anomalies of the expected size. These anomalies were interpreted as the remains of previously undocumented, 2000 year-old wooden architecture formerly located beneath Mound 1. Increasing the success of remote sensing surveys is necessary if the past is to be preserved for the future.

09:30 FAMILY PERSPECTIVES OF LOSS AND GRIEF: SUDDEN, TREMATIC LOSS VERSUS EXPECTED LOSS. Carla R. Hooper, deedee@clovernet.com, (Eric D. Miller, emiller@kenteliv.kent.edu), Kent State University- East Liverpool Campus, 400 E. Fourth St., East Liverpool OH 43920.

The purpose of this qualitative study was to investigate how various members of one family would react to the death of various family members. A major Hypothesis is that individuals within a given family would respond to the loss of other family members in idiosyncratic ways- thus, highlighting the importance of individual differences. However, it was also expected that sudden, traumatic losses would produce more unfavorable outcomes and would prolong coping, compared to the length of coping with expected losses. Seven individuals from the same family were presented with ten open ended questions (e.g. "Were you angry with God or someone else?"; "Do you feel that the pain ever totally goes away?") These questions were asked about expected loss as well as after an unexpected family tragedy occurred. These individuals tend to feel angry with God and others when discussing their loss; this pattern is highlighted when discussing the unexpected family tragedy, which in turn is associated with prolonged coping. Additionally, all respondents feel tragedy, which in turn is associated with prolonged coping. Additionally, all respondents feel that each of these losses have permanently altered their sense of self. Your first question yes this is a comparison of expected loss to unexpected loss. The study was conducted on one single family, of seven individuals. Yes the term coping is used in the sense that they were coping with grief.

09:45 THE EFFECTS OF MOTIVATIONAL LEVEL ON GENERATION OF COGNITIVE DISSONANCE IN ELEMENTARY SCHOOL CHILDREN. Lisa M. Richards (Harvard Armus harmus@uoft02.utoledo.edu) The University of Toledo, 2801 W. Bancroft, Toledo OH 43606.

The purpose of this study is to investigate the effects of motivational level on a measure of cognitive dissonance in 60 third- and fourth-grade students. The hypothesis is that a group of children with low motivation and a low value of reward for a task will display a greater level of dissonance than the groups with other combinations of motivation and reward value. The students begin by rating a list of possible rewards in order of personal value. They are told that they have a good chance of receiving a valuable reward for the task they will be performing. Half of the group is given instructions with the purpose motivating them for the task they will complete. These

instructions stress the value and importance of the task. The other half is given simple instructions for the task. Both groups are then asked to complete worksheets that involve verbal and spatial skills. Upon completion of the task, half of the students receive a valuable reward, and the other half receives a less valuable reward. This creates four groups: high motivation with high valued reward, high motivation with low valued reward, low motivation with high valued reward, and low motivation with low valued reward. The students are then asked a series of questions about their feelings toward the task they have just completed. Their responses determine their level of dissonance. This study has important ramifications for teaching situations in which rewards for achievement vary.

10:00 THE INFLUENCE OF AGRICULTURE SCIENCE AND INDUSTRY ON HIGH SCHOOL STUDENTS IN FULTON COUNTY, OHIO. John J. Torres, torres.86@osu.edu, 272 Main St. PO Box 53192 Pettisville OH 43553.

According to the Ohio Farm Bureau Federation in 1999 the agricultural industry contributes \$73 billion of revenue per year. Jobs related to food, wholesale and retail forestry, food and fiber processing, farm production, farm inputs, and food service are available in Ohio. It is the job of the agricultural communications industry to inform the public about the agricultural industry. It is also the job of the educational system to inform today's students about the impact of the agricultural industry on their everyday lives. A survey was based on Ohio's Competency Analysis Profile in Agriscience. Students (N=209) enrolled in agricultural education in five schools in Fulton County, Ohio were surveyed to determine how well they were informed about the agricultural industry and to see how well students have retained the information. Demographics of the participants were formulated using the first 6 questions of the survey (sex, grade, etc.). Ninety percent of the students were able to define "Agriculture" and "Communications." While only 70% were able to define "Agricultural Communications", 80% could identify how agriculture had an effect on global technology. Most (82.5%) stated that safety was a major issue in the agricultural industry. Students identified 33% of expected outcomes of items created by the agricultural industry, while they could only identify 25% of expected outcomes of how agriculture affected Americans. Most (82.5%) related agricultural effects on air and water. Eighty five percent realized the effects of air and water on agriculture. A majority of students concluded that agriculture was a business rather than a hobby, realized the effects of technology on agriculture, and deduced the effects of communications on agriculture. Students were able to identify 83% of products produced by the agricultural industry.

10:15 THE EFFECTS ON IDENTITY IN INTERNET-BASED DISTANCE LEARNING. Christopher D. Sutcliff, sutcliffchris@hotmail.com, University of Akron, 14296 Bridle Trail, Strongsville OH 44136.

The Internet is a key technological development with serious political, economic, and social consequences. The sociological importance of the Internet has yet to be fully understood or explored. The purpose of this paper is to examine how the Internet a particular social space; the social space of the college classroom and the experiences that people have using the Internet in their teaching. This study was conducted at Indiana State University, and involved eighteen professors involved in various levels of Internet-based distance education. The two methods used were participant observation and semi-structured interviews with the professors. It was hypothesized that Internet-based distance learning would affect the identity of professors. It was found that using Internet-based distance education had a positive effect upon the identity of the professors. For the professors I studied, being pioneers in using the Internet to teach and challenging themselves to incorporate the Internet into their classrooms reinforced their identities as facilitating educators.

10:30 STUDENT/FACULTY COLLABORATIVE RESEARCH AT THE UNDERGRADUATE LEVEL. Heidi A. Holmer, holmer@ashland.edu, R. Nicole Slaughter, Rula R. Raphael, (Alinde J. Moore, amoore@ashland.edu, Dorothy C. Stratton, dstratto@ashland.edu), Ashland University, Box 1567, 401 College Ave., Ashland OH 44805.

According to previous research, collaborating with faculty on research projects is one important way that undergraduate students may enhance their applications for graduate school admission or for employment. In such projects, students learn specific skills in communication, critical thinking and analysis, and research methodology that are useful in graduate school or in a beginning level professional position. Ashland University psychology and social work students have had opportunities not only to conduct their own research projects, but also to assist other faculty members with a qualitative research project older widowed men. In this collaborative effort, the students transcribed interviews, participated in development of a coding system, coded interviews, searched for and explicated themes emerging from the data, and compiled data for charts and tables. Interviews were conducted with current and former undergraduate research assistants who worked on the widowers study during the past 5 years. Question were designed to ascertain the skills learned, the understanding of the qualitative research process that developed, and the perceived benefits of participating in such research, especially as they related to graduate work and employment.

10:45 CHANGING GIRLS' ATTITUDES TOWARD SCIENCE AND MATHEMATICS: 1999 ACTION-WISE PROGRAM FOR ENCOURAGING WOMEN AND

GIRLS IN SCIENCE, ENGINEERING, AND MATHEMATICS. John R. Marks¹, jmarks@matc.tec.oh.us, Jack Kovach², Evan Blumer³, Sherry Hubbard³, Susan Grubbs⁴, Sue McFerren⁴, Donna Berlin⁵, Arthur White⁵; ¹Muskingum Area Technical College, 1555 Newark Road, Zanesville OH 43701, ²Muskingum College, ³The Wilds, ⁴Zanesville City Schools, ⁵The Ohio State University.

A three-year Action-WISE project, funded by the National Science Foundation, involves a close collaboration among Muskingum Area Technical College, Muskingum College, The Wilds, and Zanesville City Schools. The project, described by Marks *et al.* at the 2000 Annual Meeting of the Ohio Academy of Science, is designed to keep females engaged in and confident about math and science. Key offerings include monthly seminars with female scientists, field trips involving hands-on learning, and intensive summer camps with an environmental science focus for sixth grade, middle school, and high school females. Pre- and post surveys of science and mathematics attitudes and perceptions were administered in the 1999 summer camps and analyzed using t-tests. Thirty-one sixth graders showed a highly significant difference ($p = .007$) for science attitudes and very highly significant difference ($p = .000$) for mathematics attitudes. Thirty middle school students showed a significant difference ($p = .019$) for science attitudes but no significant difference ($p = .064$) for mathematics attitudes. Fifteen high school students showed a no significant differences for either science or mathematics attitudes. High school students scored much higher than national average for their age group. Benefits were obtained at both sixth grade and middle school levels, confirming that females' interest and attitudes toward science and mathematics decline with increasing grade level. This research shows that intervention produces significant beneficial effects at lower grade levels. Participant self-reports and teacher observations suggest a positive increase in participants' self-esteem, improved performance on standardized proficiency tests, and an increase in overall grade point average.

MEDICINE

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 013

MARY GAHBAUER-PRESIDING

02:00 TESTOSTERONE INCREASES THE BLOOD PRESSURE AND KIDNEY WEIGHT IN DIFFERENT STRAINS OF HYPERTENSIVE RATS. Umesh Sharma, Daniel Ely, University of Akron, Department of Biology, Akron OH 44325-3908.

Castration or androgen receptor antagonist is known to reduce the development of hypertension in rats. Also androgen treatment of neonatal female spontaneously hypertensive rat (SHR) tends to increase the blood pressure (BP) similar to that of male SHR during maturation. Our hypothesis is that testosterone increases the BP and kidney weight in male rats. SHR and normotensive Wistar-Kyoto (WKY) rats and strains consomic for the Y chromosome- SHR/y and autosomes- SHR/a male rats were castrated at 4-6 weeks and divided into control and sham groups (n=8/group) with testosterone and sham implants respectively. BP and blood were taken biweekly for estimation of serum testosterone and catecholamines by HPLC. The animals were terminated at 16-18 weeks and kidneys and adrenals removed for the estimation of tyrosine hydroxylase activity by HPLC. There was a significant increase in kidney weights and blood pressure in the testosterone treated rats as compared to the sham treated ones except the SHR/a strain. There was no significant difference in the renal tyrosine hydroxylase activity between the test and sham groups in any of the strains. In conclusion, testosterone increases the BP and average kidney weight possibly through activation of the sympathetic nervous system and the androgen receptor.

02:15 EFFECTS OF ACETYLCHOLINE IN THE PRE-ISCHEMIC HEART VERSUS THE POST-ISCHEMIC HEART. Melissa O. Juliano, mejuliano@hotmail.com, Seth Bradford, pantel.2k@yahoo.com, Gail Dunphy, Daniel E. Ely, ely1@uakron.edu, The University of Akron, Biology Dept., Akron OH 44325-3908.

Myocardial ischemia affects contractility, coronary flow and the accumulation of harmful substances in the heart. This study examined the effects of acetylcholine in the heart, its effects following ischemia and whether it protected the heart from ischemic damage. It is hypothesized that acetylcholine may be a "rescue agent" to the heart after ischemia due to its production of nitric oxide and vasodilating qualities. Spontaneously Hypertensive rats (SHR/y) were used (n=4/group, totaling 2 groups). Langendorff isolated heart preparation was used and hearts were stimulated at 180 bpm. Control hearts were perfused with Krebs-Henseleit solution (KH). Left ventricular diastolic and systolic pressures were measured. Flow of KH to the heart was stopped for 30-min global ischemia. Following the ischemia the heart was perfused with KH and pressures taken. Treatment hearts were perfused initially as control hearts, the KH was then switched to acetylcholine + Krebs-Henseleit solution (a+KH) and pressures taken. Flow to the heart was stopped for 30-min. Following the ischemia, the heart was perfused with KH and a+KH and pressures taken. Post-ischemic hearts showed significant increase ($p < 0.001$) in diastolic pressure versus

pre-ischemic hearts (7 to 43mmHg). Diastolic pressure in post-ischemic hearts perfused with a+KH (29mmHg) were significantly lower ($p=0.002$) than post-ischemic controls (50mmHg). Creatine kinase (CK) in perfusate of post-ischemic hearts perfused with a+KH (63 U/L) was lower than post-ischemic controls (177 U/L). These results indicate that acetylcholine decreased diastolic pressure following ischemia and that there is less damage in the heart when perfused with acetylcholine before ischemia.

02:30 LOSS OF HETEROZYGOSITY ANALYSIS OF GLIAL TUMORS. Marguerite Barth, m-barth@onu.edu, Dr. Gene Barnett, Lerner Research Institute Cleveland Clinic, Dept. of Molecular Genetics, 428 N. Main St., Ada OH 45810.

Allelic loss is often detected in gliomas. According to previously published research, loss of heterozygosity (LOH) of certain alleles is a positive predictor for chemotherapeutic response and longer survival rates. In oligodendrogliomas, for example, loss of 1p and/or 19q is analogous with chemotherapeutic response. At the conclusion of the study 43 tumors, (13 glioblastomas, 6 mixed oligoastrocytomas, 3 anaplastic astrocytomas, 13 low grade oligodendrogliomas, and 8 anaplastic oligodendrogliomas) had been examined, specifically on three chromosomes at numerous loci. This project consists of four main steps. The first step is extraction of DNA from blood and tumor tissue of patients with one of five types of brain tumors: glioblastomas, anaplastic astrocytomas, mixed gliomas, low grade oligodendrogliomas, and anaplastic oligodendrogliomas. The second step is PCR of the DNA in order to amplify the region under investigation. The third step is High Performance Liquid Chromatography (HPLC) using automated WAVE™ DNA Fragment Analysis System (Transgeomics, Inc., CA) in which the alleles are separated according to size. The final step, interpretation of the data, is achieved by comparing the blood and tumor DNA in order to determine if LOH has occurred. The results found are comparable to previous research in this field. The future goal of this project is to establish a correlation between molecular changes, histopathology, and clinical features of tumors. This may lead to an improved classification of tumors and allow more beneficial treatment.

02:45 DETERMINATION OF THE ABILITY OF A NUTRITIONAL SUPPLEMENT TO RESTORE THE DELAYED TYPE HYPERSENSITIVITY IMMUNE RESPONSE IN ETHANOL TREATED LABORATORY RATS. Brian S. Postma, b-postma@onu.edu, 402 W. College Ave., Unit 2571, Ada OH 45810.

The documented, dangerous effects of alcohol on the human body are numerous. One particular system affected is the immune system. Because the ability of the body to defend itself from attack is so important, much research has been done to determine the mechanism by which alcohol damages the immune system. There is debate over whether or not the malnutrition that frequently occurs simultaneously with alcoholism is to blame for the decreased immune response. Nine Sprague-Dawley rats that have been exposed to 10 grams of ethanol per kilogram body weight per day with varying degrees of calorie deprivation were subjected to Delayed Type Hypersensitivity skin tests with sheep erythrocytes serving as the immunogen. Measurement of the level of malnutrition was conducted through changes in body mass. The area of the skin test reactions was used to measure immune response on days 7, 14, 21, and 28 of the experiment. Changes in body mass were 7.8 ± 0.7 (mean \pm std. dev.), 12.2 ± 0.7 , 0.8 ± 3.8 , and 1.3 ± 4.2 increases for the Control, Mild Primary Malnutrition, Primary Malnutrition, and Primary Malnutrition with a General Vitamin/Nutrient Supplement groups, respectively. Overall averages for the skin tests for the same groups were all decreases of 26.5 ± 14.4 (mean \pm std. dev.), 26.6 ± 10.8 , 41.8 ± 15.0 , and 35.8 ± 16.1 , respectively. None of the differences in immune response were statistically significant. Although trends did show that the nutrient supplement did help restore some of the immune response, more research and a larger sample size are necessary to find significant results in a future study.

03:00 VARIABLES CONTRIBUTING TO INFANT FEEDING PRACTICES IN THE GREATER MIAMI VALLEY. Laura C. Laski, LASKILC@muohio.edu, (Diana M. Spillman SPILLMMD@muohio.edu) Miami University, Phillips Hall, Oxford OH 45056.

Infants have been fed in a variety of ways, ranging from introducing solid foods at several days old to the current recommendations of delaying solid foods until at least four months. The objective of the research was to determine how caregivers are feeding infants depending on income level, education level and mother's age. The hypothesis was that these variables affect infant feeding in numerous ways. One hundred caregivers participated in the survey and were recruited from the community. Eighty-eight percent of the participants were white, the average mother's age was 25.442 years and 63% of caregivers had a family income of \$30,000 or below. Results show that 23% of infants did not receive rice cereal as their first food. The average age of introduction of solids was 4.00 months. Fifty-eight percent of caregivers initially began breast-feeding their infants with 27% continuing for at least six months. Income level did not effect breast-feeding ($p=0.199$) while an increase in the mother's age ($p=0.011$) and education level ($p=0.007$) effected breast-feeding prevalence. Older mothers ($p=0.032$) and higher educated caregivers ($p=0.00$) were less likely to put an infant to bed with a bottle, and older mothers were less likely to put cereal in a bottle ($p=0.0001$). Income level did not effect infant feeding practices. Data also showed

that there were no significant relationship between WIC and non-WIC participants with regards to breast-feeding ($p=0.987$) or introduction of solid foods ($p=0.91$). Results show where more education of caregivers is needed about appropriate infant feeding practices.

03:15 HELICOPTER TRANSPORT OF ACUTE STROKE. Vladimir T. Vasconcelos¹, vtvascon@cc.owu.edu, (John E. Duldner¹, soccerdoc@aol.com, Lauren Pray², lep3@po.cwru.edu), ¹Ohio Wesleyan University, HWCC 3268, Delaware OH 43015 and ²Case Western Reserve University.

Helicopter transport (HT), in Ohio, is used to transport acute stroke patients in need for a more experienced work centers. This project evaluated aspects of stroke management related to HT. Retrospective review of ischemic stroke (ISCH) and hemorrhagic stroke (HEM) patients transported by helicopter over an 18-month period. HEM patients included non-traumatic intracerebral (sICH), subarachnoid (SAH), and subdural hemorrhage (SDH). Selected clinical parameters are presented. Of 424 patients transported, 40% (170) were ISCH strokes. Mean age was 61.5 years (range, 19 to 88 years). 45.7% (142) were female. Mean time to helicopter arrival after symptom onset was 197 minutes (3 hrs, 17 min), with no difference in arrival time due to stroke type. Average helicopter transport flight time was 11.8 minutes and average number of vital signs obtained per flight was 4.6. Mean systolic blood pressure (BP) was not significantly different between ISCH and HEM patients ($165 + 29.83$ vs. $161 + 33.31$, respectively; $p=0.41$). Diastolic BP were also similar between HEM and ISCH groups. 88 patients had documented cardiac dysrhythmia, most often sinus tachycardia, followed by atrial fibrillation. sICH patients had lower initial Glasgow Coma Scale (GCS) scores (8.3 vs. 11.5 , $p<0.05$) and were intubated more frequently than ISCH patients (53 vs. 17 ; $p<0.05$). 88% of sICH and 68% of ISCH intubated prior to transport. Only 6 percent were intubated by the HT team. 50% of patients were medicated by the HT team, most often with midazolam, followed by anti-hypertensives and paralytic agents. Most common anti-hypertensive was sodium nitroprusside. Stroke patients requiring HT are benefited from this type of transportation, because the treatment is extremely time dependent. Potential therapies and intensive management may be offered to stroke patients, not available elsewhere.

03:30 EMERGENCY MANAGEMENT OF INTRACEREBRAL HEMORRHAGE. J.T. Eckner, jte4@po.cwru.edu, Eric P. Brumwell, epb2@po.cwru.edu, Patrick M. Cottle, pmc9@po.cwru.edu, (John E. Duldner, Soccerdoc@aol.com), Case Western Reserve University, School of Medicine, 3259 Hyde Park, Cleveland Heights OH 44118.

Morbidity and mortality of intracerebral hemorrhage (ICH) are high. Clinical management guidelines are vague and emergency treatment strategies lack consensus. Guidelines for management of ICH were published in May 1999. This study's primary aim is to evaluate the effect of these guidelines on 30-day mortality in ICH patients. This study is a multi-hospital (7 hospitals in Ohio), retrospective cohort review. Data collection is still underway. Of 146 patients, mean age is 67; 49% are female, 24% are African-American. 81% arrived to the ED via ambulance. 15% had history of alcohol abuse; 63% used smoking or chewing tobacco. Decreased level of consciousness was initial presentation in 54%. History of hypertension was common (56%). Mean initial systolic and diastolic blood pressures were 170 ± 38.2 mmHg and 96.46 ± 25.1 mmHg, respectively. Blood pressures did not change significantly during ED course ($p=0.42$). Most frequently administered medications in the ED: antihypertensives (22%) and benzodiazepines (16%). Median time to cranial CT: 29 minutes. No significant laboratory abnormalities were found. Of 27 toxicology screens, illicit substances were found in 10 (5 benzodiazepines, 3 cocaine, 2 ethanol). 15 patients underwent surgery for hemorrhage evacuation. Overall case fatality rate: 34.2%. Of patients who survived, most frequent discharge dispositions: extended care facility (28.1%), home (23.9%), rehabilitation (12.3%). It is too early to tell what effect published guidelines have had on 30-day mortality in ICH patients. Conclusions that can be drawn at this time are that ICH frequently results in death and that emergency management strategies are inconsistent.

03:45 EMERGENCY MANAGEMENT OF SUBARACHNOID HEMORRHAGE. Taylor C. Bear, beartc@yahoo.com, Kevin S. Fleming, kfsf@po.cwru.edu, Gus Theodos, gxt2@po.cwru.edu, (John E. Duldner, soccerdoc@aol.com), Case Western Reserve University, School of Medicine, 2477 Overlook Rd., Apt. 304, Cleveland Heights OH 44106.

A large body of literature addresses subarachnoid hemorrhage (SAH), but treatment guidelines are broad and data describing emergency department (ED) management is lacking. Clinical indices related to evaluation, management and outcome including hypertension, interventions, therapies and effect of published guidelines are being studied. Patient records from seven Ohio hospitals are being retrospectively reviewed in this ongoing study. Thus far (N=122), mean age is 46, 52.4% are female, and 37% are African-American. Primary presentation occurred in 62% of patients, others were transported by helicopter. Decreased level of consciousness was initial presentation in 39%. Headache was chief complaint for conscious patients (81%). Less than 25% had a history of hypertension. Initial systolic and diastolic blood pressures were 192 ± 30.8 mmHg and 98 ± 8.0 mmHg, respectively. Antihypertensive therapy was administered in 16%, most commonly nitroprusside, followed by labetalol. Nimodipine was ordered in ED infrequently (14%). 6% of conscious patients deteriorated

rated in the ED, requiring intubation. All patients underwent cranial computed tomography (CT) with mean time to CT from triage of 48 minutes. One patient required lumbar puncture to diagnose SAH. Most frequent ED dispositions were to the intensive care unit (71%) and operating room (12%). Hospital outcomes included death (28%), discharge to extended care facility (19%), discharge to rehabilitation (31%) and discharge to home (22%). The data demonstrates that evaluation and management of SAH is inconsistent between hospitals and physicians. Therapies vary between patients and accepted treatments are not administered in the ED. Conclusions regarding effect of guidelines on outcome are premature.

GEOLOGY-SOILS-EDUCATION

9:00 AM SATURDAY,

MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 002

MICHAEL HUDSON-PRESIDING

09:00 HISTORY OF THE CHURCHILL MINE, LIBERTY TOWNSHIP, TRUMBULL COUNTY. Ann G. Harris, agharris@cc.ysu.edu, Youngstown State University, Department of Geology, One University Plaza, Youngstown OH 44555-0001.

The Churchill Mine is actually a complex of mines located in Liberty Township, Trumbull County Ohio. Mining began in 1864-65. It was a slope entry with a single air shaft in 1874. Unfortunately, the air circulation was poor because the air-courses bore no proportion to the furnace, and the fire was not always kept up. The mine was very extensive and employed from 150-190 men and boys inside. The coal seam is distributed in a series of basins of irregular shape, rising and falling in a series of swamps and hills without a break in their continuity. The Sharon #1 coal thinned out on the flanks of the hills. By 1880, the workings extended more than a mile from the slope entry. Production was 100,000 tons per month. It was one of the largest mines in the State of Ohio. It employed 342 men and boys, 23 worked on the surface and 319 underground. Excluding native-born Americans there were eight nationalities from Europe working in the mine. The Welsh far outnumbered the other nationalities. Before it closed down in 1886 the Churchill Slope was connected to the Churchill Shaft, Niles Shaft, Pumpkin Mine, Kline Mine and Centennial Shaft. There was 180 feet of cover over the mine. Around the 1940's, Girard, in Weathersfield township, began pumping their drinking water from an old entry of the mine.

09:15 A GAMMA-RAY ATTENUATION TECHNIQUE FOR HIGH RESOLUTION MEASUREMENT OF POROSITY IN SEDIMENT CORES. Wendy S. Freed, wfs3@po.cwru.edu, William L. Fornes, wlf2@po.cwru.edu, Gerald Matisoff, gxm4@po.cwru.edu, Case Western Reserve University, Department of Geological Sciences, 112 A.W. Smith Building, 10900 Euclid Ave., Cleveland OH 44106-7216.

Porosity of sediment cores was determined by a non-destructive gamma-ray attenuation technique. Sediment microcosms were placed between a 241Am source and a 3 mm x 3 mm cadmium-zinc-telluride (CZT) detector mounted on a computer controlled positioning system that allows the detector and source to move while the core remains fixed. 241Am photon emissions at 0.059 MeV and 0.017 MeV were counted by a multi-channel analyzer for a minimum of 1000 seconds at each position. A series of scans confirmed the attenuation of the low-energy 241Am gamma rays. Attenuation of the signal was measured with the source alone, a sediment cell plus water, and a cell plus mud. The measured activity decreased by about half with the addition of water to a cell, and by half again with the addition of mud to a cell. The cell with water represents 100% porosity and the cell with mud will be the least porous column used in the calibration. Therefore, these preliminary scans establish a range for the porosities expected in the experimental microcosms. Calibration of the gamma attenuation technique consisted of measured porosity against percent attenuation in a series of cells ranging from pure water to compact mud. The effects of benthic macroinvertebrates on the porosity will be studied. *Yoldia limatula*, a group of suspension-feeding marine clams, and *Nereis diversicolor*, a predatory marine polychaete will be added to sediment microcosms and a series of scans performed to determine how the infauna alters porosity. Different densities of the organisms will also be studied. It is hypothesized that as macrobenthic densities increase, the porosity will also increase. Because *Yoldia limatula* is a relatively shallow burrower, most of the differences are expected to be in the top layer of sediment. *Nereis diversicolor* does not maintain burrows, so a lesser affect is anticipated.

09:30 BEDROCK MAPPING OF SILICICLASTIC ROCKS OF NORTH-CENTRAL OHIO BY BULK CHEMISTRY AND STRATIGRAPHIC CORRELATIONS. Michael R. Hudson, mhudson@ashland.edu, Karmel L. Miller, and Jennifer Zurakowski, Ashland University, Department of Chemistry/Geology/Physics, Ashland OH 44805.

Previously undivided Mississippian and Pennsylvanian lithologies of north-central Ohio (Ashland, Richland, Wayne, and Holmes counties) have been differentiated and

correlated by stratigraphic and geochemical analyses, producing the first bedrock geologic map of Ashland and Richland counties. The Mississippian age Black Hand member of the Cuyahoga Formation (Waverly Group) is a coarse, deltaic facies sandstone, with characteristic low amplitude cross beds, liesegang rings, and concretions. It extends from south-central into north-central Ohio, but grades laterally (north, east, and west) into a finer siliciclastic facies that appears to be chronostratigraphically equivalent to the Armstrong member as proposed by Conrey (1921). The Armstrong ranges from shales to medium-grained sandstones, which provides evidence for lateral grading off the Black Hand delta distributary mouth bar and channel deposits into subaqueous and subaerial levee and marsh deposits. The Black Hand is characterized by greater than 85 wt. % SiO₂, while the Armstrong ranges from 41-90 wt. % SiO₂. Additionally, the Armstrong includes diagnostic calcareous cement, high organic content, and enrichment in Fe₂O₃, Al₂O₃, and Zr relative to the Black Hand. The Byer Sandstone overlies the Black Hand and Armstrong. It is thinly laminated and consists of medium-grained sandstones with occasional siltstone horizons. It is chemically indistinguishable from the Armstrong, so its correlation is based solely on stratigraphy. It is interpreted as a deltaic distal bar, deposited during a Mississippian transgression. The Massillon Sandstone, part of the Pennsylvanian age Pottsville Group, lies unconformably on the Byer and is only sparingly present. It is characterized by very high SiO₂ and low Al₂O₃, very coarse-grain size, and highly weathered cement.

09:45 A KEY TO SOIL SERIES USED IN OHIO SINCE 1900. Timothy D. Gerber, tim.gerber@dnr.state.oh.us, S. P. Lewis, K.E. Miller, Ohio Dept. of Natural Resources, 1939 Fountain Sq. Ct., Columbus OH 43224-1385.

The soil series is the lowest level in USDA's soil classification system, and almost 500 different soil series are currently recognized in Ohio. While soil series and higher levels in the classification system are defined on the basis of their morphology, relationships between the soil series are more easily understood on the basis of genetic differences. To assist users of soil survey information from multiple sources and newly hired soil scientists in the Ohio Soil Survey, a system for keying Ohio soil series with a strong emphasis on geologic materials, landforms, and natural drainage characteristics was developed. Current and historical concepts for soil series were reviewed from official soil survey documents and databases, and distribution patterns for the soil series were reviewed from geographic databases. The "Key to Ohio Soil Series" provides a reference for users of soil survey information who are curious about distinctions between any two soil series named in soil survey publications generated since 1900. It also provides a reference for identifying five to ten other soil series that are similar or are commonly mapped on similar landscapes. The key demonstrates the critical need for soil survey information that has been generated on a county-by-county basis over many decades to be updated statewide to a common vintage. Furthermore, it provides a framework for a new generation of soil scientists to learn how the concepts of previous generations of soil scientists evolved, based on how soil series have been defined.

10:00 A COMPARISON OF ALTERNATIVE TEACHING METHODS IN LARGE INTRODUCTORY EARTH SCIENCE LECTURES. David A. McConnell, damb@uakron.edu, and David N. Steer, steer@uakron.edu, University of Akron, Department of Geology, Akron OH 44325-4101.

Teaching strategies that promote higher-level learning processes were incorporated into large (150 student) sections of an introductory Earth Science course at the University of Akron in Fall semester 2000. A team of faculty shared responsibility for reorganizing courses into ten modules of 3 or 4 lessons built around key concepts. Classroom activities were restructured in two sections to increase student-student interaction. Lecture was broken into short segments of 10-20 minutes, separated by formative assessment exercises that involved students working in cooperative groups (2-4 students). A variety of classroom assessment techniques were incorporated into the cooperative exercises to evaluate basic knowledge, and to encourage critical thinking and the synthesis and/or analysis of data. The exercises take a variety of forms including making observations, analyzing map data and geologic reports, the construction of diagrams and concept maps, and role playing to model opposing views on environmental issues. Two classes were taught by the same instructor using contrasting teaching methods (cooperative groups vs. "traditional" lectures). Summative assessment was modified from wholly multiple choice tests to combinations of multiple choice/short answer exams. Short answer questions accounted for 15% of total exam grades. Multiple choice questions were separated into purely content-based questions and interpretation questions that required students to apply what they had learned to new situations. Preliminary exam results for the cooperative learning class averaged 3% higher than the traditional lecture-only class. Scores on the short answer questions alone were 8% higher in the cooperative learning class.

10:15 FILLING IN THE GAPS: USING MINI-COURSES TO TEACH EARTH SCIENCES NEEDED FOR STUDENTS' SUCCESSFUL COMPLETION OF INTERDISCIPLINARY ENGINEERING DESIGN PROJECTS. Julie Weatherington-Rice, weathringtn-rice.1@osu.edu, Carol Moody, moody.5@osu.edu, Diane Yagich, yagich.1@osu.edu, and Ann Christy, christy.14@osu.edu, Bennett & Williams Environmental Consultants, 2700 E. Dublin-Granville Rd., Suite 400, Columbus OH 43231.

By their very nature, interdisciplinary engineering design projects require that students draw concepts from multiple fields of study to solve problems in real world settings. The Ohio State University Department of Food, Agriculture and Biological Engineering addresses this need by teaching several classes as "consulting firms", assigning projects from actual sites. The use of real documents requires familiarity with subjects for which the students may have no training, especially geology, soils and hydrology. To overcome this educational barrier, a student-friendly, tutorial mini-course was developed to help undergraduate biological engineering students master these additional science fundamentals needed to understand this year's class project, the Industrial Excess Landfill site in Uniontown, Ohio. The mini-course included assignments that were added to their regular class homework. The students were given readings from several fields covering the same topics, Ohio natural resources maps and fact sheets and a copy of their home soil survey. They saw a slide show of Ohio geology and soils, were involved in several discussion periods with the project "client", held a site visit and participated in a two-hour Soils/ Geology/ Water Fair. This Fair, based on Project WET activities, had five learning stations: surface / ground / drinking water demonstrations; a bedrock geology teaching module; a glacial geology and related water resources station; a soil science display; and a hands-on station to explore the building blocks of the state's soils, glacial deposits and sedimentary rocks. Upon completion, students used this new knowledge to understand and evaluate project site reports. Assessment measures included technical quality of the students' final project reports, interviews with students and teachers, self-assessment instruments for students, and student evaluations of instructional technique. Results showed that the objectives were achieved, and that an unprecedented 100% of the students considered the mini-course helpful.

APPLICATIONS OF SCIENCE IN THE ENVIRONMENT

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 002

ROBERT VERTREES-PRESIDING

02:00 DEVELOPMENT OF A CLASSIFICATION OF DIGITAL GEOREFERENCED DATA SETS. Robert L. Vertrees, Vertrees.1@osu.edu, The Ohio State University, School of Natural Resources, 210 Kottman Hall, 2021 Coffey Rd., Columbus OH 43210-1085.

Automated Geographic Information Systems (GIS) are used in many ways to analyze a wide variety of digital georeferenced data sets (DGDS) and to present the results of these analyses. Since the first automated GIS in the mid-1960s, the number of GIS and their analytical capabilities have increased manifold as has the number and types of DGDS. A need now exists for a comprehensive classification of DGDS that is developed following scientific principles of classification. At present, the only classifications are for data sets related to particular limited purposes. A comprehensive classification is needed to serve purposes such as the inventorying of DGDS, the indexing of them in clearinghouses, the identification of where gaps in the availability of DGDS exist, and the identification of where costly redundancies in the collection and provision of DGDS might be reduced or eliminated. This paper presents the results of research that have resulted in development of a classification with 19 basic-level categories of DGDS that are intended to encompass, with as little overlap as possible, the entire universe of DGDS. The 19 categories are sequenced and ordered with reference to a systematic conceptual scheme. The structure of this scheme is an eight-part framework, with each part identified by a "Framework Descriptor." The basic-level categories are being divided into more detailed levels on the basis of experience in categorizing specific DGDS. The evolutionary nature of developing complex classifications such as this is explained in the context of a review of literature and personal experience in devising other types of classifications.

02:15 CLONAL VARIATION IN THE SUCEPTIBILITY OF ASPEN (*POPULUS TREMULA*) TO HERBIVORE ACTIVITY OF MOUNTAIN HARES (*LEPUS TIMIDUS*). Matthew K. Perlik, mattperlik@yahoo.com, 6977 Wolff Rd., Medina OH 44256.

The resistance of twelve different clones of *Populus tremula* (European Quaking Aspen) to the browsing activity of *Lepus timidus* (mountain hare) was tested. The objective was to determine a clone of European quaking aspen that contains the greatest resistance to browsing by a common herbivore. European quaking aspen is a popular silviculture tree used to replant harvested forest areas. Mountain hares are common herbivores of the forests of Finland. The experiment took place at seven sites in the forest areas outside the city of Joensuu, Finland. Known populations of mountain hares existed at the test stations. These areas were baited with fresh, wild growing European quaking aspen for two months prior to the experiment to insure the presence of the mountain hares. Clones purchased from a tree farm were placed in the forest areas in a grid pattern of 36 points of four of the same clone per point. These saplings were observed daily to note any browsing or lack of browsing that incurred

from mountain hares. This information can be used to help determine a clone of European quaking aspen that can be grown in reforestation areas cleared from logging with little risk of being browsed in the early stages of growth. It was found that no one clone resisted browsing however clones 10, 14, 34 lost statistically lower amounts of biomass. It was also found that clone 13 suffered statistically more browsing than the other clones.

02:30 AMISH WELL TESTING PROGRAM. James J. Hoorman, jhoorman@postoffice.ag.ohio-state.edu, Ohio State University Extension, One Courthouse Square, Suite 40, Kenton OH 43326-2399.

With a United States Department of Agriculture water quality grant, three Amish communities participated in a well testing program to determine and improve the quality of their drinking water. In a three-year period (1998-2000), 133 Amish wells were tested for total coliform bacteria (TCB), *Escherichia coli* O157:H7 (EC), and nitrate-nitrogen (NN). In three years, only one well tested over the Ohio EPA acceptable drinking water standard of 10 mg/L NN. In 1998, thirty-four New Order Amish wells at Belle Center, Ohio were tested. Five wells (14.7%) were contaminated with TCB and none tested positive for EC. In 1999, seventy Old Order Amish wells at Kenton and Degraff, Ohio were tested. Twenty-two (31.4%) wells were contaminated with TCB and 4 wells (5.7%) with EC. The contaminated wells were retested to document improvements in water quality. Nineteen (86.4%) Amish families followed OSU Extension recommendations on shock chlorination, well repairs, and avoiding surface water contamination with 3 Amish families (13.6%) failing to make changes. After retesting, 9 wells (40.9%) retested negative for TCB, 13 (59.1%) retested positive for TCB and 4 wells were again positive for EC. Alternative drinking water sources are being developed for the EC wells. In 2000, 29 Old Order Amish wells were tested. Eleven (37.9%) tested positive for TCB and 3 (10.3%) positive for EC. Well pits with poor drainage, well casings less than 6 inches above the ground, no well caps, and malfunctioning well equipment contributed to TCB, EC, and NN in the Amish communities' drinking water.

02:45 USEFULNESS OF ELF-97 FOR DETECTION OF ALKALINE PHOSPHATASE ACTIVITY ON INDIVIDUAL ALGAL CELLS AND IN NATURAL FRESH-WATER PLANKTON ASSEMBLAGES. Sarah E. Eichler, edeich@ezo.net, and Robert T. Heath, rheath@kent.edu, Kent State University, Department of Biological Sciences, Kent OH 44242-0001.

Phytoplankton in freshwater communities may compensate for P-limitation by adaptively producing alkaline phosphatase (APA) on the surface of their cells. Current techniques analyze APA as a community response in batch and are unable to identify whether all algae produce APA equally. The purpose of this study was to investigate whether a novel compound (ELF-97, Molecular Probes) could stain only those freshwater phytoplankton cells producing APA. ELF-97 is weakly fluorescent and soluble, but on hydrolysis by APA it precipitates and fluoresces yellow intensely. We examined the usefulness of ELF-97 examining P-replete and P-limited cultures of *Scenedesmus quadricauda* (*Sc. q.*) and *Chlorella* sp. (*Chl.*), as well as natural phytoplankton assemblages from East Twin Lake (ETL), near Kent, Portage Co., OH. APA of samples were analyzed in batch with the fluorometric procedure using methylumbelliferyl-phosphate (MUP) as substrate with a Turner Designs TD-700 fluorometer, then fixed, treated with ELF-97, and viewed on slides by epifluorescence microscopy. Only samples with high APA stained with ELF. Only *Sc. q.* stained with ELF-97 in a mixture of P-limited *Sc. q.* with high APA and P-replete *Chl.* with very low APA. Plankton from the epilimnion of ETL showed high APA in the community, yet ELF stained only *Ceratium hirundinella* (*C. hir.*), indicating that only *C. hir.* produced APA and that not all phytoplankton produced APA equally. ELF-97 is useful for identifying those species producing APA in a mixed assemblage. This study was supported in part by Lake Erie Protection Fund Grant 97-18 and by Ohio Sea Grant R/ER-37.

03:00 VEGETATION SURVEYS FOR CONSTRUCTED WETLANDS OF THE WETLAND RESERVOIR SUBIRRIGATION SYSTEMS. Lee M. Luckeydoo, Luckeydoo.1@osu.edu, Ohio State University, 590 Woody Hayes Dr., Columbus OH 43210.

The Wetland Reservoir Subirrigation System (WRSIS) project links agricultural fields, wetland, and a storage reservoir to help minimize agrochemical runoff, sediment delivery to streams and provide water supply for subirrigation of crops. Three demonstration sites located in Defiance, Fulton, and Van Wert counties in northwest Ohio, were constructed approximately five years ago. Case studies of terrestrial and aquatic vegetation development and structure on the three wetlands sites were conducted. Annual surveys were completed on all sites using a transect technique, and observations were made using Braun-Blanquet scales. Survey information indicates that species richness declined at all three sites between 1998 and 2000. The declines in species number were from 51 to 24, from 32 to 21, and from 45 to 27 species at the Defiance, Fulton, and Van Wert locations, respectively. Possible reasons for these declines include extremes in water levels and construction activities, which modified the wetlands. Wetland indicator species were most abundant at Defiance (39%) and Fulton (42%) in 1999, and in 2000 at Van Wert (52%). Overall, the sites appear to be in early stages of wetland development. Seed bank analysis of Defiance location soils showed a potential of 7 additional wetland species

not present during the 1998 field surveys. Using life history information for species presently on site and species available in the seed bank, a management plan using water level management to encourage growth of wetland and terrestrial species that have promising water quality improvement capabilities has been developed.

03:15 NATURAL RESTORATION OF "EL COCAL DE LA BOMBA" WETLAND: AN OVERVIEW OF GEOGRAPHICAL AND HYDROENVIRONMENTAL CHANGES. Yung-Tse Hung¹, Mario G. Cora-Hernandez², Mario R. Cora-Cruz², ¹Cleveland State University, Civil Engineering Department, Cleveland OH 44115, ²University of Akron, Department of Geography.

The land lots near El Coccal de la Bomba in the southern coast town of Arroyo, Puerto Rico were used as a sugarcane plantation and cattle ranch for more than fifty years. The study area is a wetland as defined in the 1985 wetland inventory published by the U.S. Department of the Interior, Fish And Wildlife Service, composed of various ecological systems. It is part of the alluvial fan resting on the nearby Cordillera Central of Puerto Rico. During the productive years the surveyed area was accessible to pedestrians and a variety of agricultural machinery. In order to dry the original wetland for agricultural purposes, the Lafayette Sugar Mill, in conjunction with the Puerto Rico Reconstruction Administration, installed a pumping station that altered the natural drainage patterns of the area. Changes in the socio-economic patterns of Puerto Rico during the 1960s led to the gradual disappearance of sugarcane production including multiple sugarcane mills. The closure of the mentioned mill led to the abandonment of the pumping station, which resulted in the restoration of the natural water patterns in the area, and the gradual reestablishment of the mentioned wetland. From 1977 to 1997, the wetland increased in size from 113.5 acres to 352.5 acres, demonstrating the effect of natural restoration. It is concluded that natural restoration can effectively remediate wetlands.

03:30 TREATMENT OF TETRACHLOROETHYLENE CONTAINING WASTEWATER WITH ANAEROBIC REACTOR. Howard H. Lo¹, Indira Yaddanapudi², Yung-Tse Hung², Ruth Yu-Li Yeh³, Cleveland State University, ¹Department of Biological, Geological, and Environmental Sciences, ²Civil Engineering Department, Cleveland OH 44115, ³Ming-Hsin Institute of Technology, Chemical Engineering Department, Hsinchu Taiwan.

The paper examines the use of upflow anaerobic sludge blanket (UASB) reactor in the treatment of high strength wastewater containing tetrachloroethylene or perchloroethylene (PCE). The UASB reactor was operated at 4 different hydraulic retention time of 6, 12, 18, and 24 hours. Synthetic wastewater contained 50 mg/l PCE and 2000 mg/l COD (chemical oxygen demand) was used as feed to the UASB reactor. The granules of 0.25 - 4 mm size were observed after 82 days having mostly methanotrix and methanosarcina bacteria. Influent PCE concentration of 5-50 mg/l decreased to less than 0.23 mg/l with 98.5% removal efficiency. The trichloroethylene (TCE) cis-1, 2-dichloroethylene, vinyl chloride and ethylene were formed from the dehalogenation of PCE. Under steady state operation conditions the COD removal of 94% and biogas production of 0.559-0.508 M/Kg COD removed with methane content of 64% were achieved. The maximum dechlorination rate of PCE was 14.28 mg PCE/g VSS and the half velocity coefficient was 0.417 mg PCE/l under steady state conditions. The UASB reactor may prove to be a potential wastewater treatment process for PCE containing wastewater.

03:45 APPLICATIONS OF ION EXCHANGE RESINS IN METAL FINISHING WASTEWATER TREATMENT. Yung-Tse Hung¹, Majid Zarrinifarsar¹, Howard H. Lo², Ruth Yu-Li Yeh, Cleveland State University, ¹Civil Engineering Department, ²Department of Biological, Geological, and Environmental Sciences, Cleveland, OH 44115, ³Ming-Hsin Institute of Technology, Chemical Engineering Department, Hsinchu Taiwan.

This paper compares the efficiency of conventional precipitation methods to the application of ion exchange resins for treatment of metal finishing wastewater. The metal processing wastewater contained 1 mg/l of Zn, Cr, Cu, Pt, and Ni at the pH of 7.0. The study was conducted at 25 C in two pilot plants: one with 15 mg/l and 30 mg/l of ion exchange resin concentrations and the other, without ion exchange resin, as control. Wastewater was fed to the reactors at different hydraulic retention times of 4.0 and 2.4 hours. A water sample with hardness of 150 mg/l Ca was used to determine the effect of water hardness on removal of heavy metal ions, as well as the potential of the resin to remove the water hardness. The affinity of heavy metal for ion exchange resin was as follows: (a) Cu > Cr and Zr, (b) Pt > Cd > Ni. Water hardness interfered with the removal of heavy metal from wastewater. The resin application increased the efficiency of treatment by 10% at low loading rates at the rate and by 5% at high loading rates. The Fe component of water hardness was removed up to 70% at high hydraulic detention time, but the overall removal of Ca and Mg was insignificant.

04:00 DETERMINATION OF OPTIMAL OPERATIONAL PARAMETERS OF ELECTROFLOTATION REACTOR USED FOR THE TREATMENT OF INDUSTRIAL WASTEWATER. Yung-Tse Hung, Mario G. Cora-Hernandez, and Ruth Yu-Li Yeh, Cleveland State University, Civil Engineering Department, Cleveland OH 44115, Ming-Hsin Institute of Technology, Chemical Engineering Department, Hsinchu Taiwan.

The paper presents the development and optimization of an electroflotation batch unit

used in the treatment of heavy metals containing industrial wastewater in the presence of organic matter. The objective of the study was to examine the ability of electroflotation to serve as an innovative technology for the treatment of wastewater containing variable concentrations of heavy metals. A 5-liter batch unit was constructed made of plexiglass with inlet and outlet ports used to add and retrieve samples. Two stainless steel plates were installed inside the device, and subsequently connected to a direct current power supply capable of providing up to 13 volts. Essential parameters in the unit were hydraulic detention time, pH, removal efficiency, and power consumption. Experiments were conducted at detention times of 5, 10, 15, 30, and 45 minutes, and current values of 1, 3 and 6 amperes. The pH level in the solutions varied from 8 to 10.5 units, adjusted by the addition of lime (Ca(OH)₂). Sodium chloride (NaCl) was added to the wastewater to assist in the electrolysis process and to reduce power consumption. The unit was capable of achieving 85, 90, and 98% cadmium removal efficiency at detention times of 15, 30 and 45 minutes, respectively. An optimal current level of 3 amperes was obtained based on the experimental results. The unit was capable of consistently achieving effluent wastewater with a cadmium concentration as low as 0.11 mg/l. These results comply with the currently promulgated effluent pretreatment standard for industrial facilities.

04:15 OIL WASTEWATER TREATMENT BY MEMBRANE BIOREACTOR. Yung-Tse Hung¹, Elizabeth Atu¹, Howard H. Lo, Cleveland State University, ¹Civil and Environmental Engineering Department, ²Department of Biological, Geological, and Environmental Sciences, Cleveland OH 44115.

This paper provides a review on the use of membrane biofilter (MBR) in the treatment of oil-containing wastewaters. One potential application of MBR is for the treatment of industrial wastewater containing hydrocarbon, chemical oxygen demand (COD), total organic carbon (TOC), oil, NH₃-N and P, which are mixed with a surfactant. The MBR used in the study consisted of an activated sludge reactor connected to an external tubular crossflow ultrafiltration unit. The dissolved oxygen was maintained at 2-3 mg/l through aeration. The removal efficiency in MBR was 93 - 98% for COD, 95 - 98% for TOC, 99.9% for fuel oil, and 98% for lubricating oil. The process took place at constant temperature of 35°C and hydraulic detention time of 7 - 14 hours and loading rate 3.5 g/l - day for the experiment process for removal of oil contained in the wastewater. To prevent clogging in the ultrafiltration membrane, backwash using chlorine, acid, or detergent are being done inside the membrane. The effluent from bio-reactor was used as backwash water for the membrane. Back wash method using water from bioreactor and then flow into the membrane again. The treated water effluent from in MBR process is of good water quality, which can be reused in an industrial process and to reduce demand of fresh water.

04:30 SOLVENT WASHING FOR REMEDIATION OF SOILS CONTAMINATED WITH WOOD PRESERVING WASTES. Yung-Tse Hung, Vidyarani Velagandula, Howard H. Lo, Cleveland State University, ¹Civil Engineering Department, ²Biological, Geological, and Environmental Sciences Department, Cleveland OH 44115.

This paper examines the remediation of soil contaminated with wood preserving or wood treating contaminants by a solvent washing process. An integrated system has been developed to remediate soils contaminated with pentachlorophenol (PCP) and polycyclic aromatic hydrocarbons (PAH). Solvent washing was evaluated to remove PCP from aged field soils contaminated with wood treating wastes. Mixtures with at least 50% (mass) ethanol extracted statistically equivalent amounts of PCP, removing 730 mg/kg for one soil. Soil-solvent contact times of approximately 1 hour were adequate to remove a majority of the PCP. Consecutive wash stages with 50% ethanol solvent followed by water rinse stages. The crosscurrent washes were performed in three and two stage processes where soils were washed with the 50% ethanol solvent followed by water rinse stages. Ethanol recoveries were greater than 90% for both three and two stage wash trains. In addition to PCP, hydrocarbons were removed from the field soils by the 50% ethanol solvent. Three-stage countercurrent soil washing with 50% ethanol was successful in reducing PCP contamination on the soil from 785 to less than 40 mg/kg. Soil washing may be expensive when compared to bioremediation techniques and it is desirable when a rapid response to a contaminated site is necessary. In addition, soil washing is cost effective when followed by the recovery of solvent and biotreatment of contaminant residuals after solvent recovery.

MOLECULAR BIOLOGY

9:00 AM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 011

KERRY CHEESMAN-PRESIDING

09:00 DIFFERENTIAL EXPRESSION OF ALPHA CRYSTALLIN IN THE ZEBRAFISH, DANIO RERIO. Stephanie A. Runkle, srunkle@ashland.edu, Julie Hill, Mason Posner, mposner@ashland.edu, Ashland University, Department of Biology/Toxicology, Ashland OH 44805.

Crystallins are a diverse group of proteins that produce the refractive properties of the

ocular lens. One of these, alpha crystallin, is a member of the small heat shock protein family. In mammals, alpha crystallin functions as a molecular chaperone. Whereas alpha crystallin has been extensively studied in the endothermic mammals, little is known about this protein in ectothermic vertebrates. Previously, we cloned and sequenced the alpha B-crystallin subunit. Here, we used the reverse-transcriptase polymerase chain reaction (RT-PCR) to clone alpha A-crystallin from the zebrafish. Semi-quantitative RT-PCR was used to examine possible heat-induced expression of zebrafish alpha B-crystallin. There was a high level of amino acid sequence similarity between zebrafish alpha A-crystallin and the alpha crystallins of other vertebrates. Zebrafish alpha A- and alpha B-crystallin were only expressed in the lens. Mammalian alpha crystallins, in contrast, are expressed in various tissues. Zebrafish alpha B-crystallin expression was not induced after a 2-hour heat shock, even though we found increased expression of HSP 70. This lens specific expression and lack of heat shock induction suggests that zebrafish alpha crystallin plays less of a role as a molecular chaperone than its mammalian orthologue. Differences in chaperone activity may be linked to the shorter life span and cooler body temperature of the zebrafish.

09:15 PARTIAL SEQUENCE OF 16S RIBOSOMAL RNA GENE OF AMERICAN MASTODON. Anice Sabag, aasabag@cc.owu.edu, Jerry Goldstein, jegoldst@cc.owu.edu, Erin Wagner, ekwagner@cc.owu.edu, Jennifer M. LaPlante, jmlaplan@cc.owu.edu, Ohio Wesleyan University, Botany/Microbiology Department, Delaware OH 43015.

In 1989 the skeleton of an American mastodon, *Mammuth americanum*, was unearthed in Newark, Ohio. The skeleton is the most complete and most well preserved collection of mastodon bones ever discovered. Along with the bones, material that proved to be the remains of its intestinal tract was also discovered. Intestinal contents of mammals contain significant amounts of epithelial cells derived from the tissues lining the intestinal tract. In 1998 DNA of an extinct sloth was successfully purified from epithelial cells present in its petrified dung and was subsequently amplified by polymerase chain reaction (PCR). Using similar procedures, samples of the intestinal contents of the mastodon were prepared for DNA isolation and PCR amplification. Primer pairs were designed for several known genes of the African elephant, *Loxodonta africana*, and PCR reactions were performed. DNA amplification was obtained with several primer pairs as noted on agarose gels. Recombinant plasmids of several successfully cloned DNA fragments were purified and the sequence of the cloned DNA was determined. The DNA sequences, with the aid of a computer, were compared with genes present in the GenBank Database. One of the gene fragments successfully amplified contains 598 nucleotides that is composed of 4 sections that were calculated to be 95%, 92% identical, 83% identical, and 85% identical to homologous regions of the 16S ribosomal RNA gene of the African elephant. To date, only one other gene fragment, a 228 base sequence of the cytochrome C gene of the American mastodon, has been obtained.

09:30 EXAMINATION OF FOCAL ADHESION KINASE (FAK) IN CELL-TO-CELL ADHESION. Melissa N. Donnelly, donnel_m@denison.edu, Catherine Smith, smithc@denison.edu, Denison University, Slayter Box 716, Granville OH 43023.

Focal adhesion kinase (FAK), a 125 kD cytoplasmic protein involved in cell-to-extracellular matrix adhesion in fibroblasts, exhibits enhanced protein-tyrosine kinase activity when bound to a substratum. In addition, cell-cell contacts in epithelial cells are associated with high levels of phosphotyrosine. FAK is one candidate protein that may be involved in mediating cell-to-cell adhesion. Our hypothesis is that activated FAK is an integral part of the protein complex involved in cell-to-cell adhesion in neuronal cells. Using an adherent, spontaneously neurotogenic cell line (B103) and a suspension, cell-to-cell adherent cell line (B103-CS), we compare FAK levels and FAK activation status to clarify the role of FAK in neuronal cell-to-cell adhesion. After performing cell lysis and fractionation yielding Triton-soluble and Triton-insoluble fractions, we immunoprecipitated both fractions with an anti-FAK antibody. Western analyses followed using an anti-FAK antibody to determine FAK levels and another antibody to determine activated FAK levels in B103 and B103-CS cell lines.

09:45 DEVELOPMENT OF SATELLITE CELLS AND MITOSIS OF NEURONAL AND NON NEURONAL CELLS IN THE SUPERIOR CERVICAL GANGLION OF THE NEONATAL MALE RAT. Christine Chiappini-Williamson, Christine M. Candea, Ronald L. Salisbury, ronald2@uakron.edu, The University of Akron, Department of Biology, Akron OH 44325.

A sex difference in neuron number occurs in the superior cervical ganglion (SCG) of rats. There are approximately 25-30% more neurons in the male rat SCG compared to the female SCG. In an effort to obtain baseline data to study factors underlying this difference, we examined cell division in neuronal and non-neuronal cells obtained from male rats on postnatal day 6, and the appearance of satellite cells on postnatal days 5, 10 and 15. Satellite cells were detected by immunohistochemistry using antibodies directed against vimentin, an intermediate filament that preferentially appears in satellite cells during postnatal development. Cell division was detected by injecting rats with 5-bromo-2-deoxyuridine (BrdU, 50mg/kg body wt.) on postnatal day 5 and the rats were terminated the next day. All animals were terminated by

cardiac perfusion of 4% paraformaldehyde in 0.13M phosphate buffer, pH 7.6. Ganglia were embedded in paraffin and cut at 6 μ . Cells positive for vimentin increased in number, staining intensity and organization with time. Complete satellite capsules were not evident on days 5 and 10, but were complete by day 15. Neuronal and non-neuronal cells positive for BrdU were few in number and randomly spread throughout the ganglion by day 6. We conclude that on postnatal day 6 mitosis occurs prior to the formation of satellite capsules.

10:00 EFFECTS OF A COPLANAR CONGENER PCB 77 (3,3',4,4'-TETRACHLOROBIPHENYL) ON CHOLINE ACETYLTRANSFERASE ACTIVITY AND CIRCULATING THYROXINE (T₄) AND TRIIODOTHYRONINE (T₃) IN 30-DAY-OLD SPRAGUE-DAWLEY RATS. Christa L. Bowen, cbowen@bgsu.edu, Terri L. Provost, Douglas Donahue, and Lee A. Meserve, Bowling Green State University, 255 Buttonwood Ave. Bowling Green OH 43402.

Polychlorinated biphenyls (PCB) are environmental contaminants that were first observed to cause physiological problems about 40 years after the initiation of their industrial use. PCB are a concern because of their ubiquitous and lipophilic properties that allow them to concentrate through food webs by accumulating in adipose tissue. Placental and lactational PCB exposure to offspring cause metabolic and endocrine disruptions including depressed body weight, hypothyroxinemia, spatial learning and memory alterations, and neurochemical and neurobehavioral alterations. Previous work has shown that Aroclor 1254 (a mixture of PCB congeners) consumed during pregnancy and lactation resulted in smaller offspring, offspring with depressed circulating levels of T₃ and T₄, problems with spatial learning, and alterations in choline acetyltransferase (ChAT) activity. The present study examined the effect of one specific coplanar congener, PCB 77 (3,3',4,4'-tetrachlorobiphenyl). Pregnant Sprague-Dawley rats were fed either a control diet (consisting of rat chow) or a treatment diet (consisting of standard rat chow with PCB 77 added at either 1.25 ppm (LPCB) or 25 ppm (HPCB)). Rat pups were sacrificed by decapitation on postnatal day 30, and serum frozen for RIA determination of thyroid hormones. Brains were quickly removed, placed on ice and the hippocampi and basal forebrains were dissected free for the radiometrical measurement of ChAT activity. The present study found that PCB 77 at both LPCB and HPCB significantly elevated ChAT activity in the basal forebrain and hippocampus. However, circulating levels of T₃ and T₄ were significantly depressed in these 30-day-old animals. Thus, the present study suggests that a coplanar PCB congener may stimulate brain-thyroid dependence, and may help explain reports of attention deficit disorders in human offspring of mothers consuming PCB during pregnancy and lactation.

10:15 PHYLOGENETIC RELATIONSHIPS AMONG EIGHT GENERA OF HETEROCYSTOUS CYANOBACTERIA USING 23S rRNA GENE SEQUENCING. Xuesong Li, lix@muohio.edu, Megan M. Smith, smithmm12@hotmail.com, Susan R. Barnum, barnumsr@muohio.edu, Daniel J. Prochaska, prochadi@muohio.edu, Linda E. Watson, watsonle@muohio.edu, Miami University, Botany Department, Oxford OH 45056.

Ribosomal RNA operons are highly expressed genes and their products have a highly conserved secondary structure. The 23S rRNA coding region is thought to be conservative and thus may be useful for determining higher level phylogeny in bacteria. Some cyanobacterial genera can fix nitrogen in specialized cells called heterocysts, which form a monophyletic lineage. A total of 24 strains representing eight heterocystous genera (*Anabaena*, *Noctoc*, *Nodularia*, *Cylindrospermum*, *Chlorogloeopsis*, *Fischerella*, *Calothrix*, *Scytonema*) of cyanobacteria was examined using nucleotide sequences of 23S rRNA genes. Sequences were amplified using PCR and cloned. A total of 72 clones from the 24 strains were sequenced and aligned, and an evolutionary tree was constructed using PAUP 4.0 software. We found that the different strains have a high sequence similarity in the 23S rRNA gene region, and that *Anabaena* and *Noctoc* are the two most closely related genera.

10:30 EVOLUTION OF NITROGEN FIXATION GENES IN HETEROCYSTOUS CYANOBACTERIA. Brian J. Henson, bhenson57@yahoo.com, Susan R. Barnum, barnumsr@muohio.edu, Linda E. Watson, watsonle@muohio.edu, Miami University, Department of Botany, Oxford OH 45056.

Diazotrophy, or nitrogen fixation, is the process of converting atmospheric nitrogen (N₂) to more reduced forms (e.g., ammonium-NH₄⁺). Diazotrophy is unique among prokaryotes, however not all prokaryotes have the ability to fix nitrogen. Most cyanobacteria do have this ability, and many genes involved in diazotrophy have been identified within them. The most extensively studied genes are from the *nifHDK* operon, which is contiguous in most cyanobacteria. However, the heterocystous cyanobacteria have an 11kb insertion element present within the coding region of *nifD*, which is excised by site specific recombination during heterocyst differentiation. It is unclear whether or not all of the heterocystous cyanobacteria genera have this genetic element. The objective of this research is to study the evolution of nitrogen fixation genes by sequencing the *nifD* gene from representatives of the eight core genera of the heterocystous cyanobacteria lineage, and to determine which of these genera have the 11kb insertion element using PCR and Southern blot hybridization. The *nifD* sequences from six strains have been compared, and they have an average similarity of 80%, ranging from 71% to 98%. The 11kb insertion element has been detected in three of the five genera examined thus far.

10:45 ISOLATING PREOPTIC REGULATORY FACTORS -1 AND -2 GENES IN 129 OLA/HSD MICE. Alisha B. Ketner, aketner@capital.edu, Capital University 473; 2199 E. Main St., Columbus OH 43209.

Gonadotropin Releasing Hormone (GnRH) has long been known to affect sexual development in mammals. Ten years ago two unique GnRH-related mRNAs, Preoptic Releasing Factors 1 and 2 (PORF-1 and PORF-2) were described. Studies done with rat brains have shown that PORF-1 and PORF-2 express regional, age and gender dependent factors. This suggests a unique role in gender-related development. A larger study was begun to identify the sequence of PORF-1 and PORF-2 in mice. As part of the larger study, DNA was isolated from the liver and spleen tissue of an eight-week-old 120 OLA/Hsd mouse and from E14TG2a mouse Embryological Stem cells. The result of this experiment was the isolation of 500ug of E14TG2a mouse Embryological Stem cell DNA. This experiment was performed to collect enough DNA in order to be later sequenced to target the PORF-1 and PORF-2 genes for knockout experiments in mice for the ultimate purpose of determining possible roles of PORF-1 and PORF-2 in mice.

ENVIRONMENTAL MICROBIOLOGY

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 011

ROBERT HEATH-PRESIDING

02:00 THE SIGNIFICANCE OF PHOSPHOMONOESTERS TO PLANKTON IN A GLACIAL KETTLE LAKE. V. B. Mattson, fantum@gateway.net, R. T. Heath, rheath@kent.edu, Kent State University, Department of Biological Sciences, Kent OH 44242-0001.

Availability of phosphorus frequently limits the growth of phytoplankton in freshwater communities, yet these communities bloom when available P is barely detectable in freshwater communities. This study examined the hypothesis that phosphomonoesters (PME) may be an important source of P to phytoplankton and bacterioplankton through the hydrolytic activity of alkaline phosphatase (AP). We compared the rate of release of phosphate from various substrates with the phosphate uptake rate by the plankton community in East Twin Lake, a glacial kettle lake in Portage Co. near Kent, OH. Phosphorus limitation was determined by detection of low concentrations of soluble reactive phosphate (SRP), short phosphate turnover times and large phosphorus debts in the algae. Using radiolabeled compounds, uptake rates for orthophosphate were compared with uptake P from radiolabeled adenosine triphosphate ($^{32}\text{P-ATP}$) and glucose-6-phosphate ($^{32}\text{P-G6P}$). AP was determined fluorometrically, using methylumbelliferyl-phosphate (MUP) as a model substrate. We found in late June 1999 that the algal community was severely P-limited, with an SRP of 67nM and a high P-debt. Rate of MUP hydrolysis indicated that PME hydrolysis by AP could account for 53% of P-uptake by phytoplankton. ^{32}P released from $^{32}\text{P-ATP}$ and $^{32}\text{P-G6P}$ and taken up by algae and bacteria indicated that these compounds can meet a significant portion of the phosphate demand to both phytoplankton and bacterioplankton in P-limited communities. These results indicate that PMEs could be a significant source of phosphorus to P-limited plankton communities. This study was supported in part by Lake Erie Protection Fund 97-18.

02:15 BACTERIOPLANKTON P-METABOLISM IS CONTROLLED BY CARBON-AVAILABILITY IN LAKE ERIE. Hong Wang, hwang1@kent.edu, Xueqing Gao, Robert T. Heath, Kent State University, Department of Biological Sciences, Kent OH 44242-0001.

Although availability of phosphorus frequently limits growth of phytoplankton in Lake Erie, the effects of P-availability on bacterioplankton activities is not well understood in nearshore and offshore plankton communities. Bacteria generally dominate the assimilation of inorganic P from lake water and often are regarded as being limited by labile dissolved organic carbon compounds (LDOC). The purpose of this study was to test the hypothesis that carbon availability controls metabolic apportionment of P-resources into sub-cellular fractions: DNA, RNA, phospholipid and low molecular weight compounds (LMW). Using ^{32}P -phosphate and radiometric tracing techniques, we studied bacteria in both laboratory cultures under enriched and limiting P and C nutrient conditions and in natural plankton assemblages at nearshore and offshore stations in Lake Erie. We found that P-uptake into both DNA and RNA was significantly reduced when cultured bacteria were C-limited. Nearshore Lake Erie stations had about 5-fold greater LDOC than offshore stations. Nearshore bacteria apportioned 30% of recently assimilated P into RNA and about 15% into DNA; by contrast, offshore bacteria apportioned 12% into RNA and about 2% into DNA. Apportionment of recently assimilated P into lipid was about 25% in both habitats, but apportionment into LMW was significantly greater in bacteria from offshore sites. Our results support the hypothesis that C-availability, rather than P-availability, controls P-metabolism in bacterioplankton in Lake Erie. This study was supported by the Ohio Sea Grant R/ER-43 and Lake Erie Protection Fund Grants 97-18 and 98-09.

02:30 ECOLOGY AND PHENOLOGY OF THE CYANOBACTERIUM PHORMIDIUM RETZII IN A LOW-ORDER WOODLAND STREAM. Dale A. Casamatta, dc274389@ohio.edu, Morgan L. Vis, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

Algae are ubiquitous components of streams, playing a host of ecological roles such as serving as food sources, attachment sites, and sediment stabilizers. *Phormidium retzii* (Oscillatoriales, Cyanobacteria) is the most prevalent macroalgal (forming macroscopic colonies) taxa found in streams throughout North America, and is common worldwide. The purpose of this study was to document the ecology and phenology of this cosmopolitan cyanobacterium in a woodland stream in the Hocking Hills region of Southeast Ohio. Ten quadrats were permanently delineated along a stream with extensive *P. retzii* mats the previous year. A variety of chemical and physical parameters were measured including nutrient levels, pH, percent cover, carbon and nitrogen content of the mats. Concurrently, samples of the microbial community (e.g., algae, cyanobacteria, and protozoa) were removed from sites with and without mats. As the season progressed, *P. retzii* cover increased from 4.6 to 18.0% cover, which was not significantly ($p > 0.05$) correlated with any measured chemical or physical parameter. However, cover was significantly ($p < 0.05$) correlated with an increase in the carbon content and decrease in carbon/nitrogen ratio of *P. retzii* mats. A total of 81 and 89 microbial taxa were identified from subsamples with and without *P. retzii* mats, respectively. Nonmetric Multidimensional Scaling (NMDS) and Canonical Correspondence Analysis (CCA) of the associated and non-associated taxa both revealed significant ($p < 0.05$) differences in the communities associated with the *P. retzii* mats. Few aquatic invertebrates were associated with the mats, perhaps as a result of an unusually dry spring and subsequent dry down of the stream.

02:45 BACTERIOPLANKTON PHOSPHATE UPTAKE IN LAKE ERIE: IS IT CONTROLLED BY CHEMICAL ENVIRONMENT OR COMMUNITY STRUCTURE? Xueqing Gao, xgao@kent.edu and Robert T. Heath, Kent State University, Department of Biological Sciences, Kent OH 44240.

Although bacterioplankton frequently dominate phosphate uptake in freshwater ecosystems, the factors controlling bacterial phosphate uptake remain unclear. This study was designed to test the hypothesis that bacterial phosphate uptake is controlled primarily by the chemical environment (e.g. dissolved P, N, and C compounds) rather than taxonomic composition of the bacterial community. Concentrations of available P, soluble reactive P (SRP), total soluble P (TSP), total P (TP), labile dissolved organic carbon (LDOC), ammonium, phosphate uptake rate, and taxonomic composition of the bacterial community from nearshore (Sandusky Bay) and offshore stations of the central basin of Lake Erie were compared in this study. Denaturing gradient gel electrophoresis (DGGE) and *in situ* hybridization were employed to characterize bacterial community structures. Importance of chemical environments and community structures in determining bacterial phosphate uptake were examined using a cross-dialysis experiment, comparing the phosphate uptake by the same bacterial communities exposed to different chemical environments and different bacterial communities exposed to the same chemical environment. Our studies showed that the nearshore and offshore Lake Erie bacterial communities differed significantly in taxonomic composition. Phosphate uptake rates of these different bacterial communities exposed to the same chemical environments were similar and phosphate uptake by the same communities differed significantly when exposed to the widely different chemical environments. Our findings indicate that the major factor controlling bacterial phosphate uptake is chemical environment rather than bacterial community composition. This study was supported by the Lake Erie Protection Fund 97-18 and Ohio Sea Grant R/ER-43.

03:00 DEPTH-INTEGRATED PHOTOSYNTHESIS ESTIMATE IN LAKE ERIE. Robert T. Heath, rheath@kent.edu, Kent State University, Department of Biological Sciences, Kent OH 44240.

Virtually all of the energy available to the plankton community in Lake Erie enters photosynthetically as phytoplankton primary production. Although photosynthesis can easily be determined at a given depth and geographical location, extending that estimate over large ranges to provide a depth-integrated estimate of primary production uniformly over oceanic-scale ecosystems is problematic. Presented here are recent results attempts to use a procedure to estimate depth-integrated photosynthesis over the entire Lake Erie from estimates of the photosynthetic parameters estimated from photosynthesis-irradiance (P-I) curves. Depth-integrated photosynthesis (DIP) was estimated from integrated water samples collected at various sites along a transect from Sandusky Bay to the central basin of Lake Erie from June through September during summers of 1999 and 2000. Radiolabeled ^{14}C -bicarbonate was added and 3 mL portions were incubated for 60 minutes at 18 different light intensities of photosynthetically active radiation ranging from 0 to 800 $\mu\text{E sec}^{-1} \text{m}^{-2}$ at ambient temperature. P-I curves were coupled with depth-irradiance curves obtained at the time of sample collection to yield an estimate of DIP. Using this procedure helped determine that the maximum photosynthesis in the central basin of Lake Erie generally occurred at a depth of 3 m; and the estimated depth-integrated production was 200 mg C fixed $\text{hr}^{-1} \text{m}^{-2}$. We found that photosynthetic parameters, especially the optimum photosynthesis, P_{opt} , found at nearshore stations differed those at offshore stations, suggesting caution for widespread use of this procedure without careful calibration. This study was supported by Lake Erie Protection Fund Grant No. 98-09.

03:15 IDENTIFICATION OF PATHOGENS, INCLUDING *ESCHERICHIA COLI* O157:H7, IN UNCOOKED CHICKEN. N. A. Stidinger, n-stidinger@onu.edu, Ohio Northern University, Department of Biological Sciences, Ada OH 45810. Fresh, packaged chicken was purchased from four local grocery stores in Clarion, PA, each involved to a varying degree with processing and handling of the chicken. The chicken was tested for the presence of pathogens, especially *Escherichia coli* O157:H7. While chicken is not a natural reservoir for *Escherichia coli* O157:H7, it is possible to contaminate the chicken during butchering, processing, and packaging. Potential pathogens were isolated through initial sampling of the chicken from both the skin and meat areas, and two different cuts of chicken breast were tested. Samples from the chicken (N=24) were initially plated on Levine EMB Agar, and classified according to their colonial morphology. Selected colonies were subcultured for purity onto Levine EMB and Columbia 5% sheep blood, and isolates underwent biochemical testing, including the indole test, which with colonial morphology is a presumptive test for *Escherichia coli* (N=28), plating on differential media (Rainbow Agar) specific for Shiga toxin producing *Escherichia coli* (N=17), and latex agglutination tests specific for O157 and H7 antigens (N=17) to confirm *Escherichia coli* O157:H7. One sample of chicken tested positive for *Escherichia coli* O157:H7 (N=1), while many samples contained other strains of *Escherichia coli* (N=17) and other human pathogens, including *Enterobacter cloacae* (N=11), *Pseudomonas aeruginosa* (N=2), and *Klebsiella pneumoniae* (N=1). Conclude that while contamination of the chicken with potentially pathogenic organisms can occur, it is uncommon to isolate *Escherichia coli* O157:H7. Human illness can be avoided by following simple guidelines regarding proper handling and cooking of poultry products.

03:30 SPONTANEOUS VS. SULFITE-KILLED, INOCULATED FERMENTATIONS OF OHIO CHARDONNAY GRAPES. Carl G Johnston¹, cjohnst@cc.ysu.edu, Lynnette L Thomas¹, Irene C Panagopoulos¹, Christopher L Myers², Bruce S Levison¹, and John D Usis¹, Youngstown State University, ¹Department of Biological Sciences, ²Department of Chemistry, Youngstown OH 44555.

This research is part of a long-term study to determine if indigenous yeast present in grape must could be used to produce a wine product with quality sensory appeal. The specific purpose of this study was to determine chemical and biological differences between spontaneous wine fermentations with indigenous yeasts and fermentations where the indigenous microbes are inhibited with 25ppm sulfite prior to inoculation with yeast (*Saccharomyces bayanus*). Both treatments were carried out in triplicate from a Chardonnay must harvested October 2000 from Markko Vineyard located in northeastern Ohio. Samples were serially diluted in sterile water and plated in triplicate on Sabouraud's agar plates. Yeast populations in both treatments rose from 10⁶ to 10⁸ colony forming units (CFU's) per ml in the first week and stayed in that range during the second week. In the third week, CFU's remained at 10⁸/ml or above in the spontaneous incubations, but dropped to 10³/ml in the inoculated fermentation. Trace organic extraction and analysis was by SPME-GC-MS to identify volatile organic compounds and their relative changes in concentration during fermentation. Of several chemicals positively identified at day 16, only dodecanoic acid was found solely in the inoculated fermentation. Decanoic acid, octanoic acid, ethyl octadecanoate, and ethyl hexadecanoate were all found at day 16 in both fermentations but in much higher amounts in the spontaneous fermentation than in the inoculated fermentation. The volatile esters are important in imparting a fresh fruity aroma in young white wines.

03:45 EXPOSURE ASSESSMENT COMPARISON FOR DRINKING WATER DISINFECTION BY-PRODUCTS FROM MULTIPLE EXPOSURE ROUTES IN THE U.S. AND BRITAIN, NETHERLANDS. Abby A. Hill, hillaa1@muohio.edu, (James T. Oris, orisjt@muohio.edu and Glenn Rice, Rice.Glenn@epamail.epa.gov), Miami University, Department of Zoology, 112 1/2 West High Street #5, Oxford OH 45056.

The disinfection processes used to treat drinking water today can result in the formation of several subclasses of chemical contaminants referred to as disinfection by-products, or DBPs. Two particular subclasses of DBPs include the trihalomethanes (THMs) and the haloacetic acids (HAAs). Modeling must be done to determine the magnitude of exposure and subsequent potential human health effects caused by these DBP subclasses of chemicals. The purpose and objectives of this research are the development of a data set describing the possible exposure routes and parameters for drinking water contamination from DBPs to the U.S. and European (specifically British and Dutch) human populations, and a subsequent comparison of this exposure data through mathematical modeling. The hypothesis is that given the expected differences in water consumption and usage patterns between Europe and the U.S., that Europeans are expected to experience significantly lower exposures to the THMs and HAAs. DBP exposure data is being collected, by way of literature research and review, for multiple exposure routes and from multiple residential sources (i.e., showers, faucets, dishwashers, etc.) for U.S. and European residents, specifically men and women of reproductive age (ages 15-45), and children (approx. age 6). A comparison of the THM and HAA exposure data through the use of a mathematical exposure model (Total Exposure Model) will be conducted, including the development of an uncertainty and variability analysis. This exposure data comparison is to be analyzed to determine the relative risks to U.S. and European residents from DBPs.

INFORMATION THEORY-CHEMISTRY 9:00 AM SATURDAY, MARCH 31, 2001 KOLENBRANDER-HARTER ROOM 003 PAUL MULLINS-PRESIDING

09:00 RESOLVING THE CONFLICT BETWEEN USER INTERFACE AND SECURE SYSTEMS DESIGN. Paul M. Mullins, mullins@cis.yzu.edu, Youngstown State University, Department of Computer Science and Information Systems, Youngstown OH 44555.

Computer security is a rarely discussed topic among computer-User Interface (UI) designers who strive to remove barriers from their users, and, while UI design is generally considered antithetical to secure design, designers of secure systems need to account for the users of their systems. It was hypothesized that UI designers need to devote more attention to security issues and that designers of security systems could devote more attention to the user without sacrificing overall security. The latter view has been supported by research at the Computer Emergency Response Team/Coordination Center (CERT/CC); the former by a recent analysis. The CERT/CC had compiled a list of over 2000 computer vulnerabilities over a ten-year span at the time of the review. The analysis and comparison of results were applied to a random sample of vulnerabilities and to all vulnerabilities cataloged between Jan 1998 and June 1999. CERT/CC uses a taxonomy that is very similar in general structure to the traditional phases of software engineering design. One category, that included problems caused by documentation or installation and configuration, could be interpreted as a user interface or usability area. This area accounted for just 11% of 654 incidents reviewed while "implementation errors" accounted for 68%, lending support to the notion that security designers could make systems more usable without affecting overall security. The review motivated the identification of a set of X characteristics that provide the basis for a new taxonomy more relevant to UI design. In this view, X specific characteristics were used to identify aspects of UI involvement in the vulnerabilities. The user interface characteristics were associated with X% of 300 vulnerabilities that have been re-analyzed, lending support to the hypothesis that is a significant relationship and the two disciplines need to work together. Specific recommendations were obviated by the analysis. UI designers, who have traditionally considered classes of users such as novice, intermediate and expert and errors as benign, need to consider two additional, orthogonal classifications of users: anonymous versus authenticated, and malicious versus benign.

09:15 STOCK EVALUATION OF INDIVIDUAL FIRMS PROVIDING INFRA-STRUCTURE FOR THE INTERNET. Richard W. Janson¹, Janson01@AOL.com, and Lala B. Krishna², ¹The Janson Industries, 1200 Garfield Ave. S.W., Canton OH 44706, ²University of Akron.

Many observers have commented on the overwhelming significance of the number one firms in the internet pantheon of industries. For example, Cisco's dominance in the router field, Oracle's dominance in the area of database management, and EMC's dominance in data base storage hardware. The personal computer industry has rewarded Microsoft and Intel with extraordinary profits, and workstation production has done the same for Sun Microsystems. During the evolution of these commanding technologies, the distinction between PCs, workstations, and servers has become blurred because memory components have become so inexpensive. The primary distinction is now one of scale, from desktop computers to mainframe servers capable of handling transactions for millions of web sites. Firms in several related industries (semiconductor, semiconductor capital equipment, telecom equipment, and wireless networks) were subjected to analysis expressed in stock security appreciation. The results were compared to Value Line's latest publication (October 27, 2000). The expectations were quite similar. Both approaches provide company names not so well known as the dominant firms that have shaped the present Internet landscape. More than 100 companies were analyzed.

09:30 DIFFERENTIAL USE OF TECHNOLOGY AMONG GRADUATE STUDENTS AS LEARNING SUPPORT. Dianne A. Brown Wright, Sajit Zachariah, Isadore Newman, The University of Akron, Department of Educational Foundation & Leadership, College of Education, Akron OH 44325-4208.

According to a Department of Commerce report, while the gender gap has closed, a digital gap continues to exist in technology usage (particularly of the internet) among both women and minorities and national usage. The goals of this research were to determine if differential use of technology as learning support exists between women and minority graduate students and non-female and non-minority graduate students, and to what extent this differential versus non-differential is consistent with national averages. The research was conducted during the Fall, 2000 semester among thirty-eight students enrolled in various graduate programs at The University of Akron, including Educational Administration, Higher Education, Geography, Urban Planning, and Biology. It was hypothesized that female and minority graduate students would be found to use technology as learning support significantly less than non-female and non-minority students. It was further hypothesized that female and

minority graduate students would perceive themselves as more dependent on university resources for technology learning support than their counterparts, and that given time and resources, there would be a significant gap in the level of sophistication of technology skill development that female and minority graduate students in comparison to non-female and non-minority graduate students would indicate their desire to focus their learning on. Overwhelmingly, however, both male and female graduate students, as well as minority graduate students, indicated interest in becoming more skilled in the use of technology for purposes of conducting both qualitative and quantitative research, in comparison to other potential aspects of computer technology training and development.

09:45 PREDICTABLE REAL-TIME SCHEDULING FOR AIR TRAFFIC CONTROL (ATC). Will Meilander, Willcm@Mcs.kent.edu, Johnnie Baker, Jbaker@Mcs.kent.edu, Kent State University, Math & Computer Science Dept., Kent OH 44242.

We present a new and distinctive paradigm for real-time control. Current ATC efforts are unable to predict performance of the system using "dynamic" scheduling algorithms, which by their very nature are unpredictable. The current ATC approach is extremely expensive "USA Today", 4-19-99, places the cost at \$41 billion, and the system is not meeting today's requirements. This fact is directly in line with many studies of "Real-Time Scheduling Theory". (M. Klein, 1994) avers an efficient real-time multiprocessor scheduling algorithm is not expected. (J. Stankovic, 1995) indicates that a real-time multiprocessor schedule for a C&C problem like ATC is unlikely. Current ATC automation approaches use multiprocessing. We show that a single instruction parallel processing technology called associative processing (AP) can complete the ATC job before a deadline time. This approach has been shown, in a military application, to overcome the limitations of multiprocessing, and at the same time provide lower hardware and much lower software cost. In that military application, the AP throughput was about 275 (212/0.76) times greater than a multiprocessor when performing identical target tracking functions. That 1979 technology could have satisfied the requirements of FAA's AAS program that was cancelled in 1995. A recent study of ATC flight plan to track association shows the ratio of memory access for the current versus the AP approach greater than 90 to 1. The real ATC problem is tractable. It becomes intractable with a multiprocessor scheduling algorithm. The static scheduling algorithm we present is completely predictable and thus can meet some worst-case deadline time.

10:00 CHARACTERIZATION OF FLAVONOIDS OF CALAMINTHA ASHEI. Rebecca Ellis, rellis@ashland.edu, (Jeffrey D. Weidenhamer, jweiden@ashland.edu), Ashland University, Department of Chemistry, Geology & Physics, Ashland OH 44805.

Plants produce a wide array of chemical substances for a variety of ecological purposes. *Calamintha ashei* is a perennial shrub found in the threatened Florida scrub community. The chemistry of this shrub has been extensively investigated, and it has been found to release several menthofuran monoterpenes in aqueous washes of the leaves. These monoterpenes exhibit phytotoxic effects in bioassays. In addition, glandular trichomes on the leaf surface have been found to contain a complex mixture of sesquiterpenes (C₁₅H₂₄). Extractions of the leaf surface constituents carried out to isolate these sesquiterpenes also result in the isolation of large quantities of flavonoids. Five flavonoids have previously been identified from *Calamintha*, but numerous others are present in these extracts. The objective of this study is to characterize the major flavonoid constituents of the leaf surface extracts. Individual flavonoids will be isolated by preparative thin layer or vacuum liquid chromatography, and characterized by NMR and other spectroscopic methods. Once the major compounds have been identified, development of an HPLC method will facilitate the further investigation of the localization of these compounds on and within the leaf, and investigations of their function.

10:15 CHARACTERIZATION OF TRICHOME CONSTITUENTS OF CALAMINTHA ASHEI. Matt Rainsberg, mrainsbe@ashland.edu, (Jeffrey D. Weidenhamer, jweiden@ashland.edu; Dale G. Ray, dgr4@po.cwru.edu), Ashland University, Department of Chemistry, Geology & Physics, Ashland OH 44805.

Calamintha ashei is a perennial shrub found in the threatened Florida scrub community. *Calamintha* is one of several scrub plants believed to produce germination and growth inhibitors which prevent the growth of grasses and herbs in the scrub. Previous work has identified several phytotoxic monoterpenes in aqueous washes of the leaves. *Calamintha* leaves are dotted with glandular trichomes. GC-MS analyses conducted previously in our laboratory to characterize the trichome constituents, which were believed to contain the monoterpenes, revealed that they contain a complex mixture of sesquiterpenes of the general formula C₁₅H₂₄. It proved impossible to separate these compounds by standard chromatographic procedures. The objective of this study is to characterize the structure of these compounds. One and two-dimension high field NMR (750 MHz) spectra have been collected for this mixture of sesquiterpenes, which contains three principal isomers. High resolution COSY, HMQC, and HMBC spectra are being used to determine the structures of these three major compounds, even though it has not been possible to isolate the individual compounds in pure form.

10:30 CHEMISTRY OF WILTED RED MAPLE (ACER RUBRUM). Joshua Ellwitz, jellwitz@ashland.edu, (Jeffrey D. Weidenhamer, jweiden@ashland.edu), Ashland University, Department of Chemistry, Geology & Physics, Ashland OH 44805.

Wilted leaves of the red maple, *Acer rubrum*, are toxic to horses. The lethal dose is as little as 3 g leaves per kg body weight. Symptoms of poisoning include a brownish discoloration of blood and urine, and drops in packed cell volume, erythrocyte count and mean glutathione levels. In the red blood cells, the formation of Heinz bodies, which are precipitated hemichromes that bind to membrane protein, is diagnostic for poisoning by wilted red maple leaves. Previous work in our laboratory indicated that wilted red maple leaves contain a compound distinguishable by its bright blue fluorescence using thin layer chromatography. However, attempts to characterize this substance proved unsuccessful. The objective of this study is to isolate, purify and identify this compound. The compound will be isolated by preparative thin layer or vacuum liquid chromatography, and characterized by NMR and other spectroscopic methods.

10:45 LEARNING OUTCOME OF A MICROPROCESSOR-BASED ROBOTIC COMPETITION. Anthony P. Messuri, Youngstown State University, Youngstown OH 44555.

The Northeast Ohio Robotics Competition (NEORC) is a regional program founded in 1998 to allow high school students from northeast Ohio (Ashtabula, Columbiana, Cuyahoga, Lake, Mahoning, Portage, Summit, Stark, Trumbull and Tuscarawas counties) the opportunity to learn outside the classroom. Annually NEORC offers a technical challenge to approximately thirty teams, each composed of five high school students (grades nine through twelve) of varying academic backgrounds to build a small remote controlled robot with the technical assistance of a coach from a college or industry along with the opportunity to demonstrate the results at a competition after eight weeks of this applied learning experience. The all-day robotics competition opens with team registration, vehicle inspection, and submission of technical journals. Competitive scoring, done by university staff and industry volunteers, is based on five areas: technical journal quality, vehicle design originality, timed fifty foot race, obstacle course maze, and an inclined plane hill-climb event, with trophies awarded in each category. Participating high school teacher/coaches attend an all-day kick-off coach-training workshop to get an overview of the competition as well as have an opportunity to ask technical questions regarding the robotic competition and receive hands-on experience in breadboarding, soldering, etc. The NEORC objective for creating this annual event is two-fold: to reinforce math and science concepts through an applied learning experience, and to hopefully increase awareness of engineering and technical careers. The challenging effort and hard work necessary to successfully compete has resulted in creativity, ingenuity, teamwork, enthusiasm, growth, and most of all, fun.

EDUCATION

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 003

MARY GAHBAUER-PRESIDING

02:00 EMPHASIZING LEARNING RATHER THAN TEACHING IN UNDERGRADUATE LAB CLASSES. M. D. Gahbauer, mgahbauer@otterbein.edu, Otterbein College, Department of Life Science, Westerville OH 43081.

The national need to improve science education has been increasingly recognized in recent years. Such bodies as the National Science Foundation, the National Research Council, and the Pew Science Program in Undergraduate Education have recommended specific strategies to achieve improvement, including hands-on and enquiry-based approaches to learning. A study has been carried out at Otterbein College over the last three years to determine the effect of changing the curriculum to incorporate these active learning techniques on: 1) scientific reasoning ability, 2) level of thinking, and 3) factual knowledge gained. Freshman and upper level physiology courses were altered by integrating lecture and lab, and by making student groups responsible for the following: planning lab activities and producing constructive criticism of each others' planned projects, reworking problems, working with 'non-covered' material, and evaluating media articles on relevant topics. This is an adaptation of Workshop Biology at the University of Oregon, and was supported by a NSF CLLI grant. Active learning outcomes were assessed by measuring scientific reasoning ability, level of thinking, and knowledge of physiology facts in each class before and after each course, and by comparing the same measurements in the active learning class with those of the same class taught in a traditional way. Based on these measurements active learning does increase reasoning and critical thinking ability, and does not decrease factual knowledge gained. Student comments on their active learning experience were very enthusiastic.

02:15 THE ROLE OF ETHICAL DISCUSSIONS IN UNDERGRADUATE SCIENCE COURSES: STUDIES FROM MOLECULAR GENETICS. Kerry L

Cheesman, kcheesma@capital.edu, Capital University, Biological Sciences Dept, 2199 E. Main St., Columbus OH 43209.

Undergraduate students routinely deal with "hot" science issues in ethics, religion, and humanities courses, and often report that without adequate science background these discussions tend to lean toward conclusions that may defy obvious scientific principles and evidence. For instance, students have learned that using a virus as a vector to engineer food crops is harmful to humans because it allows the virus to be transmitted to, and infect, those who eat the food. Therefore, it is important for undergraduate science faculty to include not only good science in their courses but also an opportunity for students to examine their biases and beliefs in light of scientific evidence. Issues such as genetic engineering, cloning, stem cell research, implications of the human genome project, and gene therapy are examples of areas where undergraduates need to be well grounded scientifically as well as ethically. In our sophomore level genetics class, students were asked to list pros and cons for the use of several of these new technologies. While it was easy to extract a list from each student, almost none (8%) were able to explain their beliefs (pro or con) based upon scientific rationale. The vast majority (75-80%) of answers on each topic were arrived at through religious or social reasoning alone. While the percentage of altered opinions following scientific and ethical examination of the issues is not known, and may change further as students mature, feedback from students about the involvement of ethics discussions in a science class has been overwhelmingly positive. Students have rated these discussions as significantly more meaningful (4.72 on a 5.0 scale; $p < .05$) than any other classroom experience. These discussions have helped students to see that science has limitations and can be misused - a lesson some science majors don't seem to get in their high school courses.

02:30 SCANNING ELECTRON MICROSCOPE ANALYSIS OF EARLY XENOPUS LAEVIS DEVELOPMENT. Kimberly D. Zander, kdz2@po.cwru.edu, (Matthew S. Hanson and David L. Mason), Wittenberg University, Department of Biology, Ward St. at N. Wittenberg Ave., Springfield OH 45501-0720.

Early vertebrate embryonic development is characterized by dramatic changes in cell shape, size, and position, which can be difficult to appreciate if observed by standard light microscopy. The objective of this study was to create a library of high-resolution images of African clawed frog (*Xenopus laevis*) embryos using a scanning electron microscope. Individual adult male and female *Xenopus* frogs were injected with human chorionic gonadotropin to induce gamete maturation and placed together in a breeding aquarium to allow for fertilization. Twenty-four hours after mating, embryos at the early-cleavage, blastula, gastrula, neurula, and tadpole stages were collected, preserved in Bouin's fixative, sputter coated with a mixture of platinum and gold, and observed using a scanning electron microscope (S-2460N, Hitachi). Digital images were acquired and later processed using the Adobe Photoshop™ software program. An annotated website has been created containing the *Xenopus* images to facilitate access for students and the larger scientific community <http://www5.wittenberg.edu/academics/biol/faculty/hanson/XenopusGallery/xenopusstages.html>. The image library provides a valuable resource for both students and faculty involved in the study of developmental biology. We will discuss the methodologies involved in this project and present samples of the collected images.

02:45 THE BENEFITS OF USING A MODIFIED DACUM PROCESS IN NEEDS ASSESSMENT FOR A NEW ASSOCIATES DEGREE PROGRAM IN HORTICULTURE TECHNOLOGY. Mary C. Halbrooks¹,

mhalbrooks@geauga.kent.edu, Chris R. Carlson², Carlson@salem.kent.edu, Randy E. James³, james.7@osu.edu, ¹Kent State University - Geauga, 14111 Claridon-Troy Road, Burton OH 44021, and ²Kent State University - Salem, and ³The Ohio State University, Geauga County Cooperative Extension Service. Successful implementation of a new Associates Degree program depends on developing an appropriate curriculum, determining the demand for graduates by employers and garnering local industry support. The *Develop a Curriculum* (DACUM) process was an effective needs-assessment tool for proposed Associates Degree programs in Horticulture Technology at Kent State University. Results of employer surveys indicated that 95% and 90% would encourage offering the proposed program; 81% and 90% would encourage employees to enroll in the program; and 75% and 70% intended to hire a technician in the next five years, for Salem and Geauga campuses, respectively. Based on these positive findings, focus groups of horticulture industry leaders were established. These groups met to (1) identify duties and related tasks required of trained horticulturists, and (2) verify and refine tasks for the core program curriculum and course content. Since programs were initiated in 1991 and 1999 at Salem and Geauga, respectively, internship placement rates of students with employers have been 100%. A 1999 survey of Salem graduates indicated that 83% had full-time work in the industry whereas 33% had part-time work. Among those working part-time, all were continuing their education or would be in the near future. The DACUM process had a long-term positive impact on the quality of programs at both campuses. The benefits of a close working relationship between industry and university personnel included establishment of advisory boards, offers of equipment, services and supplies to the campus, recruiting of students, internship opportunities and a favorable public relations value.

03:00 INQUIRY-BASED ACTIVITIES FOR INTRODUCTORY BIOLOGY LABORATORIES. P. L. Bernstein, pbernstein@stark.kent.edu, Kent State University Stark Campus, Biological Sciences, Canton OH 44720.

Project Discovery, which uses an inquiry approach to engage students in "doing" science rather than simply learning how science is done by others, was designed primarily for Ohio's pre-college students and teachers. The approach, however, also seems well-suited for college freshmen in introductory majors biology courses. For example, 37 traditional freshmen who engaged in an inquiry-based "drawing lab" about animal tissues achieved similar scores on a standard lab practical to those of a small class of nontraditional, high-achieving students in a previous semester who had not "drawn" (average grades = 80%), and there was an increase in positive comments from these students about their confidence going into the practical. A series of inquiry activities were also used to successfully prepare these students to design and run their own formal experiments during the semester, present their results orally in a mini-conference and write papers in science journal format. Presentations were generally excellent, based on a scoring rubric for format, grasp of experimental design, and understanding of the hypotheses, results and conclusions. Papers were generally not as well done (using a similar scoring rubric), but were intended primarily to provide students with an opportunity to practice writing in a format that most had never tried before. The experience of actually developing and running their own experiment was well-received by these students. On a 5-point scale, 92% agreed that the experience was helpful to them and that it was important to have an experiment in introductory biology that was not "cookbook"; 94% agreed with the statement that they enjoyed the experience.

03:15 INTEGRATING INQUIRY IN A NON-MAJORS BIOLOGY LABORATORY. Phyllis S. Laine, Laine@xu.edu, Linda J. Heath, Heath@xu.edu, Xavier University, 3800 Victory Parkway, Cincinnati OH 45207-4331.

A new approach for teaching biology laboratories for the non-major student including pre-service teachers was needed following the publication of the National Science Education Standards in 1996. The standards emphasize teaching science by the inquiry method that requires that students identify assumptions, use critical thinking, and consider alternative explanations. To this end "Discovering Life Science" was developed with goals and objectives that are aligned with the standards. The course emphasizes inquiry and includes technology, science writing, and cooperative group learning. It is organized into three phases: (1) Introduction - students experience inquiry investigations; (2) Practice - students practice an inquiry investigation; (3) Application - students perform an inquiry investigation. The effort of student teams completing this course results in three science journal articles submitted to an electronic class journal, JUBI, (Journal of Undergraduate Biological Inquiry). Three pilot sections were taught during fall 1999 and spring 2000 semesters. Following a summer faculty training session, 13 sections were offered during fall 2000. An inquiry-based laboratory manual was written. This project is being developed and evaluated by funds from Xavier University and NSF under the Course, Curriculum, and Laboratory Improvement Program DUE 99-50373.

03:30 ENVIRONMENTAL HEALTH SCIENCE AND THE SCIENCE EDUCATION CRISIS IN OHIO. Michele Morrone, morrone@ohio.edu, Ohio University, School of Health Sciences, 416 Peden Tower, Athens OH 45701.

Studies have shown that students in the United States lag behind other countries in their science knowledge and skills when they graduate from high school. Research has also shown that students are better learners when the environment is used as an integrating theme. Environmental health sciences (EHS), the study of how the environment affects human health and how humans affect the health of the environment, offers an opportunity to integrate environmental issues into numerous K-12 classes including, chemistry, biology, mathematics, and social studies. The first step in demonstrating how EHS could be integrated into the K-12 science curriculum is to get a sense of what is currently being offered in terms of EHS study. The research presented here is the result of a survey of Ohio science teachers who are involved in environmental education. The sample was drawn from teachers who are members of the Environmental Education Network. The response rate for the survey was 40%, as 455 useable surveys were returned from 1,131 mailed in February 2000. Almost 90 percent of the respondents were science teachers and 56 percent of the respondents have taught for more than 15 years. The results suggest that teachers are not accessing existing K-12 EHS resources and that the environment is generally incorporated into their classes by educational resources that do not focus on science concepts such as risk assessment and toxicology. This sample of Ohio science teachers are supportive of the National Science Education Standards, but not of proficiency testing as an assessment tool. Additionally, these science teachers are not widely using the Internet to prepare for classes, a finding that has implications on the use of environmental health science curriculum materials.

03:45 USING THE INTERNET TO BRING THE CHEMISTRY LABORATORY TO THE KITCHEN. Clarke W. Earley, cearley@stark.kent.edu, Kent State University Stark Campus, 6000 Frank Avenue, N.W., Canton OH 44720. Chemistry is a laboratory science. The facts that are taught in chemistry lectures are the result of work performed in research laboratories. However, introductory science courses for non-majors typically do not include a laboratory component. Starting with

the Fall 2000 semester, a program for one section of KSU-Stark's "Chemistry in Our World" course has been initiated that requires students to perform a variety of experiments that can be done safely in the home. Representative projects include separation of food dyes using paper chromatography, use of red cabbage as an acid/base indicator, extraction of DNA from food, and dyeing of fabric. Projects are divided into different sections to correlate with material being covered in lecture. Within each section, students have the ability to select projects that are most appealing to them. Brief summaries that link to complete descriptions of each of the projects are posted on the Internet web page for the course (<http://www.stark.kent.edu/~cearley/ChemWrld/Chemwrld.htm>). Downloadable data sheets are posted for projects that require them. Results from the first set of student evaluations conducted during the Fall 2000 semester have been generally positive. All student responses (11/11) indicated that the projects were not too time-consuming, and that the web pages provided sufficient information to complete the projects. Most students (7/11) felt that the projects should account for about half of the course grade (which is the percentage used during the Fall 2000 semester), while 1 individual felt these should be weighed more heavily, and 3 felt that the projects should account for a lower percentage of the course grade (25-30%). Students unanimously (11/11) agreed that projects should be included in this course.

04:00 TWENTY-FIVE: SOFTWARE TO SUPPORT MATHEMATICS EDUCATION IN K-8. Paul M. Mullins, mullins@cis.ysu.edu, Youngstown State University, Department of Computer Science and Information Systems, Youngstown OH 44555.

Children learning "math facts" and arithmetic skills have typically been limited to flash cards or their electronic equivalent. Recently, the game *Twenty-Four* has provided children an interesting, if limited, alternative. It is used in a tournament-style competition, with similar practice sessions, in which children win cards by finding a way to combine four numbers, using each exactly once, in a sequence of arithmetic operations that result in the target value of 24. Four students tested a computer version of *Twenty-Four*, indicating dissatisfaction with the limited levels of play and problem sets inherent in the card sets and frustration with the inability to validate or request a solution. A new game, *Twenty-Five*, allows the player to select any target value and to limit difficulty by specifying the maximum numbers used and/or limiting arithmetic operation required for a solution. A problem solver ensures each randomly selected problem has a solution, verifies solutions entered, and, upon request, displays a set of possible solutions. *Twenty-Five* also scores individuals based on time to complete, and difficulty of, each problem. Eight students and two teachers tested *Twenty-Five* indicating the necessity of making the software more game-like, including competitive scoring, and providing the capability for teachers to set game parameters and manage score files for groups of student peers.

04:15 A SURVEY OF REQUESTS FOR HELP WITH MATHEMATICS AND SCIENCE HOMEWORK IN A NON-TRADITIONAL SCHOOL SETTING. Kenneth A. LaSota*, lasota@robert-morris.edu, Rebecca A. Stanhope*, Robert.Morris@robert-morris.edu, Robert Morris College, Department of Natural Sciences, Pittsburgh PA 15219-3099 and *Mount Lebanon Extended Day Program.

Working parents require a venue to house their children for several hours before and after the traditional school day. The Mount Lebanon Extended Day Program (MLEDP) provides two hours of supervision before school and three hours after school for students K-6, in facilities located in six elementary schools. MLEDP cares for 15 to 35 students, of mixed grades, at each site. Staff include former teachers, traditional day-care workers, housewives and college students, with all staff meeting PA State standards. In addition to supervised play and activities, staff assist students with homework and other assignments. Over a two month period, staff at the Markham Elementary School site documented requests for academic help from its 35 students to determine the type and frequency of need. It was found that mathematics (68%) dominated, with spelling second (21%) and science third (11%). Requests for academic help ranged from zero per child per day to eight, with children averaging 2.6 requests per day. Fourth graders asked for the most assistance. An average of 18% of a typical day was devoted to academic help. The nature of questions varied from simple "how to" questions to a few "why" and "what if" type inquiries, with many "I don't understand what the teacher wants me to do". Children overall expressed satisfaction with the academic help provided by the staff. The study here suggests that because requests for academic help are common, some integration of the Center's programming with the overall curriculum might be beneficial.

04:30 DEVELOPING LOYALTY OF KNOWLEDGE WORKERS WITHIN COMPETITIVE ORGANIZATIONS. Alan D. Smith, smitha@robert-morris.edu, Robert Morris College, Department of Management and Marketing, Pittsburgh PA 15219-3099.

The traditional method of management of human capital, creativity, innovation, and the learning culture within an organization has long over-shadowed the management of the professional intellect. As with the Resource Based View (RVB) of the firm, the intangible strategic intelligence creates most of professional intellect of an organization, and operates on the following 4 levels (in increasing importance): Cognitive Knowledge or basic mastery of a professional discipline, Advanced Skills or the ability to translate theory into effective execution or practice, Systems Understanding or the

deep knowledge of the cause and effect relationships underlying the professional discipline, and Self-motivated creativity or the motivation and adaptability for success. The interaction of these factors allow nurturing organizations the ability to thrive in the face of today's rapid changes and renew their cognitive knowledge, especially where it increases the loyalty of its knowledge workers. A study of 20 proven loyal knowledge workers in Pittsburgh area consulting firms revealed that personal and family goals were greater motivators that financial in ensuring continued loyalty. The step-wise regression analysis revealed that the following independent variables were the most important in predicting loyalty among knowledge workers in descending order: personal and family, job recognition, success, salary, customer relations, advancement, challenge, benefits, co-worker relations, and personal growth.

04:45 COMMUNITY SERVICE LEARNING IN THE BACCALAUREATE NURSING PROGRAM AT KENT STATE UNIVERSITY REGIONAL CAMPUSES. Phyllis J. DeFiore-Golden, defiore@trumbull.kent.edu, Kathryn A. Cartechine, kcartechine@stark.kent.edu, Mary Lou Ferranto, mferranto@ksue14.kent.edu, Kent State College of Nursing, Trumbull Campus, 4314 Mahoning Ave. NW, Warren OH 44483.

Service learning is defined as the integration of public service activity into the academic curriculum, addresses actual community needs, and benefits student academic study. The service learning experience provides opportunities for students to use newly acquired skills and knowledge generated in the "Foundations of Assessment & Communication in Nursing" course in real life situations in the community setting. The purpose of service learning is to enhance what is taught in the course by extending student learning beyond the classroom and to foster the development of a sense of caring for others. As an educational methodology, service learning requires that the student develop specific behavioral objectives for the experience. Benefits of the community service learning project include exposure to health needs of individuals and families in the community, increased awareness of available community resources, and evaluation of community health strengths and limitations. The evaluation of the learning experience was based on written entries of students in reflective journals and oral poster presentations. Quantitative and qualitative course evaluations demonstrate that 90% of the enrolled students rated the course and the service learning component experience as very good to excellent. Forty-three students enrolled at one of three regional campuses Fall Semester 1999; 93% completed course evaluations. Course evaluations also indicate that community service learning fosters volunteerism and increases awareness of community health needs and resources.

ZOOLOGY I

9:00 AM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 201

TED CAVENDER-PRESIDING

09:00 LAKE-LEVEL REDUCTIONS AND STRANDING OF AQUATIC SNAILS IN NESTS OF CENTRARCHID FISHES. Jack Kovach, jkovach@muskingum.edu, Muskingum College, Geology Dept., New Concord OH 43762.

Drought-induced lowering of the water-level of the New Concord Reservoir in eastern Muskingum County, Ohio, during the summers of 1994 and 1999 resulted in the stranding and eventual demise of large numbers of aquatic gastropods which became trapped in nearshore, lake-floor depressions excavated by nesting centrarchid fishes. Species affected included *Cipangopaludina* sp. (a non-native species that is by far the most abundant snail in the reservoir with up to 228/m² counted in October 1994), *Physa* sp. (0-3/m²) and *Helisoma* sp. (17-55/m²). As lake-levels drop, these snails typically remain immersed by migrating with the declining water level. Those whose path of migration leads them into the more or less circular depressions excavated by centrarchid fishes, however, become trapped there as levels of the lake continue to drop and these temporary "ponds" eventually dry up. Collection and disaggregation of the upper 3.8 cm of sun-baked substrate from an exposed centrarchid nest collected 15 Oct. 1994 and one collected 27 Oct. 1999, each measuring 48.3 cm in diameter, yielded the following numbers of shells of dead snails. The 1994 nest yielded 93 shells of *Cipangopaludina* sp. which had opercula in place, indicating that these animals had died recently *in situ* by desiccation, 47 shells of *Cipangopaludina* sp. lacking opercula, 11 opercula, 27 shells of *Physa* sp. and 22 shells of *Helisoma* sp. Corresponding numbers for the 1999 nest were 80, 141, 49, 34 and 25, respectively. Areas between and away from centrarchid nests were practically devoid of shells. Stranding in fish nests could account for some patchy distributions of fossil and subfossil remains of snails and other biota in lacustrine sediments.

09:15 INTERACTION BETWEEN A NATIVE AND EXOTIC CRAYFISH OF THE HUDSON RIVER VALLEY: FORAGING EFFECTS ON NATIVE BIVALVES. Carolyn A. Klocker, klockerca@hiram.edu, (David Strayer, strayerd@ecostudies.org, and Prudence Hall, hallpj@hiram.edu) Hiram College, Hiram OH 44234.

The rusty crayfish, *Orconectes rusticus*, has been known to displace native crayfish and reshape the populations of macroinvertebrates in benthic ecosystems where it has been introduced. The purpose of this study was to investigate aggressive interactions and competition for shelter between the introduced species, *O. rusticus*, and a native crayfish species to the Hudson River Valley, *O. limosus*, under laboratory conditions. Crayfish were collected from 3 rivers in the Hudson River Valley. All trials took place in 10-gallon aquariums and the number of aggressive contacts were recorded. Shelters were then placed in the aquariums and 20 hrs later recordings were made of which crayfish was found in the shelter. Chi-square analysis revealed that *O. rusticus* did not significantly dominate *O. limosus* in the aggression trials and dominance did not significantly affect which crayfish obtained shelter. This lack of significance may be explained by the small sample size of only 15 trials used for this study. Feeding trials revealed that both species of crayfish consumed native mussels and fingernail clams, preferring prey of smaller size classes. These findings may still provide evidence to suggest that previous and future introductions of *O. rusticus* into the Hudson River Valley may have an effect on native crayfish and bivalves. Further study should focus on the potential effects of this exotic species on native benthic communities using larger samples.

09:30 PATTERNS OF MACROALGAL AND PERIPHYTIC ASSEMBLAGES FROM COAL MINE IMPACTED LOTIC SYSTEMS WITHIN THE UNGLACIATED WESTERN ALLEGHENY PLATEAU. R.G. Verb¹, J.B. Keiper², and M.L. Vis¹. ¹Ohio University, Dept. of Environmental and Plant Biology, Athens OH 45701. ²Cleveland Museum of Natural History.

We examined if there were particular groups of macroalgae and periphyton assemblages specific to abandoned coal mines and/or reclaimed sites within the unglaciated Western Allegheny Plateau. Fifty-six streams were visited from May to June 1999. Stream sites were placed into one of nine categories based upon catchment mining/reclamation history and other land use within the stream site's watershed. At each stream site the periphyton and macroinvertebrates (to ascertain herbivory influence) from riffles, macroalgae from a 20-meter stream segment, 29 environmental parameters (e.g. pH, metal concentrations, current velocity), and habitat were examined to assess the impacts coal mining had on the lotic system. A total of 594 infrageneric algal taxa and 40 macroinvertebrate taxa were recorded from these stream sites. Diatoms were the most abundant and diverse algal organisms (359 taxa), followed by chlorophytes (121), Cyanobacteria (42), euglenophytes (31), xanthophytes (14), chrysophytes (12), rhodophytes (6), dinophytes (6), and cryptophytes (3). Based on canonical correspondence analyses (CCA), the first and second axes were highly correlated with pH ($r=-0.96$) and specific conductance ($r=0.59$) respectively. A wide range of pH values (2.47-7.93) was found at these stream sites, primarily due to the influence of acid mine drainage from abandoned and reclaimed coal mines. Highly acidic sites were characterized by a dominant flora of *Eunotia exigua*, *Frustulia rhomboides*, *Klebsormidium rivulare*, and *Microspora tumidula*. Predictable relationships were observed between the water quality from abandoned and reclaimed mines and the biotic assemblages present, which may prove useful in the assessment and management of reclamation efforts.

09:45 GENETIC DELINEATION OF HIGHER TAXA IN FRESHWATER BRYOZOANS. Michael B Lore, lore.3@wright.edu, Tim Wood, tim.wood@wright.edu, Wright State University, Department of Biological Sciences, Dayton OH 45435.

This study addresses the systematic relationship among the five known families of freshwater bryozoans (Ectoprocta: Class Phylactolaemata). The group lends itself particularly well to genetic work because it is relatively small yet still includes a remarkable diversity of species. Bryozoans have been previously classified only by their external morphology, leaving certain phylogenetic and evolutionary relationships somewhat speculative. The approach used here is to focus on the sequences coding for the ribosomal RNA, specifically the 18s and ITS-1 regions. Much of the material examined was collected during a survey of the British phylactolaemate bryozoans by Okamura, Wood, and Lore in the summer of 2000. Additional material, such as the lophopodid species, came from Europe and North America. Results still being analyzed reveal strongly conserved genomes within the 18s region. The family status of *Hyalinella punctata* is expected to be clarified, along with the structure of the Genus *Plumatella* and relations among the nontubular taxa.

10:00 THE ORIGIN OF SIMULTANEOUS HERMAPHRODITISM IN THE FRESHWATER MUSSEL GENUS *UTTERBACKIA* (BIVALVIA: ANODONTINAE) AS INFERRED FROM PHYLOGENETIC ANALYSIS OF DNA SEQUENCES. Elizabeth A. Knazek, eknazek@kent.edu, (Walter R. Hoeh), Kent State University, Dept. of Biological Sciences, Kent OH 44242.

The freshwater mussel genus *Utterbackia* contains species which utilize either gonochoric (=dioecious) or hermaphroditic reproductive systems. *U. peggyae* and *U. peninsularis* both possess gonochoric reproductive systems while *U. imbecillis* and "*U. imbecillis*", an undescribed species, exhibit simultaneous hermaphroditism (SH). This implies an evolutionary transition if the genus is in fact a monophyletic group and, therefore, a question regarding the evolution of mating systems. A phylogenetic analysis of DNA sequence data from the four species would enable an evaluation of the number and directionality of mating system transitions in the genus. Goals of the

project include: testing the monophyly of the genus *Utterbackia*, estimating the evolutionary relationships among the four species, and estimating the number of reproductive system transitions that occurred in the *Utterbackia* lineage. A previous phylogenetic analysis of *Utterbackia*, using allozyme data, suggested that SH arose a single time within the genus and this hypothesis will also be tested. Total DNA was extracted, and a 710 bp fragment was PCR amplified. The PCR products were then purified and cycle sequencing reactions performed. The sequencing reactions were run on a LI-COR 4200S sequencer. Thus far, both strands of a 710 bp fragment of the Cytochrome c oxidase subunit I gene have been cycle sequenced for 44 individuals representing 19 populations.

10:15 FLOTATION OF SHELLS OF DEAD ASIATIC CLAMS (*CORBICULA FLUMINEA*), SALT FORK LAKE, GUERNSEY COUNTY, OHIO. Jack Kovach, jkovach@muskingum.edu, Muskingum College, Geology Dept., New Concord OH 43762.

Observations on the flotation of shells of recently-deceased individuals of the Asiatic clam, *Corbicula fluminea*, in Salt Fork Lake, Guernsey County, Ohio, are reported. Lowering of the level of the lake in 1993 for the purpose of constructing a boat ramp exposed thousands of this non-native clam, together with native species, to dessication for several weeks. As the level of the lake was later slowly restored to its normal level, one to three *C. fluminea* shells were, on several occasions, observed floating near shore at the surface of the lake. One such shell, measuring 5.3 cm long by 4.6 cm wide with a shell weight (without soft parts) of 18.95 g, collected 10-4-93, placed in a bucket of lake water and transported to the laboratory, remained floating, ventral-side up, for more than 48 hours before settling to the bottom of the bucket. More recently, a specimen 3.4 cm by 3.1 cm with a shell weight (without soft parts) of 6.55 g, which had died recently of unknown causes, was observed floating along the shore of the lake on 9-14-00. Flotation of dead clams may be a common phenomenon and could result in the transportation and deposition of clam shells to sedimentary environments in which the clams did not actually live.

10:30 TEMPORAL CHANGES IN DARTER COMMUNITY STRUCTURE SINCE 1978 IN THE LITTLE MIAMI RIVER, GREENE COUNTY, OHIO. Erin P. Grimm, grimmep@muohio.edu, Orie L. Loucks, Miami University, Oxford OH 45056.

Studies by David Wynes in 1978 afford an opportunity now to uncover how fish communities may have changed in response to changes in stream environments. The objectives of a re-sampling in 2000 were to determine whether habitat characteristics and darter species assemblages at six sites along the Little Miami River in Greene County, Ohio had changed since 1978. Fish were collected between May and September 2000 using Wynes' methods, a drag seine, and in June and August using an electroshocker. Physicochemical characteristics of the water also were measured. Since 1978, sites 5 and 6, the two sites located downstream from Beaver Creek Wastewater Treatment Plant, have recovered from the discharges of the plant. Orthophosphates, total suspended solids, and biochemical oxygen demand have decreased markedly. These sites show an increase of 82% and 100% in the number of darters collected. Sites 3 and 4, above the discharge, also showed an increase in species numbers, including the addition of two species at Site 3 and an increase from 9 to 14 species at Site 4, possibly due to the abatement of degraded habitat below the wastewater outfall. Water quality improvements also have been observed at the other sites, but darter impoverishment has occurred at all upstream sites. At Site 1, the most upstream site, only 33 individuals, representing seven species, were collected during five months and only 38 individuals were found at Site 2, representing 40.3% and 74.8% declines in the number of individuals. Decreases also were observed at sites 3 and 4 (55.1% and 49.5%) where only 66 and 53 individuals were collected. The number of species collected at sites 1 and 2 have declined by 12.5% and 38.5%. Index of Biotic Integrity scores, ranging from 33 to 41, suggest that the entire fish community has been affected.

10:45 A LOSS OF FISH SPECIES AS A RESULT OF STRESS FACTORS ACTING ON A SMALL STREAM ECOSYSTEM. Matthew J. Greene, greenem118@osu.edu, and Ted M. Cavender, The Ohio State University, Museum of Biological Diversity, 1315 Kinnear Rd., Columbus OH 43212-1192.

There were two main objectives of this research: 1) Compare historical fish records with current records to determine the extent of species decline in the headwaters of the Little Miami River. 2) Define the major stress factors that are working in the headwaters to decrease species diversity. The study area includes the drainage as it extends upstream of Clifton, Ohio. The primary land use in this area is row crop agriculture. In order to minimize flooding and maximize field perimeters streams have been modified and the riparian narrowed. The watershed above this point drains approximately 168sq.km, and has an average gradient of 2m/km. A low head dam separates the study area from the rest of the river. A total of 24 fish collection sites were made upstream of Clifton Impoundment (CI) for the purpose of determining the present status of fish populations. Additional collections were made downstream of the CI to determine if the low head dam was acting as a barrier for fish that were once upstream of it. Eleven fish collection sites upstream of the CI were selected for analysis of dissolved oxygen, turbidity, temperature, pH, nitrate, ammonium, and orthophosphates. The Index of Biotic Integrity (IBI), Shannon Index (H'), and

Qualitative Habitat Evaluation Index (QHEI) were employed in order to evaluate fish collection sites. Of nearly 48 species previously recorded for the study area, only 28 were located, or about 60% of the original fauna. Dissolved oxygen reached supersaturated conditions (>10mg/L) during daylight hours and low levels (<5mg/L) at night. Turbidity readings reached nearly 50 NTUs during high flow periods, which was high compared to low flow periods. Quantitative scores for the IBI, H', and QHEI were 34.4, 2.2, and 59.9. Riparian reduction, channel modification, and nutrient enrichment appear to be the major factors currently operating in the Little Miami River headwaters causing a reduction in species richness.

ZOOLOGY II

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 201

MICHAEL HERSCHLER-PRESIDING

02:00 QUALITY INDICATOR ANALYSIS OF HABITAT RESTORATION ON BROOK TROUT (*SALVELINUS FONTINALIS*) IN GRIFFITH BROOK, GREEN MOUNTAIN NATIONAL FOREST, VERMONT. Dana M. Jedlicka¹, dnmjdlc@otterbein.edu, Keith H. Nislow², keith.h.nislow@dartmouth.edu, Scott Wixsom³, swixsom@fs.fed.us, and Michael A. Hoggarth¹, mhoggarth@otterbein.edu, ¹Otterbein College, Department of Life and Earth Sciences, Westerville OH 43062, ²Dartmouth College, Biology Department, ³U.S. Forest Service, Green Mountain National Forest.

Large woody debris influences channel morphology and plays a pivotal role in aquatic habitat development. The determination of the effect of engineered, large woody debris on salmonid populations was examined through quality indicators. The purpose of engineered, large woody debris placement was to provide salmonid habitat improvement. Griffith Brook, a headwater stream of the Connecticut River in the Green Mountain National Forest, was chosen for this experiment. A one hundred fifty-one meter section of the brook was used for the habitat reconstruction. This section was compared to a ninety-nine meter control section that contained no habitat alteration. Native brook trout were chosen because they have an established population in Griffith Brook. Total removal of target species was performed by the use of a three-pass method, employing backpack electrofishing and block nets. Lengths, weights, biomass, age/size structure, and condition factor of the target species were measured and analyzed using ANOVA. Four sample groups composed of pre-habitat restoration control site (pr-c), pre-habitat restoration experimental site (pr-MS-2), post-habitat restoration control site (post-c), and post-habitat restoration experimental site (post-MS-2) were examined. There was no significant statistical difference for average length and weight between the pre- and post-habitat restoration control site. Statistically the *S. fontinalis* in the post-habitat restoration experimental site weighed more than the pre-habitat restoration experimental *S. fontinalis* ($T = 2.04$, $P = 0.04$). The difference between the pre- and post-experimental weights may be attributed to habitat restoration that improved the microhabitat for *S. fontinalis*.

02:15 THE EFFECTS OF 17 β -ESTRADIOL ON MALE GUPPY (*POECILIA RETICULATA*) SEXUAL BEHAVIOR. Richard A. Blatchford, blatchfordra@hiram.edu, and Kimberley A. Phillips, phillipsk@hiram.edu, Hiram College, Departments of Psychology and Biology, Hiram OH 44234-0067.

The effects of pollutants that mimic natural estrogens were investigated in two studies. In the first of these male guppies were exposed to 17 β -estradiol concentrations (10 μ g/L and 5 μ g/L) for one week and then observed for courtship behavior. We found no significant effect of 17 β -estradiol on the guppies' behavior. Although this result suggested that short-term exposure to estrogen might not have any behavioral effects, other studies have shown that long-term exposure has an effect on courtship behavior, decreasing the frequency of displays performed. Based on this, we hypothesized that there was an effect of time exposure to estrogen and that guppies would decrease the frequency of sexual displays over time. A follow-up study exposed male guppies to two concentrations of 17 β -estradiol (10 μ g/L and 5 μ g/L) four weeks. Courting behavior was assessed at one-week intervals. A significant effect of treatment was found ($F(3,15) = 3.83$, $p < 0.05$), indicating an increase in courtship behavior in the concentrated estrogen treatment group over that of the vehicle control group. Time also had a significant effect between weeks 1 and 2. However, there was no interaction effect of time and estrogen condition. The reasons for the increase in courtship displays in the concentrated estrogen condition are unknown, and further investigations are needed to obtain the answer.

02:30 NEST SITE SELECTION AND NEST SUCCESS OF ACADIAN FLY-CATCHERS. Courtenay N. Willis, cnwillis@cc.ysu.edu, Robert T. Adair, chironomus@prodigy.net, Youngstown State University, Department of Biological Sciences, Youngstown OH 44555-3601.

We located 61 Acadian Flycatcher (*Empidonax virens*) nests in beech-maple forest at the Ravenna Training and Logistics Site in Portage County, Ohio. Microhabi-

at and macrohabitat characteristics were measured and their relationship to nest success was evaluated. Forty-nine percent of all nesting attempts resulted in predation while only 2% of all nesting attempts resulted in failure due to weather. Rates of Brown-headed Cowbird (*Molothrus ater*) parasitism were very low (5%) and accounted for no nest failures. Nests were found in eight tree species, with 57% in American beech (*Fagus grandifolia*) and 15% in Sugar maple (*Acer saccharum*). The relative density of beech (33%) was about twice as high as Sugar maple (19%). Microhabitat features were similar for successful and unsuccessful nests, although successful nests were typically placed lower than depredated nests. In addition, nests initiated earlier in the breeding season were placed lower than nests initiated later in the breeding season. Nest success showed a trend of increasing late in the season. Macrohabitat features were similar for nest sites and random sites, although nest sites had a lower percent cover of leaf litter and a lower density of surrounding trees. This supports the idea that Acadian Flycatchers prefer to nest in more open places, such as over a stream or wooded trail or on the edge of a treefall gap, which may provide air space for nest defense.

02:45 THE ORIENTATION OF BEAVERS (*CASTOR CANADENSIS*) WHEN CUTTING TREES IN CENTRAL OHIO. Thomas R. Raffel, trraffel@cc.owu.edu, Catherine C. Cortright, Nicole M. Hildebrand, A. John Gatz, ajgatz@cc.owu.edu, Ohio Wesleyan University, Department of Zoology, Delaware OH 43015.

We studied patterns in the orientation of cutting when beavers cut trees around Alum Creek Lake. For 462 trees, we measured the orientation of the cut relative to the overall slope, the orientation of the cut relative to the slope at the base of the tree, the distance of the tree from the water, the radius of the tree, and the symmetry of the cut. The land around Alum Creek Lake generally slopes toward the water, so beavers trying to direct tree fall should cut a symmetrical tree from the downhill side. This was the case for trees ≥ 9 m from the water ($X^2 = 13.990$, d.f. = 2, $P < 0.01$). At distances < 9 m from shore, trees tended to lean toward the water and would fall toward the water regardless. Here, beavers cut predominantly from the uphill side ($X^2 = 25.062$, d.f. = 2, $P < 0.001$) where it should be easier to stand and there is less danger of the tree falling on them. At all distances, beavers showed random orientation when cutting trees on slopes < 20° ($X^2 = 1.799$, d.f. = 2, $P > 0.10$) whereas they cut trees on slopes $\geq 20^\circ$ predominantly from the uphill side ($X^2 = 15.819$, d.f. = 2, $P < 0.001$). Beavers cut small trees (< 5 cm diameter) mostly from the downhill side ($X^2 = 23.774$, d.f. = 2, $P < 0.001$), but tended to cut trees ≥ 5 cm diameter from the uphill side ($X^2 = 31.435$, d.f. = 2, $P < 0.001$). Overall, then, enough factors interact that no one pattern of cutting exists for all trees.

03:00 A COMPARISON OF SMALL MAMMAL DEMOGRAPHY AND PLANT COMMUNITY STRUCTURE ACROSS A TEMPORAL GRADIENT OF HABITAT DISTURBANCE. James L. Dooley Jr., Alison Light, Amanda L. Murray, and Heather E. Ramage, Muskingum College, New Concord OH 43762.

We compared population dynamics and demography of meadow vole (*Microtus pennsylvanicus*) populations distributed across three study sites in Muskingum County that were sequentially disturbed through the 1970s and 1980s by strip-mining activities. After strip-mining, all sites were reclaimed using the same reclamation protocol. We tested the hypothesis that population performance as measured by population size, survival and recruitment rates would be positively related to time since disturbance and to density of vegetation cover. We established two 40 by 40 meter study plots at each of the three study site locations. On each plot we established a 5 x 5 array of live-trapping stations. We used standard mark-recapture protocol to monitor population performance of *Microtus* populations for three or four days monthly from June 1999 through March 2000. In addition, we performed structural vegetation analyses on each study plot. Population numbers as well as survival and recruitment rates were highest at the most recently disturbed site which also featured the highest density of grasses and greatest grass thatch depth, while population performance at the other two sites was largely similar. Results from our investigation validate previous suggestions that vegetative cover is an important indicator of habitat suitability for meadow voles. However, we were surprised to see both *Microtus* population performance and the density of grassland vegetation highest at the most recently disturbed study sites. Ongoing studies are testing the relative importance of a series of different mechanisms that might account for the patterns we observed.

03:15 RADIOTELEMETRY AS A MEASURE OF AGGRESSIVE ACTIVITY IN RESIDENT INTRUDER TESTS WITH THE BORDERLINE HYPERTENSIVE (SHR/Y) RAT STRAIN. Jonathan D. Toot, jtoot@uakron.edu, Gail E. Dunphy, Daniel L. Ely, University of Akron, Dept of Biology, Akron OH 44325-3908.

Resident intruder (RI) tests are specific behavioral encounters where an intruder rat is placed into the home range/residence of another male. The objective of this study was to determine if telemetered activity counts (AC) could be used as an indicator of aggressive behavior in RI tests compared to standard fighting measurements. Housing conditions consisted of housing 8 males with 8 females, initially at 10 to 12 weeks of age. This colony environment exposed the male rats to social stresses with the formation of a dominant/subordinate hierarchy. Through the use of Data Science International radiotelemetry, AC were obtained in 15 minute RI aggression tests. The radiotelemetry transmitter was implanted in the abdominal region of the dominant rat,

where body position and movement translated to AC. When novel intruders were introduced, the dominant rat's AC increased from 0.3 to 19, attacks from 0 to 9 and intruder scarring from 0 to 4. The importance of radiotelemetry is evident when subordinate rats are removed from the colony for 24 hours and reintroduced. When reintroduced, the dominant rat's AC=4, attacks=10 and intruder scarring=0. With similar number of attacks on intruders (10 and 9), the increased AC (4 to 19) in the novel intruder test indicates more severe attacks, which is supported by increased incidents of scarring to intruders.

03:30 HUMAN POPULATION GROWTH AND LOSS OF ANIMAL BIODIVERSITY. C. David Foote, foote.3@osu.edu, (Jeffrey K. McKee mckee.95@osu.edu), The Ohio State University, Department of Anthropology, 244 Lord Hall, 124 W. 17th Ave., Columbus OH 43210.

One of the greatest threats to the global community is the loss of the world's ecosystems and biological diversity. There have been five mass extinctions in the past and a sixth appears to be in progress. The difference now is that one extremely successful species, *Homo sapiens*, is the primary cause of extinction. The current human population has grown to over 6.1 billion, and human's impact on biodiversity has never been greater. As human populations continue to grow, the demands on the natural environment continue to accelerate, leaving an irreparable mark on the planet. Our research goal is to determine the correlation between human population growth and animal biodiversity loss. Data are being collected from 230 countries to determine how human population growth interacts with other risk factors for animal extinction. Categories of this database include population for the present and in 1950, population density, population growth rate for present and for 1950, fertility rate, latitude and longitude, average rainfall and average temperature. These variables are measured against frequencies of species in IUCN categories that include: Extinct in the Wild, Critically Endangered, Endangered, and Vulnerable. Initial results have not shown a simple correlation between current population growth rates and the number of species in the IUCN categories. The remaining variables that affect biodiversity must be factored in. Projected population growth rates can then be used along with global data to build a model for predicting future trends.

03:45 CRATERING OF ROADSIDE SOILS BY GEOPHAGOUS ACTIVITY OF WHITE-TAILED DEER, SALT FORK STATE PARK, GUERNSEY COUNTY, OHIO. Jack Kovach, jkovach@muskingum.edu, Muskingum College, Geology Dept., New Concord OH 43762.

Geophagy, the active consumption of soil, by white-tailed deer (*Odocoileus virginianus*) has produced extensive cratering in roadside soils at several locations along paved roads in Salt Fork State Park in Guernsey County in eastern Ohio. Geophagous behavior by deer in the park is presumably driven by the elevated concentrations of sodium in roadside soils that result from the application of de-icing salt on park roads, applied at a rate of about 200 tons/yr averaged over the period 1988-1997. Cratered areas are typically elongate depressions (up to 4 m long, 1 m wide and 0.12 m deep), the long axes of which parallel the road verge. Destruction by deer of vegetation, sod and underlying soil to within 0.15 m of the road pavement in some areas increases erosion and jeopardizes the integrity of the pavement. Interviews with maintenance personnel at the park on 12-19-97 indicate that repair and restoration of one extensively cratered area in 1997 required 160 tons of fill dirt, about 100 person-hours of labor and some \$200 worth of grass seed, with an estimated total cost of \$2,500. Based on this estimate, repair and restoration of all existing areas of extensive cratering by deer of roadside soils in the park could cost an additional \$10,000 - \$12,500. These costs, while modest, together with the recognition that geophagy is an indicator of physiological stress, provide additional justification for maintaining deer populations in the park at ecologically-sound levels.

04:00 MOLECULAR SYSTEMATICS AND EVOLUTIONARY TRENDS IN THE WOLF SPIDER GENUS GEOLYCOSA SUGGEST THE PRESENCE OF CRYPTIC SPECIES. Kory A. Thornburg, kthornbu@kent.edu, (Walter R. Hoeh, whoeh@kent.edu, Samuel D. Marshall, marshallsd@hiram.edu), Kent State University, Department of Biological Sciences, Kent OH 44242.

Nineteen species of *Geolycosa* have been described, based on a limited number of morphological characteristics. Thus, while the genus is well defined, the species interrelationships are poorly understood. The primary goal of this project is to estimate the evolutionary relationships among *Geolycosa* populations and species using comparisons of both cytochrome c oxidase subunit I (COI; a mitochondrial gene) and internal transcribed spacer (ITS-I; a nuclear gene) DNA sequences. Species identifications were based on the most current revision of the genus. We extracted total DNA from 100 *Geolycosa* individuals from a total of 38 sites in the US (primarily Florida). The extracted DNA was then PCR amplified, separated on a purifying agarose gel, and cycle sequenced. The DNA sequences for both genes were generated via a LI-COR 4200S automated sequencer. The data gathered by the automated sequencer was phylogenetically analyzed using PAUP, a computer program that performs phylogenetic analyses using parsimony. Preliminary analyses of the COI data set suggest that Floridian *Geolycosa* are a monophyletic assemblage. However, five of the nine species analyzed do not constitute monophyletic taxa, possibly indicating the presence of multiple cryptic species. Not only have we discovered evidence consistent with numerous undescribed species, but also the

apparent patterns of diversification differ radically from existing models of Floridian historical biogeography. This work is part of a larger study that encompasses biogeographic analyses as a means to recognizing areas of great biotic significance in order to focus conservation efforts.

04:15 VIDEOGRAPHY AND THE INVESTIGATION OF FUNCTIONAL MOUTHPART MORPHOLOGY IN LARVAL CHIRONOMUS RIPARIUS (DIPTERA: CHIRONOMIDAE). Sarah E. Beck, becke@marietta.edu, (Dave McShaffrey, mcscaffd@marietta.edu), Marietta College, Dept of Biology, Marietta OH 45750.

Chironomidae are an abundant and vital part of aquatic ecosystems worldwide and their mouthpart morphology is the only reliable way to identify most species. Despite the detailed knowledge of this morphology, little is known about the way Chironomidae use the various mouthparts in foraging. The goal of this project is to determine the function and various positions of these mouthparts during feeding using videographic and microscopic techniques. *Chironomus riparius* were reared in 10gal glass aquaria with mesh flight cages overhead and were fed sinking commercial fish food three times a week. Feeding behavior in *Chironomus riparius* was observed using Olympus SZH10, Olympus IX50 and an Olympus BX60 microscopes. The behavior was recorded using a JVC CCD video camera, a Sony VCR and played back on a television. Observations were then made about the position and use of mouthparts. In addition to examination of the precise use of mouthparts, other observations included the extent of coprophagy, other aspects of foraging behavior, silk spinning and tube construction.

04:30 THE EFFECT OF BURROWING MAYFLIES (HEXAGENIA SPP.) ON CHEMICAL AND PHYSICAL PROPERTIES OF THE OVERLYING WATER. Elizabeth R. Toot, etoot@heidelberg.edu, (Kenneth A. Krieger, kkrieger@heidelberg.edu), Heidelberg College, Box 0191, 44 Greenfield Street, Tiffin OH 44883.

In the early 1990's nymphs of the burrowing mayfly *Hexagenia* spp. began to repopulate the western basin of Lake Erie. This project was conducted to determine the effect of these nymphs on the water in which they reside. This was accomplished by constructing 15 cells containing sediment and water into which individual mayflies were placed and monitored for 16 days. The water in each cell was tested every 48 hours to determine its chemical and physical properties. Preliminary results show that the nymphs had a direct effect on the overlying water by lowering the pH by as much as pH .5, the dissolved oxygen concentration which was found to be between between 4.2mg/L to 8.8mg/L and the nitrate concentration to .77mg/L and increasing the turbidity as high as 18 NTU. The nymphs seemed to have no effect on conductivity, total phosphorus, ammonia, chlorides, silica, sulfite, soluble reactive phosphorus, and total kjeldahl nitrogen. These results indicate that *Hexagenia* spp. nymphs are effective in modifying some chemical and physical characteristics of the water in close proximity to their burrows and that these changes might be detectable in Lake Erie near large populations of mayfly nymphs.

04:45 DIVERSITY, PHENOLOGY, AND FLOWER HOSTS OF ANTHOPHILOUS LONG-HORNED BEETLES (COLEOPTERA: CERAMBYCIDAE) AT SEVERAL SITES IN A SOUTHEASTERN OHIO FOREST. W. Bradford Bond¹, bbond@ee.net, and T. Keith Philips², Keith.Philips@wku.edu, ¹101 Hillside Way, Marietta OH 45750, ²Western Kentucky University.

The Lepturinae in Ohio present a unique opportunity to study the diversity of a group of insects; species richness is high, the group is taxonomically well known, many species are diurnally active on blossoms, and individuals are relatively large and often distinctively colored and shaped, making identification easy. The species, numbers of individuals and their flower hosts were recorded from early May through late July. Rather than collecting all individuals, most specimens were observed on the flowers and left undisturbed. A total of 7918 anthophilous Cerambycidae in Washington County, Ohio, were recorded over six field seasons (1995-2000) and included 22 genera and 29 species. The most commonly used inflorescences were those of goatsbeard (*Arunus dioicus* [Walt.]) and wild hydrangea (*Hydrangea arborescens* L.) and queen anne's lace (*Daucus carota* L.). *Judolia cordifera* (Oliv.), *Metacmaeops vittata* (Swederus), *Strangalepta abbreviata* (Germar), and two species of *Brachyleptura* preferentially feed upon goatsbeard and wild hydrangea. At the most diverse site (Reas Run), the greatest number of species (17) was recorded in the third week of June while the greatest number of individuals (116) was observed a week later. The most abundant species was *Typocerus velutinus* accounting for 33% of the observations. *Analeptura lineola*, *S. abbreviata* and two species of *Brachyleptura* accounted for an additional 47% of the observations.

FOREST ECOLOGY
9:00 AM SATURDAY,
MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 202
BRIAN C. MCCARTHY-PRESIDING

09:00 FUEL LOADS IN TWELVE SOUTHEASTERN OHIO HARDWOOD STANDS. Cynthia L. Riccardi, cynthia.riccardi.1@ohio.edu, and Brian C. McCarthy, mccarthy@ohio.edu, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701-2979.

Forest fire behavior and intensity is largely related to fuel characteristics. Some fuel characteristics include size, shape, loading, moisture content, and arrangement of living and dead plant material. Some studies (mostly western conifer forests) have yielded complex models to predict fire intensity incorporating numerous variables. However, fuel loads have been poorly studied in much of the eastern deciduous forest. Models for western forests are likely not appropriate to second-growth mixed-oak or oak-hickory hardwood forests of central Appalachia. To elucidate fire fuel loads in the region, ground and surface fuels were measured from July through September 2000 along seventy-two 20 m transects in each of 12 forest stands in southeastern Ohio (N = 864). Ground fuels included the L, F, and H forest floor layers (litter and duff). Surface fuels included 1-, 10-, and 100-hr fine fuels and woody debris (CWD) material, which was greater than 75mm in diameter that intersected the 20m sampling plane. The mean litter and duff depths were 27.4 and 26.4 mm respectively. Fine wood and surface fuels were 0.719, 3.67, and 4.017 MT \times ha⁻¹ and the mean diameter of sound and rotten CWD was 16.7 and 17.8 cm, respectively. Our results provide quantification of fuel loads in the Central Hardwoods region and will provide for further elucidation of fire behavior in the region.

09:15 SOIL TEMPERATURE AND MOISTURE FLUCTUATIONS DURING AND AFTER PRESCRIBED FIRE IN SOUTHERN OHIO FORESTS. Louis R. Iverson, liverson@fs.fed.us, Todd F. Hutchinson, thutchinson@fs.fed.us, USDA Forest Service, 359 Main Road, Delaware OH 43015.

Prescribed fire is being used in eastern forests, but few studies have documented soil temperature and moisture trends resulting from such fires. Two prescribed fires were conducted on March 26, 1999, in mixed-oak forests of Vinton County, OH. Just before burning, seven electronic sensors were buried (1-cm depth) that recorded temperature every 2 seconds. Following the fires, hourly sensing (2-cm depth) occurred on 12 sensors – six from mesic sites and six from xeric sites, from April 1 to October 16. Soil moisture was calculated gravimetrically at the same sites six times. Surface fires had flame lengths less than 75 cm and maximum temperatures averaged 222°C at 10 cm above the soil. Soil temperatures increased an average of 9.3°C for a 6-minute period with fire, and then dropped to pre-burn temperatures within 1.5-4.7 hrs of burning. These temperatures are not expected to cause lasting direct effects on soil microorganisms. However in the following months, the soils on burned sites were warmer and drier, especially on xeric sites. Compared to controls, maximum daily soil temperatures averaged 3.5-5.7°C (maximum of 13°C) higher on the burned xeric sites and 0.5-0.6°C higher on burned mesic sites during the first 30 days after the fires. The elevated temperature effect lasted about 75 days on the mesic sites and 155 days on the xeric sites. On xeric sites, moisture levels were lower after burning throughout the year, while on mesic sites, this phenomenon only occurred late in the season. These cumulative effects could be biologically significant.

09:30 DENDROECOLOGICAL STUDIES OF WHITE OAK IN A SOUTH-EAST OHIO MIXED OAK FOREST. Cary S. Miller, cm297998@ohio.edu, Brian C. McCarthy, and Darrin L. Rubino, Ohio University, Honors Tutorial College, Athens OH 45701.

Little is known about the disturbance history of mixed-oak forests in southeastern Ohio. The use of tree rings, or dendrochronology, offers a rare opportunity to describe past stand dynamics. Dendrochronological techniques were applied to N = 10 white oak (*Quercus alba*) basal slabs. Most (N = 8) of the trees originated between 1841-1848, with the oldest sample dating to 1691, yielding a 308 yr chronology (1691-1999). Based on the small rings near the pith, the majority of the samples appear to have originated under a closed canopy. Release events were observed in 1888 and 1915. Fire scars were observed on several of the trees in 1845, 1915, and 1925. Additionally, an attempt was made to determine if a correlation existed between diameter at breast height (DBH), diameter inside bark at stump height (DIB), and age at stump and breast height. Increment cores at breast height and basal slabs (N = 7) from the same white oaks were dated, and the mean difference was found to be 6.29 yr \pm 1.38 SE. Increment cores of 148 white oaks were dated at breast height and compared with DBH. Robust regression revealed a significant relationship between age and DBH ($R^2 = 0.59$; $P < 0.0001$). Robust regression analysis was also performed on 48 different white oak samples to predict the amount of wood at base (DIB) from DBH. A significant relationship was found ($R^2 = 0.9792$; $P < 0.0001$), and a model, $DIB = 1.177333 + 1.158829 \times DBH$ developed.

09:45 RADIAL GROWTH OF FIVE APPALACHIAN HARDWOOD TREE SPECIES DURING A SUMMER DROUGHT. James S. Rentch, jrentch2@wvu.edu, Ray R. Hicks Jr., James R. Runkle, West Virginia University, Division of Forestry, P. O. Box 6125, Morgantown WV 26506-6125.

This study examined the 30-year dendroclimatological response of five Appalachian hardwood tree species (white oak, northern red oak, sugar maple, white ash, and yellow-poplar) to moisture and temperature in two second-growth hardwood stands in southeastern Ohio. Historic climatic responses were then compared to radial growth during the 1999 growing season, which was characterized by lower than average precipitation and higher than average temperatures. Finally, weekly dendrometer readings from a smaller sample of trees (20, four for each species) were recorded from May 20 through October 14, 1999, and compared to precipitation events and soil moisture availability. Red oak and yellow-poplar showed the greatest average radial increase, with red oak exceeding its 30-year mean. White ash showed the smallest increment, 79% of its 30-year mean. Historic climatic sensitivity was greatest for yellow-poplar and ash. Growth for all species showed a strong positive correlation with June precipitation, and all but yellow-poplar had a negative correlation with June temperature. Yellow-poplar and ash showed strong, positive correlations with spring precipitation. Weekly radial increments were generally predicted by species' historic climatic responses, with the exception of yellow-poplar. Despite lower than average precipitation in May and June, sustained low soil moisture levels did not occur until August. White ash showed the smallest radial growth, and ceased radial growth earliest in the growing season. In contrast, yellow-poplar was able to sustain radial growth by exploiting intermittent rain events in June and July, and by extending growth into September. This species also probably benefited from a favorable lower slope position.

10:00 IDENTIFICATION AND ASSESSMENT OF THE IMPACT OF THE PHYTOPLASMIC DISEASE, ASH YELLOWS, IN CUYAHOGA AND GEAGA COUNTIES. Michele A. Nagy, man3313@aol.com, (Britt A. Bunyard, bbunyard@ursuline.edu), Ursuline College, Biology Department, 2550 Lander Rd., Pepper Pike OH 44124.

Ash yellows is a disease caused by phytoplasmic microorganisms that affect the tree genus *Fraxinus*. Typical symptoms of the disease include branch dieback, witches' brooming, and interveinal chlorosis. In order to assess the impact of ash yellows on the Northeast region of Ohio, specifically, Cuyahoga and Geauga counties, sampling was conducted on white ash trees (*Fraxinus americana*). It is hypothesized that both visual identification of disease symptoms and laboratory diagnostic detection will verify the presence of ash yellows in the Northeastern Ohio region. Individual white ash trees were selected from the regions noted above in the fall of the year 2000 and branch and leaf material was removed for sampling. Confirmation of the disease is accomplished using DNA extraction and PCR detection, which amplifies a 16S-23S rDNA spacer region specific to the phytoplasm responsible for ash yellows. The PCR product is then detected electrophoretically indicating either the presence or absence of the disease-causing phytoplasm.

10:15 HERB LAYER RESPONSE TO SEASONAL SOIL NITROGEN DYNAMICS IN MANAGED AND MATURE OAK FORESTS OF SOUTHEASTERN OHIO. Christine J. Small, cs225388@ohio.edu, Brian C. McCarthy, mccarthy@ohio.edu, Ohio University, Dept. of Environmental and Plant Biology, Athens OH 45701.

Eastern deciduous forests have been noted for their high compositional diversity, due primarily to a rich layer of understory herbaceous vegetation. In these forests, understory composition is often correlated with microenvironmental conditions, particularly soil fertility. While these forests have historically been nitrogen-limited, the relationship of soil nitrogen to understory diversity is poorly understood, particularly relative to site conditions and management disturbances. Therefore, we examined patterns of soil carbon and nitrogen relative to understory diversity in managed (logged) and mature oak stands of southeastern Ohio. Because fertility can vary greatly in topographically-dissected regions, the influence of topography was also examined. Understory vegetation was sampled in April and June to capture peak growth of vernal and summer herbs. Upper mineral soil samples were collected from each plot during these periods and analyzed by dry combustion for organic carbon and nitrogen contents. Sample plots contained 144 plant species, including 92 herbs. Forest management negatively influenced soil nitrogen, with lower nitrogen in logged than mature forest soils (spring = 0.165% vs. 0.145%, summer = 0.197% vs. 0.146%, $P < 0.001$). Topography also influenced soil nitrogen, with greater availability on lower and north-facing slopes ($P < 0.05$). The carbon:nitrogen ratio was a strong predictor of understory richness in mature forests but less so in logged stands ($r^2 = 0.634$ vs. 0.309; each $P < 0.001$). Results of this study suggest that soil nitrogen dynamics, strongly influenced by site conditions and management, may critically affect vegetation diversity in our eastern forest systems.

10:30 THE EFFECT OF HYDROLOGY ON ABOVEGROUND NET PRIMARY PRODUCTION IN BOTTOMLAND HARDWOOD FORESTS IN CENTRAL OHIO. Matthew W. Cochran, Cochran.54@osu.edu, Virginie Bouchard, Bouchard.8@osu.edu, The Ohio State University, School of Natural Resources, 2021 Coffey Rd., Columbus OH 43210.

Bottomland hardwood forests are riparian ecosystems located between rivers and upland systems and historically have been negatively impacted by dikes and levees built to control the flow of waterways. Bottomlands are considered one of the most productive ecosystems in the world because the river provides a constant source of water and nutrients. With the construction of levees, ecosystem production has declined. The goal of this research was to quantify the effect of flooding intensity on the aboveground net primary production (ANPP) of three bottomlands located along the Olentangy River in central Ohio. Two of the bottomlands are hydrologically open while the third is hydrologically restricted by a levee. ANPP was quantified by analyzing tree growth rates during low (1999) and high (1995 and 2000) precipitation years. We estimated the ANPP of mature tree species using the point quarter method in a number of 500m² plots throughout each site. It was hypothesized that ANPP of bottomlands not regularly flooded will be significantly lower than ANPP of bottomlands more regularly flooded. Our data suggest that hydrologically restricted bottomlands produce approximately 800 g/m²/yr during low precipitation years and 1000 g/m²/yr during high precipitation years. Hydrologically open bottomlands produce approximately 1100 g/m²/yr and 1500 g/m²/yr, respectively. These initial results suggest that hydrologically restricted bottomlands are less productive than hydrologically open bottomlands during both high and low precipitation years.

BOTANY & COMMUNITY ECOLOGY

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 202

CAROLYN HOWES-PRESIDING

02:00 T. RICHARD FISHER'S ROLE IN THE DEVELOPMENT OF PLANT SYSTEMATICS AT THE OHIO STATE UNIVERSITY (1956-1968). Ronald L. Stuckey, The Ohio State University, 1315 Kinnear Road, Columbus OH 43212-1192.

T. Richard Fisher (1921-2000), hired in 1956 at the instructor level in the University's Department of Botany and Plant Pathology, developed a viable and active graduate-level program in plant systematics. Bernard S. Meyer, Department Chairman since 1946, long recognized the need for this sub-discipline if the Department was to have a credible balance in its course offerings and to provide well-rounded training for graduate students in botany. Although Meyer did not discuss Fisher's achievements in his book, *Botany at The Ohio State University: The First 100 Years (1983)*, a study of Fisher's life shows that he accomplished this mission in twelve years by: (1) teaching new courses in advanced plant systematics at the Columbus campus, and in field botany and aquatic vascular plants that were added to the curriculum at the Stone Laboratory, (2) establishing a research program with over \$400,000 support from the National Science Foundation to study the systematics and evolution of the genus *Silphium* that resulted in seven journal publications, (3) supervising 13 students who earned eight M. S. and eight Ph. D. degrees, and (4) making possible the hiring of Ronald L. Stuckey (1965) as an additional faculty member. Because of Fisher's effective, aggressive approach in his work, he developed a successful graduate program, resulting in advancement from instructor (1956) to full professor (1964) in eight years while at The Ohio State University.

02:15 EMANUEL D. RUDOLPH'S STUDIES IN THE HISTORY OF NORTH AMERICAN BOTANY: THE MAKING OF A BOOK. William R. Burk, billburk@email.unc.edu, University of North Carolina, Biology Library, CB #3280 Coker Hall, Chapel Hill NC 27599.

Emanuel D. Rudolph (1927-1992), lichenologist and historian of botany, had life-long research interests in the popularization of North American botany. His intentions of writing a book on this topic were eclipsed by his untimely death at age 64. The Ohio State University botanist and executor of the Rudolph estate, Ronald L. Stuckey, and University of North Carolina biology librarian William R. Burk, first conceived the idea of publishing a memorial volume of Rudolph's writings in August 1992. Among Rudolph's research archives were numerous manuscripts, particularly for papers he presented at meetings of The Ohio Academy of Science; Ohio Academy of Medical History; Historical Section, Botanical Society of America; and the Midwest Junco for the History of Science. These manuscripts and other documentation formed the foundation for gathering and editing papers for the book. Eight major themes in Rudolph's studies emerged: 1) botany textbooks, 2) botany in children's books, 3) botanical teaching, 4) botanical educators, 5) botanical illustration, 6) women in American botany, 7) writing a history of Shaw's Garden, and 8) writing botanical history. Thirty research papers and eight talks on the relationships between science and religion presented by Rudolph at Wellesley College constitute a 410-page memorial volume with over 200 illustrations issued in October 2000 by the Botanical Research Institute of Texas, Fort Worth, as *Sida Botanical Miscellany*, No. 19.

02:30 TAWAWA WOODS NATURAL LANDMARK; GEOLOGIC, CULTURAL AND LAND USE HISTORY. Cadance A. Lowell', clowell@csu.ces.edu, John Silvius' and Shelia Darrow', Central State University, Department of

Natural Sciences and Mathematics, P.O. Box 1004, Wilberforce OH 45384-1004, Cedarville College, Department of Biology.

The Tawawa Woods, Xenia Township, Greene County, OH (39° 42'N, 83° 52'W) was given natural landmark status in 1990 because of its unique potential as a study site of forest recovery following a natural disaster (tornado). The purpose of this research was to document the history, geology and cultural land use of the Tawawa Woods to better understand changes in biodiversity both prior to and following the tornado in 1974. Archival-based accounts were used to reconstruct prior land use patterns. Historic tree species diversity and importance were estimated using Land Surveys from 1799-1856. Current tree species composition of Tawawa Woods was estimated (1988, 1999), by using a combination of plot and point-centered quarter sampling methods. Tree and herbaceous species outside plot sample areas were identified by walk-throughs and documented with photographs. Historically, the Tawawa Woods was a cultural "focal point" in Greene County used by ancient Native Americans, the Shawnee, and pioneers. Tawawa Woods today is a riparian forest adjacent to Massies Creek and an upland forest community on north-facing slopes adjacent to the Central State University campus. Slope soils are Miamian and/or Hennepin, while floodplain soils are classified as Genessee. Soils are calcareous and depth to bedrock is in excess of 1.5 m. Historic accounts suggest that the number of springs and flow rates have significantly decreased which may have affected species composition. Severe pollution in Massies Creek, trash dumping in the woods, and increased demand for lumber during the 1890's also may have altered biodiversity in this area. Witness tree data from land surveys identify 15 different tree species with the majority of trees identified as hickory (33%) and Sugar Maple (12%). Current surveys recognize 30 tree species with the majority of trees identified as Sugar Maple and Black Cherry. In addition, over 60 herbaceous and shrub species have been identified in the Tawawa Woods.

02:45 SPORES FROM THE LATE DEVONIAN CLEVELAND SHALE OF OHIO, U.S.A. Shyamala Chitale, schitale@cmnh.org, and Wilmer Stowe, The Cleveland Museum of Natural History, 1 Wade Oval, University Circle, Cleveland OH 44106-1767.

Several outcrops of the Late Devonian Cleveland Shale around the greater Cleveland area expose grayish black fragile shale, occasionally mixed with siltstone. Over fifteen years of study in this shale have revealed the presence of many lycopsid axes and cones, and some progymnosperms. The compressed cones bear on central axis helically arranged sporophylls with sporangia and spores. The rock matrix around one such lycopsid cones has been investigated for the presence of spores. Maceration of the mineral matter for separation of the spores, was as follows. A piece of 5.08 cm x 5.08 cm silty shale was washed in distilled water and then covered with HCl to dissolve the calcium. Then it was treated with HF to dissolve the silica. After washing well with distilled water it was covered with Schulzes Solution (HNO₃ + KClO₃). The time of exposure for each treatment varied with different kinds of matrix. To neutralize the acids, the macerated sample was treated with sodium bicarbonate. The spores were separated by centrifugation. Microslides were prepared using resin permount or glycerin jelly. The sample yielded predominantly round and triangular spores with triradiate marks and the algal cysts *Tasmanites*. A few spores possessed long or short spines. With a few exceptions, most of the spores showed little affinity to the associated cone. These spores must have come from other plants growing in the distant Late Devonian forest of Ohio. These spores were either wind borne or water borne to have been buried in the Cleveland Shale of Ohio.

03:00 GENETIC VARIATION OF *SCEPTRIDIUM DISSECTUM* (OPHIOGLOSSACEAE) ASSESSED BY ISSR (INTER-SIMPLE SEQUENCE REPEAT) MARKERS. Michael S. Barker, barker_m@denison.edu, Warren D. Hauk, hauk@denison.edu, Denison University, Department of Biology, 307 Higley Hall, Granville OH 43023.

Species of the genus *Sceptridium*, like other members of Ophioglossaceae, are difficult to distinguish. Intraspecific morphological variation creates problems for identifying stable characters on which to base species circumscriptions. Within *Sceptridium dissectum*, there is substantial variation in blade shape and degree of dissection. Historically two varieties (var. *dissectum* Sprengel and var. *obliquum* (Muhl.) Clute) have been recognized. However, a range of morphological intermediates exist between the two typified varieties. It is unclear whether the two varieties represent distinct genetic lineages. We used the ISSR (Inter-Simple Sequence Repeat) marker system to assess the genetic structure of *Sceptridium dissectum*. A total of 69 *S. dissectum* sporophytes from 17 populations were collected from different sites within Ohio. The 69 individuals represented both var. *dissectum* and var. *obliquum* as well as a range of morphological intermediates. We generated 44 loci from three ISSR primers. UPGMA (Unweighted Pair Group Method with Arithmetic averages) cluster analyses did not group individuals of the same variety. The analyses of ISSR data revealed more intraspecific genetic variation than documented previously by isozyme studies. These results suggested that the morphologies associated with var. *dissectum* and var. *obliquum* do not correlate with genetic structure. It is likely that morphological variation in *Sceptridium dissectum* is influenced by non-genetic factors. Currently, we are using more ISSR primers to further examine the genetic structure of *S. dissectum*.

03:15 PRESERVING BIODIVERSITY IN NORTHEAST OHIO. I. A SURVEY OF FUNGAL DIVERSITY WITHIN THE WEST WOODS PARK OF THE GEAGA PARK DISTRICT. Britt A. Bunyard, bbunyard@ursuline.edu, Ursuline College, Biology Department, Dauby Science Center, Pepper Pike OH 44124.

One of the goals of the Geauga County Park District is to protect high quality natural areas from rapidly encroaching development. One measure of an ecosystem's importance, as well as overall health, is in the richness of species living within the habitat. Species diversity can be used to monitor the future status of the ecosystem. The purpose of this two-year investigation was to inventory species of fungi present within The West Woods Park (Gauga County, Ohio) and to evaluate overall diversity among different taxonomic groups of fungi present. Fruiting bodies of Basidiomycetous and Ascomycetous fungi were collected weekly throughout the 2000 growing season, identified using taxonomic keys, and photographed. At least 90 species from 23 families of Basidiomycetous fungi and at least 14 species from 8 families of Ascomycetous fungi were identified. Some species are considered rare in North America. Additionally, all five of the major families of slime molds [Class: Myxomycetes] found in the Midwest were verified. Although few similar studies in Northeast Ohio have been published, these preliminary results show the West Woods to have fungal diversity as great as, or greater than, any natural area in the region. Furthermore, these findings point to the need of locating and preserving other biologically important natural areas in the future.

03:30 COMPOSITION AND ECOLOGY OF MACROFUNGAL AND MYXOMYCETE COMMUNITIES ON OAK WOODY DEBRIS IN AN OAK-HICKORY FOREST OF SOUTHEASTERN OHIO. Darrin L. Rubino, dr246988@ohio.edu, Brian C. McCarthy, mccarthy@ohio.edu, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

Although coarse woody debris (CWD; logs ≥ 10 cm diameter) is recognized as an important structural component in forested ecosystems, little is known about the fungal communities it supports. The objectives of this investigation were to identify the macrofungal (Ascomycetes and Basidiomycetes with sporocarps approximately 1 mm or larger) and true slime mold (Myxomycetes) communities on CWD and to explore relationships between environmental parameters and fungal distribution. From early September through late October 2000, sporocarps were collected from 50 oak (*Quercus*) logs that were stratified across slope aspect and slope position in an oak-hickory forest in southeastern Ohio. Four sampling trips resulted in the collection of 102 taxa distributed among 20 orders, 34 families, and 60 genera. Basidiomycetes were the most diverse group found on the CWD (61 taxa distributed among 10 orders, 20 families, and 34 genera). Twenty-four Ascomycetes (5 orders, 7 families, and 12 genera) and 17 Myxomycetes (5 orders, 7 families, and 14 genera) were found on the logs. CWD species richness (relativized by log surface area) ranged from 0.4 to 9.3 species/m² with a mean of 2.4 species/m² \pm 0.3 SE. To explore relationships between fungi and environmental parameters, canonical correspondence analysis (CCA) was performed. CCA revealed that the species' distributions were significantly related ($P = 0.005$) to the measured environmental parameters (slope aspect, percent slope, topographic position, and CWD surface area) and that the parameters explained 45.3% of the variance in the species' distributions. Fungal community diversity and composition is hypothesized to reflect CWD moisture availability.

03:45 SURVEY OF SILVER CREEK ECOSYSTEM: BIOTIC AND ABIOTIC FEATURES. Matthew C. Price, pricemc@hiram.edu, (Samuel D. Marshall, marshallsd@hiram.edu, and Martin K. Huehner, huehnermk@hiram.edu), J.H. Barrow Field Station, 11305 Wheeler Rd., Garrettsville OH 44231.

In the summer of 2000 a study was designed to survey the health of the Silver Creek ecosystem, using both biotic and abiotic features to ascertain the health and overall quality of the stream. Four sample sites were established in riffle beds within the portion of Silver Creek contained in Hiram College Field Station property. At each site, three Hester-Dendy sampler blocks were fixed to the streambed to assess invertebrate numbers as an artificial substrate for invertebrate colonization. The samplers were left in the stream for two, six-week periods, with the colonizing invertebrates removed and recorded at the end of the first and second six-week periods. Abiotic tests for temperature, flow rate, dissolved oxygen, pH, conductivity, phosphates, alkalinity, hardness, chloride, nitrates and sulfates were also conducted during the first of the six-week periods at the four sample sites. Results of the abiotic sampling suggest good to excellent water quality, with hardness and nitrate levels as low as 150mg/L and 0.2mg/L respectively—while sensitive indicator invertebrates were collected during biotic sampling, a much lower concentration of invertebrates (less than 23 organisms per square meter) were collected than expected. This may be due, in part, to the presence and abundance of a predatory crayfish, *Orconectes obscurus*. A follow up predation experiment, offering various prey types to the crayfish, was conducted to determine that the crayfish were in fact actively feeding on other invertebrates in the ecosystem. Results of the study suggest good to excellent water quality, but perhaps a crayfish overpopulation problem.

04:00 COMPOSITION OF THE WOODY REGENERATION LAYER IN THREE FORESTS IN SOUTHEASTERN OHIO. Matthew A. Albrecht, ma323500@ohio.edu, Jill E. Brown, jb266496@ohio.edu, Brian C. McCarthy, mccarthy@ohio.edu, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

In oak-dominated hardwood forests of the central Appalachian Region, the species composition of the canopy and woody understory are frequently different. This is now a widely established pattern throughout the landscape. *Acer* spp. are abundant in the understory and likely to replace the now dominant oaks, hickories, and tulip trees. Several factors may influence this compositional change, including greater browsing pressure by deer, suppression of fire, and anthropogenically generated habitat stresses. The purpose of this study was to provide a detailed assessment of the regeneration layer of three forests in southeastern Ohio (Zaleski State Forest, Raccoon Experimental Research Area (REMA), and Tar Hollow State Forest). Saplings and tree seedlings were censused in 120 (50 x 20m) plots distributed across 12 stands within three forests. There were small, medium and large size classes for both seedlings and saplings. The structure of all individuals placed in these size classes loosely resembles a reverse J-curve, with a strong bottleneck in the largest seedling category. A total of 37 tree species were found among the three forests. An ordination of saplings revealed that there was considerable similarity in species composition among the three forests, but variance patterns differed. An ordination of seedlings shows very distinct separation of the three forests, with no overlap. The first three axes explain ca. 60% of the variation in both ordinations. These data suggest broader variability in species composition at the seedling stage with a strong convergence in composition with stand maturity.

04:15 INTERIOR VS. EDGE VEGETATION IN A FRAGMENTED FOREST LANDSCAPE. Matt Weand, mw422693@ohio.edu, and Brian C. McCarthy, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

As a result of fragmentation, forest edges are subjected to dramatic changes in microclimate relative to the interior. Moreover, edges may permit non-native species to establish more easily than in the forest interior. This study examines differences in vegetation and microclimate in and around managed forest fragments created by surface mining inside the Athens Unit of the Wayne National Forest, Hocking County, Ohio. Forest interior and edge areas with either northeastern or southwestern edge orientations were surveyed for woody species diversity, abundance, and coverage. Microclimate, soil C:N ratio, soil acidity, and canopy coverage were also measured at each edge and interior ($N = 12$). Average species richness varied, with 32.0 ± 1.0 SE species in edge areas, and 35.1 ± 1.2 species in interior areas. Richness was different ($F = 3.87, P = 0.063$) between edge and interior. There were significantly ($F = 11.20, P < 0.01$) more invasive species at the edge (8.6%) relative to the interior (4.8%). Edge aspect did not affect species richness ($F = 0.17, P = 0.68$). Soil C:N ratios were significantly ($F = 6.20, P < 0.05$) greater at edges (14.92 ± 0.45) relative to interiors (13.34 ± 0.45). Results suggest that non-native species may easily penetrate recently disturbed forests. This study will aid efforts in determining which locations in a forested landscape are more likely to contain non-native species, and how surface mining affects succession in adjacent forests.

04:30 A COMPARISON OF THE ABOVEGROUND VEGETATION AND SEED BANK IN A STAND OF *PHRAGMITES AUSTRALIS*. Christy T. Carter, ct346390@ohio.edu, I. A. Ungar, ungar@ohio.edu, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

Phragmites australis (a non-native invasive grass) reproduces vegetatively once established and forms dense monotypic stands. In an inland salt marsh in Rittman, Ohio, *P. australis* has been observed encroaching into the higher saline areas. Our goals were to compare the aboveground vegetation to the seed bank within a *P. australis* stand, and to determine whether the seed bank density fluctuated throughout the year. This study was part of a larger investigation that assessed seed bank recovery when *P. australis* was experimentally manipulated in the field. For seed bank estimates, soil cores were collected monthly from 40 plots over a 12-month period (July 1999 to August 2000) and were returned to the lab where seeds were permitted to germinate. Aboveground vegetation was recorded in each of the 40 plots in September, 2000. No *P. australis* seeds were found in the seed bank. Percent frequency of species in the aboveground vegetation included *Phragmites australis* (100%), *Atriplex prostrata* (30%), *Cyperus flavescens* (17.5%), *Aster subulatus* (10%), and *Salicornia europaea* (5%). Percent frequency of species in the persistent seed bank included *Atriplex prostrata* (97.5%), *Cyperus flavescens* (27.5%), *Salicornia europaea* (27.5%), *Spergularia marina* (7.5%), and *Cardamine hirsuta* (2.5%). Seed density of the dominant species did fluctuate throughout the year. Percent similarity between the aboveground vegetation and seed bank in August, 2000 was 32%. Although *P. australis* does not produce a persistent seed bank, it does reproduce vegetatively by rhizomes and may, potentially, replace other smaller light-requiring halophytic species, removing them from the aboveground vegetation.

RESTORATION & INVASIVE SPECIES
9:00 AM SATURDAY, MARCH 31, 2001
KOLENBRANDER-HARTER ROOM 203
CAROLYN McQUATTIE-PRESIDING

09:00 POTENTIAL CHANGES IN FOREST SUCCESSION BY AN INVASIVE SHRUB, AMUR HONEYSUCKLE (*LONICERA MAACKII*). Kurt M. Hartman, kh349592@ohio.edu, and Brian C. McCarthy, mccarthy@ohio.edu, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701. Although many studies have shown general community modifications by invasive plants, few have examined the effects of invasive species on the trajectory of succession. The goal of this investigation was to examine a chronosequence of Amur honeysuckle (*Lonicera maackii*) invasion and study its effects on vegetation. Sixteen forest stands in southwestern Ohio were studied: 12 honeysuckle invaded sites of various ages and 4 non-invaded control sites. Trees were increment cored ($n = 224$) to determine stand age, and honeysuckle stems were cut and aged ($n = 448$) to determine time since invasion. Soil cores were collected ($n = 224$), and seeds were grown to study germinable seed composition. At fourteen points per site, the forest layers including herbs, tree seedlings, saplings, shrubs, and canopy were quantified. Of all species honeysuckle showed the greatest seedling recruitment ability (mean density = $3.7 \text{ stems} \times \text{m}^{-2} \pm 1.2 \text{ SE}$; density range = 0.3 to $18.3 \text{ stems} \times \text{m}^{-2}$). Honeysuckle age ($11.5 \text{ yrs} \pm 1.1$; max = 42) was not significantly ($P > 0.05$) correlated with canopy age (mean = $55.6 \text{ yrs} \pm 5.6$; max = 119) indicating broad invasibility by honeysuckle in terms of stand maturity. Honeysuckle biomass at sites ranged from 49.3 to $1147.8 \text{ kg} \times \text{ha}^{-1}$ (mean = $316.5 \text{ kg} \times \text{ha}^{-1} \pm 68.7$). Richness and Shannon-Weiner diversity of seedbanks, herbs, tree seedlings, and saplings were negatively related to honeysuckle biomass ($R^2 = 0.83$, $P = 0.04$). This suggests that honeysuckle dominance in stands could adversely affect community diversity and succession.

09:15 SURVIVAL, GROWTH, AND FECUNDITY OF TWO UNDERSTORY PERENNIAL HERBS IN THE PRESENCE AND ABSENCE OF THE EXOTIC INVASIVE SHRUB *LONICERA MAACKII* (AMUR HONEYSUCKLE). Kara E. Miller, millerke@muohio.edu, David L. Gorchov, mgorchodl@muohio.edu, Miami University, Department of Botany, Oxford OH 45056. Studies that examine invasive species and invaded communities rarely quantify direct effects of invasive plants on native species. We investigated effects on understory herbs of the exotic shrub *Lonicera maackii* (Rupr.) Herder (Amur Honeysuckle), which has invaded forests in eastern North America. Transplants of 120 individuals each of *Anemone thalictroides* L. (Rue-anemone) and *Allium burdickii* (Hanes) A.G. Jones (Wild Leek) were placed in a blocked design of three treatments (*L. maackii* present, absent, and removed) at an anthropogenically disturbed and an undisturbed forest stand in Oxford, Ohio (Butler County). Herb demography was monitored for 4-5 seasons following transplanting to test the hypothesis that *L. maackii* reduces herb survival, growth, and fecundity. Log-likelihood tests revealed that *A. thalictroides* individuals survived equally well in all treatments at the undisturbed site, and had higher survival under *L. maackii* in the disturbed forest. At the undisturbed site *A. burdickii* survival was higher in the shrub's presence, but no significant difference was detected at the disturbed site. Growth, as determined by average leaf number (*A. thalictroides*) or sum of leaf widths (*A. burdickii*), occurred in all treatments at both sites, but was greatest for individuals in the absent or removal treatments (mixed model ANOVA). *Lonicera maackii* reduced the proportion of *A. burdickii* flowers at the disturbed site, and reduced flower and seed number per plant for both species at both sites. These results suggest that *L. maackii* does not reduce survival of perennial forest herb individuals, but hinders population growth of these species due to reduced growth and fecundity.

09:30 COMPARISON OF STANDING HERBACEOUS VEGETATION AND SEED BANK COMPOSITION OF A RESTORED PASTURE. Cathlene I. Leary, learyci@miaxv1@muohio.edu, Carolyn Howes Keiffer, keiffch@muohio.edu, Miami University, Department of Botany, Oxford OH 45056. In areas of anthropogenic disturbance, effective means of restoration are necessary to re-establish functional communities and habitats. Disturbances related to restoration planting have the potential to influence this process by exposing the seed bank. Different planting regimes were evaluated in restoring a pasture to a lowland forest on an industrial site in southwestern Ohio (Butler County). Eight 0.1 ha plots were established of four treatments, with 2 replicates of each: Control (no planting), Seedlings (120 individuals of 5 species planted), Saplings (200 individuals of 5 species planted), Mixed (120 seedlings, 100 saplings, each of 5 species). Changes in herbaceous vegetation composition were observed among the eight plots by the end of the first growing season. The seed bank was evaluated to determine if differences in above ground vegetation observed among plots could be explained by differences in composition of the seed bank. Based on cluster analysis, the seed bank and above ground vegetation composition form two discrete groups, suggesting the seed bank does not fully explain standing vegetation. Results indicate that the seed

bank and standing vegetation had a similarity of 33% (Sorensen's index) overall with similarity ranging from 17% to 31.5% among plots. Further analysis will investigate whether seed bank composition combined with micro-environmental differences among plots may be driving the herbaceous vegetation changes observed.

09:45 SPATIAL DISTRIBUTION AND SPREAD OF GARLIC MUSTARD FROM NASCENT FOCI. Daniel R. Scott, dr_dkscott@yahoo.com, and Emilie E. Regnier, regnier.1@osu.edu, The Ohio State University, Dept. Hort and Crop Science, 2021 Coffey Rd., Columbus OH 43210. Garlic mustard is an exotic weed of the forest understory that is competing with native spring ephemerals. It spreads rapidly through a site from low-density nascent foci that eventually merge to form a high-density population with a large front. A study was initiated in 1998 and continued through 2000 to quantify the spread of nascent foci in established wood lots. Plots were selected at three sites in Ohio: Buck Creek State Park, Clark County; Badger Farm of Ohio Agricultural Research and Development Center (OARDC), Wooster; and Western Branch OARDC, Clark County. The sites selected were based on remoteness of small populations of garlic mustard rosettes. Grids were established on each plot as 0.5 meter per side blocks. The area occupied by seedlings in 1999 was on average 53% to 170% greater than 1998 at the three sites. The area occupied by rosettes in 2000 increased by an average of 161% over the first season (1998) at Wooster, OH. The density of each plot increased by an average of 8.3% at Wooster. The number of rosettes in 2000 was an average of 301% higher than the number of rosettes in 1998 at Wooster and 588% greater at Western. Rosette numbers declined by an average of 43% and the area occupied by rosettes declined by an average of 18% at Buck Creek State Park. This was attributed to lower rainfall. Approximately 30% of 1999 seedlings survived to flower in 2000. Elimination of these nascent foci should be the primary goal for controlling garlic mustard.

10:00 STAND RESPONSE TO HEMLOCK WOOLLY ADELGID INFESTATION IN CONNECTICUT. Aaron R. Weiskittel¹, weiskittel.3@osu.edu, and David A. Orwig², orwig@fas.harvard.edu, ¹The Ohio State University, School of Natural Resources, 2021 Coffey Road, Columbus, OH 43210-1095 and ²Harvard University. Understanding the response of stands infested with hemlock woolly adelgid (HWA, *Adelges tsugae*) is a critical step in identifying the influences this introduced insect will have on ecosystem processes and landscape dynamics. Stand response was examined by establishing 24-400 m² sample plots within eight recently infested *Tsuga canadensis* (eastern hemlock) stands greater than three ha in size. Within these plots, species, diameter at breast height (dbh), crown class, and vigor were recorded for all living and dead trees greater than ten cm dbh. Increment cores were taken from 24 randomly selected living trees in each stand. Age ranged from 81 to 116 years, with total basal area between 39 and 62 m²/ha. Overstory hemlock mortality was between zero and seven percent and all crown classes were affected by HWA. The average hemlock tree in sites with high mortality lost 50 to 75% of their foliage, while hemlock trees in sites with moderate mortality on average had 25 to 50% foliar loss. From 1992 to 1998, hemlock growth on sites with high mortality decreased over fourteen percent annually and hemlock growth on sites with moderate mortality decreased nearly twenty percent annually between 1996 and 1998, illustrating that the physiological damage caused by HWA on an individual tree is the most severe in the first few years of infestation. *Betula lenta* (black birch) and *Acer rubrum* (red maple) were the primary species regenerating in these stands. Thus, these hemlock stands will continue to deteriorate slowly, which will alter microenvironment conditions, nutrient-cycling, and decomposition rates of these ecosystems.

10:15 THE EFFECTIVENESS OF THE EZJECT CAPSULE INJECTION SYSTEM™ IN THE ERADICATION OF THE INVASIVE SHRUB, *LONICERA MAACKII*, AMUR HONEYSUCKLE. Cybil R. Franz, franzcr@po.muohio.edu, and Carolyn Howes-Keiffer, Miami University, 4200 E. University Blvd., Middletown OH 45042. Amur honeysuckle (*Lonicera maackii*) is a non-native shrub that is aggressively invading open fields and forests in the Midwest. Because current methods of removal are difficult or time consuming, we field-tested a new device (EZJECT Capsule Injection System™), which directly injects herbicide into the cambium layer. We conducted two studies to determine if the EZJECT would be successful in the eradication of *L. maackii* and comparing effectiveness between methods of injection. Our first experiment was undertaken in the summer of 1998 when we injected 947 shrubs of various sizes. A survey conducted two months after injection, indicated that 78% of the treated shrubs were dead. The second study began in the Spring of 1999, to determine if seasonal translocation would affect survival. For this study, we used 100 shrubs total; half were injected in the spring and the remaining half in the fall. We also subdivided each season into two groups and injected herbicide into either the main stem only or into all stems of each individual. A survey, conducted 6 months after injection, indicated that the spring-injected shrubs had 56% mortality, while the fall-injected group experienced 80% mortality. Injecting all stems was more successful than only injecting the main stem. The fall treatment group exhibited 88% mortality, when all stems were injected. Based on our studies, the best practice of using the EZJECT against Amur honeysuckle is to inject in the fall, making sure to inject all stems that are large enough to accommodate a capsule.

10:30 COMMUNITY AND ALLELOPATHIC EFFECTS OF THE EXOTIC SPECIES, *LESPEDEZA CUNEATA* G. DON (FABACEAE), ON OLD FIELD VEGETATION. Wendy M. Dobrowski, wd392893@ohiou.edu, Irwin A. Ungar, Ohio University, Department of Environmental and Plant Biology, Porter Hall, Athens OH 45701.

The exotic species *Lespedeza cuneata*, Chinese lespedeza, was introduced into the United States in 1896 from eastern Asia. The goal of this project was to determine the effects of *L. cuneata* on the diversity and density of the old field plant communities by observing a population at Waterloo Wildlife Experimental Station (WWES) in south-eastern Ohio. Its presence has been hypothesized to dramatically decrease native plant diversity as it establishes and spreads throughout a region. In order to determine the effects of *L. cuneata* on the plant community, four types of observational plots were set up at Waterloo Wildlife Experimental Station (WWES) to observe species composition, diversity and density of the plant community throughout the growing season. Results indicated that *L. cuneata* did significantly decrease plant diversity and density. The second objective of this project was to determine if allelopathy is a mechanism by which *L. cuneata* succeeds. Germination and growth experiments, using *L. cuneata* plant parts and phenolic compounds, were conducted to address this issue for four target species *Tridens flavens*, *Daucus carota*, *Setaria faberi*, and *Solidago canadensis*. The germination of *S. canadensis* and the germination and growth of *D. carota* were significantly inhibited by the phenolic compounds found in *L. cuneata*. Phenolic compounds in *L. cuneata* were shown to be highest in leaves, then seeds, roots, stems, dead stems, and soil, respectively.

PLANT BIOLOGY

2:00 PM SATURDAY, MARCH 31, 2001

KOLENBRANDER-HARTER ROOM 203

CAROLYN MCQUATTIE-PRESIDING

02:00 CATTAIL PHENOLOGY AND HYBRID INCIDENCE AT THE OLENTANGY RIVER WETLANDS RESEARCH PARK. Sarena M. Selbo, selbo.1@osu.edu, and Allison A. Snow, The Ohio State University, Evolution, Ecology and Organismal Biology, 1735 Neil Ave., Columbus OH 43210.

Three cattail are generally recognized in Ohio: *Typha latifolia* L. (broad-leaved cattail), a North American native, *Typha angustifolia* L. (narrow-leaved cattail), thought to be introduced, and a hybrid between the two species, *Typha x glauca* Godr. The hybrid has intermediate characteristics of its parental species and thus is difficult to identify morphologically. The goals of this study were to identify the cattail taxa present at an artificial wetland and to investigate the potential for interspecific hybridization. In June 2000, we randomly selected 100 individuals at the Olentangy River Wetlands Research Park on the campus of The Ohio State University and took four morphological measurements as well as collected pollen and leaf tissue samples from each. DNA was extracted from a subset of the individuals and RAPDs were run to identify potential hybrids. The morphological measurements along with the pollen type were compared with species-specific RAPD markers, and in all but one case were found to correspond (N = 30). No hybrids were found. In order to investigate the potential for hybridization we studied the phenology of *T. angustifolia* and *T. latifolia*. Ten plots containing both species were set up and flowering times were recorded tri-weekly by observing which individuals were flowering in each plot. These data indicate that the overlap in flowering time between the two species is minimal. This information aids in understanding the potential for hybridization between cattail species.

02:15 TEMPORAL AND GEOGRAPHIC VARIATION IN SEED PREDATION ON *HIBISCUS MOSCHEUTOS*. Elisabeth Kathryn F. Bauman, bauman.51@osu.edu, (Allison Snow, snow.1@osu.edu), Ohio State University, Department of Evolution, Ecology, and Organismal Biology, 1735 Neil Ave., Columbus OH 43210.

Because seed predation can be a strong force in the survival and growth of plant populations, potentially shaping population structure, or even acting as a selective agent, understanding its dynamics can be particularly useful in the context of conservation, agriculture, and the study of invasive species. Using *Hibiscus moscheutos* (Malvaceae), this study attempted to identify some less-considered factors underlying seed predation dynamics. The two seed predators on *H. moscheutos* (*Althaeus hibisci* and *Conotrachelus fissinguis*, both Coleopterans) typically damage 50-90% of fruits each year. This study examined how number of fruits damaged on *H. moscheutos* varied among four populations from July 23 to October 14, 2000 and in one focal population from 1993 to 2000. Predation levels were also correlated to rainfall, flowering time, and season flower production. Damage was ascertained by presence and number of *C. fissinguis* larval exit holes on the fruit wall. Number of fruits having damage varied widely between populations (G test of independence, $p = 0.00$, $n = 1,754$), with one population having 93% of fruits damaged, and another having no predation at all. Predation levels did vary between years, ranging from 0% to 90% of fruits damaged in the focal population, but were not correlated to rainfall in

any way. Date of flowering was not a good predictor of the level of predator damage, but there was a decrease in predation levels as the season progressed (linear regression, $p = 0.00$, $r^2 = 0.16$, $n = 184$). Season flower production was not associated with variation in predation levels (linear regression, $p = 0.81$, $r^2 = 0.00$, $n = 52$).

02:30 EFFECT OF PHENOTYPIC PLASTICITY AND SEED SOURCE ON GROWTH IN CONTRASTING LIGHT ENVIRONMENTS. A. Christina W. Longbrake, aw371587@ohio.edu, and Brian C. McCarthy, Ohio University, Dept. of Environmental and Plant Biology, Athens OH 45701.

Paulownia tomentosa (Scrophulariaceae) is a tree native to China introduced into North America in the 1840's. Although *P. tomentosa* is a sun-adapted plant, it has been observed to colonize tip-up mounds in intact Ohio forests. *P. tomentosa* is presently naturalized throughout the southeastern US. We wanted to explore differences in phenotypic plasticity using seed source from three populations. Seeds were collected from a population in Athalia OH, Charleston WV, and Pigeon River NC. Plants grown in full sun and shade treatment (~5% full sun) in a common garden in Athens OH. Two harvests of ~20 plants were made during the growing season. Plants were larger in full sun than shade treatment in the second harvest. Analysis of allometric ratios showed effects ($P < 0.05$) of light treatment and population, particularly for leaf area ratio and specific leaf area. Relative growth rates of roots differed between populations ($P < 0.05$). Comparison among populations showed the OH and WV populations to be more similar to each other than the NC population. Despite its recent immigration to the US, naturalized populations of *P. tomentosa* show variation in response to light environment. This coupled with its phenotypically plastic response to light environment may be one key to this invader's success.

02:45 MORPHOLOGICAL AND ANATOMICAL RESPONSES OF PITCH PINE MYCORRHIZAE TO ENVIRONMENTAL POLLUTANTS. Carolyn J. McQuattie, mcmcquattie@fs.fed.us, George A. Schier, USDA Forest Service, 359 Main Rd, Delaware OH 43015.

The beneficial symbiosis between mycorrhizal fungi and tree roots may be altered by atmospheric or soil pollutants. We conducted a series of growth chamber studies on seedlings of *Pinus rigida* inoculated with the mycorrhizal fungus *Pisolithus tinctorius* to determine effects of ozone (0, 50, 100 or 200 ppb O₃), carbon dioxide (350 or 700 u/l CO₂), excess nitrogen (3x ambient NO₃-N or NH₄-N in nutrient solution), or aluminum (0, 12.5, 25 or 50 mg/l Al in nutrient solution) on mycorrhizal colonization and root anatomy. After 13 weeks exposure to each stressor, percentage of mycorrhizal colonization of roots was measured, and mycorrhizal short roots were examined by light and electron microscopy. Seedlings grown at elevated CO₂ had the highest percentage of root colonization (>92%), while those fumigated with O₃ had the lowest colonization levels (11-25%). Mycorrhizal roots of seedlings grown at elevated CO₂ or with excess nitrogen had more complex branching patterns than roots from other treatments. Necrotic root tips were seen only after exposure to the two highest Al levels. Accumulations of electron-dense material were common in mantle hyphae from Al- and NO₃-N treated roots, whereas glycogen (storage starch) was seen in hyphae from elevated CO₂ and excess NH₄-N treatments. Root meristem cells showed increased vacuolation of the cytoplasm after exposure to excess nitrogen or Al; swelling of cellular membranes was observed after exposure to the highest O₃ level. Decreased mycorrhizal colonization and anatomical disruptions after exposure to O₃, excess nitrogen, or Al may reflect reduced photosynthate transport, nutrient imbalances, and/or ion toxicity.

03:00 EDAPHIC FACTORS INFLUENCING THE DISTRIBUTION OF ACORUS CALAMUS L. (ACORACEAE) IN SOUTHEASTERN OHIO. Aswini Pai, ap345389@ohio.edu, and Brian C. McCarthy, Ohio University, Department of Environmental and Plant Biology, Athens OH 45701.

Acorus calamus (sweetflag) is a perennial herb widely distributed in temperate and subtropical Asia, Europe and North America. Populations of the species are found along edges of ponds, streams, and lakes. The rhizome of sweetflag is important to several ethnopharmacopias and is used mainly for stomach ailments. Currently, pharmaceutical companies in the USA are exploring the use of the rhizome for commercial exploitation. However, little is known regarding the distribution and abundance of this species relative to its environment. Thus, the objective of this study is to examine the edaphic factors influencing distribution of *A. calamus* in southeastern Ohio. We hypothesize that edaphic factors at sites where *A. calamus* is located will vary significantly from adjacent areas where the plant is not found. Twelve populations of *A. calamus* were identified in Ohio (Athens and Meigs Counties). Each population was transected at its longest dimension and soils were sampled at different locations along the transect. Soil samples were gathered from the center, periphery, and 30 m from periphery of each population. Soil was also sampled at a distance of 30 m uphill from each population. Soil samples were analyzed for texture, pH, moisture, nitrate, organic matter and inorganic ions using standard soil analysis procedures. There appears to be a significant difference ($F = 13.2$, $p < 0.001$) in soil moisture among sites. However, there is no significant difference ($F = 0.52$, $p > 0.05$) in nitrate levels (ppm) among sites. The results from this study with the aid of subsequent greenhouse experiments will assist in the cultivation of sweetflag.

03:15 EFFECT OF VARIABLE SHADE ON GROWTH AND BIOMASS OF *HYDRASTIS CANADENSIS*. Stephen Mulhall, mulhall.4@osu.edu, (Martin F. Quigley), The Ohio State University, Dept. of Horticulture and Crop Sciences, 2001 Fyffe Court, Columbus OH 43210.

Hydrastis canadensis (Goldenseal) is an herbaceous understory perennial, native to the eastern forests of North America, and is valued for its fleshy rhizomes, which contain the important alkaloids hydrastine and berberine. Over-collection and threat of extirpation have spurred research into methods of cultivation for this and other medicinal herbs. While it is understood that relative shade influences growth and yield of *H. canadensis*, optimal shade density has not yet been established. We hypothesized that, in contrast to full sun or complete shade, moderate shade would produce superior growth. Goldenseal plants (n=375) grown from rhizomes in the greenhouse were kept under shade cloth for five months. Treatments were five different shade levels (plus control group, full sun) ranging from >60% of incident light to <5%. Measured variables included rootlet length, bud development, and rhizome mass. Decreasing shade density had a major impact on plant condition and growth. Those plants grown with the most sun exposure displayed 100% scorch damage to the foliage, in comparison to <35% damage in the densest shade. Plants grown under moderate shade produced longer and more numerous rootlets, a larger number of bud primordia, and had greater rhizome and healthier leaf mass than did those plants grown under dense shade. The results indicate that low to moderate shading can result in faster establishment of plantings and greater yields. Further research will address soil nutrient balances and interspecific competition.

03:30 FITNESS COSTS OF INDUCED DEFENSE IN *ARABIDOPSIS THALIANA*. Donald F. Cipollini, don.cipollini@wright.edu, Wright State University, Department of Biological Sciences, 3640 Colonel Glenn Hwy., Dayton OH 45435.

In addition to directly reducing fitness in plants, competition is thought to increase the magnitude of fitness costs of resistance. The effect of salicylic acid (SA) on peroxidase (POD) activity and seed mass of five lines of *Arabidopsis thaliana* grown alone or in competition with intraspecific neighbors was examined in a greenhouse experiment. SA is a hormone known to induce increases in levels of many chemical defenses, including POD. In addition to wild-type controls, lines included the transgenic nahG line, that degrades SA acid in planta, the nim1-1 mutant, that is defective in a SA-dependent signaling pathway for the induction defense, and the cep mutant, that constitutively expresses high levels of SA. Ten plants of each line in each competition treatment were sprayed with SA at a concentration of 0 mM, 0.5 mM, or 1.0 mM, three times during the experiment. POD activity and seed mass data were analyzed with ANOVA using line, SA, and competition as main effects, including all interactions. SA increased POD activity, while competition reduced activity. Lines varied in POD activity, and were differentially affected by SA and competition. Total seed mass varied among the lines. Competition reduced seed mass overall, but its effect varied by line. Seed mass in the nahG line was severely reduced by competition, while seed mass in the wild-type ecotype Wassilewskija was unaffected by competition. SA reduced seed mass, but its effects varied by line and the presence of competition. Seed mass was reduced by 1.0 mM SA with or without competition, but reductions in seed mass by 0.5 mM SA were only detectable with competition.

03:45 JASMONIC ACID TREATMENT AND MAMMALIAN HERBIVORY DIFFERENTIALLY AFFECT CHEMICAL DEFENSES AND GROWTH OF WILD MUSTARD (*BRASSICA KABER*). Michelle L. Sipe, Sipe.3@wright.edu, Donald F. Cipollini, don.cipollini@wright.edu, Wright State University, Department of Biological Sciences, 3640 Colonel Glenn Hwy., Dayton OH 45435.

Plants produce many chemical defenses in response to damage, which can be specific to the type of damage incurred. In a field experiment, we compared the effects of jasmonic acid (JA) application on the expression of chemical defenses and growth of wild mustard (*Brassica kaber*) to the same responses following naturally occurring mammalian herbivory. Treatments were as follows: control (undamaged and unmanipulated) plants (n=30), undamaged with JA treatment (n=28), groundhog-damaged plants with ~80% leaf area removed and meristem remaining (n=34), and groundhog-damaged plants with ~80% leaf area removed and meristem removed (n=40). JA, a wound-related hormone that elicits responses similar to those elicited by wounding or insect damage, significantly increased trypsin inhibitor activity and glucosinolate concentration, and moderately increased peroxidase activity, as predicted. Levels of these chemical defenses in re-growth foliage of plants that had ~80% of their leaf area removed by groundhogs (*Marmota monax*) did not differ from those in undamaged and untreated controls. This may be due to speed and pattern of leaf area removal, or resource constraints caused by leaf area loss. Although JA significantly elevated levels of chemical defenses, it did not affect height of plants through the season and only slightly reduced time to flower. Mammalian herbivory significantly reduced height and substantially delayed or abolished flowering, particularly when coupled with apical meristem removal. Despite having no effect on chemical defense production, leaf area loss was much more costly to growth and fitness than the effects of JA. The costs of defense production in plants are likely to be minimal when compared to the risk of losing leaf area. Thus, if they are effective at deterring herbivory, the benefits of inducible defense production likely outweigh the costs in most cases.

04:00 THE EFFECTS OF SALICYLIC ACID ON WOUND-INDUCED SYSTEMIC RESISTANCE IN *ARABIDOPSIS THALIANA*. Caleb R Slemmons, slemmons.2@wright.edu, (Donald Cipollini, don.cipollini@wright.edu), Wright State University, Dept. of Biological Sciences, 3640 Colonel Glenn Hwy, Dayton OH 45435.

Plants rely on inducible defense mechanisms to resist attack from herbivores and pathogens. One system, called Systemic Acquired Resistance (SAR), is activated by pathogen attack and is dependent on the hormone Salicylic Acid (SA). Another system, Induced Systemic Resistance (ISR), is activated by insect herbivores and is dependent on the hormone Jasmonic Acid (JA). These systems can act independently but there is evidence to suggest a certain amount of cross-talk between SA-mediated pathways for SAR and JA-mediated pathways for ISR. The general goal of this study is to examine the relationship between SAR and ISR and their possible interactive effects. This was carried out using *Arabidopsis thaliana* (ecotype Columbia) and a mutant strain of the parent ecotype, jar1-1. Jar1-1 is mutated in its ability to induce ISR but is competent to induce SAR. Ten, 28-day-old, plants were subjected to each of the following treatments: wounding (40% leaf area of three rosette leaves crushed), foliar spray of SA (.5mM), wounding and SA, and no wounding or SA. A radial diffusion bioassay was performed to examine Trypsin Inhibitor (TI) activity in soluble leaf protein extracts. TI, a proteinase inhibitor defense protein, is a hallmark indicator for ISR. Results were analyzed with a two-way ANOVA. It was found that wounding increased TI activity in the wild-type but had no effect on the jar1-1 mutant. SA did not increase TI activity either line but appeared to have an effect on induction of TI in the wild-type plants. Plants receiving SA and wounding had less TI than those that received wounding alone.

04:15 FLOWER VISITATION AND POLLINATION EFFICIENCY OF SELECTED ROCKY MOUNTAIN BUTTERFLIES. Lauren D. Augusta, lil_turnip@hotmail.com, and David W. Haines d-haines@onu.edu, Ohio Northern University, Dept of Biology, Ada OH 45810.

There is a hypothesis among scientists who study insects that butterflies are not significant pollinators of plants. Research on the topic has shown mixed results. This study attempted to provide further insight into the idea. During the months of July and August 2000, several butterfly species were observed nectaring on plants in Beaver Meadows (Rocky Mountain National Park, CO). A preference for *Knautia arvensis* by Rocky Mountain Parnassian (*Parnassius smintheus*), Alexandra's Sulphur (*Colias alexandra*), Western Tiger Swallowtail (*Papilio rutalis*), Pale Swallowtail (*Papilio eurymedon*), the Dark Wood Nymph (*Cercyonis oetus*) and various fritillary species (*Speyeria* sp.) was observed. A pollination cage was built around several stands of the plant to determine if the butterflies were able to transport enough pollen while nectaring to pollinate the flower. After the butterflies were released from the cage, the flowers were observed for seed set and the butterflies were microscopically examined for pollen. Observations show *Parnassius smintheus* and *Papilio eurymedon* were most efficient in carrying *K. arvensis* pollen on their bodies. An ANOVA was used to determine significance among butterfly visitation rates. While there was no statistical evidence that certain butterfly species were more consistent in their visitation, it seems reasonable to suggest that there is biological significance to the visitation rates of *Colias alexandra*, *Cercyonis oetus* and *Parnassius smintheus*. During the study it was determined that *Knautia arvensis* is able to self-pollinate, as a result, it cannot be positively determined if butterflies play a role in pollinating that species.

OFFICIAL ANNOUNCEMENT

Saturday, March 31, 2001, 5:30 PM.
Mount Union College, Alliance, Ohio
Kolenbrander-Harder Room 011

ANNUAL BUSINESS MEETING FOR MEMBERS ONLY:

There shall be an Annual Business Meeting for the membership of the Academy during the Annual Meeting. The business session shall be conducted in accordance with the most recently published edition of "Robert's Rules of Order". The order of procedure shall be as follows:

- A. A Call to Order by the President.
- B. A summary of the Minutes of the previous meeting shall be read by the Secretary.
- C. Presentation of the report of the tellers of the election of officers and other positions.
- D. Voting on any proposed amendments to the *Constitution* or *By-Laws*.
- E. Business from the floor.
- F. Adjournment.

Maps

Directions to Mount Union College

Mount Union College's 115-acre campus is located in Alliance, Ohio (population 25,000).

By Air:

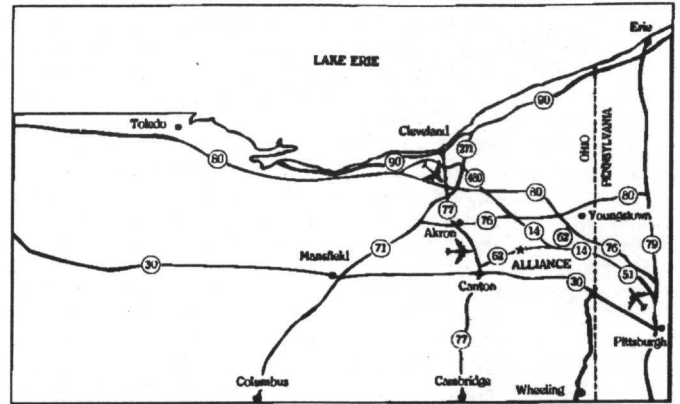
The Akron-Canton Airport is located approximately 20 miles west of Alliance and is served by the major airlines. Limousine service to and from the airport can be arranged through Carnation Coach at (330) 823-3124. Mount Union is also located just 70 miles southeast of Cleveland and 80 miles west of Pittsburgh. Both cities have major airports.

By Car:

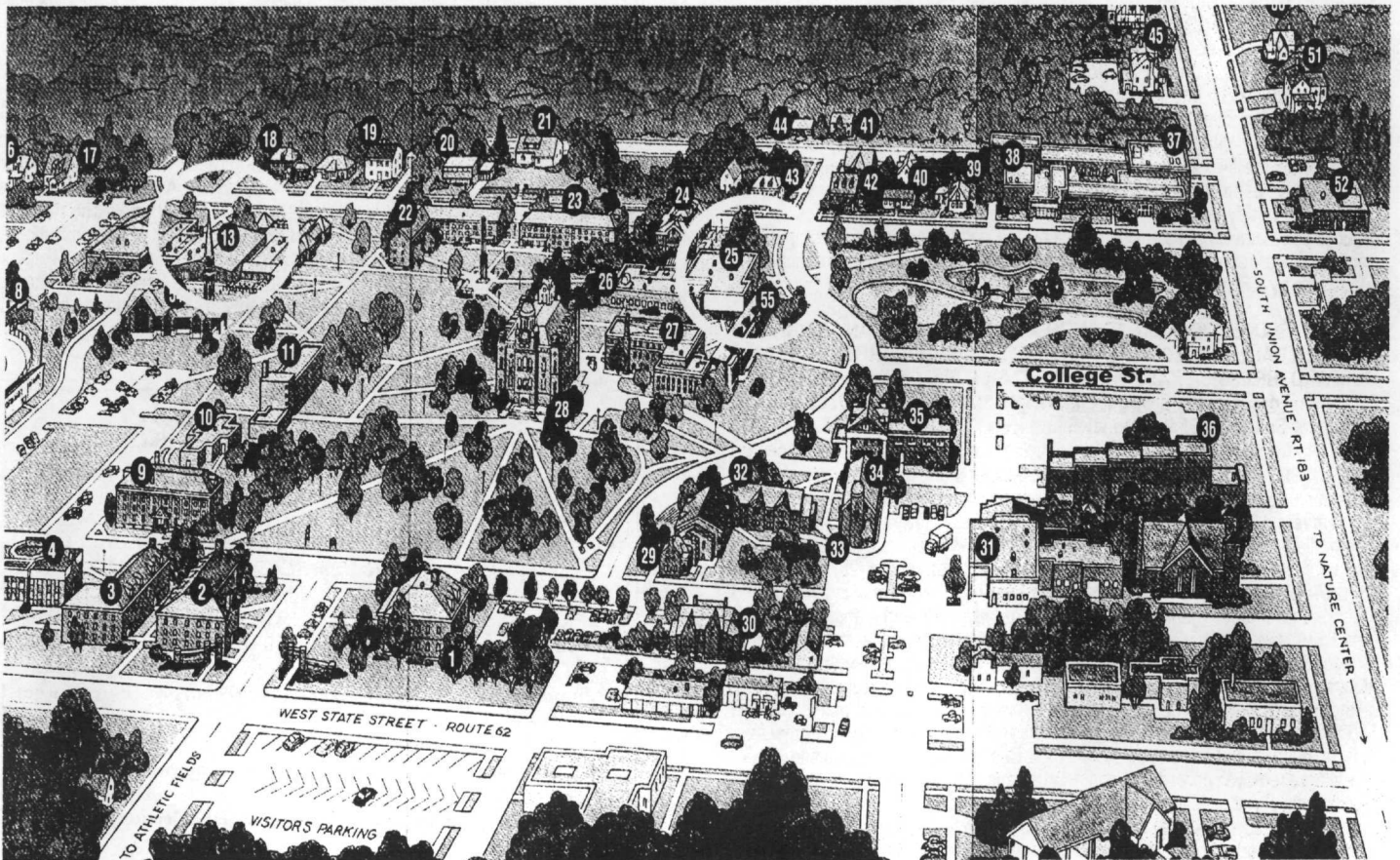
Several major highways bring you close to Alliance. Specific routes from major metropolitan areas are as follows:

FROM CLEVELAND—Take I-77 south to Canton, then Rt. 62 east to Alliance. The College is located on 62.

FROM COLUMBUS—Take I-71 north to Mansfield, then Rt. 30 east to Canton. Follow I-77 north to Rt. 62 east. Take the Alliance exit. The College is located on Rt. 62.



FROM PITTSBURGH—Take Rt. 60 north to Beaver Falls, then take Rt. 51 west to Alliance. Stay straight on this highway, although routes will change from 51 to 14 to 14A and 62 west into Alliance...OR Take the Pennsylvania turnpike west (I-76 west) to the Ohio Turnpike. Continue west on the Ohio Turnpike to Exit 16 (Rt. 7). Follow Rt. 7 south to Rt. 14 west. Take 14 west to combined Rts. 173 and Rt. 62 west which will lead into Alliance. The College is located on Rt. 62.



PARKING - On Saturday Please Use Lots off Campus St. on East Side (right above) of campus
REGISTRATION & Oral Sessions in Kolenbrander-Harder Information Center (55 on map)
Poster Sessions & Refreshments in Tolerton & Hood Hall of Science (25 on map)
Meals & All-Academy Lecture in Campus Center (13 on map)