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Preparation, Characterization and DFT Studies of Some New N-Nitrosocarbamates and N-Nitrosoureas


Ragavan Narayanan
University of Dayton

Helene Hedian
University of Dayton

Eric Shamo
University of Dayton

Vladimir Benin
University of Dayton, vbenin1@udayton.edu

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Poster Session A 9:00 – 10:00 AM

Board 01 AQUACULTURE INITIATIVE PHASE II: LOCAL FEEDING STIMULANTS AND SUBSTITUTES FOR FRESHWATER PRAWN (*MACROBRACHIUM ROSENBERGII*) DIETS. Danielle T. Brzezinski, brzezi_d@denison.edu, Denison University, Granville OH 43023, (Jessica E. Rettig, rettig@denison.edu), Denison University, Dept of Biology, Thomas A. Evans, Denison University, Dept of Chemistry, David Swenson, Saginaw Valley State University, Dept of Chemistry.

The Aquaculture Initiative began as an effort to eliminate the dumping of thermal wastewater from a local sugarbeet processor into the Saginaw River in mid-Michigan. The aim was to use the thermal wastewater to heat greenhouses, which contain tanks for growing freshwater prawn to be sold in regional markets. The aim of this study was to determine the effectiveness of local feed substitutes in place of commercial feed or stimulants in addition to commercial feed on the growth of freshwater prawns. Because feed constitutes over 50% of production costs, the use of local feeds may be an alternative that not only reduces cost but also maintains local interest and support. Five experimental diets were compared to a control diet over a seven-week period. Three of the diets used the feed substitutes soybean, dried distillers' grain with solubles (DDGS), or a 50:50 mixture of soybean:DDGS, while the other two used standard commercial feed plus betaine, a by-product of sugarbeet processing, or garlic juice (known feeding stimulants). The prawns were fed a feed mass of 7% of their average body weight based on weekly mass measurements. All diets, except the garlic stimulant and the soybean substitute, showed a greater average increase in percent body mass over the control. Examinations are being conducted on how the diet influenced growth over the course of the experiment. Currently, analyses are underway to assess cholesterol and glycogen concentrations in the prawn meat, to evaluate the effect of diet on meat quality.

Board 03 SEASONAL CHANGES IN NEARSHORE AND OFFSHORE LAKE ERIE BACTERIAL ASSEMBLAGES: ANALYSIS USING FLOURESCENT *IN SITU* HYBRIDIZATION (FISH). Dana L. McDermott, dldmcderm@kent.edu, (Robert T. Heath, rheath@kent.edu), Dept of Biological Sciences, 256 Cunningham Hall, Kent State University, Kent OH 44242.

Differences in community structure between nearshore and offshore bacterial assemblages in Lake Erie were examined using fluorescent *in situ* hybridization (FISH), monthly, from May through September 2005. Epilimnetic water triplicates of 11 nearshore and offshore sites were collected and preserved in formalin for later analysis. Bacterial taxa were visualized by attaching a fluorescent Texas Red label to the end of a complimentary RNA sequence bound to RNA. Fixed sample was filtered through 0.2µm filters, probed, and observed under a Texas Red filter-set fluorescent microscope. Gamma proteobacteria percent composition varied throughout the summer (range: 0.145-4.75%). Gamma-proteobacteria numbers generally were greater at all sites than alpha- and beta-proteobacteria. Alpha proteobacteria comprised less than 2% of total bacteria at all sites, though numbers increased toward the end of the summer. Beta proteobacteria concentrations were highest at nearshore sites (range: 0.14-3.71%) in May and July and highest at offshore sites in June and September (range: 1.13-3.36%). Throughout the summer, the lowest alpha-, beta-, and gamma-proteobacteria values were observed in Sandusky Bay (less than 3% percent composition). These results suggest that bacterial community structure varies seasonally, possibly altering ecosystem function.

Board 05 DIRECTIONAL QUANTIFICATION OF MACROINVERTEBRATES IN BIG WALNUT CREEK, OHIO, USA. Ben G. Van Allen, bgv2404@yahoo.com, (Michael A. Hoggarth, mhoggarth@otterbein.edu), Dept of Life and Earth Sciences, Otterbein College, Westerville OH 43081.

The goal of this study was to determine if macroinvertebrates colonize substrate only by drift (flowing downstream in the current) or by other means. Knowledge concerning invertebrate dispersion in streams is needed to understand their ecology and evolution,

and could help develop more accurate water quality testing methods. Macroinvertebrates are currently used to determine compliance with water quality standards. During this study, Hester-Dendy plates were used as bare substrate for macroinvertebrate colonization. Unmodified control plates were placed vertically in the stream. Experimental plates were modified by attaching a shield that blocked the plate from one direction. Each plate was positioned vertically by attaching it to a concrete block, which maintained its position and orientation in the flowing water. Two plates for each treatment (control, front-blocked, rear-blocked, and side-blocked) were attached to each cinder block. Two sets of cinder blocks were placed in Big Walnut Creek three times from 15 April to 15 October 2005. Each set of plates was in the water for a period of six weeks. Preliminary results suggest macroinvertebrates (other than Chironomidae) disproportionately colonize substrate from downstream and upstream. If the trend suggested by preliminary results holds true for the remainder of the study, it could mean that proper placement of Hester-Dendy plates requires consistency of orientation of the plates. It also may suggest that macroinvertebrates have adapted to life in flowing water by moving opposite to the direction of drift.

Board 07 ZOOPLANKTON RESPONSES TO MANIPULATIONS OF FISH PREDATORS AND AMPHIBIAN COMPETITORS. Nicole R. Gray, gray_n@denison.edu, (Jessica E. Rettig, rettig@denison.edu), Geoffrey R. Smith, Denison University, Dept of Biology, Granville OH 43023.

This study examines the response of zooplankton to an experimental manipulation of two different food webs containing fish and tadpoles. In the summer of 2004 we set up artificial pond communities in cattletanks (800 L) containing a gradient of tadpoles, American toads (*Bufo americanus*) or bullfrogs (*Rana catesbeiana*), at densities of 0, 25, 50, or 100 per tank. The amphibian treatment was crossed with the presence or absence of bluegill sunfish (*Lepomis macrochirus*). Bluegills are predators on zooplankton but also may cause tadpoles to modify their feeding behavior. In addition, tadpoles are potential competitors with zooplankton for algal resources. Tadpoles were added soon after hatching and each experiment lasted until the tadpoles began to metamorphose (American toads = 19 days; bullfrogs = 28 days). Zooplankton were sampled during the experiment to assess the direct and indirect effects that bluegill might have on them. The zooplankton community consisted of a mixture of taxa including *Daphnia*, *Bosmina*, copepods (cyclopoid and calanoid), and copepod nauplii. We are currently counting the zooplankton from the two experiments and will analyze the effect of treatments on total zooplankton abundance and the density of specific taxa.

Board 09 GROWTH-LIMITATION BY PHOSPHORUS AND CARBON AT AN OFFSHORE STATION IN LAKE ERIE. James P. Hurley IV, jphurley@kent.edu, (Robert T. Heath, rheath@kent.edu), Kent State University, Dept. of Biological Sciences, Kent OH 44242.

The purpose of this study was to determine whether natural bacterial assemblages collected from a station 16km offshore in the Sandusky Sub-basin of Lake Erie were growth limited by phosphorus, carbon, both, or neither. Samples were collected monthly and compared in July, August, and September of 2005. Bacterial assemblages were grown at ambient room temperature (23°C) in the dark, and growth was measured by increase in cell numbers and average cell biovolume at 0hrs, 24hrs, and 48hrs. The control was determined at t=0. Potassium phosphate and glucose were used as phosphorus and carbon sources, respectively. This study was performed using a factorial design of nine 250mL flasks with designations of "No", "Low" (80nM phosphate or 25µM glucose), and "High" (400nM phosphate or 125µM glucose) to represent concentrations of both phosphorus and carbon, respectively. Growth of bacterial assemblages was limited both by carbon and phosphorus availability, but predominantly carbon. This study was supported by grants from the NSF (UMEB-0305126) and Ohio Sea Grant College Program (R/ER-67).

Board 11 BEHAVIORAL RESPONSES OF *PLETHODON CINEREUS* SALAMANDERS TOWARDS POTENTIAL COMPETITORS. Amber A. Burgett, burget_a@denison.edu, (Geoffrey R. Smith, smithg@denison.edu), Denison University, Slayter Box 418, Granville OH 43023.

Centipedes and salamanders compete for resources including food and territory. Previous studies have shown that salamanders

respond with similar aggressive reactions when exposed to other salamanders and centipedes. Red backed salamanders, *Plethodon cinereus* should respond aggressively towards both conspecific and heterospecific (centipedes) competitors when exposed to chemical cues as well as the actual competitor. This study tests that hypothesis by exposing *P. cinereus* salamanders (n=52) to 4 treatments: their own substrate, a conspecific's substrate, a centipede's (*Scolopocryptops sexspinosus*) substrate, or a control substrate. By comparing differences in behaviors across treatments, the impact of a possible competitor's chemical cues on *P. cinereus* are determined. *P. cinereus* were also paired with another salamander (n=15) or a centipede (n=15) in a large Petri dish (15 X 300mm) lined with damp filter paper to test physical aggressiveness and behavior between interacting competitors. Trials occurred in either the focal salamander's container (which they resided in for 6 days prior) or in a "neutral" territory, which consisted of a new dish with dampened filter paper. Initial observations indicate that salamanders recognize and respond to the substrates of a control, of a different salamander and of a centipede more aggressively than their own substrate and chemical cues. Initial observations also indicate that *P. cinereus* reacts differently to conspecifics than it does towards centipedes, which is contrary to previous studies that show similar aggressive behaviors of *P. cinereus* towards conspecifics as well as centipedes because both are potential competitors.

Board 13 EFFECT OF DOMINANCE ON SPACE USE IN CAPTIVE FEMALE GORILLAS. Katherine L. Theobald, theobaldkl@xavier.edu, (George Farnsworth, farnsworth@xavier.edu), Dept of Biology, Xavier University, 3800 Victory Parkway, Cincinnati OH 45207.

Previous research on juvenile gorillas in a caged exhibit at the Cincinnati Zoo showed that juvenile gorillas limited their space use based on dominance and dominance was determined by weight. The present study investigated whether weight-based dominance would also be observed in a group of young females in a more naturalistic exhibit. It was hypothesized that juvenile females limit their space use according to dominance determined by weight with the largest limiting space use the most. The focus of the study was a group of three females, Mara, Chewie, and Shanta, approaching sexual maturity (8, 10, and 10 years old) in a naturalistic exhibit at the Cincinnati Zoo. The exhibit space was divided into uneven zones and the position of the three females was recorded every 30 seconds. More than 12 hours of observations were recorded, resulting in 1440 data points for each female gorilla. The data was analyzed using a modified spread of participation index (SPI) which evaluated whether use of space was evenly distributed. A value of 0 indicated use of only one zone and a value of 1 indicated even use of all the zones. The largest female by weight, Chewie, spent more than 65% of her time in one zone of the exhibit. Mara and Shanta, however, displayed a more even use of the exhibit zones. Observations show a limited use of space by the largest female indicating a weight-based dominance affecting space use.

Board 15 EFFECTS OF PERINATAL POLYCHLORINATED BIPHENYL EXPOSURE ON THE DEVELOPMENT OF SOCIAL BEHAVIOR IN THE RAT. Maegan Horinek¹, hmaegan@bgsu.edu, Asia Johnson¹, johnsad@bgsu.edu, Logan McKnight¹, loganem@bgsu.edu, Christina Asbrock¹, casbroc@bgsu.edu, H. Casey Cromwell^{2,3}, hcc@bgsu.edu, Lee.A. Meserve^{1,3}, lmeserv@bgsu.edu, Depts of ¹Biological Sciences and ²Psychology and the ³J.P. Scott Center for Neuroscience, Mind and Behavior, Bowling Green State University, Bowling Green OH 43402.

Polychlorinated biphenyl (PCB) ingested by pregnant mammals alters thyroid status, neurophysiological and cognitive function of the offspring. Less is known about development of social behavior after PCB exposure. This study compared the development of social behavior between control and PCB exposed young rats using established behavioral measurements. Mothers of control rats were fed regular chow and the diet of PCB-exposed rats contained 12.5 or 25.0 ppm of PCB (mixture of two congeners, PCB 47/77). Each group represents at least 5 litters of rats. Conditioned odor preference test measured the ability of two week-old rats to discern between a characteristic odor (lemon) associated with the mother or the same odor associated with a neutral stimulus; social interaction was estimated by observing play behavior in 30-50-day-old rats; and comparative social investigation by 60-day-old rats of an adjacent cage that contains a littermate was determined using the social port test. Analysis of variance was used to determine significant differences. Control animals exposed to

mother-odor compound stimuli displayed a clear preference for the odor location (105 vs 92 sec.), while PCB-exposed pups showed a lack of preference for the odor location. Control animals showed typical levels of play, including dorsal contacts and pins (100/session). PCB-exposed animals showed a significant decrease in play behavior, with impairment greatest after social isolation (40/session). PCB exposed rats spent more time (125 sec/5 min) exploring social ports than did controls (90 sec/5 min). These results will foster a greater understanding of how toxin exposure in early development can alter complex behaviors involved in social interaction.

Board 17 UNDERSTANDING THE EVOLUTION OF THE DISEASE GENE, GLUCOSE-6-PHOSPHATE DEHYDROGENASE (G6PD), WITH EMPHASIS ON THE EXON-INTRON STRUCTURE. Kevin P. Riehle, riehlep@notes.udayton.edu, (Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu), Dept of Biology, University of Dayton, Dayton OH 45469-2320.

Mutations in the X-linked gene, glucose-6-phosphate dehydrogenase (*G6PD*), result in a deficiency in the enzyme of the same name in humans. This deficiency is a leading cause of hemolytic anemia, a condition where bone marrow activity cannot compensate for erythrocyte (red blood cell) loss. Although there is no known cure for *G6PD* deficiency, PCR-based methods for the detection of known mutations in *G6PD* make prenatal examination possible. The *G6PD* gene is at least a billion years old as it is seen in mammals as well as nematodes (minimum chordate-nematode divergence time = 1062 ± 81 million years). Consequently, there is also much diversity in the structure of this gene, with a wide range in the number of exons among different taxonomic groups. This project aims to understand the evolution of this gene, with an emphasis on the origin of novel exons and introns. Complete gene sequences with intron-exon structure have been collected from NCBI for six species, and more are being sought in order to obtain sequence data for at least one species per major taxonomic group so as to be able to reliably trace the evolution of the gene. Furthermore, the origin of exons and introns will be investigated by means of BLAST searches within the corresponding genomes where completely sequenced genomes are available. It is hoped that this investigation will further the understanding of this disease from an evolutionary perspective and will also help understand the mechanism of the genesis of novel exons and introns.

Board 19 PLANKTONIC ABUNDANCE OF THREE FIDDLER CRABS (UCA SPP.) ALONG AN ESTUARINE GRADIENT NEAR BEAUFORT, NORTH CAROLINA: IMPLICATIONS FOR SETTLEMENT. Jena R. Buchhop, s07.jbuchhop@wittenberg.edu, (James M. Welch, jwelch@wittenberg.edu), Wittenberg University, Box 1812, PO Box 6100, Springfield OH 45501-6100.

In the southeastern United States, there are three species of fiddler crab (*Uca pugilator*, *Uca pugnax*, and *Uca minax*) that different habitats: high salinity sand flats, moderate to high salinity salt marshes, and low to moderate salinity salt marshes, respectively. After offshore planktonic development, fiddler crab megalopae use selective tidal stream transport to move up the estuary to settlement sites. We hypothesize that *Uca pugilator* will selectively settle in high salinity areas, so that *Uca pugilator* megalopae will be less abundant farther up-estuary. In July 2005, plankton samples were collected just inside the Beaufort Inlet, at the entrance to the Carrot Island embayment (2 km up-estuary), and at Bell's Creek salt marsh (10 km up-estuary) with a 333-micron, 0.25-m diameter net during incoming tides at night. The samples were then sorted for *Uca* spp. megalopae. Because *Uca* spp. cannot be identified morphologically as megalopae, a PCR-RFLP analysis was used. The internally transcribed spacer region 1 gene (ITS-1) was amplified, digested with the restriction enzyme *HpaII*, and the resulting fragments were separated using a 3% agarose gel. Initial results show a distribution evenly split among the three species at the mouth of the Newport River estuary, and to date, only *Uca pugnax* have been found in the plankton from the marsh, supporting our hypothesis.

Board 21 SETTLEMENT OF FIDDLER CRABS UCA SPP. AT CARROT ISLAND, BEAUFORT, NORTH CAROLINA: SELECTIVE OR RANDOM? Rachel L. Allan, s06.rallan@wittenberg.edu, (James M. Welch, jwelch@wittenberg.edu), Wittenberg University, Box 3691, PO Box 6100, Springfield OH 45501.

Three species of fiddler crabs commonly occur in the southeast United States. *Uca pugilator* is found in sandy, high-salinity areas, while *Uca pugnax* and *Uca minax* are found in salt marsh areas, of high to moderate salinity and moderate to low salinity, respectively. Carrot Island, near Beaufort, North Carolina, has a large, high-salinity intertidal sandflat with a dense monospecific population of *Uca pugilator*. This study examines whether this distribution is due to selective settlement by *Uca pugilator* or random settlement by all three species with post-settlement mortality or emigration of *Uca pugnax* and *Uca minax*. It is hypothesized that all settling megalopae found at Carrot Island will be *Uca pugilator*, indicating selective settlement. If species other than *Uca pugilator* are found, the hypothesis would be rejected and the distribution may be controlled by a post-settlement process. To distinguish between these alternatives, settling *Uca* spp. megalopae were collected and identified to species. Collectors were 0.25 m² squares of hog's hair filter material, which were exposed overnight and rinsed with fresh water to remove settled megalopae. Because fiddler crab megalopae cannot be identified to species by morphology, a PCR-RFLP technique was used. The ITS-1 gene was amplified, digested with the enzyme *Hpa*II, and the resulting fragments separated using a 3% agarose gel. Initial genetic results show that of 33 settled megalopae, all are *U. pugilator*, supporting the hypothesis of selective settlement.

Board 23 MICROARCHITECTURE OF THE CANINE ZONA PELLUCIDA. Matthew O. Lunn, lunnmato@notes.udayton.edu, Shirley J. Wright, University Of Dayton, Dept Of Biology, Dayton OH 45469-2320.

Mammalian oocytes are surrounded by an extracellular matrix called the zona pellucida (ZP) that sperm penetrate and fertilize the oocyte. The structure and function of the ZP of model organisms has been well studied. Although ZP architecture is variable between species, it is generally consistent within species. Little is known about ZP ultrastructure of companion animals. The objective of the study was to elucidate ZP microarchitecture of the canine (*Canis familiaris*) oocyte by scanning electron microscopy (SEM). Over 200 oocytes were isolated from ovaries from more than 20 different dog breeds aged 6 months to 9 years. Oocytes were fixed, critical point dried and viewed by SEM. It was found that canine ZP ultrastructure was unexpectedly heterogeneous. Because of this, oocytes were placed into one of three groups based on their ZP appearance: Type I (N = 7), smooth ZP with no or few small (0.5 µm) pores; Type II (N = 122), fenestrated ZP with regularly spaced pores; and Type III (N = 108), rough and uneven ZP with irregular hollows and pores. The heterogeneous ZP morphology was independent of dog breed, age of donor, and maturity of the oocyte as reflected in oocyte size. When pores were present in the ZP, many were spherical or elliptical. Some pores were also conical and bifurcated into smaller pores that did not appear to completely penetrate through the ZP, suggesting that the ZP may prevent viruses, such as the canine distemper virus from penetrating the ZP and infecting the oocyte/embryo. Funded by the AKC Canine Health Foundation.

Board 25 ARE SPECIES DISTRIBUTION OF FIDDLER CRABS UCA SPP. IN NORTH CAROLINA SALT MARSHES DETERMINED BY SELECTIVE SETTLEMENT OR POST-SETTLEMENT MORTALITY? Lenore A. Bamberger, s06.lbamberger@wittenberg.edu., (James M. Welch, jwelch@wittenberg.edu), Wittenberg University, Box 2329, P. O. Box 6100, Springfield OH 45501-6100.

In the southeastern United States three species of fiddler crabs are present: *Uca minax*, *Uca pugilator*, and *Uca pugnax*, each in a particular habitat. *Uca minax* inhabits low to moderate salinity salt marshes and *Uca pugnax* lives in moderate to high salinity marshes. *Uca pugilator* prefers high salinity sites with sandy substrates such as sand flats. Bell's Creek salt marsh, an area of moderate salinity area near Beaufort, North Carolina, USA, is characteristically inhabited by equal adult populations of *Uca minax* and *Uca pugnax*. Few if any *Uca pugilator* are found here. In this experiment, megalopae were collected with hog's hair filter material and several dozen recently settled juveniles were collected with forceps. Megalopae and early juveniles of *Uca* spp. are indistinguishable morphologically, but a PCR-RFLP technique can be used to determine species. We amplified the ITS-1 gene, digested it with the restriction enzyme *Hpa*II, and separated the resulting fragments using a 3% agarose gel. This analysis results in species-specific banding patterns. If the species distribution of settlers is comparable to the adult population, we will conclude that *Uca* spp. might settle selectively, possibly using chemical cues from conspecific adults, sediment or other sources. If the species

distribution is not comparable, then it is likely that the megalopae settle randomly and the adult population is determined by post-settlement processes such as emigration or mortality.

Board 27 ACCUMULATION OF NFκB1 AND NFκB2 IS ESSENTIAL FOR APOPTOSIS INDUCED BY PROTEASOME INHIBITION IN A LYMPHOMA MODEL. Sarah K. Edwards¹, edwardsk@notes.udayton.edu, Leon Bernal-Mizrachi², Lee Ratner², ¹University of Dayton, Dept of Biology, Dayton OH 45469-2320, ²Washington University School of Medicine, Section of Molecular Oncology, Division of Oncology, Dept of Internal Medicine, St. Louis MO.

The proteasome is a novel target in the therapeutic approach of different subtypes of lymphomas. The proteasome degrades proteins involved in cell cycle progression and apoptosis and plays a central role in the equilibrium between anti-apoptotic signals derived from NFκB subunits p50 and p52, and tumor suppressor signals derived from the larger NFκB precursors p100 and p105. Our objective was to determine whether proteasome modulation of the tumor suppressor signals or anti-apoptotic signals is more important for the induction of apoptosis in lymphomas. We tested the apoptotic effect of proteasome inhibitor PS341 in two lymphoma cell lines after knocking down NFκB large subunit expression using lentivirus expressing siRNA's. After 24 hours of treatment, we measured apoptosis and NFκB inhibition by Annexin V-alexa fluorescent and NFκB luciferase reporter assays, respectively. Co-expression of siRNA against both p100 and p105 and selective knock down of each individual large precursor rendered cells resistant to the induction of apoptosis at clinical doses of PS341 (5 and 10 nM) compared to the controls. Western Blot analysis demonstrated much lower accumulation of p100 and p105 in the siRNA expressing cells as compared to controls. IκB, an NFκB inhibitor, remained stable or increased during treatment in the p105 and/or p100 siRNA expressing cell lines, despite the reduction in apoptosis. In conclusion, the current study demonstrates the essential role that the accumulation of the tumor suppressor forms of NFκB (p105 and p100), but not IκB, play in the induction of apoptosis produced by proteasome inhibition in a lymphoma model.

Board 29 TOWARDS A STRAPPED PORPHYRIN LOGIC GATE. Rudy J. Wojtecki, wojteckirj@hiram.edu, (Colleen Fried, friedca@hiram.edu), Dept of Chemistry, Hiram College, 10096 Infirmary Rd., Mantua OH 44255.

Short chain "basket handle" porphyrins (5,10,15,20-tetraphenyl-21H,23H porphyrin rings bearing alkoxy chains of 4,5, and 6-carbon atoms) will be synthesized. A salicylaldehyde derivative, containing a 6-carbon bridge, was first prepared then reacted with pyrrole. This will yield a mixture of porphyrins and polymerized pyrrole. These were separated by pressurized column chromatography. The reaction produces three "basket handle" porphyrin isomers that will, again, be separated, by column chromatography. This porphyrin will then be complexed with a zinc (II) ion, inserted into the porphyrin center, by dissolving the porphyrin in chloroform then adding a dilute solution of zinc(II) acetate dehydrate dropwise and allowing the reaction to come to completion. NMR will be used to characterize these compounds. The porphyrin's optical properties, determined with UV/Vis and FT/IR, and the dichromic properties of this molecule will be used to construct a logic gate. A logic gate will be assembled at a macroscopic scale with both dry crystalline porphyrins (grown by liquid diffusion) and wet 'porphyrin cells'. The conceptualized method is: focusing a polarized LASER on a porphyrin crystal, that will theoretically interact with the molecules and radiate light (of a shorter wavelength) at several angles transverse to the radiation source as well as refracting the incidental light. This emitted and refracted light could be captured on a position sensitive photo-detector. By placing crystals in an array, so that the emitted and refracted light of one crystal is perpendicular to another, a foundational operation of binary logic (AND, OR, or NOT) could be demonstrated. Variations of the crystals orientation and position could produce the other two essential operations of binary logic.

Board 30 NANOLITHOGRAPHY USING ATOMIC FORCE MICROSCOPY. Rudy Wojtecki¹, wojteckirj@hiram.edu, Kristian Molhave², krm@mic.dtu.dk, ¹Dept of Chemistry, Hiram College, 10096 Infirmary Rd., Mantua OH 44255, ²Centre for Micro- and Nanotechnological Research, Danish Technical University, Denmark.

Atomic force microscopy (AFM) was used to fabricate a variety of controlled nanostructures by three methods: (1) Voltage-pulse

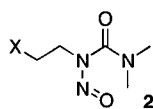
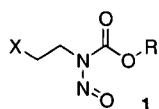
(anodic oxidation), (2) a Set-z method, in which the AFM cantilever remains at a constant height, and (3) Set-point, where the cantilever remains at a constant pressure. A variety of structures were produced by all three methods: lines, grids, spirals, circles, and single dot depressions. (1) involves the application of a positive voltage to a substrate surface with respect to the tip in an ambient environment. This method was applied to two variations of a silicon substrate (i) with a native oxide layer and (ii) a hydrogen passivated surface. Oxidation patterns were visually more well defined with a hydrogen passivated surface as compared to the surface with a native oxide layer. This allowed for smaller and qualitatively cleaner oxidation patterns. (2) was used to 'scrape' patterns on a thin layer of PMMA. This yielded rough edged patterns with circular indentations at the structure's boundaries. This method was used to make a pattern on 50nm film of PMMA on silicon. After this lithography procedure aluminum was deposited on the surface with Alcatel e-beam metal evaporation system. The PMMA and aluminum, in contact with the PMMA, was lifted off with acetone. This procedure demonstrated the application of AFM for the fabrication of nanostructures.

Board 31 SYNTHESIS AND CHARACTERIZATION OF TCNQ, CHARGE TRANSFER COMPLEX WITH OCTAMETHYLBIPHENYLENE. Erica L. Booth, ebooth@muskingum.edu, (Raymond D. Rataiczak, ray@muskingum.edu), 163 Stormont Street, New Concord OH 43762.

Since the discovery of organic superconductors in 1979, extensive research has gone into identifying and studying organic materials made up of electron donor-acceptor complexes. Previously, a charge transfer complex was formed from tetracyanoquinodimethane, TCNQ, and octamethylbiphenylene that resulted in a 50% charge transfer to the TCNQ, which was determined from the 2pm bond elongation of the octamethylbiphenylene in the charge transfer complex with TCNQ. The goal of this research is to synthesize a charge transfer complex from the strong pi-electron acceptor 2,3,5,6-tetrafluoro-7,7,8,8-tetracyanoquinodimethane, TCNQF₄, and the electron donor octamethylbiphenylene. The resulting charge transfer complex's structure and physical properties will be elucidated using infrared spectroscopy, UV-Visible spectroscopy, nuclear magnetic resonance spectrometry, and single crystal X-ray diffraction.

Board 33 PREPARATION, CHARACTERIZATION AND DFT STUDIES OF SOME NEW N-NITROSO CARBAMATES AND N-NITROSOUREAS. Ragavan Narayanan, narayar@notes.udayton.edu, Helene Hedian, Eric Shamo and Vladimir Benin, Dept of Chemistry, University of Dayton, Dayton OH 45469-2357.

We are presenting the preparation, characterization and density functional theory (DFT) studies (*B3LYP/6-31+G(d)*) of several related classes of N-nitrosocarbamates and N-nitrosoureas, whose general structures are shown below. The long-range goal is the design and preparation of compounds, which would undergo photochemical or hydrolytic decomposition, to yield stabilized cyclic cations that can serve as alkylating agents at various nucleophilic centers, including DNA bases.



R = ArCH₂, Et

a: X = Cl

b: X = CH₃S

c: X = (CH₃)₂N

Carbamates 1a have been prepared by reaction of 2-chloroethyl isocyanate with the corresponding alcohols. Carbamates 1b and 1c were synthesized via interaction of 2-(methylthio)ethyl amine or 2-(dimethylamino)ethyl amine with the corresponding chloroformates, while ureas 2b and 2c were prepared by reactions of those amines with carbamoyl chloride. Structures of all compounds 1 and 2 have been confirmed, including preliminary X-ray crystallographic data for compounds 1c. Carbamates 1c and urea 2c are isolated in the form of their hydrochloric salts, rendering them soluble in aqueous medium. DFT calculations were used to locate and optimize minima and transition states on the decomposition pathways. Calculations, in each of the studied cases, locate the corresponding cyclic intermediate (chloronium, sulfonium or ammonium cation) as a distinct minimum on the potential energy surface. The exothermicity of intermediate formation increases in the order chloronium < sulfonium < ammonium cation. In conclusion, we have prepared new compounds, belonging to several related classes of N-nitroso carbamates and N-nitrosoureas. The identity of the target structures has been confirmed by standard physical methods, with preliminary X-ray

data on the tetrafluoroborate salt of 1c. DFT studies demonstrate that each of these structures does indeed decompose to yield a cyclic cationic intermediate.

Board 35 INFORMATION ASSURANCE THROUGH BINARY VULNERABILITY AUDITING. William B. Kimball, kimbalwb@notes.udayton.edu, (Saverio Perugini, saverio@udayton.edu), 1162 Abbott Rd., Batavia OH 45103.

The goal of this research is to develop improved methods of discovering vulnerabilities in software. A large volume of software, from the most frequently used programs on a desktop computer, such as web browsers, e-mail programs, and word processing applications, to mission-critical services for the space shuttle, is unintentionally vulnerable to attacks and thus insecure. By seeking to improve the identification of vulnerabilities in software, the security community can save the time and money necessary to restore compromised computer systems. In addition, this research is imperative to activities of national security such as counter-terrorism. The current approach involves a systematic and complete analysis of the low-level organization of software systems in stark contrast to existing approaches which are either ad-hoc or unable to identify all buffer overflow vulnerabilities. The scope of this project is to develop techniques for identifying buffer overflows in closed-source software where only the software's executable code is available. These techniques use a comprehensive analysis of the software system's flow of execution called binary vulnerability auditing. Techniques for binary vulnerability auditing are grounded in science and, while unproven, are more complete than traditional ad-hoc approaches. Since there are several attack vectors in software, this research will focus on buffer overflows, the most common class of vulnerability.

Board 37 GENAV: A GRAMMATICAL EVOLUTION SYSTEM FOR ROBOT NAVIGATION. Scott D. Reynolds, reynoldsd@notes.udayton.edu, (Jennifer Seitzer, Jennifer.Seitzer@notes.udayton.edu), University of Dayton, 300 College Park, Dayton OH 45409.

Grammatical Evolution is a method of machine generating computer programs of any arbitrary computer language, so long as that language has an associated Backus-Naur Form (BNF) grammar. Our system, *Grammatically Evolved Navigation* (GENAV), uses the method of Grammatical Evolution to generate a robot control program that implements the boundary navigation problem. Using the OOPic[®] micro controller, and the BNF of its control language (a diminutive form of the C++ programming language) as input, the GENAV system evolves an optimal program for the task of boundary navigation of the Botster robot. One iteration of a typical evolutionary system operates on a current generation of possible solutions, assesses the fitness (merit) of each solution, and then selects one of the solutions in the group to continue on for the next iteration and to produce offspring. One unique aspect of the GENAV system, is the active participation of the robot during all three phases of this algorithm. Using the robot's on board processor and PC/104 board with a wireless connection to the desktop part of the GENAV system, the robot executes and thus demonstrates the efficacy of each possible solution as it is generated.

Board 39 SYNTHESIS OF TASK-SPECIFIC ROBOTIC WRISTS. Eric M Grimm, grimterm@notes.udayton.edu, Andrew P. Murray, andrew.murray@notes.udayton.edu, 1017 Yorkshire Place, Dayton OH 45419.

A spherical four-bar mechanism has four revolute joints, or hinges, whose axes of rotation intersect at a single point in space. Due to this common point of intersection, the spherical four-bar mechanism is useful for reorientation actions only. A coupler-driven spherical four-bar mechanism, or CDs4R, adds to the four-bar a length-changing leg that drives one of the links in the mechanism directly. Specifically, the length-changing leg is attached via ball joints to a fixed location in space at one end and to the coupler (the outermost link of the spherical mechanism) at the other. This length-changing leg moves the mechanism by applying a force to the coupler directly along the line of action defined by the current locations of the ball joints. A CDs4R may be synthesized to achieve a finite number of designer-specified orientations. The capabilities of a CDs4R stand in contrast to the capabilities of a robot wrist may produce any orientation. In many applications, however, robot wrists are used to move between only two or three distinct orientations. Hence, robot wrists are a far more sophisticated piece of machinery than needed by many manufacturing processes. Moreover, in high-speed

assembly or the manufacture of large volumes of parts, a CDs4R device designed to meet the exact demands of a process will be faster, more accurate, and consume less energy. If successful in practice, these devices present an intriguing new and cost-effective option to industrial users of robot wrists. The research challenge is to generate a methodology by which a designer can specify a desired number of orientations and produce the kinematic parameters of a CDs4R that achieves these orientations. The method utilized was to generate the equations that express the relationships between the kinematic parameters of a CDs4R and the orientations it achieves. Then, these equations were manipulated to produce relationships critical to allowing a designer to solve them via an interactive software tool. The result is a design methodology and corresponding software tool to perform the kinematic synthesis of the CDs4R. The software tool was developed in the Matlab™ environment and aids the designer in the graphical specification of problems and the generation, viewing, and evaluating of the CDs4R mechanisms that solve them.

Board 41 DESIGN A NOVEL BROADBAND LEAKY WAVE ANTENNA. Hai Jiang, jianghaz@notes.udayton.edu, Krishna M. Pasala, krishna.pasala@notes.udayton.edu, University of Dayton, Dept of Electrical Engineering, Dayton OH 45469.

For many air-borne applications, such as in Avionics, it is advantageous to have antennas which are light-weight, have a low profile and high bandwidth. It is also desirable for these antennas to be capable of low-angle radiation, towards horizon. Printed leaky wave antennas meet these requirements and are considered here. The specific configuration consists of an open microstrip excited asymmetrically to realize the first higher mode and was discussed first by Menzel. This can also be realized in "half-width" configuration and was considered by Zelinsky, who used the Finite Difference Time Domain (FDTD) approach to analyze this antenna. In the present work, analytical expressions are derived for the propagation constant and the fields in microstrip and the Finite Elements (FE) method is used as a tool to validate the theory. The agreement between theoretical and simulated results is on the order of 5%. The theory is used to determine analytical expressions for the wave and driving point impedances. The calculated driving point impedance may be used to terminate the antenna to absorb the residual power and minimize the reflections. The FE approach is especially suitable to simulate and analyze inhomogeneous dielectric structures. It is demonstrated that by periodically loading the microstrip line with air gaps and keeping the period much less than a single wavelength, it is possible to control the characteristics of the leaky wave mode to realize a leaky wave antenna whose band-width is increased by a factor of 50% or more compared to the homogeneous substrate antenna while leaving the pattern characteristics essentially unchanged.

Board 43 DETERMINING RELATIVE CONTRIBUTIONS TO THE VOLUME SWELL OF FLUOROSILICONE O-RINGS BY SPECIFIC SPECIES IN A COMPLEX MIXTURE. Chad M. Huelsman, huelsmcm@notes.udayton.edu, (John L. Graham, grahamjl@udri.udayton.edu), Energy and Environmental Engineering Group, Research Institute, Kettering Laboratories, Rm. 102, University of Dayton, 300 College Park, Dayton OH 45469-0114.

Volume swell due to neat model penetrants is often assessed by using weight change or volume change by way of water displacement as a measure of solvent uptake. However, in complex mixtures such as jet fuel, these methods do not provide information on the relative contribution to the volume swell by specific species or compound classes. The purpose of this study is to determine if gas chromatography-mass spectrometry (GC-MS) can be used to quantify the uptake of specific species from a complex mixture to determine the relative contributions of each species to the overall volume swell. It is hypothesized that the volume change of an o-ring immersed in a complex fluid will be the sum of the volumes of the individual species absorbed. To test this hypothesis, samples of a fluorosilicone o-ring material (Parker L1120) will be immersed in a mixture at room temperature containing a series of normal alkanes from nonane to hexadecane (80%v/v) and a series of normal aromatics from ethyl benzene to pentyl benzene (20%v/v). This mixture will simulate the major compound classes found in jet fuel. The volume change of the o-rings will be measured using method ASTM-D471 until the samples are at equilibrium. The solvent uptake will then be measured using direct thermal desorption GC-MS in conjunction with prepared standards of the mixture components. From the GC-MS analysis and the density of the penetrants the volume occupied by each penetrant will be

calculated. The total penetrant volume will be compared with the measured volume change. Additionally, the relative contribution of each penetrant to the volume change will be reported.

Board 47 EFFECT OF FUNCTIONALIZED TiO₂ NANOPARTICLES ON CELLULAR APOPTOSIS AND FORMATION OF REACTIVE OXYGEN SPECIES. Jeff Calhoun¹, calhoujd@notes.udayton.edu, Mike Check², checkmih@notes.udayton.edu, Melanie Tomczak³, mtomczak@ues.com, Elmo Blubaugh⁴, Elmo.Blubaugh@udri.udayton.edu, Jay Johnson⁴, Jay.Johnson@udri.udayton.edu, (Marie-Claude Hofmann¹, Marie-Claude.Hofmann@notes.udayton.edu), ¹Dept of Biology, The University of Dayton, ²Dept of Chemical Engineering, The University of Dayton, ³UES, Inc, ⁴University of Dayton Research Institute, 300 College Park, Dayton OH 45469-2320.

Recently, nanoparticles have received enormous attention to create novel analytical tools for biotechnology and the life sciences. The purpose of this study was to analyze the cytotoxicity of functionalized TiO₂ nanoparticles. These particles are thirty nanometers in diameter and have been created to modulate signaling pathways in the male germ line depending on their photoactivation. Previous data from our lab have shown that these nanoparticles do not affect cell viability, membrane integrity or mitochondrial function. However, a more thorough cytotoxicity analysis is necessary since events such as the first steps of apoptosis and the formation of reactive oxygen species within cells are not readily visible. We used the germline stem cell line C18-4 as a mouse model for these studies. For the apoptosis assay, the cells were cultured to 70% confluency, and functionalized TiO₂ nanoparticles were added to the cultures at concentrations of 0.0, 0.5 and 1.0 µg/ml in triplicates. After 24 h incubation, the cells were washed three times in cold PBS and analyzed using two fluorescent dyes. The YO-PRO-1 dye selectively passes through the plasma membrane of apoptotic cells and labels their nuclei with green fluorescence. The nuclei of necrotic cells are stained red-fluorescent with propidium iodide. Cells were assessed with an inverted fluorescence microscope, and a minimum of 500 cells counted per sample. Our data show that the nanoparticles do not induce apoptosis before or after photoactivation. Further assays are underway to analyze the effects of activated nanoparticles on the intracellular formation of reactive oxygen species.

Board 49 EQUIVALENT CIRCUIT MODEL OF AN ELECTRICAL IMPEDANCE SYSTEM FOR COMPUTING MULTIPLE PARAMETERS. Ajay B Siddoju¹, siddojab@notes.udayton.edu; Shamachary Sathish², shamachary.sathish@wpafb.af.mil; Address : Caldwell Street Center, 300 College Park Ave, University of Dayton, Dayton OH 45469; ¹Dept of Electrical Engineering, University of Dayton OH 45469, ²University of Dayton Research Institute, Dayton OH 45469.

Electrical impedance measurement systems are widely used in a variety of materials, biological tissue and chemical analysis applications. Electrical Impedance system, like an Eddy current instrument used to measure conductivity of metals is severely affected by noise due to changes in electrical characteristics of cable, sensor and cable-sensor coupling for measurements above 500 KHz. Although frequent calibration of instrument using standard test samples increases the reliability of experimental results, there is no valid procedure to determine and compare major noise contributing parameters. An equivalent circuit model of an Eddy current instrument based on HP8753D network analyzer with a frequency range of 30 KHz -3 GHz was developed using commercial software Pspice® and Matlab®. The instrument parameters like physical length of cable, impedance characteristics of cable, sensor and properties of test material are used to simulate the frequency response of impedance and power. The comparison of frequency responses of power in range 30 KHz - 10 MHz, obtained from the model simulation and the experiment using network analyzer, 50Ω cable of 1m length, 100µH inductive sensor without any test sample revealed similarities of peak at 100 KHz and minimum at 10 MHz. The noise contributing parameters like slight changes in length, impedance of cable and sensor due to different test conditions are simulated by varying the values individually to determine major noise contributing parameters in each case. The analysis of major noise parameters revealed the frequency dependent characteristics in sweep frequency response. The frequency dependent conductivity and noise parameters give an alternative way to identify noise contributing parameters during experiments.

Board 51 SOLID-STATE NMR CHARACTERIZATION OF LANTHANIDE ACETYLACETONATES. Janet H. Gaba, janet.gaba@otterbein.edu, (Joseph R. Sachleben, jsachleben@otterbein.edu), Chemistry Dept, Otterbein College, Westerville OH 43081.

Samarium acetylacetonate, $\text{Sm}(\text{acac})_3$, and yttrium acetylacetonate, $\text{Y}(\text{acac})_3$, were analyzed by solid-state ^{13}C nuclear magnetic resonance (NMR) spectroscopy in order to assess the effects of paramagnetism and crystallinity on the NMR spectrum. $\text{Sm}(\text{acac})_3$ and $\text{Y}(\text{acac})_3$ were obtained from Alfa Aesar and were recrystallized from a 60/40 ethanol/water solution. Crystals thus obtained were studied by cross polarization magic angle spinning (CPMAS) on a Bruker DMX 400 MHz NMR spectrometer operating at a ^{13}C frequency of 100.63 MHz. It was expected that the peak widths of the unrecrystallized compounds' spectra would be wider than those of the recrystallized compounds, and that the peaks of the $\text{Y}(\text{acac})_3$ spectrum would be narrower than those of $\text{Sm}(\text{acac})_3$. Spectral comparisons support the conclusion that highly crystalline samples provide significantly improved NMR spectra that can then be used for structural analysis. Next, we intend to test 90/10 mole percent $\text{Y}/\text{Sm}(\text{acac})_3$ mixed crystals. With the samarium atoms isolated, the effects on carbon atoms will be due primarily to one samarium atom instead of many. Future multidimensional NMR experiments will allow the extraction of paramagnetic shifts from these spectra which are related to the distance between the paramagnetic metal and the nucleus under study.

Board 53 KINEMATIC SYNTHESIS OF PLANAR PLATFORM MANIPULATORS. Suresh K Akepati akepatsk@notes.udayton.edu, Andrew P. Murray, andrew.murray@notes.udayton.edu, 903 Wilmington Ave, Apt#301, Dayton OH-45420.

The goal of this research is to develop a methodology for the kinematic synthesis of planar robots or, more generally, planar chains composed of revolute and prismatic joints. Successful kinematic synthesis identifies the joint locations, joint types, and number of links in a chain such that a desired workspace is reachable by the chain. A workspace specifies the desired capabilities of a planar chain without specifying the chain itself. A simple kinematic synthesis problem, for example, is to find the dimensions of a planar chain (of rigid bodies) connected by three revolute joints that can move a body to any location in workspace that is a 24 inch by 30 inch rectangle while able to rotate it anywhere from -20° to $+30^\circ$ inside the rectangle. Particularly useful kinematic synthesis methodologies allow a designer to specify limitations on the sizes of components in the chain, on the capabilities of the joints in the chain and leave open the capacity to design additional chains to create a different class of robots called platform manipulators. Platform manipulators are of interest because they are currently under investigation for a wide variety of applications due to their potential higher speeds, stiffness and accuracy when compared to more traditional robotics. An additional challenge worthy of note is that many kinematic synthesis techniques rely on designer intuition and a variety of brute force procedures. Due to the nonlinear relationships between the parameters used in kinematic synthesis and the chain's workspace, this brute force approach results in difficulty for the designer due to the inability to straightforwardly connect the parameters and the workspace. The method utilized to develop a kinematic synthesis technique is to analyze the set of design equations capable of being applied to any planar chain consisting of revolute and prismatic joints.

Board 55 EFFECT OF MACHINE VARIATION ON END EFFECTOR POSITION FOR A SPHERICAL FOUR-BAR David A. Perkins, perkindz@notes.udayton.edu, Michael Turner PhD., Michael.Turner@notes.udayton.edu, University of Dayton, 303 W. Monument Ave, Dayton OH 45402.

The objective of this research was to investigate the effect errors in the fabrication of the links have on the motion of a spherical four-bar mechanism (s4R). While these mechanisms have been examined in theory, little effort has been made to apply them practically. A spherical four-bar is a kinematic linkage with a single degree-of-freedom, allowing for a single motor attached to the input link to drive the mechanism and achieve spatial motion and orientation. The axes of the revolute pivots between the links intersect at a common point causing the links to move along the surfaces of concentric spheres. The fabrication of any mechanism has errors within certain tolerances, but it is unknown how this affects the displacement and orientation of its parts. To determine this, an error was assumed in the spherical angles of the links that still allowed the joint axes to intersect at a common point. As a result, the mechanism was still a functioning s4R linkage, albeit a

different one. The objective of this study was to determine how tightly the tolerances for the fabrication of the links should be held to maintain a given end effector position and range of motion. An error of 1-degree for each link angle was assumed as the worst case scenario for this tolerance study as this error corresponded to a machining error of 0.005". This is a normally attainable tolerance for modern machine fabrication purposes. Using solid modeling within the Pro-E™ and SolidWorks™ software packages and mathematical simulations in MATLAB™, 30000 different link angle combinations were chosen at random and their susceptibility to errors were analyzed by comparing the original motion to the motion of the same mechanism with errors in the links. Through these simulations was determined that the probability of a larger error corresponded inversely with a mathematical formulation known as the T-Conditions. These conditions are calculated from the link angles and determine how closely the mechanism operates to a folding condition singularity. Away from these conditions, the errors are relatively small and within the allowable tolerance. Through additional simulation it was found that if the axes did not intersect at a common point, that motion was still possible so long as the three non-input revolute joints became cylindrical joints, creating an R3C mechanism.

Board 57 BEAVER (CASTOR CANADENSIS) HERBIVORY EFFECTS ON AN ANTHROPOGENICALLY ALTERED LANDSCAPE. Paul Hughes, phughes@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont St., New Concord OH 43762.

Beaver (*Castor canadensis*) have been referred to as ecosystem engineers, meaning that they greatly alter their environment. Beaver are able to affect species diversity and richness through their harvesting of woody plants. The goal of this study is to access the impact of beaver foraging on forest systems across the heavily altered landscape of the Wilds (in Muskingum county, Ohio). Prior to the establishment of the Wilds in the 1990s, this ecosystem was drastically altered by strip mining. Vegetation transects were established at sites currently used by beaver as well as at abandoned beaver sites. Tree species diversity was found to be low, and highly dominated by Autumn Olive and Sweetgum. Variables recorded were plant species composition as well as recruitment data in each of four subplots for nine transects across three sites. Descriptive statistical analysis will be used to compare patterns of foraging activity and plant community impacts within and between sites. Within site analyses will include comparisons of response variables as a function of distance from water. Comparisons of currently active with abandoned areas should provide insights as to longer-term impacts of beaver foraging. Results from this study may provide important insights to develop a beaver management plan for the Wilds.

Board 59 PLETHODONTID SALAMANDER POPULATION DENSITIES AS INDICATORS OF HABITAT HEALTH. Brandon D. Hartman, bhartman@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Muskingum College, Conservation Science Program, 163 Stormont St., New Concord OH 43762.

According to several studies, plethodontid salamander populations have been slowly declining over the past several years. Environmental stressors can directly or indirectly affect both the species and the habitat by interfering with the biological community's ability to function properly. Salamander populations are influenced by several elements in their environment that include: soil moisture and humidity, the abundance of cover, the depth of leaf litter, the amount of organic material in the soil and the temperature on the forest floor. Plethodontid salamander populations may play an important role in processing nutrients for forest growth and productivity making them useful in evaluating ecosystem health. In addition they are known to have an important role in maintaining ecosystem integrity because they are likely to respond to changes in the environment more quickly than other forest amphibians. The study was conducted in a hollow, located on private property in White Cottage, Ohio in Muskingum County during the month of May 2005. The objective was to investigate the use of cover and other habitat features by plethodontid salamanders. While studying the use of cover objects, we also investigated the role of moisture in habitat selection of a plethodontid population. When observing the two sites we found that in site A the leaf litter depth was found to be more abundant cover for salamander species ($.7452 \pm 0.0859$ vs. $0.4837 \pm .1082$). In site B the tree diversity and diameter at breast height was higher (2 ± 0.731 vs. 11.198 ± 4.54). There was a significant difference in pH levels between site A and site B (5.97 ± 0.24 vs. 5.71 ± 0.26).

Board 61 DEVELOPMENT OF A LAND USE MODEL FOR THE CONSERVATION BIOLOGY OF MOLE SALAMANDERS (*AMBYSTOMA*) IN THE TILL PLAINS OF WESTERN OHIO. Elizabeth A. Rhoads, rhoadsea@notes.udayton.edu, P. Kelly Williams, kelly.williams@notes.udayton.edu, University of Dayton, Biology Dept, 300 College Park, Dayton OH 45469-2320.

The Till Plains Region is dominated by agriculture and contains numerous isolated wet woodlots. Six species of mole salamanders (*Ambystoma*) breed in woodland vernal pools in this region. These salamanders require both aquatic and upland habitat, and have experienced decline due to wetland drainage and deforestation. This study assessed salamander breeding sites to develop a model that correlates landscape characteristics with salamander presence in order to aid conservation efforts. Through analysis of known breeding sites, salamander presence at unknown sites was predicted using habitat characteristics. Fifty sites from fifteen counties in western Ohio were sampled for larvae and landscape variables in 2004 (known sites) and 2005 (unknown sites). Larvae were captured with dip nets and preserved for identification. Global positioning system points were recorded and additional landscape data was obtained using GIS applications. Four species (*A. maculatum*, *A. texanum*, *A. tigrinum*, *A. jeffersonianum* complex) were found across thirty-four sites (N = 415). Salamanders were present at all known sites and 62% of previously unknown sites. In 2005, 80% of pools within or adjacent to forest and 17% of unforested pools contained larvae. Chemically, pH for sites with salamanders ranged from 6.95-8.14 in 2004 and 7.21-8.11 in 2005, and 7.39-8.46 in 2005 sites without salamanders. Average percent open water for sites with salamanders was 33% in 2004 and 52% in 2005, and 66% in 2005 sites without salamanders. The best predictor of salamander presence in this region was forest cover associated with the breeding pool.

Board 63 BEHAVIORAL TESTS OF AN INTRODUCED POPULATION OF THREESPINE STICKLEBACK (*GASTEROSTEUS ACULEATUS*) IN LAKE MICHIGAN. Jeffrey A. Jackson, jjackson@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont Street, New Concord OH 43762.

Within the past 20 years threespine stickleback (*Gasterosteus aculeatus*) have invaded the Great Lakes. Although several papers document the appearance and migration of this fish, there are no studies on their behavior in this new environment. This study was designed to compare differences in reactions to dummy conspecifics by male stickleback. The population of Lake Michigan stickleback most likely originated from an Atlantic population via the St. Lawrence Seaway. Tests were run on 18 males collected from Trail Creek in Michigan City, IN during June of 2004 and documented their reaction to dummies of conspecifics. Responses were compared to data from a population from Long Island (N=20), which is postulated to be where the Lake Michigan population originated. Paired T-tests were used along with wilcoxon signed rank tests to determine any significant difference between behaviors within the Lake Michigan population. The majority of courting behavior by males was directed to dummy females than dummy males ($t = -2.942$, d.f. = 17, $p < 0.01$) and attacks directed to the dummy males was greater than dummy females ($w = -69.0$, $N = 18$, $p = 0.109$). In general, the Long Island fish responded more frequently than the Lake Michigan population with significant differences in both bites to the male stimuli ($t = 259.0$, $n = 20$, $p < 0.01$) and courting behaviors to the female stimuli ($t = 227.0$, $n = 20$, $p < 0.001$). Further testing should be conducted to determine what factors caused the differences in behavior that were observed between the two populations.

Board 65 MONARCH BUTTERFLY LARVA (*DANAUS PLEXIPPUS*) DISPERSAL EFFECTS ON AN ANTHROPOGENICALLY ALTERED LANDSCAPE. Rebecca Showalter, rshowalt@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont St., New Concord OH 43762.

Monarch butterflies (*Danaus plexippus*) are bioindicators; their population performance may reflect the overall health of the ecosystem they inhabit. In addition, a number of studies have indicated that the relative abundance of monarch butterflies may reflect important cues about the composition of plants within the local communities. The study included fifteen distinct habitat patches containing monarch butterflies across the heavily altered landscape of the Wilds in Muskingum and Guernsey County, Ohio. Prior to the establishment of the Wilds in the 1990s, this ecosystem

was drastically altered by strip mining. Plots were established at sites containing at least one of three different types of milkweed (common milkweed (*Asclepias syriaca*)(n=296), swamp milkweed (*Asclepias incarnata*)(n=622), and orange milkweed (*Asclepias lanceolata*)(n=1)). The types and relative composition of different milkweed species found in each patch were recorded as well as the number of the number monarch butterfly (*Danaus plexippus*) eggs (n=175), and the number of larvae(n=92). The larva was observed from September 11 2005 to October 7 2005. Comparisons across distinct habitat patches should provide important insights that will enhance understanding of ecosystem recovery as well as the ecology of monarch butterflies. The results of this study may provide important insights to develop a monarch butterfly management plan for the Wilds.

Board 67 HABITAT SELECTION OF NESTING BLUEBIRDS (*SIALIA SIALIS*) IN HOMOGENEOUS HABITAT AT TANNENHAUF GOLF CLUB IN NORTHEASTERN OHIO. Emily R. Snode, esnode@muskingum.edu, (James L. Dooley, jdooley@muskingum.edu), Conservation Science Program, Muskingum College, 163 Stormont St., New Concord OH 43762.

Over the past 50 years, there has been increasing concern over the decline of Eastern bluebird (*Sialia sialis*) populations. Biologists have calculated that eastern bluebird populations may have declined by as much as 90 percent, possibly due to the combination of competition for nest sites, decline of nest cavities due to human agriculture practices, climate change, pesticide use, and food supply decline. It has been demonstrated that bluebirds generally prefer and are more successful in open areas with sparse ground cover and short grass relative to areas of denser tree and ground cover. In this study, the objective was to assess whether bluebirds demonstrate fine-grained habitat selection within an open landscape that features only attributes that coarser comparisons have suggested as favorable (e.g., low tree density and short ground vegetation). A total of 35 nest boxes were studied May 2005 through August 2005 at Tannenhauf Golf Club in Alliance, Ohio. The total number of: bluebird occupants, eggs, nestlings, and fledglings were recorded at each nest box. In addition, we recorded whether the nest box was usurped by another cavity nesting species. Distance to the nearest tree, building, and body of water were recorded, as were the number of trees within 50 meters of the nest-site, and the percentage of vegetation within 3 meters of nest-site. One-way ANOVA analyses will be run on using the number of bluebird occupants, eggs, nestlings, and fledglings as dependent (response variables) while habitat variables will be analyzed as independent variables. Results from this more fine-tuned investigation into habitat associations may allow biologists to develop more detailed recommendations for eastern bluebird management.

Board 69 THE EFFECTS OF A RECLAIMED STRIP MINES' HABITAT ON THE AMERICAN KESTREL, *FALCO SPARVERIUS*. Daniel M. Hollenbaugh, danielh@muskingum.edu, (Jim Dooley, jdooley@muskingum.edu), Muskingum College, Conservation Science Program, 163 Stormont St., New Concord OH 43762.

American kestrels, *Falco sparverius*, are raptors that prey upon amphibians, reptiles, small mammals, passerine birds, annelids, and arthropods. They live in agricultural areas, open fields, cities, wood edges, or dead trees. The purpose of this research project was to examine the extent to which habitat alteration affected nest site selection and reproductive success. The hypothesis of this study is that if ground cover is abundant, kestrels will occupy nest boxes at a higher rate because there may be more prey available. The location of the study was at the Wilds, a reclaimed strip mine located in Cumberland, Ohio. Sixteen nest boxes were established across a variety of sites within the largely grassland landscape. The nest boxes were observed to see whether or not kestrels occupied them based on a habitat analysis of vegetation surrounding them. The environments were surveyed by forming a five meter radius around the nest box area, by taking measurements of the plants, by determining the amount of ground cover, and by identifying the different species of trees surrounding the nest boxes. The average percent ground cover was the same for unoccupied and occupied nest boxes ($\bar{x} = 58.57\% \pm 14.67$ vs. $64.375\% \pm 10.19$). Fifty percent or more of the young survive to fledging on sites in which ground cover is between 60% and 80%. Data comparisons will be conducted using descriptive statistics. Conclusions will be made to determine why some of the nest boxes are occupied as opposed to others based on the results of the habitat analysis.

Board 71 ONSET OF CENOZOIC VOLCANISM AND REGIONAL EXTENSION IN NORTHEAST

NEVADA. Michael T. Rigby,
rigbymit@notes.udayton.edu, (Allen J. McGrew,
allen.mcgreg@notes.udayton.edu), Dept of
Geology, University of Dayton, 300 College Park,
Dayton OH 45469-2364.

From 60 to 35 Ma, the western U.S. Cordillera experienced a time-transgressive transition from large-scale crustal shortening to regional extension. Proposed mechanisms for this transition include evolution of plate boundary conditions, buoyancy forces due to Mesozoic crustal thickening and/or replacement of mantle lithosphere by hotter, more buoyant asthenosphere. Widespread volcanism across the Cordillera is broadly synchronous with the onset of extension and has been linked to asthenospheric buoyancy models, but few studies have specifically documented this linkage. Our hypothesis is that extension and volcanism co-evolved at the Copper Basin in northeast Nevada (Elko County). Copper Basin is flanked on the west by the Copper Creek detachment fault and consists of >1.5 km of late Eocene to Oligocene strata grading conformably upward from the volcanoclastic Dead Horse Formation into the conglomeratic Meadow Fork Formation. The appearance of metamorphic and granitic boulders eroded from the footwall of the fault defines a younger age limit of 29.4 Ma for the onset of faulting based on dating of an ash horizon within the upper Meadow Fork Formation. Additional dating of tuffs near the base of the Meadow Fork Formation will tighten this bracket relative to a 37.4 Ma age from the uppermost Dead Horse Formation. To develop a detailed history of footwall denudation, 1- 5 kg samples of conglomerate and ash fall tuff were collected throughout the sequence for clast counts and radiometric dating. Also, 50 granitoid cobbles were collected from four different stratigraphic horizons within the Meadow Fork Formation for U-Th/He dating. Analysis of these cobbles will be used to constrain the lower temperature cooling histories and thus the movement through the crust of the eroded footwall rocks.

Board 73 A COMPARISON OF MANURE AND INORGANIC NITROGEN FERTILIZER AND THE RATE OF CORN PRODUCTION. Alan P. Sundermeier,
sundermeier.5@osu.edu, Ohio State University
Extension, 440 East Poe Rd, Bowling Green OH
43402.

Is substitution of manure in corn production systems a viable replacement for inorganic nitrogen fertilizer? The objective of this study is to evaluate various application rates of inorganic nitrogen on fields treated with manure with respect to corn production. After this evaluation, then the application of inorganic nitrogen fertilizer may be reduced without a reduction in corn production. Field test plots were established in 2003, 2004, and 2005 in Wood County, Ohio. Each plot received an application of 7,000 gallons per acre of liquid dairy manure each year. Randomized, replicated field plots then had inorganic nitrogen fertilizer applied at the rate of zero, 50 and 100 pounds per acre. Three years of multiple site sampling collected data on the following indicators: soil nitrate, soil ammonium, corn leaf tissue nitrogen, corn stalk nitrate, and corn grain yield. The data collected indicate that there is no statistical difference (F value .05) in corn production between the three application rates of inorganic nitrogen fertilizer. Three year corn production averages in bushels per acre were 178.7 for zero rate, 182.2 for 50 pound rate, and 183.8 for 100 pound rate. These differences are not statistically significant. Results indicate that 7,000 gallons per acre of liquid dairy manure was able to support maximum corn production without the need for additional inorganic nitrogen fertilizer.

Board 75 DEVELOPMENT OF A HYPERLINKED DATABASE FOR THE PROTECTION AND MANAGEMENT OF NORTHEASTERN KENTUCKY KARST RESOURCES. Stacey R. Wharton
s06.swarton@wittenberg.edu and Horton H.
Hobbs III hhobbs@wittenberg.edu, Dept of
Biology, Wittenberg University, Springfield OH
45501-0720.

Karst features, including caves, springs, sinkholes, vertical shafts, and natural bridges, of Carter County in northeastern Kentucky are numerous and varied. Data on over 150 karst attributes have been gathered since 1980, and 41 caves have been surveyed for a total of 18.1 km of passages. Many of these support a diverse flora and fauna, including the Federally endangered Indiana bat, *Myotis sodalis* Miller and Allen. In order to protect and manage these resources, a database of Carter County karst features was developed using Microsoft® Excel that allows for hyperlinkage to various data sets (e.g., locations, maps, descriptions, flora and fauna lists, photographs, survey data, references). Most of the data points are from within the boundaries of Carter Caves State Resort Park, although numerous data are from other parts of the county. The

database allows the State Park and researchers within the park to access pertinent information about each karst element, allowing for better management and protection of these unique features. This is particularly crucial since many of the caves within the county serve as hibernacula for *M. sodalis*, including Bat Cave, which is designated a Critical Habitat for the bat. Rare plant species, such as the Mountain Maple (*Acer spicatum* Lamarck) and the Canadian Yew (*Taxus canadensis* Marshall), occur in this karst region and use of the database will aid in conserving these and other hypogean and epigean species.

Board 77 AN INTEGRATED BIOSTRATIGRAPHIC APPROACH TO REFINING THE LOWER PALEOZOIC TIME SCALE OF CENTRAL IDAHO. Gary J. Motz¹,
motzgarj@notes.udayton.edu, (Daniel Goldman¹,
dan.goldman@notes.udayton.edu), Steve A.
Leslie², saleslie@ualr.edu. ¹University of Dayton,
Dept of Geology, 300 College Park, Dayton OH
45469-2364, ²University of Arkansas, Little Rock
AR.

The geologic time scale is perhaps the most fundamental tool for studying Earth's dynamic systems. Modern Earth science studies increasingly rely on precise, time-calibrated data. Fossils have special status as the most important source of relative geologic time information. The primary objective of this research is to refine time scale for the Ordovician Period (489-443 mya). We plan to construct an integrated biostratigraphic model, for this period, using graptolites and conodonts. Specimens of these two groups usually occur in different types of rocks, causing correlation difficulties. The Trail Creek region of central Idaho has one of the most complete successions of Ordovician graptolite-rich rocks in the world, but no conodonts have been reported from this region. Samples were collected for processing from four sections: Trail Creek Summit, Little Fall Creek, Trail Creek Road, and Trail Creek. The Summit section is the longest stratigraphically, spanning the Lower Ordovician to Lower Silurian Periods, but it has a large stratigraphic gap in its lower portion. Additional graptolites collected from Little Fall Creek represent the time interval missing from the Summit section. Our faunas span the *Cardiograptus morsus* to *Nemagraptus gracilis* graptolite biozones. We also document the first conodonts known from the Trail Creek region in the Summit and Road sections. The Summit fauna belongs to the *Pygodus anserinus* conodont biozone and the Road fauna are currently under taxonomic review. By integrating the two fossil biozones, we will be able to correlate rocks from disparate biofacies, thereby refining the Ordovician time scale.

Board 79 NEW MAP OF THE SURFICIAL GEOLOGY OF THE LORAIN AND PUT-IN-BAY 30 X 60 MINUTE QUADRANGLES, OHIO. Edward M.
Swinford, mac.swinford@dnr.state.oh.us, Richard
R. Pavey, Glenn E. Larsen, and Kim E. Vorbau;
Ohio Dept of Natural Resources, Division of
Geological Survey, 2045 Morse Road, Bldg. C1,
Columbus OH 43229.

As part of a statewide surficial geology mapping effort, a map depicting the surficial geology of the Lorain and Put-in-Bay 30 x 60 minute (1:100,000-scale) quadrangles has been produced by the Ohio Department of Natural Resources, Division of Geological Survey. Data sources include field mapping, county soil surveys, Ohio Department of Transportation and Ohio EPA boring logs, engineering logs, water-well logs, theses, and published and unpublished geologic and hydrogeologic reports. Surficial deposits were mapped at 1:24,000 scale for 36 7.5-minute quadrangles, compiled digitally using GIS technology, and converted into a full-color, print-on-demand, 1:100,000-scale, surficial-geology map which includes all or portions of Erie, Huron, Lorain, Lucas, Sandusky, and Seneca Counties in north-central Ohio. Map polygons were attributed using a stack-unit designator that indicates the thickness and stratigraphic sequence of major material units (e.g., till, gravel, sand, silt, and clay), from land surface down to and including the uppermost bedrock unit. Several regional material trends are apparent on the map, including large areas of lacustrine clay and silt landward of Lake Erie, the prominence of shallow bedrock paralleling the Lake Erie shoreline, a deltaic sequence deposited during higher levels of water of ancestral Lake Erie, locally widespread and thick organic and marl deposits, and the expanse of Wisconsinian-age till mantling most of the area in the quadrangles. The map text explains how to read the map, provides lithologic descriptions of mapped glacial and bedrock units, and offers other explanatory information. A GIS Geodatabase contains spatial information on each polygon and data attributes of the stack units that can be queried on the basis of material types and thickness to quickly create derivative maps.

Board 81 DEMOGRAPHIC CORRELATES BETWEEN UPLAND AND WETLAND USAGE IN *AMBYSTOMA MACULATUM*. Christian D. Wright, wright_c@denison.edu, (Rebecca N. Homan, homanr@denison.edu), Denison University, Slayter Hall 1064, Granville OH 43023.

Amphibian populations have been declining worldwide for decades and because of their importance as environmental indicators, and recently there has been an increase in the number of studies performed by conservation biologists studying these organisms. A 5 year study was initiated on a population of *Ambystoma maculatum* (spotted salamander) in an undisturbed environment located in the Denison University Biological Reserve in Granville, Ohio. The long term study is intended to examine the effects of habitat fragmentation on local amphibian populations. Specifically the goal of this study is to examine correlations between age structure and habitat quality in this local population. The data gathered will be used as a control to compare populations of *A. maculatum* in undisturbed habitats to those suffering from habitat fragmentation. Our hypothesis is that older individuals will inhabit habitats with a higher quality and that these relationships will be reflected in both wetland and upland habitats. Using a drift-fence immediately surrounding a semi-permanent pond that dries out between July and September, we monitored the number, sex, reproductive success, and orientation of this population daily. Upland habitat included any habitat surrounding the pond 100 meters away from the edge of the drift-fence which was positioned immediately around the pond. Habitat quality was ranked based on known information about habitat preferences in other populations of *A. maculatum* examined by researchers around the country. Approximately 30 percent of the population was tagged with a Passive Integrated Transponder and had a toe clipped to age the collected individuals. The population was aged using a long-bone growth ring analysis, specifically counting the number of lines of arrested growth from the toe sections. Previous experiments have shown that there are preferences in the selection of upland and wetland habitat for different age classes of *A. maculatum*. Statistical relationships have not been assessed due to continuing research.

Board 83 THE DIETS OF EASTERN COYOTES (*Canis latrans*) AT THE WILDS, A RECLAIMED SURFACE MINE IN SOUTHEASTERN OHIO. Leeanna L. Pennington, leeannap@muskingum.edu, (Danny Ingold, ingold@muskingum.edu), Muskingum College, Biology Dept, New Concord OH 43762.

The objective of this research is to determine if there are differences in coyote diet during different times of the year on a reclaimed surface mine, by examining scat samples collected from January 2005 through November 2005. We hypothesize that coyote scat during the winter months (December-February) will include less plant material and more animal material than during the rest of the year. The Wilds is a 3,700 hectare wildlife preserve located at the intersection of Guernsey, Muskingum and Noble counties, consisting mostly of grasslands, but also scattered tracks of *Lespedeza* sp. (woody legume), as well as islands of mixed hardwood-coniferous forest. Specifically this study will attempt to determine if there are detectable differences in coyote diet during the different seasons (winter = Dec-Feb, spring = Mar-May, summer = June-Aug, fall = Sept-Nov) using a series of one-way analysis-of-variance tests (content of scat = dependent variable; season = independent variable). Coyote scat will be collected along roadways and trails on all portions of The Wilds during each season. Scat will be identified as that of a coyote, by its dimensions, mass and content (see Green & Finders, 1981, J. Wildl. Manage.). Samples will be stored in labeled zip-lock baggies in a freezer and later autoclaved and rinsed through a sieve before analyzing the contents. Prey items in the scat (e.g. bones, hair, insect parts, etc.) will be identified using keys and reference books. The remains of vegetation (fruits, seeds and grasses) will also be identified when possible. The results of this study will help to shed light on the diets of coyotes on a reclaimed surface mine and whether those diets vary across seasons.

Board 85 DESCRIPTION OF THE FIRST MITE DEFENSE SECRETION BY A NOVEL FORM OF REFLEX BLEEDING IN A TERRESTRIAL RED MITE. Jacob T. Ark, s08.jark@wittenberg.edu, Eric J. Rellinger, s07.erellinger@wittenberg.edu, Joshua B. Benoit, s05.jbenoit@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Wittenberg University, Dept of Biology, Springfield OH 45501.

Balaustium mites are known for their quickness, bright red color, and population bursts in landscaping and on the walls of buildings. The key taxonomic feature of these mites is a pair of tubercles (urnulae) located on the dorsal idiosoma behind the eyes. Prior to

this investigation, the function of these structures was unknown. Contribution of functional information regarding the urnulae was the goal of this study. Histological and morphological examination of urnulae by positive staining and ammoniacal silver nitrate revealed innervated longitudinal muscle and glandular tissue consistent with the function of an exocrine gland. In fact, disturbances prompt urnulae to evert and secrete a viscous, red fluid spread by setae over the mite's body surface, suggesting the derived fluid may have semiochemical properties. Allomonal characteristics were evaluated by applying the secretion to mealworms (*Tenebrio molitor*) and monitoring rate of attack by predatory ants. Frequency of attacks decreased 70% for mealworms treated with the secretion (N=15 replicates of 3 mealworms each with 10 ants per Petri dish), confirming defensive characteristics of the exudate. True to semiochemical parsimony, urnulae-derived secretion also prompted excited dispersal of conspecific mites. Of interest, alarm and defense responses were also noted in the presence of hemolymph extract, indicating the secretion's active ingredients are also present in the blood. Fluid dispersal over the entire body surface (not directed at the site of disturbance), blood-borne allomones, and ability to disrupt predatory chemoreception are all characteristic features of the *Balaustium* mite defense mechanism that parallel reflex bleeding in aposematic beetles.

Board 87 A RAPID DEHYDRATION FEATURE OF THE ENTOMOPATHOGENIC FUNGUS *METARHIZIUM ANISOPLIAE* USED AGAINST TICKS IN BIOLOGICAL CONTROL. Justin L. Tank, s09.jtank@wittenberg.edu, Jacob T. Ark, s08.jark@wittenberg.edu, Eric J. Rellinger, s07.erellinger@wittenberg.edu, Joshua B. Benoit, s05.jbenoit@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501.

Ticks spend the vast majority of their life crawling on the ground, enhancing exposure to commonly encountered fungi such as *Scopulariopsis brevicaulis*, *Aspergillus niger*, *Cladosporium cladosporioides*, *Penicillium glabrum*, and entomopathogenic *Metarhizium anisopliae*. Fungal infections, along with relative humidity, are important regulators of tick populations in nature. To evaluate the interdependence of these two factors, water balance characteristics of nonfed female lone star ticks were determined following exposure to individual mycoflora associates (N=45 ticks/treatment). Treatment with *M. anisopliae* induced a two-fold increase in water loss rate, which prevents ticks from stabilizing water levels (water gain \sim water loss) at their critical equilibrium activity (CEA) of 0.85a_v-0.93a_v (a_v; a_v=r.h./100). Thus, *M. anisopliae* induces death by desiccation and served as our benchmark for comparing treatments with soil molds abundant in nature. Water loss rates were not altered by treatment with *C. cladosporioides*, which is consistent with its classification as a harmless saprophyte. For *Scopulariopsis brevicaulis*-treated ticks, elevated water loss rates are reported, but no effect was apparent for treatment with *A. niger*, implying this facultative parasite either was unable to switch to parasitism or could not effectively use ticks as a substrate. Ticks treated with *P. glabrum* lost water similarly to *S. brevicaulis*, indicating this saprophyte is pathogenic to ticks. Thus, fungal fauna directly impacts habitat preference, as infections can alter moisture requirements of their tick host. In addition, water loss rates are useful in assessing the pathogenicity of fungi targeted for use in biological control against ticks.

Board 89 TESTES PROTEIN CLONING AND CHARACTERIZATION IN THE LEPIDOPTERANS *HELIOTHIS VIRESCENS*, *HELIOTHIS PELTIGERA*, AND *HELIOTHIS SUBFLEXA* SPERMTAIL. Benjamin H. Thirlby, thirlbbh@notes.udayton.edu, (Mark G. Nielsen, Mark.Nielsen@notes.udayton.edu), University of Dayton, Dept of Biology, 300 College Park, Dayton OH 45409-2320.

Research in *Drosophila* species revealed that a fundamental component of its spermtail axoneme, Beta2 tubulin, has not evolved in amino acid sequence in 60 million years. Yet, data from two species indicates Beta2 evolves rapidly in Lepidopterans, raising the question, why is the same protein evolving rapidly in one taxa and not at all in another? One important difference between the Dipteran and Lepidopteran testis is that Dipterans use a major alpha tubulin isoform in the spermtail axoneme, and Lepidopterans a testis-specific alpha isoform. It is proposed that use of a testis-specific alpha isoform frees the Lepidopteran testis-specific beta isoform to evolve. To test this hypothesis, Beta2 is being cloned and testis proteins characterized in a third Lepidopteran species, *Heliothis subflexa*. RNA was isolated from dissected testes (N=4 preparations) and reverse transcribed into cDNA using Beta2-specific primers. A 1.3kb cDNA was amplified using polymerase chain reaction, and sequenced (Northwoods DNA, Bemidji, MN). A

GenBank nucleotide blast search (<http://www.ncbi.nlm.nih.gov/BLAST>) identified the cDNA as Beta2 tubulin (probability it is not Beta2 tubulin = $1/6 \times 10^{-151}$). In our largest read of unambiguous sequence (519bp of 3' sequence), 5 non-synonymous amino acid substitutions were identified compared to its closest relative in which Beta2 has been cloned (*H. virescens*). To determine if its rapid evolution extends to other testis proteins, in particular to alpha tubulin, testis protein preparations of *H. subflexa* (N=5) and *H. virescens* (N=5) are being analyzed using 2-dimensional gel electrophoresis, and compared to fruit fly testis proteins.

Board 91 α AND β TUBULIN ISOFORM EXPRESSION IN ANOPHELES GAMBIAE. Michael D. Wigton, wigtonmd@notes.udayton.edu, (Mark G. Nielsen, Mark.Nielsen@notes.udayton.edu), Dept of Biology, University of Dayton, 300 College Park Drive, Dayton OH 45469-2320.

How does protein function constrain protein evolution? The Drosophilid testis specific Beta2 has not evolved in 60 million years; in contrast, Lepidopteran Beta2 is evolving rapidly. One difference between these taxa which could affect evolution rates is the alpha tubulin isoform used in the testis; Drosophilids use the major alpha isoform, which also supports somatic function, and Lepidopterans use a testis-specific alpha isoform. If mosquitoes use a major alpha isoform to support the spermtail axoneme, we expect the testis-beta tubulin to evolve slowly in mosquitoes and relatives, but if it uses a testis-specific alpha, we expect the testis-specific beta tubulin to evolve rapidly. To address these hypotheses tubulin isoforms are being characterized in *Anopheles gambiae*. *Anopheles gambiae* were reared to adulthood and their tissues dissected for RNA and protein extraction. Gene specific DNA primers were designed to amplify *Anopheles* tubulins using sequences obtained from GenBank. The primers were tested on genomic DNA and products sequenced to verify their specificity (N=1 for each primer set). Primers were used in reverse transcription reactions using *A. gambiae* RNA isolated from testis and somatic tissues as templates. The EST data showed that both major alpha isoforms are expressed in testis and somatic tissues (N=1 for each tissue and isoform), a feature shared with *Drosophilids*. *Anopheles* Beta2 isoform was expressed in the testis, but was not testis-specific (N= 1 for each tissue). Two-dimensional protein gels are in progress to determine the effect of this change in isoform use on testis protein use and evolution.

Board 93 INVESTIGATING WATER BALANCE CHARACTERISTICS OF THE TERRESTRIAL RED MITE (BALAUSTIUM SP.) TO ASSESS THEIR USE IN BIOLOGICAL CONTROL. Eric J. Rellinger, s07.erellinger@wittenberg.edu, Jacob T. Ark, s08.jark@wittenberg.edu, Joshua B. Benoit, s05.jbenoit@wittenberg.edu, Jay A. Yoder, jyoder@wittenberg.edu, Dept of Biology, Wittenberg University, Springfield OH 45501.

A new species of red *Balaustium* mite rapidly crawls over landscaping and concrete edifices throughout central Ohio. Adults of the mite are conspicuous in late Spring, when populations number in the thousands but slowly decline over the subsequent month. Notably, *Balaustium* sp. possess chelicerae that are modified into a sword-like stylet that is differentially adapted for the predation of soft-bodied arthropods, such as scale insects and spider mites, which suggests that this mite may be useful in biological control. To provide insight into fundamental questions related to their survival, distribution, and possible range of application, we established the water balance profile for female adult *Balaustium* sp. (unidentified) (total N=300 mites). Notably, this mite features a 71% body water content, a 39% dehydration tolerance, and a modest water loss rate of 2%/h, prompting us to classify this mite as xerophilic. Unusual to these mites is their inability to absorb ambient water vapor at vapor activities ($a_v = \%RH/100$) close to saturation and uptake water after first day passive gains. Absence of an active uptake mechanism was confirmed by scanning electron microscopy (N=20 mites), as no salt accumulation was observed around the base of the gnathosoma (SEM). *Balaustium* mites imbibe free water only when severely dehydrated, indicating that the primary water source for this mite is dietary. The relatively brief duration of the adult stasis and aggressive predatory life style make this mite ideal as a potential biological control agent.

Board 95 THE CHARACTERIZATION OF PROTEIN EXPRESSION PATTERNS AMONG SIX DIPTERAN SPECIES. Lisa M. Griffith, griffilm@notes.udayton.edu, Mark G. Nielsen, Mark.Nielsen@notes.udayton.edu, Mike Wigton, wigtonmd@notes.udayton.edu, University of Dayton, 2916 San Rae Dr. Apt. 7, Kettering OH 45419.

A fundamental component of Drosophilid spermtail axonemes, Beta2 tubulin, has not evolved at a single amino acid site in 60 million years. This protein comprises 35% of the mass of the spermtail. Previous research has found that small changes to Beta2 structure results in a complete loss of function and immotile sperm, putatively due to loss of proper interactions with other proteins in the axoneme. Therefore, it is hypothesized that Beta2 identity might control the evolution of other proteins within the axoneme, forcing them into a configuration amenable to Beta2 function. The objective of this research was to discover if Beta2 tubulin forces a particular molecular morphology onto the spermtail axoneme by using 2-dimensional gel electrophoresis to compare spermtail proteomes between *Drosophila melanogaster*, *D. virilis*, and *D. hydei*, which use the conserved Beta2 protein, and fly species using Beta2 proteins different from Drosophilid Beta2, *Musca domestica*, *Megaselia abdita*, and *Anopheles gambiae*. The 2D gel profiles (N=2 for each species) fell into two distinct groups, with Drosophilids and non-Drosophilids each displaying unique profiles. The Drosophilid profile was characterized by a diamond-shaped migration pattern, composed of eight proteins, reflecting proteins of both high and low molecular weight, and acidic and basic pH. However, the non-Drosophilids displayed approximately twenty fewer proteins overall. Their profiles formed a three-banded migration pattern reflecting high, mid, and low molecular weights near neutral pH. The results of this experiment reveal that the use of the conserved Beta2 tubulin does correlate with spermtail molecular phenotype, supporting previous research that identified a stringent structure/function relationship between Beta2 tubulin and the spermtail axoneme.

Board 97 THE IMPACT OF TWO COMMON HERBICIDES ON GROWTH, DEVELOPMENT, AND SURVIVAL OF EASTERN GRAY TREEFROG TADPOLES (HYLA VERSICOLOR) Erica A. Kovacic, EKovacic@wooster.edu, Richard M. Lehtinen, RLehtinen@wooster.edu, 931 College Mall, The College of Wooster, Wooster OH 44691.

In the last twenty years, amphibian declines have become a worldwide concern and appear to be occurring both in areas that are disturbed by humans as well as those that are considered to be relatively unimpacted. One hypothesis for the decline is lethal or sublethal effects from herbicides. In particular, two commonly used herbicides, atrazine and Roundup®, have been linked to reducing amphibian populations. To test this hypothesis, we conducted an experiment on Eastern gray treefrog tadpoles (*Hyla versicolor*) with a control and four treatments (atrazine at 5 ppb and 15 ppb and Roundup® at 0.3 ppm and 3 ppm). The experiment was conducted in 568 liter cattle tanks and each treatment was replicated five times with 19 tadpoles per replicate. Tadpole mortality and growth rates, the number of metamorphs, mass at metamorphosis and time to metamorphosis were analyzed to determine what effects the herbicides had on tadpole development. Roundup® treatments averaged 5.1 deaths in the first 10 days while atrazine treatments averaged 2.6 deaths and the control averaged 2.8 deaths in the same time period. Furthermore, the higher concentration of Roundup® showed higher mortality, with an average of 5.4 deaths as opposed to 4.8 in the low concentration of Roundup®. However, a multivariate analysis of variance found no statistically significant differences among any of the treatments ($p = 0.777$). This indicates that the herbicide treatments did not have any additional effects on the tadpoles beyond what occurred in a control where no herbicides were present.

Board 99 ANALYSIS OF HYDROCARBON BIOREMEDIATION BY SERRATIA MARCESCENS IN CONTAMINATED SOIL. Deirdre M. Waddell, deedee.waddell@otterbein.edu, John Tansey, jtansy@otterbein.edu, (Amy Jessen-Marshall, ajessen-marshall@otterbein.edu), Otterbein College, SMC Box# 14053, One Otterbein College Westerville OH 43081.

Hydrocarbon contamination of soil and water is of environmental concern and considerable research has been undertaken to identify microbes capable of metabolizing hydrocarbons to be used for bioremediation of contamination sites. Our goal was to identify soil microbes capable of hydrocarbon bioremediation and characterize the enzymatic pathways involved. Soil was collected from various soil parking lots exposed to gasoline and oil contamination located on the Otterbein campus, Westerville, OH. The soil was serially diluted and each dilution was plated on eight different hydrocarbon and minimal salt plates to culture the microbes present in the sample. The eight hydrocarbons consisted of used motor oil, clean motor oil, gasoline, hexanes, heptane, xylene, toluene, and cyclohexane. Plates were left in aerobic conditions at room temperature. After four days, there was substantial growth on the used motor oil, toluene, heptane, cyclohexane and hexane plates. *Serratia marcescens*, based on colony color and phenotype, was the

most common microbe growing on each of the plates. Surrounding each colony of *S. marcescens* was a clear zone, suggesting its ability to degrade the hydrocarbon on the plates, and was capable of bioremediation. Liquid gas chromatography was employed on toluene, heptane, hexanes, as well as hexanoic acid with the intention to assay the metabolic byproducts of *S. marcescens*. Characterization of the enzymes involved in the metabolism of these hydrocarbons is ongoing.

Board 103 MICROBIAL DIVERSITY IN METAL CONTAMINATED SOILS OF KILGORE FARM USING GENOME SEQUENCING AND MICROBIOLOGICAL TECHNIQUES. R. Alexander Mack, alexander.mack@otterbein.edu, Matthew Fosnaugh, matthew.fosnaugh@otterbein.edu, (Amy E. Jessen-Marshall, ajessen-marshall@otterbein.edu, Simon Lawrance, slawrance@otterbein.edu, Jeffrey Lehman, jlehman@otterbein.edu), Otterbein College, 1 Otterbein College, Westerville OH 43081.

The Kilgore Farm, Delaware Co., OH, was home to ammunition manufacturing facilities during World War II. The destruction and burial of wastes took place on the property in a marked 'burn pit'. Our interest in the site is to determine the microbial diversity of the burn pit and to screen for bacteria tolerant for the metal contaminants present in the soil. Soil samples were taken from three sites within the burn pit and two sites out of the pit with the same soil type. From each site, samples were taken at a depth of 12", 24" and 40". Soils were digested with acid for ICP-MS spectrophotometric analysis to determine the metal composition in the samples. Genomic DNA was isolated from the samples using a gDNA isolation kit from Epicentre®. Bacterial universal primers were used with *Escherichia coli* DNA and the correct PCR conditions for amplification of the bacterial DNA from soil were determined. Metagenomes of DNA present will be obtained via a genome-sequencing of the 16srRNA subunit. Databases of bacterial sequences will then be analyzed in order to determine the bacterial genera present in the soil. In addition in-situ bacteria capable of metabolizing heavy metals are being identified on plates with various concentrations of barium, arsenic and copper. Classification and analysis of these bioremediators will be compared to the full diversity analysis by sequencing. Studying the transport and chemical pathways of the identified bacteria will aid in future research of bioremediation of the site.

Board 104 ANALYSIS OF SEDIMENT CORES FROM CONTINENTAL SHELF AND CONTINENTAL SLOPE TO DETERMINE A PREFERENTIAL SITE FOR ORGANIC CARBON BURIAL IN THE OCEAN. Myung W Han, mhan@csc.edu, Michael Hailu, mhailu@csc.edu, Dept of Biological and Physical Sciences, Columbus State Community College, Columbus OH 43216.

Biogeochemical cycle of carbon in the ocean, encompassing its production, decomposition and preservation, has been perturbed by the enhanced input of land-born nutrients and pollutants. The subsequent increase in carbon production in the form of particulate organic matter in coastal oceans has been known to serve as a "sink" of atmospheric CO₂ through the burial of particulate organic carbon in sediments. Two contending sites have been proposed for burial of organic carbon: continental shelf and continental slope. From each of the areas off Gampo, East (Japan) Sea a gravity core was retrieved and analyzed to determine if there is any physiographic preference for sedimentary organic carbon preservation. Concentrations of interstitial nutrients and total CO₂ were all distinctly higher with greater gradients in the shelf core (698 μM for ammonia, 25 μM for phosphate, 3.9 mM for total CO₂, all at the 43 cm subsurface) than the slope core (542 μM for ammonia, 12 μM for phosphate, 2.9 mM for total CO₂, all at the same depth). More rapid decrease in the interstitial sulfate concentration with depth in the shelf core (0.2 mM/cm) than in the slope core (0.07 mM/cm) indicates greater sulfate reduction at the shelf core. Sedimentary organic carbon and nitrogen contents were all lower and decreased more rapidly with depth at the shelf core. These interstitial and sedimentary results suggest that the particular organic carbon undergoes more active decomposition at the shelf core, supporting a preferential burial of organic carbon in the continental slope.

Board 105 MODELING THE COST OF EVOLUTIONARY INTERMEDIATES USING GRAPH THEORY. Jeremy Joseph Lynch, lynchjej@notes.udayton.edu, Mary Loneta Hickey, hickeymz@notes.udayton.edu, (Mark G. Nielsen, mark.nielsen@notes.udayton.edu, Atif Abueida,

atif.abueida@notes.udayton.edu), University of Dayton, 232 Stonemill Road, Dayton OH 45409.

The problem of intermediates is fundamental to evolutionary biology - there may be adaptive forms that never evolve because the pathway to their evolution entails non-adaptive intermediates. To model this problem, we have constructed a 64 x 64 matrix whose vertices consist of the 64 nucleotide codons (the coding matrix). A "1" is entered in the matrix when a transition between two codons can occur in a single mutational step, and a "0" when >1 steps are needed, an intermediate step is necessary. Raising the matrix to the power n provides the number of paths of n steps between each codon pair. The cost of intermediates is given by the ratio λ , of single step to intermediate step transitions where $\lambda_{n(\text{coding})} = \sum [a_{ij}]^n / \sum [a_{ij}]^{n+1}$. We then construct a second matrix, the function matrix, with the same vertices as the coding matrix, but with entries consisting of the probability of a transition occurring between two codon states based in the functional implications of the amino acid transition, as obtained from the Dayoff PAM250 amino acid transition matrix: transitions between amino acids of different chemistries are much less likely than transitions between similar amino acids, $\lambda_{n(\text{function})}$. These ratios reveal the cost of intermediates to optimal evolutionary solutions: small numbers indicate that many of the best solutions to adaptive problems are not possible, and nature is a compromise, not the best of all worlds but the best possible world.

Board 107 A NOVEL TWO-STAGE VALIDATION PROCESS USING FIELD TESTING TO IDENTIFY CARDIOVASCULAR DISEASE RISK IN ADOLESCENTS. Anne R Crecelius, crecelar@notes.udayton.edu, Reba A Sedlacek, sedlacr@notes.udayton.edu, David A Berning, berninda@notes.udayton.edu, (C. Jayne Brahler, brahler@udayton.edu), Dept Health and Sport Science, University of Dayton, 300 College Park, Dayton OH 45469.

Body mass index [BMI; weight (kg) / height² (m²)] and percent body fat (% BF; assessed using the OMRON™ Fat Analyzer Model HBF-3ed) are estimates of body fatness that are easily measured in non-laboratory settings. Body fatness is an independent risk factor for cardiovascular disease (CVD). Physical fitness is also an independent predictor for CVD and can be determined in K-12 children in non-laboratory settings using tests that provide normative data for comparison. However, fitness testing is time- and resource-intensive. The aim of this study is to validate the use of % BF versus BMI in predicting fitness levels in high school students while controlling for the influence of gender and age. It is hypothesized that % BF, not BMI, will reliably predict fitness across all groups using prediction equations based on data from approximately 1200 Xenia City School District 9th-12th grade students from Spring 2005. Validity and reliability testing will be completed using similar data collected Fall 2005. The usefulness of % BF as an indicator of cardiovascular disease risk is tested on data from a separate age- and gender-matched sample of students for whom fitness, BMI, % BF and blood chemistry data are available (N = 60). The statistical techniques to be used are a one-way ANOVA to determine significant differences between groups and multivariate stepwise regression to determine predictive equations. The information gleaned from this study will be used to advise Xenia City School District if it would be useful to make % BF determinations as a means for profiling CVD risk.

Board 109 CARDIOVASCULAR RISK PROFILE FOR HIGH-RISK ADOLESCENTS AT XENIA HIGH SCHOOL. Lydia Mychkovsky, mychkolc@notes.udayton.edu, Katelyn Bennett, bennetke@notes.udayton.edu, (C. Jayne Brahler, brahler@udayton.edu), Dept Health and Sport Science, University of Dayton, 300 College Park, Dayton OH 45469.

Statistically, eighty percent of obese American children become obese American adults; and an adult with obesity, who also was obese as a child, is at the highest risk for developing cardiovascular and metabolic disorders. Physical activity has the potential to ameliorate obesity and many of the related negative health conditions. Unfortunately, most K-12 students are required to participate in only 30 minutes of physical activity per week; falling far short of the Surgeon General's recommendation of 20-60 minutes of physical activity on most, if not all, days of the week. Subjects were a convenience sample of 59 female Xenia High School Students (ages 15-18) enrolled in the walking class Fall 2005 at Xenia High School (Xenia, Ohio). Study subjects were identified as being at risk for developing cardiovascular disease based on age- and gender-adjusted body mass indices (BMI) equivalent to the adult cut off points of BMI \geq 25 for overweight and BMI \geq 30 for obesity. The purpose of this descriptive study is to provide Xenia

with a more comprehensive cardiovascular disease (CVD) risk profile for this sample of at-risk students and to provide baseline data for predicting the effectiveness of a new "Walking" class on the CVD risk profile for participating Xenia High School students. Data will include blood lipoprotein fractions, blood glucose concentrations, blood pressures, % body fat, and completion times for a one-mile walk/run test. Descriptive statistics will be used to determine if the subjects are at risk for CVD according to criteria established by the American College of Sports Medicine. Correlation tests will be completed to determine if mile run times are associated with CVD risk factors.

Board 111 THE EFFECTS OF AMERICAN INFLUENCE ON ITALIANS: CORRELATIONS BETWEEN DIET, CULTURE AND PUBLIC HEALTH. Sarah McGilllem, mcgillse@notes.udayton.edu, Kate Mone, monkatm@notes.udayton.edu, Lindsay Badertscher, badertle@notes.udayton.edu, (Patricia Dolan, dolanp@notes.udayton.edu, C. Jayne Brahler, brahler@notes.udayton.edu), Dept of Health and Sport Science, University of Dayton, 300 College Park, Dayton OH 45469-1210.

Have Italians begun to progressively drift away from the Mediterranean diet of fresh fish, fruits, vegetables, pasta, and olive oil toward the American trend of convenient and fast food? Unfortunately, the linear relationships between body fatness, consuming food away from home within the last 24 hour period and chronic diseases are already cause for public health concern in America. Is the same trend unfolding in Italy? For the current study, a survey was developed in English that asked respondents about their attitudes toward food and selected cultural beliefs. The survey also included a nutrition profile for each participant to fill out detailing specific food items they eat each week and where and with whom the food is consumed. The survey was translated into Italian, and English and Italian versions were posted online. Respondents were asked to complete the survey once and forward the email to ten friends (N = 2000). Descriptive statistics and frequencies will be calculated for all variables, and ANOVA tests will be run to check for significant differences between average number of meals eaten at home or eaten out during the week, and average number of snacks consumed per day between different age, gender, marital status, education and Nationality groups. Univariate General Linear Profile Plots will be drawn in order to visually identify the effects of age, gender, marital status, level of education and Nationality on dietary trends, meals eaten out or at home, and snacking habits. This study strives to determine the degree to which the diets of persons living in Italy are becoming Americanized.

Board 113 AN ULTRASTRUCTURAL STUDY OF SPERMIOGENESIS WITHIN THE TESTIS OF THE GROUND SKINK, SCINCELLA LATERALE. Erin M. Mills, s06.emills@wittenberg.edu, Kevin M. Gribbins, kgribbins@wittenberg.edu, Wittenberg University, PO Box 720, Springfield OH 45501-0720.

While the events of spermiogenesis are commonly studied in mammals, the amount of research available for reptiles is lacking. Many studies have described the morphological characteristics of mature spermatozoa in reptiles but few detail the ultrastructural changes that occur during spermiogenesis. The purpose of this study was to gain a better understanding of the subcellular events of spermiogenesis within the temperate Ground Skink (*Scincella laterale*). Samples of testes from 20 specimens were prepared using standard techniques for transmission electron microscopy. During early spermiogenesis within the Ground Skink testis, vesicles from the Golgi merge to form the acrosome and proacrosomal granules near the apex of the nucleus. Dispersed nuclear chromatin is then condensed into thick longitudinal fibers. Nuclear elongation occurs in response to further compaction of chromatin and stretching by the machette, a layer of microtubule scaffolding surrounding the sperm nucleus. The midpiece consists of a pair of centrioles surrounded by a fibrous sheath and a concentric ring of mitochondria. The centrioles are anchored in a depression at the base of the sperm nucleus and sustain the axoneme that appears at the end of the midpiece. The axoneme extends through the central part of the flagellum and gives rise to the typical 9 + 2 pattern of microtubules associated with the sperm tail. These morphological data are similar to that of the Jamaican anole and other tropical and temperate lizard species and suggest that seasonality and germ cell development strategy have little impact on the highly conserved steps of spermiogenesis within Sauria.

Board 115 EVIDENCE OF CONTINUOUS SPERMATOGENSIS WITHIN THE TESTIS OF THE JAMAICAN ANOLE, ANOLIS LINEATOPUS. Jeremy C.

Toffle. s06.jtoffle@wittenberg.edu, Kevin M. Gribbins, kgribbins@wittenberg.edu, Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501-0720.

Male reproductive activity in reptiles is typically seasonal. Most temperate species are highly asynchronous and only produce sperm during the warmer months of the year. Similar information suggests that many tropical species in both low and high elevation habitats practice seasonal sperm development in response to different amounts of rainfall. A recent study on the equatorial lizard, *Sceloporus bicanthalis*, provides evidence for continuous spermatogenesis with no seasonality. Similar results have been found for species within the genus *Barisia* in Costa Rica. The purpose for this study is to investigate sperm development within the tropical anole, *Anolis lineatopus*, and compare its germ cell development and seasonality to that of other tropical reptiles. Anoles were collected monthly in Jamaica from October 2004 to October 2005 (N=48; 4 per month). Three mm pieces of testis were fixed with 0.2% glutaraldehyde, dehydrated with ethanol, embedded in Spurr's plastic, sectioned (2µm) with an ultramicrotome, and stained with toluidine blue and basic fuchsin. Histological observations indicate that Jamaican anoles exhibit spermatogenesis and spermiogenesis throughout the year. Spermatogonia, spermatocytes, and spermatids at various stages of development were observed within the seminiferous epithelium of every month sampled. Mature spermatozoa were also found in the lumina of seminiferous tubules in every month anoles were collected. Continuous spermatogenesis suggests that males always have sperm present. The importance of these data in relation to female oogenesis is not known. Little reproductive and life history information exists for male and female Jamaican anoles.

Board 117 AN ULTRASTRUCTURAL STUDY OF SPERMIOGENESIS WITHIN THE TESTIS OF THE JAMAICAN ANOLE, ANOLIS LINEATOPUS. Jessica J. Schultz S07.jschultz@wittenberg.edu, Kevin M. Gribbins kgribbins@wittenberg.edu, Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501-0720.

In the present study, the steps of spermiogenesis are described for the Jamaican anole. The data collected from this ultrastructural study will help clarify details found at the light microscope level, which provided the first description of a primitive germ cell development strategy within an amniotic testis. Standard transmission electron microscopic techniques were performed on testicular tissue collected from Jamaican anoles sampled during each month of 2004 (n=48; 4 samples/month). Two proacrosomal granules produced from a juxtapositioned Golgi complex develop into the mature acrosome during early spermiogenesis. Nuclear condensation of DNA during elongation follows the pattern described for other amniotes. The fine filamentous chromatin is gradually replaced with coarser dense granules that seem to arise from smaller dispersed nucleosomes within the nucleoplasm. The basal nuclear surface forms a fossa where it joins the proximal centriole of the tail. This region of the spermatozoa represents the midpiece and houses many mitochondria, which form a concentric ring around the centrally located flagellum. The proximal centriole is arranged perpendicular to the elongating distal centriole, which makes up the longest part of the flagellum (<30µm). This study provides specific data on the subcellular changes occurring to spermatids as they progress through spermiogenesis that parallels changes observed in germ cells at the light microscopic level. These data are also similar to the findings of other reptilian and avian species and support previously reported phylogenetic relationships that imply the close kinship shared by reptiles and birds using morphological characters of both spermiogenesis and mature sperm.

Board 119 THE EFFECT OF β-GLUCAN ON IMMUNE FUNCTION IN CATS. Savannah S. Spring, sspring@notes.udayton.edu, Robert J. Kearns, kearns@udayton.edu, University of Dayton, 107 Evanston Ave, Dayton OH 45409.

β-glucan is a glucose polymer typically found in yeast, fungi, bacteria and mushrooms. Previous studies have demonstrated that the intravenous administration of β-glucan increased the bactericidal activity of macrophages and neutrophils commensurate with stimulating humoral and cellular immunity. A paucity of information is available regarding the efficacy of orally administered β-glucan. The focus of this study was to determine whether orally administered β-glucan (500 ppm) enhanced immune function in cats. Control (n=14) and test (n=14) cats were initially placed on a controlled basal diet prior to the initiation of the study. Blood and fecal samples were obtained at day 0, 30 and 60 days post dietary supplementation with β-glucan. Data were analyzed using a one-way ANOVA. Animals fed β-glucan exhibited no significant

difference in NK cell activity (expressed as % cytotoxicity) when compared with control animals (Day 0: control 12.7 ± 1.3 ; test 9.8 ± 1.7 , $p > 0.05$; Day 60: control 21.02 ± 3.3 , test 22.11 ± 3.3 , $p > 0.05$). Similarly, there was no effect of β -glucan on fecal IgA (Day 0: control 38.9 ± 8.4 $\mu\text{g/g}$, test 47.3 ± 18.9 $\mu\text{g/g}$, $p > 0.05$, Day 60: control 30.1 ± 3.8 $\mu\text{g/g}$, test 42.8 ± 11.0 $\mu\text{g/g}$, $p > 0.05$); IgG (Day 0: control 0.34 ± 0.1 $\mu\text{g/g}$, test 0.38 ± 0.01 $\mu\text{g/g}$, $p > 0.05$, Day 60: control 0.39 ± 0.13 $\mu\text{g/g}$, test 0.33 ± 0.14 $\mu\text{g/g}$, $p > 0.05$) or cortisol levels (Day 0: control 2.98 ± 0.5 $\mu\text{g/g}$, test 3.39 ± 0.65 $\mu\text{g/g}$, $p > 0.05$, Day 60: control 2.98 ± 0.46 $\mu\text{g/g}$, test 3.34 ± 0.45 $\mu\text{g/g}$, $p > 0.05$). Results from this study indicate that the oral administration of β -glucan in cats had no significant effect on NK cell activity, immunoglobulin or cortisol levels when compared with cats maintained on a basal diet.

Poster Session B 10:00 – 11:00 AM

Board 02 MOLECULAR CHARACTERIZATION OF CHIRONOMID SPECIES AND THEIR USE AS BIO-INDICATORS. Monita Sharma, monita.sharma@wright.edu, Chad Ferguson, chad.ferguson@wright.edu, Dan E. Krane, dan.krane@wright.edu, 235A, Biological Sciences, 3640 Col Glenn Hwy, Wright State University, Dayton OH 45435.

Members of the family Chironomidae represent one of the most widely distributed and abundant insects in freshwater. Of all major aquatic invertebrate groups, midges of the family Chironomidae display the greatest range of pollution tolerances, in terms of both levels and types of pollution. While chironomids are excellent biological indicators of aquatic ecosystem integrity over various temporal and spatial scales and environmental gradients, their identification to species level – where they are the most informative – is limited by subtle morphological differences between species. Molecular, DNA-based techniques such as the Polymerase Chain Reaction (PCR) and ribosomal DNA (rDNA) sequencing have the potential to overcome these problems and expand the utility of chironomids in bioassessment. The conserved flanking sequences of the Intergenic Spacer Regions (IRS) regions, specifically the 18S and 28S subunits, facilitate amplification of these regions through PCR. Analysis of IRS-1 and IRS-2 of chironomid rDNA provide sequence data that suggests high amounts of variation between species of this group while intraspecific variation is low, confirming that this method is useful for discriminating species of the Chironomidae. Using the above molecular markers and methods, we have obtained sequence data for the following species: *Thienemanniella xena*, *Hayesomyia senata*, and *Tribelos fuscicornis*. Finally, molecular characterization of the Chironomidae allows important phylogenetic analyses and may provide insights into patterns of pollution tolerance in evolutionary relationships.

Board 04 A COMPARISON OF MAXIMUM LIKELIHOOD AND MAXIMUM PARSIMONY METHODS OF PHYLOGENETIC INFERENCE UNDER CONDITIONS OF SUBSTITUTION RATE HETEROGENEITY. Sudhindra R. Gadagkar, gadagkar@notes.udayton.edu, Dept of Biology, University of Dayton, 300 College Park Ave., Dayton OH 45469-2320.

Phylogenetic reconstruction using molecular sequences is typically undertaken under the assumption of homotachy (similar substitution rates across all the lineages for a given site in an alignment). However, it is being increasingly demonstrated that this assumption may not always hold in empirical sequence alignments, thus resulting in "heterotachy" among the sequences. Sequence alignments are likely to exhibit heterotachy with varying degrees of severity because the intensity of purifying selection and adaptive forces at a given amino acid or DNA sequence position is unlikely to be the same in different species. Several recent studies have examined various effects of heterotachy in sequence alignments. One such study investigated the influence of heterotachy on the performance of different phylogenetic methods using computer simulation, and reported that the Maximum Parsimony (MP) method generally outperformed the Maximum Likelihood (ML) method under these conditions. However, their findings are contradicted when these two methods are compared under the entire range of heterotachous sites. For example, it is seen that MP has a lower BL_{50} (the minimum internal branch length at which 50% of the simulation replicates accurately reconstruct the phylogeny) than ML only when the proportion of heterotachous sites is in the range of 32% - 68%; ML is distinctly superior everywhere else. Again, when the entire range of possible heterotachous sites is considered,

the proportion of trees inferred correctly by ML is 50% higher than that inferred correctly by MP. Therefore, in general, ML is superior to MP even under conditions of heterotachy in an alignment.

Board 06 GINGIVITIS AND INTEGRIN-BETA-2: A SINGLE NUCLEOTIDE POLYMORPHISM ASSOCIATION STUDY. Kacy D. Walton, KacyWalton16@gmail.com, Benjamin K. Metz, BenMetz@hotmail.com, (Simon K. Lawrence, slawrance@otterbein.edu), Dept of Life & Earth Sciences, Otterbein College, Westerville OH 43081.

Current research supports the hypothesis that gingivitis is caused not only by a lack of dental hygiene but also by genetic factors. The goal of this research is to test the hypothesis by assessing the relationship between single nucleotide polymorphisms (SNPs) in the integrin beta-2 gene and gingivitis. Previous research findings about integrin beta-2 and gingivitis in adult subjects have led us to hypothesize that the polymorphisms in the integrin beta-2 gene are significant genetic determinants in gingivitis. The recently published "HapMap" of single nucleotide polymorphisms (SNPs), including those in the integrin beta-2 gene, affords the opportunity for a case-control study designed to test the relationship between integrin beta-2 SNPs and gingivitis. A study population will be recruited from students at Otterbein College, Westerville, Ohio. Severity of gingivitis will be assessed for each subject using a standardized scoring system. DNA will be obtained from each subject using collection swabs and extraction solution from the Epicentre Buccal Amp kit. Polymerase chain reaction (PCR) reactions will be used to amplify the integrin beta-2 gene. PCR products will then be analyzed by single base extension to identify integrin beta-2 SNPs using the Applied Biosystems SNaP kit. The results of both types of subjects, positive or negative for gingivitis will then be compared to determine whether there is a link between the SNPs and gingivitis in the candidate gene integrin beta-2. It is anticipated that the results of this study will make a valuable contribution to our understanding of the role of genetics in periodontal disease.

Board 08 DIFFERENTIAL GENE EXPRESSION IN PROSTATE TUMOR CELL POPULATIONS. Katie E. Brown (kbrown10@kent.edu), Jennifer L. Reese (jreese5@kent.edu), Kylie M. Graham, Gail C. Fraizer (gfraizer@kent.edu), Dept of Biological Sciences, Kent State University, Kent OH.

A better understanding of cell-cell communication between prostate epithelial and stromal cells is central to treating prostate cancer and may lead to novel therapeutic approaches. Microarray studies have provided an unbiased view of those transcripts differentially expressed in tumor cells compared to normal. However, these studies are difficult to interpret since both tumor and normal samples actually contain a mixture of cells (and therefore, the cellular source of the transcripts cannot be identified). This study analyzes differences in gene expression between cell types within the euplastic prostate. Our hypothesis is that potential pathways of cell-cell communication between tumor epithelial cells and adjacent stromal cells can be identified by differences in gene expression patterns. This is important because if stromal cell gene products alter the microenvironment of the adjacent tumor epithelial cells, they would affect growth of the prostate tumor in the patient. The gene expression patterns of tumor epithelial cells were compared to those of interstitial stromal cells. Approximately 1000 to 2000 epithelial and stromal cells were obtained by laser capture microscopy of frozen tumor tissue sections from three different patients with prostate cancer. Fourteen different RNA preparations were purified and their quality and quantity were assessed by Agilent Bioanalyzer. Nine different RNA samples were amplified and labeled for hybridization to Affymetrix U133V2 oligonucleotide arrays. The signal strength of seven scanned arrays was normalized and genes whose expression was 2-fold or greater in epithelial than in stromal cells (and vice versa) were identified. 50 genes were up-regulated 23-fold or greater in epithelial cells and 59 genes were up-regulated >23-fold in stromal cells. The genes expressed in the tumor epithelial cells included both prostate specific genes like PSA/Kallikrein 3 (upregulated 119-fold) and epithelial marker genes like ketatin 18 (up 50-fold). Similarly stromal marker genes like vinculin (up-regulated 24-fold) and desmin (up 38-fold) were expressed in the cells collected from adjacent stromal tissue. Gene ontology analyses revealed that genes upregulated in stromal cells fell into eight functional categories. Within the cell proliferation category were growth factor genes up-regulated in stromal cells, including: basic fibroblast growth factor (FGFb) and Insulin-like growth factor 1 (IGF-1). Since their cognate receptor genes (FGFR-2 and IGF-1) were up-regulated in epithelial cells, this suggested a potential mechanism of cell-cell communication. That is, if these transcripts were translated, then stromal cells could have provided

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