

FIELD TRIPS

Sunday, April 30, 1995

PLANT SCIENCES FIELD TRIP: AN OLD-GROWTH FOREST COMMUNITY IN NORTHEASTERN OHIO

8:30 AM, Sunday, April 30, 1995

Arranged by: ALLISON W. CUSICK, Chief Botanist, Division of Natural Areas and Preserves, The Ohio Department of Natural Resources

Transportation will be in private vehicles leaving from Roush Hall at Otterbein College at 8:30 AM; return by 4:00 PM. Travel time is approximately three hours round trip from Westerville. Lunch is on your own. Carpooling is encouraged since parking is limited at the destination. Maps will be provided. Mature forest communities are rarities in any part of the State of Ohio. We will visit a remarkable old-growth oak forest on the Wisconsin till plain of northeastern Ohio in Wayne County. The understory and herbaceous layers are classic in composition and not altered by browsing or the invasion of nonindigenous species. The large block of woodland also provides refuge for neotropical migrant birds in the midst of agricultural land. This forest is a recent addition to the state system of nature preserves. No collecting will be permitted. *Attendance is limited to the first 30 registered participants.*

GEOLOGY FIELD TRIP: AN UPPER DEVONIAN-LOWER MISSISSIPPIAN SEQUENCE IN CENTRAL OHIO, WITH EMPHASIS ON THE BEDFORD AND BEREA FORMATIONS

8:00 AM, Sunday, April 30, 1995

Arranged by: LAWRENCE A. KRISSEK and KENNETH P. COATS, The Ohio State University

Transportation will be in private vehicles leaving from Roush Hall at Otterbein College at 8:00 AM to visit sites in Franklin and Delaware Counties. Lunch is on your own following the field trip.

The Devonian and Lower Mississippian stratigraphic sequence exposed in central and east-central Ohio consists of the Columbus Limestone, the Delaware Limestone, the Olentangy Shale, the Ohio Shale, the Bedford Shale, the Berea Sandstone, and the Sunbury Shale. On this field trip we will examine portions of the above units at three localities: Camp Lazarus, Galena, and Rocky Fork. The Camp Lazarus locality contains exposures of the uppermost Columbus Limestone (low river level permitting), Delaware Limestone, Olentangy Shale, and lower Ohio Shale. The Galena locality contains exposures of the Ohio Shale-Bedford Shale contact and the lower Bedford Shale. The Rocky Fork locality contains exposures of the "Red Bedford", upper Bedford Shale, Berea Sandstone, and Sunbury Shale. During the Late Devonian and Early Mississippian, Ohio was located at approximately 10-15 degrees south latitude, and was covered by the shallow epeiric seas of the Appalachian Basin. The composite section we will observe on this trip represents a major transgressive-regressive sequence deposited in the western part of the basin, and is capped by the subsequent transgressive deposit of the Sunbury Shale. To register for the trip check the space on the registration form and pay the field trip fee which includes a guidebook. *Attendance is limited to the first 30 registered participants.* For further information please contact SCOTT BROCKMAN, Ohio Division of Geological Survey, phone 614/265-7054.

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ANIMAL SCIENCE - ECOLOGY

1:30 PM SATURDAY, APRIL 29, 1995

ROUSH HALL 114

JOHN F. WING - PRESIDING

1:30. FOOD HABITS OF TURKEY VULTURES IN WEST CENTRAL OHIO. NEIL B. SABINE, DEPARTMENT OF NATURAL SCIENCES AND MATHEMATICS, INDIANA UNIVERSITY EAST, RICHMOND IN 47374.

Between 13 July and 20 November 1994 I made weekly collections of regurgitated pellets beneath a Turkey Vulture (*Cathartes aura*) roost near Braffettville, Ohio. A sample of 490 pellets was randomly selected from 1421 collected. Mammalian remains were most common (94%) and indicated the use of mostly small wild carrion. Ten species of mammals were identified with Raccoon (*Procyon lotor*) and Opossum (*Didelphis marsupialis*) being the two most common species (36% and 17%, respectively). Domestic sources, including unknown bird remains (6%), were found in only 8% of the castings. No difference in prey selection was noted between summer and fall.

1:45. NEST SITE SELECTION OF A SMALL POPULATION OF THE PROTHONOTARY WARBLER IN THE CUYAHOGA RIVER, GEAUGA COUNTY, OHIO. KELLY A. STANEK AND E. BRUCE McLEAN, DEPT. OF BIOLOGY, JOHN CARROLL UNIVERSITY, UNIVERSITY HEIGHTS OH 44118.

The Prothonotary warbler (*Protonotaria citrea*) is usually associated with the wooded swamps of the Southeastern United States. With wooded swamp lands scarce in Ohio, small populations of nesting pairs exist in scattered locations throughout Ohio. The Cuyahoga River in Geauga County is one such location. This section of the Cuyahoga River is characterized by two distinct habitats. One has been channelized and provides shade from silver maples (*Acer saccharinum*), and one has remained undisturbed and lined with button bush (*Cephalanthus occidentalis*), which provides no shade. Nest boxes were constructed from polyethylene jars and placed in the river to determine nest site selection in shaded and sunny sections of the river. A significantly larger number of nesting attempts was observed in shaded areas compared to unshaded areas.

2:00. EFFECTS OF INTRASPECIFIC NEST PARASITISM ON ABANDONMENT BY WOOD DUCKS NESTING IN BOXES. COURTENAY N. WILLIS, DAVID W. WALLER, & LOWELL P. ORR, DEPT. OF BIOLOGICAL SCIENCES, KENT STATE UNIVERSITY, KENT OH 44242.

The effects of intraspecific nest parasitism on abandonment by Wood Ducks (*Aix sponsa*) nesting in boxes were investigated to determine how the rate of parasitism and timing of parasitism in the nest season influence host decisions to incubate or abandon nests. Nest boxes were monitored at Mosquito Creek Waterfowl Management Area, characterized by high nest box density, and at Ravenna Arsenal, characterized by low nest box density, in northeastern Ohio, from March through July, 1994. The higher frequency of abandonment at Mosquito (44%) compared with Ravenna (23%) was correlated with greater nest parasitism at Mosquito (89%) than at Ravenna (63%). Hosts parasitized during first nesting attempts were more likely to abandon nests (77% at Mosquito vs. 28% at Ravenna) than hosts parasitized during second nesting attempts (8% at Mosquito vs. 0% at Ravenna). The higher frequency of re-nesting at Mosquito (53%) compared with Ravenna (50%) was correlated with the greater frequency of first nest abandonment's at Mosquito (77%) than at Ravenna (28%). These results suggest that intraspecific nest parasitism may increase the likelihood of abandonment by Wood Ducks nesting in boxes.

2:15. OBSERVATIONS ON THE SPAWNING BEHAVIOR OF THE RIVER RED HORSE (*MOXOSTOMA CARINATUM*) IN BIG DARBY CREEK, OHIO, 1994. HOWARD ALBAN AND ROGER THOMA, 5233 BIGGERT RD., GROVE CITY OH 43123.

During the spring of 1994 we conducted a survey of sucker (*Catostomidae*) spawning activity in Big Darby Creek, Franklin County, Ohio in an effort to chronicle the sequence and duration of spawning for all suckers found in the system. Numerous observations of river redborse spawning were made and revealed a contradiction between our observations and the published literature. Hackney, Tatum, and Spencer 1968 reported that in the Cahaba River system of Alabama, river redborse display pre-spawning nest building activity by males prior to the arrival of females on the spawning riffles. In Big Darby Creek no pre-spawning nest construction was observed. Male river redborse first arrived on spawning riffles April 24 and began competing for

position. Successful spawning first occurred on May 12 at temperatures of 16°C. Spawning occurred at depths of approximately 95 cm and in currents of approximately 2.5 ft/sec. Similar to many red horse species, fighting between males was common. Spawning groups consisted of one female flanked by two males. Thirteen spawning acts lasted an average of 6.1 seconds. Males remained in the riffle while females congregated in a staging area in the pool just upstream of the spawning riffle. The entrance of a female into the spawning area frequently generated frantic fighting amongst the nearby males. Further details will be presented and illustrated with visual aids.

2:30. PALEOLIMNOLOGICAL ANALYSIS OF FISH PREDATION IN TOOLIK LAKE, ALASKA. REBECCA L. EVANS AND MICHAEL C. MILLER, UNIVERSITY OF CINCINNATI, DEPARTMENT OF BIOLOGICAL SCIENCES ML 006, CINCINNATI OH 45221-0006.

Fish predation on Chironomidae (*Crustacea: Diptera*) larvae in Alaskan Lakes results in distinct changes in chironomid tribe, subfamily and genus composition depending on the dominant predator within the lake. A 1.65 meter sediment core of Toolik Lake, Alaska was collected in July 1993 and sampled every 5.0 cm. Chironomid head capsules were counted, mounted on slides and identified to genus. The number of individuals and taxonomic identifications were used to reconstruct the composition of recent chironomid communities in Toolik Lake. Geochemical and paleobotanical data from previous studies of Toolik Lake were compared to changes in chironomid community structure to determine what changes in chironomid communities correlate with variations in productivity and chemistry. This information was then used to determine the onset and changes in intensity of fish predation over time based on changes in chironomid communities that could not be explained by other factors. Data show that fish predation began around 7,000 years b.p. as is evidenced by changes in the proportion of large Chironomidae head capsules to small head capsules.

2:45. POPULATION STRUCTURE AND HYBRIDIZATION IN FISH: LAKE VICTORIA TILAPLA STUDIED WITH RANDOMLY AMPLIFIED POLYMORPHIC DNA (RAPD) MARKERS. WILSON MWANJA¹, MARK CHANDLER¹, LES KAUFMAN¹, AND PAUL A. FURST¹, DEPTS. OF MOLECULAR GENETICS¹ AND ZOOLOGY², THE OHIO STATE UNIVERSITY, COLUMBUS OH 43210, NEW ENGLAND AQUARIUM³, BOSTON MA 02110 AND DEPT. OF BIOLOGY⁴, BOSTON UNIVERSITY, BOSTON MA 02215.

The cichlid fauna of the Lake Victoria basin in Africa has suffered significant species loss after the introduction of an exotic predator, the Nile Perch, *Lates niloticus*, and an ecologically labile exotic cichlid competitor, the Nile tilapia, *Oreochromis niloticus*. Among the species severely affected was the Ngege, *O. esculentus*, one of two endemic L. Victoria tilapias. Ngege were extirpated from L. Victoria, and survive only as remnant populations in several small satellite lakes. We have used molecular methods, including RAPD markers, to examine population structure of remaining populations of Ngege. Populations of Ngege from Lakes Nabugabo, Manywa, Kachira, Mburo, and Kanyoboli, and congeners from these lakes and from Lakes Victoria, Albert and George, were studied. Genetic differences in RAPD patterns between individuals within populations are small, but population differentiation is manifest. Hybridization between *O. esculentus* and sympatric congeners, including *O. niloticus* and *O. leucostictus*, is estimated. Ls. Kanyoboli and Manywa appear to maintain populations of *O. esculentus* with little introgression from other species. Ngege from along western Lake Victoria, and from L. Kyoga on the north show genetic evidence of hybridization with Nile tilapia. For tilapia, RAPDs are a useful tool to identify population and species differences, even if other tools suggest little population differentiation. (Support: NSF & Pew Mem.)

3:00. COMPARISON OF RAPDs AND mt-DNA WITH ALLOZYMES IN THE STUDY OF THE ENDANGERED WESTERN BANDED KILLFISH. DUSTIN B. SEARS AND PAUL A. FURST, DEPARTMENT OF MOLECULAR GENETICS, THE OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Genetic variability and population differentiation were studied in the western banded killifish, *Fundulus diaphanus menona*. Since 1920, the species has decreased in abundance throughout the midwest. Populations in Ohio have been extirpated. Among natural populations, only that at Miller's Blue Hole in Sandusky County is known to survive. Ohio considers it a state endangered species. The Ohio Dept. of Nat. Res. has an active restoration project for the species. Managed breeding was done at the Columbus Zoo, and derived populations are established at the ODNR Xenia Fish Hatchery; and in isolated ponds near Sandusky. Previously, we investigated allozyme genetic variability in populations from around the Great Lakes, to determine divergence between the MBH Ohio population and populations of *F. diaphanus menona* across its geographic range. We detected very little allelic variation in any populations, and high genetic similarity between populations. Here, we extend this study, analyzing variation in the same populations for nuclear DNA gene markers assayed using Randomly Amplified Polymorphic DNA (RAPD) mark-

ers, and for maternally inherited mt-DNA sequences. RAPDs show higher levels of within population variation than were revealed by allozymes. However, levels of intrapopulation heterozygosity are still low. Comparison of RAPDs, mtDNA and allozymes reveal similar patterns of population differentiation. It is hoped that such studies are useful to wildlife managers in defining the utility of populations from throughout the species range as genetic source stock for restoration of this endangered species. (Supported by ODNR-Div. Wildlife).

3:15. USING TRICHOPTERAN POPULATIONS TO CLASSIFY OHIO WETLANDS. R.J. GARONO¹ & J.G. KOOSER², ¹TILLAMOOK BAY NATIONAL ESTUARY PROJECT, PO Box 493, GARIBALDI OR 97118. ²RETTEW ASSOCIATES, INC., 5010 RITTER RD., SUITE 102, MECHANICSBURG PA 17055.

Earlier studies indicated it was possible to classify wetlands based on their Trichopteran populations. These earlier studies were based on single trapping events at each wetland studied; collections made over several years at individual marshes were more similar to each other, than were collections made at different sites. In order to further evaluate the use of trichopterans as a management/monitoring tool, to see if these trends hold, and to test the variability in trap returns, we used light traps to sample nine Ohio wetlands over a 10-day period during August, 1994. Sample sites included emergent, shrubby and forested wetlands in Northeast Ohio and along the south shore of Lake Erie. Paired light traps were operated from dusk to dawn at each site for three nights during the study period. A total of 54 collections were made over the 10-day period. We compared variability of Trichopteran collections on different days within a site, and 3-day collection totals between sites. Canonical Correlation Analysis showed distinct clusters composed of Lake Erie coastal wetlands, inland wetlands with large open water components, sphagnum-dominated wetlands, and shrub-dominated wetlands. Trichopteran populations were compared between constructed and natural wetlands. This work was supported by the Ohio Biological Survey.

3:30. SIZE VS. FREQUENCY OF CAPTURE OF ADULT ANISOPTERA IN OHIO. AMY L. WOODDELL AND DAVID G. MCSHAFFREY, BIOLOGY DEPARTMENT, MARIETTA COLLEGE, MARIETTA OH 45750.

This study analyzed the relationship of the size of adult Anisoptera to the frequency of their capture. It is believed that larger Anisoptera are more difficult to capture, therefore data from the Ohio Odonata Survey may not be an accurate representation of Ohio's Anisoptera population. Preliminary studies conducted in Washington County, Ohio, using eight species of Anisoptera support this hypothesis. These same evaluative methods are currently being applied to all Anisopteran species in the complete Ohio Odonata Survey database (including 1994 records of over 10,900 Anisoptera) to determine the validity of the statewide study as a tool for assessing species rarity.

3:45. REGIONAL CYCLING OF FURBEARING MAMMALS IN THE PACIFIC NORTHWEST AS PROBABLY CENTERED IN THE COLUMBIA RIVER BASIN. JOHN WING, WITTENBERG UNIVERSITY, PO Box 720, SPRINGFIELD OH 45502.

Wing (1995) has reported near synchronous cycling of furbearers in the state of Washington. Here evidence is provided of weaker, more variable cycling in Idaho, Oregon, and California, as well. For a given species the U. S. states differ in phase lag by 1-3 yrs. Strongest cycling appears to center on the Columbia River Basin, and cycling may be partly driven by salmonid and other Pacific drainage basin spawners. Data presented show the Bonneville Dam salmon count correlates significantly with fur returns of muskrat ($r=.42$, $p<.02$), mink ($r=.41$, $p<.05$) and otter ($r=.48$, $p<.01$), and both it and a Columbia River canned Salmon count show 10-12 yr. and 20-24 yr. cycles ($p<.05$). Spawning extends widely throughout the Columbia basin and must play a directly significant role in riverine species. However, since some non-riverine species exhibit cycles as well, many other causes must also be present.

4:00. SYNCHRONOUS CYCLES IN THE FURBEARER RECORDS FOR THE STATE OF WASHINGTON. JOHN F. WING, WITTENBERG UNIVERSITY, PO Box 720, SPRINGFIELD OH 45501.

Correlational and contingency periodogram analyses were performed on annual fur records for ten species in Washington state as reported in Novak et al (1978). Raw records showed mostly positive zero-lag correlation's amongst primary and secondary consumers (nutria, muskrat, badger, raccoon), but the skunk gave mostly negative correlation's partly due to declining trend. Correlation of these records with predators (mink, red fox, otter, bobcat, lynx) also gave mostly positive and significant ($p<.05$) results either in the same or following year. Species showed visual evidence of cycling in near unison. Records of sufficient length (raccoon, skunk, red fox, and bobcat) showed significant ($p<.05$) approximate 10-yr. and 20-yr. cycles when subjected to periodogram analysis. Analysis of detrended records confirmed that most

species' records were still significantly intercorrelated because of synchronous fluctuations, especially those related to approximate 10-yr. and 20-yr. cycles. Phase lag analysis showed that predators tracked prey with 0-2 year lags.

4:15. PATHOLOGY OF ASPIDOGASTER CONCHICOLA (TREMATODA: ASPIDOGASTREA) IN NATURALLY AND EXPERIMENTALLY INFECTED CIPANGOPALUDINA CHINENSIS SNAILS. MARTIN K. HUEHNER, BIOLOGY DEPT., HIRAM COLLEGE, HIRAM OH 44234.

Every *Cipangopaludina chinensis* snail examined from the Upper Cuyahoga River in NE Ohio was found to contain from 1 to 12 *Aspidogaster conchicola* trematodes in the duct lumina of the hepatopancreas. Tissue sections stained with Hematoxylin and Eosin demonstrated that pathology associated with natural infections included erosion of duct columnar epithelia, hemocytic infiltration, fibrosis, and tissue compression. Tissue reactions to large worms produced encapsulation - like swellings that were visible on the exterior of the hepatopancreas with the unaided eye. Experimental infections of *C. chinensis* showed epithelial erosion at 30 days and hemocytic infiltration after 60 days. After 150 days duct dilation and extensive fibrosis occurred as worms grew and continued feeding. A single instance of encapsulation was observed when a young worm penetrated the hepatopancreatic duct and invaded the surrounding hemal space. Results of experimental super infections indicate that the presence of adult worms in snails will impede new juveniles from establishing in the hepatopancreas.

4:30. POPULATION DYNAMICS OF SPOTTED TURTLES (CLEMMYS GUTTATA) IN WEST-CENTRAL OHIO. TIMOTHY L. LEWIS, BIOLOGY DEPT., WITTENBERG UNIVERSITY, SPRINGFIELD OH 45501.

Spotted turtles (*Clemmys guttata*) have been studied at Prairie Road Fen in west-central Ohio for 14 years. Each turtle located is given a unique notching pattern on its carapace, weighed, sexed, aged, and released at the point of capture. A sample of the population ($n=35$) is fitted with radio transmitters to examine migration and daily movements. We have located and uniquely marked 118 turtles, approximately half in the last 5 years. The population has remained stationary at approximately 45 turtles. During 8 of 12 years for which sufficient sample sizes existed ($n \geq 10$), females constituted over half of the population, with males and prereproductive constituting the other half. In 1993 females constituted just 40% of the population. Reproduction has been low, with 0 of 5 nests studied producing live offspring. Raccoon (*Procyon lotor*) predation seems to be the principle cause of nest failure. No immigration from other populations nor successful dispersal has been recorded in 3 years of telemetry study. Numerical structural, and distributional data indicate an isolated population smaller than necessary for long-term viability but showing no immediate tendency to increase nor decrease.

4:45. INTERACTIONS BETWEEN ZEBRA MUSSELS AND FRESHWATER SPONGES IN LAKE ERIE AND THE ST. LAWRENCE RIVER. FRED SNYDER, DAVID KELCH AND ANTHONY RICCIARDI, OHIO SEA GRANT EXTENSION, CAMP PERRY BLDG. 3, PORT CLINTON OH 43452.

A preliminary study was initiated in 1994 in Lake Erie and the St. Lawrence River to examine (1) spatial interactions between *Dreissena* spp. and freshwater sponges (*Eunapius fragilis*), (2) a possible preference by sponges for vertical vs. horizontal substrates, (3) the effects of water depth on sponge development, and (4) mortality of mussels overgrown by sponges. At two Lake Erie locations sponges were counted and photographed for area measurements. Samples of overgrown mussels were compared to adjacent samples of uncovered mussels to estimate mortality rates both in Lake Erie and the St. Lawrence River. Sponges were most abundant on vertical surfaces. On surfaces having patchy mussel distribution, sponges occurred adjacent to mussels but not overgrowing them. On vertical surfaces entirely covered with *Dreissena* all sponges occurred as overgrowth on mussels. *Dreissenid* clusters overgrown by sponges for one or more months contained a greater proportion of dead mussels than adjacent uncovered populations and mussels that survived overgrowth had significantly lower dry tissue weight/shell length ratios than uncovered mussels.

ANIMAL SCIENCE - SYSTEMATICS
9:00 AM SATURDAY, APRIL 29, 1995
ROUSH HALL 429
PAUL M. DANIEL - PRESIDING

9:00. USE OF RANDOMLY AMPLIFIED POLYMORPHIC DNA (RAPD) TO STUDY POPULATION DIFFERENTIATION IN THE AFRICAN CICHLID FISH *ASTATOREOCHROMIS ALLUAUDI*. MELISSA BLACK¹, GREGORY BOOTON¹, MARK CHANDLER², LES KAUFMAN³, AND PAUL A. FUERST¹, DEPTS. OF MOLECULAR GENETICS¹, THE OHIO STATE UNIVERSITY, COLUMBUS OH 43210, NEW ENGLAND AQUARIUM², BOSTON MA 02110, AND DEPT. OF BIOLOGY³, BOSTON UNIVERSITY, BOSTON MA 02215.

The fishes of the Lake Victoria basin in Africa have suffered significant species extirpation following the introduction of an exotic predator, the Nile Perch, *Lates niloticus*, and an ecologically labile exotic cichlid, the Nile tilapia, *Oreochromis niloticus*. The cichlid, *Astatoreochromis alluaudi*, is a form closely related to the cichlid species flock which evolved in Lake Victoria. *A. alluaudi* remains widespread, both in L. Victoria and in surrounding rivers and lakes. Phylogenetically, this species is closely related to the Lake Victoria species haplochromine cichlids. The population structure of *A. alluaudi* was studied using RAPD markers revealed using PCR on a series of primers. Samples were obtained from several natural populations in the Lake Victoria basin, including Lakes Kachira, Kyoga, and Victoria. Genetic variability (gene heterozygosity) was determined from the proportion of shared RAPD loci bands between individuals. Variability within populations was low. Differentiation between populations of *A. alluaudi* appears to be less than in three sympatric species of tilapia. Comparison of RAPD banding patterns of *A. alluaudi* with species of haplochromine cichlids from Lake Victoria supports the hypothesis that *A. alluaudi* is part of a sister clade to the Lake Victoria cichlids, but has not undergone the explosive speciation characteristic of the Lake Victoria forms. (Support: NSF & Pew Mem. Trust)

9:15 POPULATION GENETICS OF THE RUFFE EVASION IN THE GREAT LAKES: A DNA COMPARISON WITH EUROPEAN POPULATIONS. MARK D. CHANDLER AND CAROL A. STEPIEN, DEPT. OF BIOLOGY, CASE WESTERN RESERVE UNIVERSITY, CLEVELAND OH 44106.

Intraspecific sequence variation of mtDNA of the ruffe percid fish (*Gymnnocephalus cernuus*), from St. Louis River/Lake Superior and Russian samples are analyzed and compared. The hyper-variable control (D-loop) region of approximately 1200 bp was amplified using PCR and Sanger dideoxy sequenced. Results show that the St. Louis River/Lake Superior population has a relatively low level of genetic variation that suggests a small initial colonization size, i.e., "founder effect". Comparisons with the Russian population show that they are genetically distinct and differ by "fixed" sequence substitutions. This suggests that the sampled Russian population is probably not very closely related to the founding population. Additional European sites are being analyzed to determine the source of the colonizing population. This work will enable us to determine whether future colonization sites in other Great Lake regions are due to range expansion of the existing St. Louis/Lake Superior population or due to new invasions.

9:30 EVOLUTIONARY RELATIONSHIPS OF BLENNIOID FISHES: AN ANALYSIS OF MITOCHONDRIAL DNA SEQUENCES. KRISTEN L. CHASE AND CAROL A. STEPIEN, DEPT. OF BIOLOGY, CASE WESTERN RESERVE UNIVERSITY, CLEVELAND OH 44106.

The families Clinidae and Labrisomidae of the Blennioidei suborder of perciform teleost fishes, which are common fishes in temperate and tropical nearshore marine habitats, are analyzed using mitochondrial (mt)DNA sequencing. The Clinidae are found primarily in warm temperate waters and contain both egg-laying and live-bearing tribes, which are geographically separated. The Labrisomidae are found in warm temperate and tropical waters of the New World and primarily egg-laying. The objective of this study is to test the monophyly of these two blennioid families and the relationships among them and their component tribes and genera. The 12s mtDNA region is isolated, amplified, and sequenced. Aligned sequences are then analyzed using Phylogenetic Analysis Using Parsimony (PAUP) by comparing substitutions, insertions and deletions at given positions to test the proposed hypotheses. The trees obtained from the PAUP analysis indicate that the Clinidae and Labrisomidae are one large monophyletic clade and may best be referred to as one superfamily. The monophyly of the Clinidae is supported by the trees, but the monophyly of the Labrisomidae is disproven by its division into three groupings. The egg-laying clinid *Clinitrachus argentatus* is ancestral to the live-bearers *Heteroclinus Wilsoni* and *H. scotti*. The trees also indicate that the South American clinid *Myxodes viridis* may have given rise to the North American species *Heterostichus rostratus*, *Gibbonsia metzi*, and *G. elegans*.

9:45 GENETIC POPULATION STRUCTURE OF LAKE ERIE WALLEYE: EVIDENCE FROM SEQUENCING MITOCHONDRIAL DNA. JOSEPH E. FABER AND CAROL A. STEPIEN, DEPT. OF BIOLOGY, CASE WESTERN RESERVE UNIVERSITY, CLEVELAND OH 44106.

Identifying distinct walleye populations in Lake Erie has not been possible until recently due to lack of variation in morphological and allozyme data. Tagging studies of Lake Erie walleye have suggested homing to natal tributary rivers and potential for stock structuring within the lake. With the advent of new molecular methods, analysis of restriction fragment length polymorphisms (RFLPs) of mitochondrial (mt)DNA provide support for separate breeding stocks between the Maumee and Sandusky Rivers. We have found DNA evidence for genetic population structure in spawning populations of walleye among several tributary rivers, discerned from PCR amplification and sequencing of the highly variable mtDNA control region. DNA sequencing has revealed a greater number of useful characters, including variable base substitutions, different numbers of a repeated 11bp sequence and a greater number of DNA haplotypes than was discerned with RFLP analysis. Analysis of our preliminary data suggests genetic divergence of walleye among the Maumee, Sandusky and Grand rivers, and Dunkirk Bay, New York. Corroboration of genetic divergence among tributaries supports the hypothesis that separate breeding populations of walleye will home to tributaries of Lake Erie. Future study of genetic population structure of walleye in Lake Erie by our laboratory will have important implications for management of this species.

10:00 GENETIC VARIATION IN THREE SPECIES OF STREAM DWELLING FISHES. MICHAEL R. HEITHAUS AND ROGER H. LAUSHMAN, BIOLOGY DEPT., OBERLIN COLLEGE, OBERLIN OH 44074.

We studied allozyme variation in three fish species commonly found in Ohio rivers and streams. The stoneroller minnow (*Camptostoma anomalum*), rainbow darter (*Etheostoma caeruleum*), and eastern greenside darter (*E. blennioides*) are all found in riffle habitats, however, they represent a continuum from a generalist (stoneroller) to a specialist (rainbow darter). A pilot study of stoneroller and rainbow darter populations in the Vermilion River revealed twenty four loci using starch gel electrophoresis. The study found higher levels of variation in stonerollers. For this study, four populations of each species were sampled on the Kokosing, Vermilion, Huron, Black, and Rocky rivers. Previous studies indicate that these rivers represent a gradient of water quality from the Black (heavily polluted) to the Kokosing (relatively unpolluted). This pattern has been supported by preliminary observations of species diversity and abundance during collections. Results will be presented on the overall levels of genetic variation within and among populations of each species. Also, the influence of river quality and degree of ecological specialization on genetic variation will be discussed.

10:15 MOLECULAR EVOLUTION OF STURGEONS (ACIPENSERIFORMES) DETERMINED FROM SEQUENCES OF THE NUCLEAR 18S rRNA GENE. JEANETTE KRIEGER, GREGORY C. BOOTON, TED CAVENDER¹ AND PAUL FUERST, DEPTS. OF MOLECULAR GENETICS AND ZOOLOGY¹, OHIO STATE UNIVERSITY, COLUMBUS OH 43210

Sturgeons are members of the Order Acipenseriformes, one of the non-teleostean groups which constitute the actinopterygian fish. They are an old order, identifiable from the Jurassic. To better understand the evolution of this group, molecular methods were used to compare sturgeons and other fish. The sequence of the 18s rRNA gene was determined from *Acipenser fulvescens*, the lake sturgeon, and is being determined for the paddlefish (*Polyodon spathula*) and the shovelnose sturgeon (*Scaphirhynchus platorhynchus*), and from a *Polypterus* sp., a member of a sister actinopterygian order of the Acipenseriformes. The rRNA gene sequence is amplified with the Polymerase Chain Reaction (PCR) using universal 18S rRNA primers developed in our laboratory. Sequences will be compared with those from several species of teleost fish, of chondrichthys, and from the coelocanth, *Latimeria chalumnae*. The tree is rooted using a sequence from the lamprey *Lampetra aepyptera*. In a preliminary phylogenetic analysis of the 18S rRNA sequence, *A. fulvescens* appears as a sister clade of the teleosts, after the branching of *Latimeria*. The sequence of *A. fulvescens* is very distinct from other taxa. The accumulation of an unusual number of changes in the 18s rRNA of *A. fulvescens*, relative to other fish, suggests that this gene may be evolving at an accelerated rate within the Acipenseriformes lineage. This will be tested with the other sturgeon sequences. Application of a molecular clock from the 18s rRNA gene to estimate the divergence time between sturgeons and other fish should be viewed with great caution. (Support by Ohio Sea Grant/NOAA).

10:30 FRESHWATER AND LAND MOLLUSCS IN THE HEFNER ZOOLOGY MUSEUM OF MIAMI UNIVERSITY. PAUL M. DANIEL, AND KELLY A. TINKER, DEPARTMENT OF ZOOLOGY, MIAMI UNIVERSITY, OXFORD OH 45056.

The Hefner Museum has been a part of the Department of Zoology at Miami University since the creation of the department in 1904. Molluscs have long been an important holding of the museum and recent attempts have been made to collect and observe in localities to compare present day fauna with material from older collections. The notable collection of George Twitchell

M.D. from Cincinnati was studied and catalogued by Norman Mattox in the 1930's. Mattox also added specimens from Ohio and Illinois to the museum's holdings. R. J. Long and R. A. Hefner added specimens from the headwaters of the Scioto River in Hardin County in 1948. S. R. Williams added material from Put-in-Bay and other localities over a forty year period in the first half of the 20th century. Paul Daniel and Robert Hayes visited locations in the Licking River (Kentucky) watershed to collect freshwater clams during the 1970's. Recent visits have been made to some of these same localities. The collections serve as references in distribution studies of freshwater and land mollusca in the midwest during the 20th century.

10:45 DEVELOPMENT OF MICRO SATELLITE MARKERS IN THE AFRICAN CICHLID FISH *ASTATOREOCHROMIS ALLUAUDI* AND THEIR USE IN POPULATION GENETIC STUDIES. LIZHAO WU¹, MARK CHANDLER², LES KAUFMAN³, AND PAUL A. FUERST¹, DEPTS. MOLECULAR GENETICS¹, THE OHIO STATE UNIVERSITY COLUMBUS OH 43210, NEW ENGLAND AQUARIUM², BOSTON MA 02110, AND DEPT. OF BIOLOGY³, BOSTON UNIVERSITY, BOSTON MA 02215.

Microsatellites consist of short tandemly repeated DNA with repeat units not more than 6 bp, such as (GT)_n or (AAC)_n. They are highly abundant and randomly distributed in all vertebrate genomes. For example, in humans there are about 50,000 to 100,000 (CA)_n repeats, with n between 15 to 30. As highly polymorphic genetic markers, they have been successfully applied to a variety of population genetic problems. We have constructed an *A. alluaudi* subgenomic DNA library. About 9,000 clones with insert size 300-500 bp were screened with (GT)₁₂ and (CT)₁₂ probes. Over 100 positive clones were isolated, and 24 were sequenced; all of the 24 except one have short repeat motifs, with the range of repeat number being between 9 and 47.5. To evaluate the utility of the markers for population genetic studies in cichlid species, we designed a set of PCR primers flanking the repeat region of clone LW9 and screened *A. alluaudi* populations from the Lake Victoria basin. Preliminary data indicate that i) this marker is highly polymorphic; and ii) one of three initial populations (Lake Kachira) is highly homogeneous, whereas the other populations (Lakes Kyoga and Victoria) are highly heterogeneous. Further, this set of primers produces homologous PCR products from *A. straeleni*, an *A. alluaudi* congener, suggesting that microsatellite markers developed in *A. alluaudi* might be useful for studying other closely related cichlids, such as the haplochromine cichlids and the tilapias. (Support: NSF & Pew Mem. Trust).

within this classification is the mentally disabled who diagnostically meet the DSM IV criteria of major mental illness. Inclusion within this group would be individuals with psychosis, major depression, schizophrenia, etc. A case presentation involving a thirty seven-year-old paranoid schizophrenic establishes the application and relevancy of the Act to this protected group. The lack of relevant technical assistance by EEOC creates a climate where case law will determine applicability of the statute in lieu of federal interpretative rule making.

9:30. THE COURTS AND RACIAL FAIRNESS: A TEST IN NORTHWEST OHIO. LARRY K. HARDESTY, BLUFFTON COLLEGE, BLUFFTON OH 45817.

Criminal justice is not possible without commitment to larger ideals. There are many threats to justice, but never more present than when prejudice distorts the capacity to operate fairly and equally. Like wiser social scientific analysis is not possible without commitment to larger ideals, and, there are many methodological and political threats to this process. Research may be contradicted because some studies are methodologically sound, while others are not. It may also be expedient to promote a specific agenda, thus, certain investigations may be editorially ignored or the findings distorted. Various summary statements on racial bias in sentencing have resulted in the perpetuation of unproductive units of analysis. Generally, a hypotheses of ubiquitous and overt racial discrimination has been conveyed as widely supported. Furthermore, misguided and misrepresented results, while appropriate to certain social or political interests, have obfuscated the relative significance of racial discrimination in the criminal justice system. With proper focus on the offender's type or category of crime, and other legally permissible variables, we propose that the sentence received is not dependent on racial characteristics, but on the character of the offense. This study attempted to explore a number of important variables in the operation of the felony courts in a "medium intake county" in northwest Ohio. The data utilized throughout this study refer to cases handled by the court during the calendar year 1992. A profile of felony offenders was compiled by examining those cases which enabled the authors to quantify the factors that illustrated patterns in sentencing.

9:45. SEXUAL ABUSE AS A PREDICTOR OF SUBSTANCE ABUSE. THOMAS KOEBERNICK AND ELIZABETH MCPARTLAND, DEPARTMENT OF SOCIOLOGY, WRIGHT STATE UNIVERSITY, DAYTON OH 45435.

Sexual abuse not only is widespread, but clinical observations indicate the likelihood that abuse victims will turn to alcohol and drugs as ways of coping with their pain and anger. Interviews with 180 respondents drawn from a metropolitan university and an adult offender minimum security unit in the same community revealed a statistically significant relationship ($r=.30$; $p=.001$) between age of first sexual abuse and age of initial use and abuse of drugs and alcohol. Although the incarcerated group experienced significantly greater levels of sexual and substance abuse, the causal linkage was similar for both groups. Sexual abuse first occurs most often during prepubescence. The younger the abused, the more likely that coercion was a factor. Once individuals are sexually active, they become significantly at risk for other potentially harmful "adult" activities such as alcohol and drugs. Persons sexually abused are also more likely to use these substances as coping mechanisms. A public policy implication of the data is that greater emphasis should be given to effective interventions with sexually abused children as a strategy for controlling substance abuse and other criminalized behaviors.

10:00. ELDER ABUSE: COMMON CHARACTERISTICS. SUZANNE MYERS AND ROBERT GANDEE, GERONTOLOGY PROGRAM, SLIPPERY ROCK UNIVERSITY, SLIPPERY ROCK PA 16057.

The purpose of this descriptive, pilot study was to identify common characteristics among forty-four, protective service agency documented cases of elder abuse. These data were compiled from agency caseworker intake reports for age and gender of the victim, type of abuse (physical and emotional), environmental/situational factors, and nature of abuse. From the statistical analysis of these data, the following emerged: females are most frequently abused, and a number of abuse characteristics and environmental/situational factors contribute to elder abuse. These data have implication for educators in training professionals to work with abused older adults, governmental and agency policy makers and administrators, agency caseworkers, and care givers involved in the development and implementation of elder abuse prevention and intervention strategies, and techniques for individuals at risk.

10:15. IMPACT OF GERONTOLOGICAL EDUCATION ON KNOWLEDGE OF AND ATTITUDES TOWARDS THE ELDERLY AMONG NURSING AND NON-NURSING COLLEGE STUDENTS. LINDA BENSON, CLARION UNIVERSITY-VENANGO CAMPUS, OIL CITY PA 16301 AND ROBERT GANDEE, SLIPPERY ROCK UNIVERSITY, SLIPPERY ROCK PA 16057.

APPLIED SOCIAL SCIENCE: IMPROVING THE HUMAN CONDITION 9:00 AM SATURDAY, APRIL 29, 1995 ROUSH HALL 214 ALINDE MOORE - PRESIDING

9:00. ANALYSIS OF THE AMERICANS WITH DISABILITIES ACT OF 1990 IN ITS APPLICATION TO THE MENTALLY ILL AS DEFINED BY THE DSM IV. ROBERT M. CIKRAJI, ASHLAND UNIVERSITY, 401 COLLEGE AVE., ASHLAND OH 44805.

The Americans with Disabilities Act of 1990, effective July 26, 1992, prohibits employers, state and local governments, employment agencies and labor unions from discriminating against individuals with physical and mental disabilities. A statistical analysis of individuals covered by the Act clearly establishes that the largest protected class pursuant to the Act is the mentally ill, with evidence to indicate that upwards of forty million Americans meet the diagnostic criteria established for inclusion within this group. Technical assistance in the area of interpretive rules and filings pursuant to mental disability provisions reflect a trend indicating a misunderstanding of the legislative intent of the law, and an inability of government to provide concise interpretive technical assistance in matters related to individuals diagnosed pursuant to the major mental disorder provisions of the DSM IV.

9:15. MAJOR MENTAL ILLNESS AND THE AMERICANS WITH DISABILITIES ACT: A CASE STUDY ESTABLISHING THE RELEVANCY AND APPLICABILITY OF THE STATUTE. ROBERT M. CIKRAJI, ASHLAND UNIVERSITY, 401 COLLEGE AVENUE, ASHLAND OH 44805.

Enacted in 1990, the Americans with Disabilities Act became effective July 26, 1992. The law prohibits discrimination by employers, state and local governments, employment agencies and labor unions against physically and mentally disabled Americans. The largest protected group pursuant to the Act is the mentally disabled. The federal literature indicates the least understood

Using the *Facts on Aging Quiz* (Palmore, 1988), the purpose of this study was to examine the knowledge level of and attitudes toward the elderly among 220 nursing (NS) and non-nursing (NN) students enrolled in a rural, state university. Using the Chi Square statistical procedure, knowledge level of and attitudes toward the elderly were significantly higher among the NS when compared to the NN. While not demonstrated in NN, an inverse relationship was found between knowledge and negative attitudes towards the elderly in NS. The results of this study have implications for the value of clinical/field experiences, interaction with, and the study of the elderly. In view of our graying society, these data provide administrators and curriculum planners with a benchmark of the importance of gerontological education in nursing programs of study, as well as the general and liberal studies programs found in institutions of higher education across the country.

10:30. HUMAN HEALTH AND THE PET CONNECTION: HEALTH BEHAVIORS AS A POSSIBLE MECHANISM. KELLY A. RADA, DEBBY D. MILLER, MARYJO CARNOT, AND SARA STAATS, OHIO STATE UNIVERSITY AT NEWARK, FOUNDERS HALL, 1179 UNIVERSITY DRIVE, NEWARK OH 43055.

What are the effects of pet ownership on the health and emotional well-being of the human owner? The research results have been mixed. Whereas some researchers have found a positive correlation between pet ownership and owner health, other researchers have been unable to identify a significant relationship. If pet ownership does indeed contribute to improved health for the pet owner, mechanisms for this link need to be identified. In this study, we have proposed a direct behavioral link between pet oriented health behavior and owner's health oriented behavior. One hundred and twenty three subjects completed questionnaires assessing various attitudes towards humans and pets. Our primary hypothesis that human health care behaviors and pet health care behaviors would be related was supported ($r = .29$, $p < .01$). Other correlations indicated the influences of mood and also gender. However, the directional influences of the pet health care and human health care relationship demands further investigation.

10:45. DEVELOPMENT OF A SCALE TO MEASURE COMMITMENT TO PETS. DEBBY MILLER, MARY JO CARNOT, KELLY RADA, JENNIFER TURNES, MELISSA BOYD, AND SARA STAATS, 2044 FOUNDERS HALL, THE OHIO STATE UNIVERSITY AT NEWARK, 1179 UNIVERSITY DRIVE, NEWARK OH 43055.

Many pets are abandoned or given to Humane societies. Lack of owner commitment to the pet contributes to this situation. The ability to predict owner commitment prior to pet placement has practical as well as theoretical applications. The present research presents the Miller Pet Commitment Scale as a useful screening and research tool. A typical item is "If a young pet required extensive veterinary care, I would get rid of it". Preliminary testing of the Scale on 106 college students yielded a high reliability (Cronbach's $\alpha = .903$). Validity of the Scale is indicated in that individuals who were more committed to their pets tended to view their pets more positively, and to have greater emotional attachments to their pets than those individuals with low pet commitment. Highly committed pet owners also viewed their pets as contributing more to their quality of life. This Scale may help explicate previous conflicting results in pet attachment studies and will be of use in pet placement.

AQUATIC BIOLOGY - MICROBIOLOGY

9:00 AM SATURDAY, APRIL 29, 1995

ROUSH HALL 116

ROBERT T. HEATH - PRESIDING

9:00. DIVERSITY IN SANDUSKY BAY AND LAKE ERIE PELAGIC COMMUNITIES. ROCHELLE STURTEVANT, S.-J. HWANG, M. SORRICK, AND R.T. HEATH, DEPT. OF BIOLOGICAL SCIENCES AND WATER RESOURCES RESEARCH INSTITUTE, KENT STATE UNIVERSITY, KENT OH 44242.

Knowing the diversity of an entire community is of interest to ecologists for scientific and management purposes. Often, phytoplankton diversity is reported as an index of the overall diversity of a lake community, with the implicit assumption that diversity of the entire community is related to the phytoplankton diversity. We tested this assumption by separately and jointly evaluating the diversity of four constituent assemblages of the pelagic community (phytoplankton, protozoa, microzooplankton, and macrozooplankton) at monthly intervals over the summers of 1993 and 1994 at four stations along a transect from eutrophic Sandusky Bay to the mesotrophic central basin of Lake Erie. A modified Shannon index was used, taking micromoles carbon in each

taxon (rather than number of individuals) as the base unit of the index. By using the proportion of carbon we avoided many of the problems associated with comparing organisms over wide ranges in individual and population sizes. We found that phytoplankton diversity varied temporally and spatially more than the other groups. Indices that depend only on phytoplankton numbers may incorrectly imply alterations in community structure not represented in other parts of the community. This study was supported by Ohio Sea Grant.

9:15. RELATIONSHIP BETWEEN MICROZOOPLANKTON GRAZERS AND PRODUCTION OF DISSOLVED ORGANIC PHOSPHORUS COMPOUNDS. HELEN PATTERSON, R. STURTEVANT, AND R.T. HEATH, DEPT. OF BIOLOGICAL SCIENCES, KENT STATE UNIVERSITY, KENT OH 44242.

Dissolved organic phosphorus can be of nutritional significance to the phytoplankton community in phosphorus limited systems, but its autochthonous origin is not well known. Zooplankton grazing on phytoplankton and bacteria has been implicated in production of DOP; the purpose of this study was to test this idea. Since bacteria take up a significant proportion of phosphate and bacterial phosphorus can represent a significant pool at the base of the food web, grazing of bacteria by rotifers and heterotrophic nanoflagellates could be a significant source of DOP. We approached this question by comparing the release of DOP in serial size-fractionations of the planktonic community along a spatial gradient of phosphorus limitation. In addition we correlated DOP release with the density of heterotrophic nanoflagellates present within each size fraction. We found that removal of organisms larger than 1 μm decreased DOP production. The highest release was correlated with the presence of organisms in the 30-200 μm size fraction which contains the microzooplankton assemblage (i.e. rotifers and ciliates). This study was supported by Ohio Sea Grant.

9:30. MICROBIAL DECOMPOSITION OF CATTAIL LITTER IN A NORTHWEST OHIO WETLAND. COLIN R. JACKSON AND R. L. SINSABAUGH, DEPT. OF BIOLOGY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

Estimates of microbial decomposition rates in aquatic systems have been difficult to obtain. In order to evaluate the potential of microbial enzyme activities as indicators of breakdown rates, the litterbag technique was used to monitor the decomposition of cattail litter at two sites in a Lake Erie coastal wetland. Mass loss rates were dependent upon particle size with the fastest breakdown occurring for coarser particles. The activities of six microbial enzymes involved in the degradation of lignocellulose were monitored over the course of the study. Mass loss rates were related to patterns of hydrolytic enzyme activity for all sizes of particles used in the study. The activities of phenol oxidase and peroxidase were found to be reliable indicators of breakdown rates only for particles < 0.063 mm. Sediment cores were taken from the two sites concurrently with the litter bag study and assayed for the same group of extracellular enzymes. Estimates of unconfined litter breakdown rates were obtained from the relationships obtained in the litterbag study. The method provides a means for the estimation of microbial decomposition rates in situ.

9:45. STOCKING ALEWIFE: POTENTIAL IMPACT ON ZOOPLANKTON AND PLANKTIVOROUS FISH COMMUNITIES IN AN OLIGOTROPHIC LAKE. LIN WU, DEPARTMENT OF BIOLOGY, MOUNT UNION COLLEGE, 1792 CLARK AVENUE, ALLIANCE OH 44601.

Prey manipulation has been historically used to increase predator populations (i.e. sport-fishing production) in fisheries management. Many of these manipulations have positively influenced target species. However, complex interactions between introduced species and native species can produce responses that are unexpected. To determine how effective stocking landlocked alewife (*Alosa pseudoharengus*) would be in Newfound Lake, an oligotrophic lake in New Hampshire, we conducted field and laboratory studies to examine (1) whether Newfound Lake could provide suitable habitats for alewives and (2) how alewives interacted with native zooplankton and its potential competitors, yellow perch (*Perca flavens*) and rainbow smelt (*Osmerus mordax*). Our field results showed that Newfound Lake, a deep and well-oxygenated lake, would provide suitable habitats for both alewife yearlings and adults. Laboratory feeding experiments using zooplankton collected from Newfound Lake suggested that young-of-year alewives selected *Daphnia* and *Bosmina*. This diet preference by alewives could cause a further decline of already low cladoceran populations in Newfound Lake. High diet overlap among alewife, yellow perch, and rainbow smelt can have negative effects on these planktivorous populations.

10:00. ZOOPLANKTON COMMUNITY GRAZING ON ALGAE AND BACTERIA IN LAKE ERIE AND SANDUSKY BAY. SOON-JIN HWANG AND ROBERT T. HEATH, DEPT. OF BIOL. SCI. AND WATER RESOURCES RESEARCH INST., KENT STATE UNIV., KENT OH 44242-0001.

The purpose of this study was to evaluate the relative importance of algae and bacteria as energy sources for zooplankton (cladocerans, copepods, rotifers, nauplii). Grazing of labeled *Chlamydomonas reinhardtii* and *Escherichia coli* (or native bacteria) was done in offshore Lake Erie (LE) and Sandusky Bay (SB) from May through August in 1993 and 1994. Both algal and bacterial C-flux to zooplankton was significantly higher in SB than in LE. Algal C-flux ranged 0.07 - 4.83 $\mu\text{gCL}^{-1}\text{hr}^{-1}$ and 0.02 - 0.93 $\mu\text{gCL}^{-1}\text{hr}^{-1}$ for both years in SB and LE, respectively. Bacterial C-flux ranged 0.41-5.97 $\mu\text{gCL}^{-1}\text{hr}^{-1}$ and 0.01-1.21 $\mu\text{gCL}^{-1}\text{hr}^{-1}$ in SB and LE, respectively. A greater amount of algal and bacterial carbon was transported to microzooplankton (rotifers and nauplii) than to macrozooplankton (cladocerans and copepods) in both habitats. High bacterial C-fluxes to macrozooplankton were observed only when cladocerans dominated the zooplankton community. Average bacterial C-flux was similar to algal C-flux in both regions each year. These results indicate that bacteria are an important carbon source for zooplankton in Lake Erie and Sandusky Bay. This study was supported by Ohio Sea Grant.

10:15. COMPARATIVE HOME RANGES OF THREE TROPICAL SNAIL SPECIES. D.W. HAUSWIRTH, T. L. LEWIS, AND J. T. PENTECOST, DEPT. OF BIOLOGY, WITTENBERG UNIVERSITY, PO BOX 720, SPRINGFIELD OH 45501.

Three species of tropical snails, *Nerita peleronta*, *Nerita versicolor*, and *Tectarius muricatus* inhabit similar zones on the rocky shores of San Salvador, the Bahamas, and apparently occupy similar niches in the ecosystem. To determine how the snails differed ecologically they were tracked for 10 days to determine their daily movements. A Cartesian coordinate system was constructed on a vertical cliff face terminating at the water's edge. A total of 77 snails was tracked, 32 *T. muricatus*, 34 *N. versicolor*, and 11 *N. peleronta*. The home ranges of the snails were analyzed with DC80 home range analysis software. Home range size differed significantly ($P < .0001$) between species. The minimum perimeter polygon area for *T. muricatus* was 0.4839 m^2 , the 95% error ellipse was 1.3378 m^2 . For *N. versicolor* the values were 1.8988 m^2 and 5.7048 m^2 , for *N. peleronta* the values were 4.6989 m^2 and 11.418 m^2 , respectively. The vertical distribution of the three species of snails also differed significantly ($P < .0001$): the *T. muricatus* averaged 42 cm higher on the rocky face than the *N. peleronta* which were 14 cm above the *N. versicolor*. These differences support the conclusion that each species occupies an ecologically different niche in the cliff ecosystem and that competition is thus minimized between the species.

10:30. EFFECT OF ZEBRA MUSSELS (*DREISSENA POLYMORPHA*) ON ALGAL-BACTERIAL COUPLING. ROBERT T. HEATH AND S.-J. HWANG, DEPT. BIOLOGICAL SCIENCES AND WATER RESOURCES RES. INST. KENT STATE UNIVERSITY, KENT OH 44242.

Our previous studies have shown that phosphate uptake by bacteria was greatly slowed in the presence of zebra mussels although bacteria were slightly grazed, if at all. Here we report evidence that this results from the effects of zebra mussels on algal-bacterial coupling. Zebra mussels (15 freshly collected, 1.0 - 1.5 cm long) were placed in bottles containing 4L freshly collected unfiltered water from a mesotrophic site in Saginaw Bay. Control bottles containing water but without mussels were run in tandem, incubated at ambient temperature and light conditions up to 48 hours. Rate of uptake of ^3H -thymidine into nucleic acids decreased by 60-70 percent. The phytoplankton community was dominated by chlorophytes and diatoms grazed to numbers only 20% that of the control bottles. Filtered water from control bottles partially restored bacterial activity in bottles containing zebra mussels. Other experiments showed that the effects of zebra mussels on bacterial activities could be mimicked by incubation of the assemblage in the dark, and that this inhibition of phosphate uptake and bacterial production in the dark could be partially restored by addition of amino acids. These findings suggest that bacterioplankton depend on a constant release of labile DOC from phytoplankton that is rapidly lost as algal cells are grazed. This study was supported by National Sea Grant College Program.

10:45. USE OF MOLECULAR BIOLOGY TECHNIQUES TO INVESTIGATE PROTEIN STRUCTURE. MARGARET A GOODMAN, BIOLOGY DEPT., WITTENBERG UNIVERSITY, SPRINGFIELD OH 45504-0720.

Random mutagenesis of a specific beta turn in the enzyme Staphylococcal nuclease has been performed to investigate the relationship between the amino acid sequence of the turn region (primary structure) and the local structure of the protein (secondary structure). The turn selected is located on the outside of the protein to minimize interactions with other parts of the protein (tertiary interactions) and therefore isolate the secondary structure interactions. Mutagenesis and subsequent probing of the stability of the resultant enzymes yields information on the compatibility between the particular amino acid sequence and the required turn structure. This information can be used to

evaluate the relative contributions of the turn-forming propensity of the individual amino acids involved and the restrictions placed on the amino acid strand by the forces stabilizing the protein's tertiary structure. Such studies are currently being used to study all elements of secondary structure: alpha helices, beta sheets and beta turns. The results of these experiments will help to elucidate the protein-folding process and the complex interactions stabilizing proteins.

BIOLOGY: GENETICS - PHYSIOLOGY 9:00 AM SATURDAY, APRIL 29, 1995 ROUSH HALL 331 KIM RENEE FINER - PRESIDING

9:00. DNA SEQUENCE ANALYSIS OF THE *LYS1* GENE OF THE FISSION YEAST *SCHIZOSACCHAROMYCES POMBE*. RICHARD A. FORD AND J.K. BHATTACHARJEE, 4890 BATTERY LANE #105, BETHESDA MD 20814.

The α -amino acid pathway For the biosynthesis of lysine is unique to fungi. Molecular properties of the cloned *lys1+* gene required for the synthesis of α -amino acid reductase (AAR) was investigated in the fission yeast *Schizosaccharomyces pombe*. The complete *lys1+* gene has been subcloned within a 5.2kb EcoRI-HindIII DNA insert of the pLYS1 H plasmid. The promoter region (5'-end) of the gene and the *lys1-1131* mutant complementing function have been located within 1.778kb HindIII-EcoRI DNA of the pLYS1H. This 1.778kb DNA fragment was sequenced from the p-Bluescript plasmid pLYS1D using the dideoxy chain termination method. Analysis of the sequence revealed polII promoter elements (TATA, CCAAT, poly(dA-dT)), and the yeast GCN4 consensus sequence span over 368bp upstream of a continuous open reading frame (ORF) of 1410bp. The ORF included 470 amino acids initiated with methionine residue. The DNA sequence exhibited 56.6% identity with the isofunctional *LYS2* gene of *Saccharomyces cerevisiae* and the encoded polypeptide showed 49% identity with the *LYS2* encoded AAR. There were two highly conserved (more than 90% identity) amino acid sequences within the ORF and the codon use frequency for both genes was very high. These results indicated a significant sequence divergence of this gene between *S. pombe* and *S. cerevisiae*.

9:15. INTRON MEDIATED ENHANCEMENT OF GENE EXPRESSION IN BLUEGRASS (*POA PRATENSIS*). KIM R. FINER, DEPT. OF BIOLOGICAL SCIENCES, KENT STATE UNIVERSITY/STARK CAMPUS, 6000 FRANK AVE. CANTON OH 44720.

The use of introns to enhance foreign gene expression has been demonstrated in both animal and plant cells. In this study, we evaluated the effects of 7 different introns on transient gene expression in embryonic cells of bluegrass. The introns were isolated from the translated or untranslated regions of monocot and dicot genes and were inserted between the CaMV 35S promoter and the uidA gene (coding for β -glucuronidase, GUS) for transient expression studies. The following introns were evaluated: adh1-S intron from maize, bz-W22 intron from maize, sh1 intron from maize, act1 intron from rice, ubi1 intron from maize, chsA intron from petunia and wxy intron from maize. The various intron-containing constructions were introduced into rapidly growing embryonic cells via particle bombardment. Transient gene expression was evaluated both enzymatically and histochemically. pUbi-GUS, a construct containing the ubi1 intron, produced a 25 fold increase in enzymatic GUS activity. Five of the introns examined enhanced expression ranging from a slight increase (adh) to a 2.5 fold increase (act) in enzymatic activity. The wxy intron of maize did not enhance expression. These results demonstrate a direct dependence on six of the introns for chimeric gene expression in bluegrass.

9:30. AMPLIFICATION AND CLONING OF BELUGA CD4. DENISE K. GRUBER, TRACY A. ROMANO, AND SIMON K. LAWRENCE, DEPT. OF LIFE AND EARTH SCIENCES, OTTERBEIN COLLEGE, WESTERVILLE OH 43081-2006.

To broaden our understanding of cetaceans we are focusing on developing reagents for the study of the cetacean immune system. DNA and antibody probes will be useful in monitoring the health of cetaceans and in the comparative study between species including humans. For example, CD4 probes will enable the quantitation of CD4⁺ cells in cetaceans to be used for these purposes. To isolate a DNA probe of beluga CD4, beluga DNA (*Delphinapterus leucas* LDL 94-2) from liver tissue was obtained during a sanctioned Inuit hunt at Point Lay, Alaska in July, 1994. This DNA along with oligonucleotide primers corresponding to regions of the CD4 gene conserved between humans and mice were amplified by the PCR. The products were

identified using gel electrophoresis. The observed beluga bands occurring at 510, 210, and under 100 base pairs are now being cloned into M13 for further study.

9:45. IDENTIFYING THE ORIGIN OF HAIR SAMPLES: NON-INVASIVE SAMPLING METHODS COUPLED WITH ANALYSIS OF MITOCHONDRIAL GENE SEQUENCES BY PCR. JAMIE AUSTIN¹, F.E. POIRIER² AND PAUL A. FUERST^{1,2}, DEPTS. OF MOLECULAR GENETICS¹ AND ANTHROPOLOGY², THE OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Hair samples are a valuable source of potential genetic information in forensic and natural resources management investigations. For the population biologist, hairs represent an ideal source of genetic material, since it can be sampled non-invasively for population and behavioral studies of mammalian species. Methods of DNA extraction, and the use of the Polymerase Chain Reaction (PCR) to amplify small DNA samples extracted from hair roots and hair shafts will be illustrated. The genes for the cytochrome b (cyt-b) locus, the 12S ribosomal RNA and control region of the mitochondrial genome are being studied using DNA extracted from hair samples by several different techniques. The sequences obtained from unknown or unidentified samples can be identified by comparisons with a database of mammalian mt-DNA sequences. Comparison of human sequences with the database allows the potential population origin of a sample to be identified. As part of the development of micro-techniques for working with single hairs, the mt-DNA sequences of a sample of humans, gibbons, chimpanzee, several species of bears and goats are being determined. In addition, a series of unknown samples have been obtained to investigate the utility of these methods in the forensic application of DNA techniques.

10:00. GENETIC DIVERGENCE OF ZEBRA AND QUAGGA MUSSELS IN THE NORTH AMERICAN GREAT LAKES FROM EUROPEAN POPULATIONS: A MITOCHONDRIAL DNA SEQUENCING APPROACH. ALLYSON N. HUBERS, LIDIA M. FUTEY, AND CAROL A. STEPIEN, DEPT. OF BIOLOGY, CASE WESTERN RESERVE UNIVERSITY, CLEVELAND OH 44106.

Mitochondrial (mt) DNA sequences of the zebra mussel *Dreissena polymorpha* and the quagga mussel *D. bugensis* from invasive populations in the North American Great Lakes are compared with each other and with European populations. Comparisons of invasive populations with putative parental populations may be useful for (1) determining origin(s) of the colonizing population, (2) estimating how many separate invasions have occurred, and (3) analyzing whether the invading populations exhibit a "founder effect". In contrast to RFLP and allozyme studies, the DNA sequencing approach of the present study yields a markedly greater number of variable characters among populations for genetic analysis and a direct measure of genetic variation (DNA sequences) rather than an indirect estimate of variation based on the products of DNA sequences. mtDNA evolves at a rate five to ten times that of most nuclear DNA regions and is thus particularly useful for analyzing genetic relationships among populations and closely related species. Appropriate levels of sequence substitutions to address these problems were found in the ND4 and cytochrome B genes of the mussels. Analysis of DNA substitutions in these regions confirm species-levels separation between the zebra and quagga mussels. The North American zebra mussel is genetically diverse, suggesting that it was founded by relatively large numbers of divergent individuals.

10:15. AERODYNAMICS OF FOUR DIFFERENT SHAPES OF FLIGHT FEATHERS FROM THE ROCK DOVE (*COLUMBA LIVIA*). STEVEN A. EDINGER, DEPT. OF BIOL. SCI., OHIO UNIVERSITY, ATHENS OH 45701.

The lift and drag generated by four different shapes of flight feathers (straight rachis, equal vane areas; straight rachis, unequal vane areas; curved rachis, equal vane areas; and curved rachis, unequal vane areas) was measured in a wind tunnel at different pitch and sweep angles. Feathers with curved rachises and unequal vane areas (leading edge primaries) displayed the best aerodynamic characteristics, while those with straight rachises and equal vane areas (central tail feathers) displayed the poorest. Flow visualization using pieces of thread attached to the feathers ("tattle tails") showed the straight rachis, equal vane area feathers produced the most turbulence from the top side of the feather, while the curved rachis, unequal area feathers produced the least. Producing a turbulent wake from the top side of an airfoil increases pressure drag and decrease lift production. Four wing tip models (one for each feather shape) using five feathers also found the curved rachis, unequal vane area feathers had the best aerodynamic characteristics. These results show curved rachises and unequal vanes areas are at least favorable and perhaps required for gliding flight. This suggest these traits may have evolved for gliding flight, primly preadapting an ancestral avian gliding wing for powered flight.

10:30. METABOLIC EFFECTS OF DECREASING TEMPERATURE IN GREEK TORTOISES (*TESTUDO GRAECA*). STEPHEN BEATY AND JERRY STINNER, DEPT. OF BIOLOGY, UNIVERSITY OF AKRON, AKRON OH 44325-3908.

Lowering body temperature in reptiles and amphibians typically produces marked transient reductions in the respiratory exchange ratio (R) with corresponding accumulations of CO₂ in the animals. These findings suggest that there may be gradual adjustments in ventilation following a change in temperature, which may serve to achieve the changes in CO₂ stores. To test this hypothesis, we measured ventilation and metabolism in six Greek tortoises (*Testudo Graeca*) cooled from 30 to 10°C. The tortoises were held at 10°C for 10 days. Within about 5 hours of cooling, R fell to 0.2-0.3 and gradually returned to control values over 160 hours. The drop in R was the result of a reduction in CO₂ elimination rather than a change in O₂ consumption. Consistent with our hypothesis, the minute ventilation/O₂ ratio was low soon after cooling and increased as R returned to precooling levels. We conclude that Greek tortoise ventilatory adjustments to a 20°C drop in temperature are not sudden, but take at least 7 days to occur.

10:45. RELATIONSHIPS OF THE RARE DEEP SEA SHARK MEGAMOUTH TO OTHER SHARKS: DNA EVIDENCE. KIMBERLY BOYES AND CAROL STEPIEN, DEPT. OF BIOLOGY, CASE WESTERN RESERVE UNIVERSITY, CLEVELAND OH 44106.

Discovered in 1976 off of the coast of the Hawaiian island Oahu by the United States Navy, the first known megamouth shark (*Megachasma pelagios*) is preserved at the Bernice P. Bishop Museum in Honolulu. Other megamouth specimens were found in the eastern north Pacific Ocean (1984, preserved in Los Angeles, California), eastern Indian Ocean (1988, preserved in Perth, Australia), western north Pacific Ocean (two in 1989, one dead and lost and the other was released alive off of Shizuoka, Japan). Of these specimens, the only fresh tissue sample was taken from the 1990 megamouth under the direction of Dr. R. Lavenburg and we have sequenced mtDNA from it. Hypotheses based on morphological data propose that megamouth (1) belongs to the order Lamniformes, (2) is most closely related to basking and whale sharks, (3) is most closely related to the family Lamnidae, and (4) is sister to all other lamnoids. Cytochrome b mtDNA was amplified using PCR and sequenced using standard Sanger di-deoxy reactions. In the present study, aligned sequence data were analyzed with Phylogenetic Analysis Using Parsimony (PAUP). Data suggest that megamouth is ancestral and sister to all other lamnoid sharks that have been sequenced (*Carcharodon carcharias*, white shark; *Isurus oxyrinchus*, shortfin mako; *Isurus paucus*, longfin mako; and *Lamna nasus*, porbeagle) supporting hypotheses (1) and (4).

CARDIOVASCULAR DISEASE: TESTING, ANALYSIS, APPLICATION 9:00 AM SATURDAY, APRIL 29, 1995 ROUSH HALL 330 DIANA M. SPILLMAN - PRESIDING

9:00. THE EFFECTS OF ENRICHED AND IMPOVERISHED ENVIRONMENTS ON RATS EXPOSED PRENATALLY TO ETHANOL. ADRIA N. MARANGI, BOX C-2177, COLLEGE OF WOOSTER, WOOSTER OH 44691, AND CLAUDIA R. THOMPSON, DEPT. OF PSYCHOLOGY, COLLEGE OF WOOSTER, WOOSTER OH 44691.

Since the identification of Fetal Alcohol Syndrome (FAS) by Jones and Smith (1973), several effects of prenatal ethanol exposure have been found, including morphological defects (e.g., craniofacial abnormalities and organ dysfunctions), motor deficits (e.g., poor balance and ataxia), and behavioral abnormalities (e.g., hyperactivity, attention deficits, and impaired learning abilities). Because of the detrimental consequences of prenatal ethanol exposure found in humans, animal models have been used to determine the exact effects of *in utero* alcohol exposure on developing offspring. The results of the animal studies are consistent with the results found in humans in most categories (see Driscoll, Streissguth, & Riley, 1990). Some recent investigators (e.g., Hannigan, Berman, and Zajac, 1993) have examined how experience in different early postnatal environments interact with prenatal ethanol exposure. In particular, Hannigan et al. have reported that enriched environments ameliorate some of the effects of FAS in rats. The present study constitutes an extension of Hannigan's research. Pregnant female rats were fed controlled liquid diets containing either 35% ethanol or 35% sucrose. Half the offspring from each litter were raised for 30 days post weaning in an enriched environment; the other half of each litter were housed individually with no opportunity to interact with objects or other animals (the impoverished

condition). Beginning with postnatal day 51, all of the rats were tested first in a Morris maze task, and subsequently in an open field apparatus where general activity levels and exploration behavior directed toward novel stimuli were measured. Early effects of ethanol treatment were observed in differences in litter sizes, birth weights, and mortality rates between the ethanol- and sucrose-treated litters. In the behavioral tests, it was expected that ethanol exposure and environment would interact such that ethanol-treated impoverished rats would perform the worst, and sucrose-treated enriched rats would perform best. Results of both the Morris maze task and the open field test are as yet inconclusive. The utility of animal models in the study of environmental enrichment effects on FAS is discussed.

9:15. EXPRESSION AND REGULATION OF ANGIOTENSINOGEN mRNA IN ASTROCYTES. MARGARET A. SMITH AND AMY MILSTED, DEPT. OF BIOLOGY, UNIVERSITY OF AKRON, AKRON OH 44325-3908.

Angiotensinogen (Aogen) is the substrate of the renin-angiotensin system (RAS), in which a cascade of enzymatic processing steps leads to production of bioactive angiotensin (Ang) peptides. The objective of this study was to quantify regulation of Aogen mRNA by Ang II and Ang-(1-7) peptides. Optimal conditions for the study of Aogen mRNA were determined by administering Ang-(1-7) and Ang II and determining time course and dose/response effects on steady-state levels of Aogen mRNA in astrocytes cultured from hypertensive and normotensive rats. Astrocytes were obtained from the medulla oblongata of one-day old rat pups. After separation from neurons and oligodendrocytes, the astrocytes were subcultured. Twenty-four hours later, the cells were placed in serum-free medium and treated with the Ang peptide. Total cellular RNA was isolated from four subconfluent plates, loaded on a formaldehyde-containing gel, separated by electrophoresis and analyzed by Northern blotting. The probe was a nick-translated insert encoding rat Aogen. A single band was detected with a size of approximately 1.9 kilobases as predicted. We have detected Aogen mRNA in 5 μ g of poly (A)+ RNA and in 15 μ g of total cellular RNA. Changes in Aogen mRNA expression were normalized by comparing to expression of a constitutively expressed mRNA, glyceraldehyde-3-phosphate dehydrogenase. Results of this study indicate that astrocytes cultured from the medulla oblongata are an appropriate model for studying the molecular mechanisms of Ang peptide regulation of Aogen gene expression.

9:30. CORONARY ARTERY ATHEROSCLEROSIS: HISTOCHEMICAL ANALYSIS USING NEAR-INFRARED RAMAN SPECTROSCOPY. TJEERD J. ROMER, JAMES F. BRENNAN III, YANG WANG, ANNA M. TERCYAK, ROBERT S. LEES, JOHN R. KRAMER JR., RAMACHANDRA R. DASARI AND MICHAEL S. FELD. C/O J.R. KRAMER, DEPT. OF CARDIOLOGY, DESK F 25, CLEVELAND CLINIC FOUNDATION, 9500 EUCLID AVE., CLEVELAND OH 44195 AND MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE MA.

We have developed a method to quantitatively analyze the biochemical composition of human coronary artery *in situ* by near-infrared (NIA) Raman spectroscopy. Human coronary arteries were obtained from hearts removed after transplantation. Samples of normal artery (intima/media and adventitia), non-calcified and calcified plaque were illuminated with 830 nm excitation light from a CW Ti:sapphire laser. Raman spectra with sufficiently high S/N were collected in seconds using a spectrograph and a cooled, deep depletion CCD detector, and calibration and background corrections were made. The spectra were analyzed using a recently developed model to quantitate the relative weight fractions of cholesterol, cholesterol esters, triacylglycerol, phospholipids, protein and calcium salts. Standard biochemical techniques were then used to determine the lipid weight and the amount of the major lipid categories as a percentage of the total lipid content. A comparison between the results of Raman spectroscopy and the biochemical assay indicates that our spectral model can accurately determine, *in situ*, the total lipid content as well as the percentages of the major lipid categories. Protein and calcium salts assays will begin shortly. A compact, transportable clinical instrument has been developed to allow the remote acquisition of NIR Raman spectra from coronary artery *in vivo* by use of a multifiber probe. Clinical studies are underway to test the feasibility and potential of this technique *in vivo* in diagnosing and studying human atherosclerosis, its progression and response to drug therapy.

9:45. THE ROLE OF LIPOPROTEIN (LPA) IN CARDIOVASCULAR DISEASE. DIANA M. SPILLMAN PhD, RONALD J. IANNOTTI PhD, NADAR RUFAL, AND ALAN ZUCKERMAN, M.D., 18 PHILLIPS HALL, MIAMI UNIVERSITY, OXFORD OH 45056.

Certain constituents of blood lipids have been well documented as a major contributors to cardiovascular disease (CVD). These constituents usually have a cholesterol component and are placed in the category of low density lipoproteins. Low density lipoproteins are well known contributors to CVD. Recently a new cholesterol containing compound was found in the blood lipids of individuals with familial (CVD). The compound has a heavier molecular

weight and size than other low density lipoproteins and has been termed Lpa. There is growing evidence that Lpa is a primary cause for CVD. Thirty sets of subjects, Afro-American mothers and two of their children were recruited for a blood lipid, dietary habits and adiposity research study. Dietary histories were compiled via recalls and food frequency questionnaires. The diets were analyzed for caloric percentages, as well as specific nutrients. Fasting blood lipid profiles were obtained. Adiposity was measured via skin folds, girth and BMI measurements. It was found that diet had little to no direct association with Lpa blood values. The elements that were related to Lpa values were family history of CVD and obesity and maternal BMI. If Lpa is a function of obesity and increased BMI, then dietary measures for weight control are very valuable. Research supported by the National Heart, Lung and Blood Institute (HL355261 and HL47388).

10:00. HUMAN CARDIOMYOPATHIC HEARTS HAVE ALTERED LEVELS OF MINERALS AND MYOFIBRILLAR PROTEINS. REBECCA L. LIEBES AND DENIS M. MEDEIROS, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Human epidemiology and experimental animal studies have suggested a link between mineral metabolism and certain types of heart disease. Furthermore, the animal studies have demonstrated a connection between contractile proteins and cardiac hypertrophy. In this study, we examined the levels of copper, zinc, sodium, potassium, magnesium and iron in human heart explants of diagnosed cardiomyopathic and non-cardiomyopathic autopsied subjects (n = 27). A small sample (n = 17) of ventricular heart tissue was digested using a microwave procedure and analyzed by atomic absorption spectrophotometry (Cu, Zn, Fe, Ca, & Mg) and flame photometry (Na & K). Heart samples from a subsample (n = 9) of both cardiomyopathic and autopsied subjects had specific myofibrillar protein extracted to quantify using a 10-20% gradient SDS-PAGE. Several myofibrillar proteins were found to be correlated with the minerals measured. Desmin levels were negatively correlated with levels of Fe (r = -.81) and Mg (r = .89), but positively correlated with Zn:Fe (r = +.83) and Ca:Mg (r = +.93). Actin levels were positively correlated with Mg (r = 1.87) and alpha actinin was positively correlated with Zn (r = +.89). As subjects became older, the level of desmin decreased (r = -.92) and actin increased (r = +.99). These preliminary data suggest that iron, zinc, & magnesium are linked with contractile proteins of cardiomyopathic subjects. Further collections of heart tissue for these analyses and other potential biochemical linkages are ongoing.

10:15. AGE, GENDER, AND CONGESTIVE HEART FAILURE INFLUENCE DELTA-6 DESATURASE ACTIVITY, TISSUE PHOSPHOLIPID FATTY ACID COMPOSITION IN LEAN SHHF/MCC-RACP RATS. Y.W. LIU, L.C. MEDEIROS, B.M. ELDER, S.A. McCUNE, A. M. SMITH, 265 CAMPBELL HALL, 1787 NEIL AVE., OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Studies show that Δ -6 desaturase (Δ 6D) activity decreases with age. However, research comparing desaturase function in aging males and females is lacking. This study compared male and female SHHF/MCC-racp rats for Δ 6D activity and tissue phospholipid fatty acid composition as a function of age or heart failure. Male and female rats were 6 mo., 9 mo., or in congestive heart failure (CHF) (19 mo. in males and 24 mo. in females) were studied. Δ 6D activity was analyzed using 14 C-linoleic acid as previously described (J Clin Invest 1994;93:450). Lipids were extracted from serum, platelet, adipose, liver and heart using chloroform/ methanol (2:1,v/v) and quantified by gas chromatography after methylation. In contrast of other studies, male rats showed increased Δ 6D activity at older ages, with significant increases in CHF group. Female 6 mo. old rats had higher Δ 6D activity (p<.05) than the CHF female rats. Females had higher Δ 6D activity than males at both 6 mo. and 9 mo. The trend reversed in CHF. Serum, platelet, and liver phospholipid arachidonic acid (AA) content (as % of total fat) did not vary with Δ 6D activity in both males and females. Sex hormones are known to influence desaturase activity and may account for the observed gender differences. The gender differences seen in CHF rats may have been affected by age since CHF developed at a younger age in males.

**CELL DEVELOPMENT, PROTEINS,
AND DISEASES
1:30 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 331
JUDY ADAMS - PRESIDING**

1:30. THE POSTNATAL DEVELOPMENT OF AUDITORY BRAIN STEM AND MIDBRAIN NUCLEI IN THE BIG BROWN BAT, *EPTESICUS FUSCUS*. REBECCA D. BOATRIGHT, BOX C-1161, COLLEGE OF WOOSTER, WOOSTER OH 44691, AND ELLEN COVEY, DEPARTMENT OF NEUROBIOLOGY, DUKE UNIVERSITY MEDICAL CENTER, DURHAM NC 27710.

Echolocation, the process by which bats orient in darkness, depends upon the ability of the animal to accurately derive acoustic information from the returning echoes of previously-emitted ultrasonic pulses. The bat's auditory system is highly specialized to process this information; this specialization can be seen in the relatively large size and high degree of differentiation of brain stem auditory pathways. Included in these pathways are the cochlear nuclei, the superior olivary nuclei, the nuclei of the lateral lemniscus, the inferior colliculus, and the thalamic medial geniculate body. The goal of the present study was to investigate the postnatal development of auditory structures in the big brown bat, *Eptesicus fuscus*. The brains of one newborn bat and one adult bat were cut into 40 sections, mounted on glass slides, and stained. The auditory nuclei from each bat and the stretch of brain stem reaching from the caudal end of the CN to the rostral end of the GM were scanned into a computer program to determine the area and volume of each section. These measurements were then summed to determine the volume of each structure as a whole; these volumes were contrasted between the newborn and the adult to quantify gross anatomical changes. The results indicate that while all nuclei undergo substantial postnatal growth, the rates of growth are not uniform for different structures. Specifically, the volume of the lateral superior olive (LSO) appears to increase significantly less than other auditory nuclei with the nuclei of the lateral lemniscus (NLL) and the superior paraolivary nucleus (SPN) undergoing the greatest amount of postnatal development. The relative lack of postnatal growth of the LSO suggests that it matures early, around the time of birth. This finding further suggests that the function of the LSO may have less to do with the acquired ability to echolocate than with non-echolocative auditory processes. Conversely, the large amount of postnatal development of the NLL and SPN suggests that these nuclei are the most specialized for echolocation.

1:45. HUMAN WHITE BLOOD CELLS EXPRESS CAVEOLIN, THE PROTEIN, BUT HAVE VERY FEW CAVEOLAE, THE STRUCTURES. TIMOTHY J. CAIN AND JOHN M. ROBINSON, DEPT. OF CELL BIOLOGY, NEUROBIOLOGY & ANATOMY, OHIO STATE UNIVERSITY, COLLEGE OF MEDICINE, 333 W. TENTH AVE., COLUMBUS OH 43210.

Caveolae are small flask-shaped invaginations of the plasma membrane thought to function in the uptake of small extracellular molecules and ions. Examination of caveolae have shown clusters of GPI-anchored proteins, tyrosine kinases, and calcium pumps and channels to be associated with these small membrane structures. In addition a 22kDa protein, termed caveolin, has been localized to the cytoplasmic surface of these specialized regions of the plasma membrane. Caveolin was originally isolated as a substrate for membrane-associated v-src kinase suggesting a potential role for caveolae in cell signaling. Caveolin shares identity with the protein VIP21 which has been implicated in membrane transport. Prominent in endothelial cells, smooth muscle cells and fibroblasts, the distribution of caveolae in human leukocytes is not well documented. In the present study we show, by electron microscopy, that peripheral blood neutrophils, monocytes, lymphocytes and platelets exhibit few, if any, caveolae. However, immunoblotting and immune fluorescence data show that neutrophils, monocytes and platelets express caveolin even though caveolae are not prominent features of these cells.

2:00. EFFECTS OF HIGH CERULOPLASMIN CONCENTRATIONS OR LOW ZINC CONSUMPTION BY RATS ON VLDL + LDL OXIDATION. ROBERT A. DI SILVESTRO, ASHLEY BLOSTEIN, AND AMY JONES, HUMAN NUTRITION & FOOD MANAGEMENT, OHIO STATE UNIVERSITY, 265 CAMPBELL HALL, 1787 NEIL AVE., COLUMBUS OH 43210.

Low and very low density lipoprotein (LDL & VLDL) oxidation is proposed to contribute to atherosclerosis development. The addition of the plasma copper protein ceruloplasmin to LDL in vitro promotes oxidation, while zinc addition does the opposite. This study found that rats, with plasma ceruloplasmin contents elevated for two weeks, did not show unusually rapid copper ion catalyzed VLDL + LDL oxidation in vitro. The discrepancy between studies done in vivo and in vitro may have been due to alterations in the ceruloplasmin-copper bonds during ceruloplasmin preparation. Low zinc intake by growing rats for about two weeks produced VLDL + LDL which showed rapid oxidation by copper ions in vitro. Rats were verified to be in suboptimal zinc status based on body weight and plasma zinc. This data raised the possibility that zinc status can be a factor in atherosclerosis, but high ceruloplasmin concentrations are not directly involved.

2:15. THE ROLE OF 5HT1B SEROTONIN RECEPTOR AS A POSSIBLE GENETIC LINK WITH AGGRESSION. BRADLEY A. ELDRIDGE, SIMON K. LAWRENCE, LARRY E. COX, DEPARTMENTS OF LIFE SCIENCE AND PSYCHOLOGY, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

The search for the biochemical roots of aggression in humans has begun to focus on serotonin and animal models. In the species *Mus Musculus*, lower concentrations of the neurotransmitter serotonin have led to an increase in aggressive behavior. Two different sublines of BALB/cJ are phenotypically described by Jackson Labs as "extremely" and "normally" aggressive. The level of aggression will be confirmed behaviorally by observing interactions between an individual male from a "home" cage, (that's shared with other animals) and another male that has been isolated for two weeks. A subline's aggression level is defined by the amount of aggressive behavior characteristic of its species in the interactions between those of the same and those of different sublines. Rene Hen, of INSERM in Strasbourg, France, stated the absence of a certain serotonin receptor, called 5HT1b, has the same effect as reducing the serotonin concentrations. Since the specific gene for 5HT1b has been targeted, the gene will be amplified from a DNA sample from each subline by using a polymerase chain reaction process. The genetic sequence of these two genes will be examined and compared for possible differences. The results may potentially identify a genetic link with aggression in *Mus Musculus* and advance the research in humans that have an analogous serotonin receptor 5HT1d.

2:30. SUBCELLULAR FEATURES HELPFUL IN THE DIAGNOSIS OF HUMAN DISEASES. DAVID L. MASON, MIGUEL A. PEDRAZA, AND FERIDUN A. DOSLU, WITTENBERG UNIVERSITY AND COMMUNITY HOSPITAL, SPRINGFIELD OH 45501.

In the past, the electron microscope (EM) was used extensively as an aid to conventional light microscopy for diagnosing many human diseases. With the advent of labeled antibodies, the role for the EM in medicine has diminished significantly. However, it still plays a role in helping to determine selected diseases, especially cancers, kidney, and infectious diseases. This presentation concentrates on features visualized at the EM level that help to determine specific diseases.

2:45. ANALYSIS OF TRANSMEMBRANE DOMAIN SIZE VARIATIONS IN INTEGRIN BETA-4: POSSIBLE ROLE IN PSORIASIS. MARIE MYERS, ANNE BOWCOCK, VITO QUARANTA, AND SIMON LAWRENCE, DEPT. OF LIFE SCIENCES, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

Psoriasis is a noncontagious skin disorder of unknown pathogeny. A recent study mapped susceptibility to familial psoriasis to the distal end of human chromosome 17q. The integrin beta 4 gene, which is located on chromosome 17q, is a candidate gene for the psoriasis susceptibility locus. Integrins are heterodimeric adhesion receptors that interchange signals between intracellular and extracellular structures. Integrin beta 4 normally is limited to the basal surfaces of epithelial cells, but in some psoriasis patients it is inappropriately expressed in the super-basal and pericellular layers. Several heritable diseases have been associated with mutations in trinucleotide repeats. The transmembrane domain in the integrin beta 4 gene contains twelve repeats of the sequence CTC. We are analyzing the transmembrane domain for size variations by polymerase chain reaction (PCR). Primers corresponding to the sequences flanking the CTC repeats are being used to amplify transmembrane domains from normal and psoriatic DNAs. The sizes of the amplified products are being measured by gel electrophoresis. Correlation of size variation in the trinucleotide repeats and psoriasis would provide direct evidence of a role for integrin beta 4 in the pathogeny of psoriasis.

3:00. STUDIES IN PORPHYRIA: PLASMA PORPHYRINS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC). MICHAEL R. LUST, EDWARD J. TIRAKIS, AND MARTHA KREIMER-BIRNBAUM, ST. VINCENT MEDICAL CENTER, RESEARCH DEPT., 2213 CHERRY ST., TOLEDO OH 43608.

Porphyrias are inborn or acquired conditions characterized by partial deficiency in enzymes of the heme biosynthetic pathway. The presence of porphyrins in plasma indicate a derangement in heme synthesis. Therefore, sensitive methods for plasma porphyrin detection can be useful to facilitate the differential diagnosis of the porphyrias. Plasma was mixed with an equal volume of a mixture of trichloroacetic acid and dimethylsulfoxide. After deproteinization and centrifugation, the extracts were run on a reversed phase HPLC system with fluorescence detection. Mobile phase A consisted of distilled water, acetonitrile, acetone and methanol, modified by phosphoric acid and 2,6-lutidine, and mobile phase B consisted of acetonitrile, methanol and acetone. Chromatograms of plasma from non-porphyrin controls showed no porphyrin peaks. Plasma from members of a family carrying Acute Intermittent Porphyria showed characteristic peaks in the uroporphyrin (octacarboxylic) region. A patient on hemodialysis due to chronic renal failure showed a pattern similar to the one observed in patient with confirmed Porphyria Cutanea Tarda, namely peaks in the octacarboxylic and heptacarboxylic porphyrin regions. This method is sensitive (detection limits = 9 pmoles/ml) may lend itself to routine clinical application. [Supported in part by a grant from the F.M. Douglass Foundation.]

ECOLOGY AND ENVIRONMENTAL SCIENCE **1:30 PM SATURDAY, APRIL 29, 1995** **ROUSH HALL 204** **CAROLYN J. McQUATTIE - PRESIDING**

1:30. HYDROLOGICAL INFLUENCES ON THE BENTHIC HETEROGENEITY OF AN OHIO RIVER FLOODPLAIN, SOUTHEAST, INDIANA. RICHARD W. KOCH AND M. C. MILLER, DEPT. BIOL., UNIVERSITY OF CINCINNATI, CINCINNATI, OH 45220.

The hydrology of an oxbow floodplain at the confluence of the Great Miami and Ohio Rivers was analyzed (from URGE daily flow data) for its relationship to benthic biota. The annual floodplain stage variation of 3.5 meters was controlled by the seasonal discharges of the larger rivers. However, surface water cation concentrations indicated that the flood waters were primarily from the Great Miami River. Flood water resident time of 80 days per year, caused increasing dissolved organic matter, decreasing particulate organic matter and decreasing nutrient (TRP, NH_3) concentration gradients from the larger river into the floodplain. Decreased silt load, increased retention times and elevated temperatures allowed for increased autochthonous production in the wetland area during an average 8 day event. Benthic invertebrate communities were influenced by sediment particle size, organic matter content, dissolved oxygen concentrations and overall primary production throughout the floodplain. Taxa structure showed spatial and temporal variations in relation to microhabitat heterogeneity. Maximum and minimum invertebrate densities coincided with high and low organic contents of the sediments, respectively. Although driven by flood water nutrients and detritus, the high autochthonous production and invertebrate biomass were not assimilated by riverine fish or transferred to the large rivers as predicted by the "flood pulse hypothesis."

1:45. COMPARISON OF BACTERIAL COMMUNITIES WITHIN THE CUYAHOGA RIVER. BEVERLY J. BROWN AND LAURA G. LEFT, KENT STATE UNIVERSITY, DEPT. OF BIOLOGICAL SCIENCES, PO Box 5190, KENT OH 44242-0001.

Along the Cuyahoga River, located in northeastern Ohio, the extent of anthropogenic disturbance increases from headwaters to mouth. The purpose of the study was to examine longitudinal differences in the bacterial communities. Water samples were collected in fall and spring from five sites along the river. Total numbers of bacteria determined by epifluorescent microscopy ranged from 2.5 to 3.5 X 10⁶ cells/ml, with no apparent downstream increase. Of colonies grown on a medium selective for coliforms, only 1 strain examined was a coliform (*Citrobacter freundii*), indicating that fecal coliforms entering from incomplete sewage treatment or agricultural run off do not persist. Abundance of lactose fermenters (primarily *Aeromonas hydrophila*) increased with distance from the headwaters. *Burkholderia cepacia* was common at all sites and most abundant in the headwaters, representing more than 40% of the colonies.

2:00. AN UNUSUAL NUTRIENT/WATER BUDGET OF A EUTROPHIC WOODLAND RESERVOIR. W. ALEX BRENCE, M.C. MILLER, AND D.J. JENKINS, UNIVERSITY OF CINCINNATI, COLLEGE OF ARTS AND SCIENCES, DEPT. OF BIOLOGICAL SCIENCES, CINCINNATI OH 45221-0006.

Riawakin Pond is characteristic of many highly eutrophic, shallow, woodland reservoirs. This reservoir's origin dates back to early 1800 from the impoundment of its 2^o feeder stream, Rockawalkin Creek, for use as a 'mill pond'. Its large agriculturally and residentially dominated watershed (585Ha), when combined with its large surface area (3.8Ha) and generally shallow morphometry ($x=1.3\text{m}$) contribute to very short water residence times ($t \leq 1/0.007\text{yr}$) and high average nutrient loading rates on the order of 0.7g $\text{P}_{\text{total}}/\text{m}^2/\text{day}$ and 6.3g $\text{N}_{(\text{NO}_3+\text{NH}_4)}/\text{m}^2/\text{day}$. A nutrient budget was constructed from bi-monthly measurements of flow, nitrogen (as $\text{NO}_3\text{-N}$ and $\text{NH}_4\text{-N}$), and phosphorus (as total, particulate, and soluble reactive $\text{PO}_4\text{-P}$) input to and discharge from the system over a seven month period from February to August, 1992. The effects of draining the system and an algicidal copper sulfate treatment were also determined. It was determined that this highly variable system functions as an overall nutrient "sink" for nitrate and orthophosphorus, while being a net exporter of ammonia and particulate phosphorus. The algicidal copper treatment combined with draining the system beforehand produced a net shift in the system to retain ammonia and orthophosphorus, but to export nitrate and particulate phosphorus. *Spirogyra* spp dominated the entire water column both before and immediately after treatment. The high levels of nutrients in the groundwater and surface runoff input to this system and high water turnover rates severely restrict restoration options to this shallow eutrophic reservoir.

2:15. WATER TABLE EFFECTS ON BROMIDE, NITRATE AND PESTICIDE TRANSPORT. Z. JIANG AND L.C. BROWN, AGRICULTURE ENGINEERING DEPT., OHIO STATE UNIVERSITY, 590 WOODY HAYES DRIVE, COLUMBUS OH 43210-1057.

Large undisturbed soil columns (30-cm dia. x 91-cm L) were used to study the effects of controlled drainage on agrichemical (bromide, nitrate, atrazine, alachlor, metolachlor) transport and fate in Clermont and Rossburg silt loam soils. Three drainage controls were applied; water table at soil surface, at plow depth, and free drainage. Soil-water content was measured using Time Domain Reflectometry (TDR); water was applied 60+ days at 1L/d (1.37-cm/d rainfall equivalent) using automated irrigation. Soil solution samples and column effluent was analyzed. Initial results indicate that bromide exhibited two distinct breakthrough curve (btc) patterns dependent upon water table level: convex for high water table; complex for free drainage. A high water table produced larger peak concentrations and smaller times to peak compared to free drainage. Bromide recovery for all drainage control treatments was greater than 95%. Nitrate btc patterns were similar to those of bromide, and nitrate recovery for the high water table was significantly smaller than that for free drainage. The ratio of nitrate to bromide recovery ranged between 0.6 and 0.85 with a water table compared to free drainage, suggesting transformation of nitrate (possibly denitrification). Compared to bromide and nitrate, the pesticides had lower transport velocities and recovery was very small. Flow-weighted mean concentrations indicated that atrazine was the most mobile and alachlor the least mobile. High water table conditions appeared to increase pesticide transport, suggesting that degree of saturation may affect adsorption and degradation. For wet agricultural soils, these preliminary results suggest that water table levels for optimal control of nitrate discharges should be at plow depth, and at drainage depth for optimal control of pesticide discharges.

2:30. THE HYDROLOGY OF THE PRAIRIE ROAD FEN STREAM IN NEW MOOREFIELD, OHIO. TONYA N. FISH, DEPT. OF BIOLOGY, WITTENBERG UNIVERSITY, SPRINGFIELD OH 45501.

Little is known about the hydrologic parameters of fen streams. Therefore, the purpose of this experiment was to characterize abiotic gradients along a stream in a protected fen habitat. Mean values for dissolved oxygen, conductance, total dissolved solids, pH, and temperature were determined over an annual period at seven sites in Prairie Road Fen. Dissolved oxygen, temperature, and pH values increased with distance downstream. Conductance and total dissolved solids were greatest at the effluents. Gurley meter readings showed that site velocities ranged from 0.140 m/s to 0.439 m/s. Stream discharge ranged from 9.66 m³/s to 0.370 m³/s. These gradients correlate with the distribution of biotic communities and may help explain their dispersion patterns.

2:45. RECLAMATION IN AN URBAN HYPEREUTROPHIC MEXICAN LAKE. MICHAEL C. MILLER, DEPT. OF BIOLOGICAL SCIENCES, UNIVERSITY OF CINCINNATI, CINCINNATI OH 45221

Lago de Ilusiones is a shallow hypereutrophic lake receiving raw sewage from the center of a growing city, Villahermosa, Mexico. The sewage enters into one arm in a series of connected basins, now largely surrounded by upper class homes. The water column is mixed daily ($Z_m = 5\text{m}$, $Z_{bar} = 2\text{m}$) and water replacement is about once per year. Plankton biomass varied from 20-150 mg/m³ chlorophyll a, total PO_4 from .01-1.2 mg P/liter, and secchi depth from 46 to 31 cm. The oxygenated water column showed daily oscillations from 6-8mg/l at night to 10-15 mg/l by mid afternoon, while pH increased from <9 to >9. The phytoplankton in the cleaner arms of the lake were dominated by *Scenedesmus*, *Selenastrum*, *Pediastrum* and *Cyclotella*. Planktivory was very high, thus the daytime zooplankton were restricted to rotifers (*Banchionus*, *Kellicotia* and *Synchaeta*). In all, 41 species of fish have been documented in the lake in surveys 1979-1990. The cattail and water hyacinth forms floating mats later invaded by many aquatic plants covering the surface of water completely. Current restoration involves removing the plant mass and dredging the P-laden sediments. This low tech solution maintains a minimally acceptable water quality.

3:00. COMPARISON OF NITROGEN CYCLING RATES IN TWO NORTHEASTERN FOREST ECOSYSTEMS WITH DIFFERENT ATMOSPHERIC DEPOSITION REGIMES. AMANDA FULLER, SLAYTER Box 863, DENISON UNIVERSITY, GRANVILLE OH 43023.

Net potential nitrogen mineralization and nitrification rates were studied at two northeastern forest sites representing an atmospheric nitrogen depositional gradient: the Catskills in New York (about 10-11 kg/ha/yr), and the White Mountains in New Hampshire (about 7 kg/ha/yr). Rates of translocation of organic nitrogen to inorganic forms were studied in organic forest floor samples from both locations. Samples were taken from homogeneous litter in

single-species stands of four tree species (beech, sugar maple, yellow birch, and hemlock). Nitrate and ammonium (inorganic nitrogen) concentrations were measured before and after twenty-one days of incubation. Net potential mineralization and nitrification rates were calculated from inorganic nitrogen accumulation during the incubation period. Although higher nitrogen cycling rates were expected in the Catskills, samples from only one species, sugar maple, showed higher mineralization and nitrification rates there. Beech showed higher mineralization in the White Mountains, and yellow birch showed significant differences only in nitrification. Hemlock showed no significant differences with location. For all species, nitrification represented a higher fraction of mineralized nitrogen in Catskill samples than in White Mountain samples, which may help explain elevated nitrate levels in Catskill surface waters. Interspecific relationships were inconsistent; beech rates were highest within the White Mountains stands, whereas maple rates were highest among Catskills samples.

3:15. SOIL ECOLOGICAL INTERACTIONS BETWEEN SITE MANAGEMENT AND LONG-TERM ACIDIFICATION IN OAK FORESTS, I. CHEMICAL AND PHYSICAL PROPERTIES. KELLY L.M. DECKER, R.E.J. BOERNER, AND ELAINE K. SUTHERLAND, PLANT BIOLOGY DEPARTMENT, OHIO STATE UNIVERSITY, COLUMBUS OH 43210 AND U.S.D.A. FOREST SERVICE, 359 MAIN ROAD, DELAWARE OH 43015.

As part of a larger study of oak forest dynamics in the Ohio River Valley, we sampled soils from managed (thinned in the early 1960's) and unmanaged white oak-dominated experimental forest plots in the McKee and Robinson Experimental Forests in southern Kentucky. Overall, the soils at McKee had been acidified to a greater degree, i.e. the McKee soils had significantly lower pH, Mg, Ca, and P soil solution concentrations and Ca:Al ratio and significantly higher Al and Fe soil solution concentrations than those at Robinson. Furthermore, soils of control sites were more acidified (lower pH and Ca:Al ratio, higher Al) than those of the managed sites. Although these differences were consistent with a direct effect of silvicultural management on nutrient cycling and soil processes, the lack of pre-management soil chemical data from the 1960's prevents us from robustly testing that hypothesis. As a means of investigating whether such differences might be important in broad scale changes in oak abundance, we present preliminary results of experiments which will test hypotheses for the effects of these differences in soil properties on growth and competitive ability of oak vs. yellow-poplar seedlings.

3:30. SOIL ECOLOGICAL INTERACTIONS BETWEEN SITE MANAGEMENT AND LONG-TERM ACIDIFICATION IN OAK FORESTS, II. EFFECTS ON SOIL NITROGEN DYNAMICS AND MICROBIAL ABUNDANCE. SHERRI J. MORRIS, R.E.J. BOERNER, AND ELAINE K. SUTHERLAND, PLANT BIOLOGY DEPT., OHIO STATE UNIVERSITY, COLUMBUS OH 43210 AND U.S.D.A. FOREST SERVICE, 359 MAIN ROAD, DELAWARE OH 43015.

This study examines turnover of organic N and supply of inorganic N to plants and microbes in relation to differences in soil chemistry between the McKee and Robinson Experimental Forests and silvicultural management. Net N mineralization averaged approximately 0.5 mg N/kg soil/day and did not differ between McKee and Robinson soils. In contrast, net NO_3^- accumulation and proportional nitrification were significantly greater at Robinson than McKee. Rates of organic N turnover were also greater in managed plots than in control plots, with the magnitude of the differences in NO_3^- accumulation and nitrification being greater in the more fertile Robinson soils. The fungal hyphal length in soils from McKee (mean of 8.19 m hyphae/g soil) was significantly greater than from Robinson (4.57 m/g), but there was no clear relationship between fungal hyphal length and management. We will present regression models of N turnover on soil chemical and microbiological factors.

3:45. DIFFERENCES IN ULTRASTRUCTURE AND ALUMINUM LOCALIZATION IN MYCORRHIZAL AND NONMYCORRHIZAL PITCH PINE ROOTS EXPOSED TO ALUMINUM. CAROLYN J. MCQUATTIE AND GEORGE A. SCHIER, USDA FOREST SERVICE, 359 MAIN RD., DELAWARE OH 43015.

The ability of the mycorrhizal fungus *Pisolithus tinctorius* to ameliorate cellular symptoms of aluminum toxicity in pitch pine (*Pinus rigida*) seedling roots was examined. Four-week-old pitch pine seedlings, inoculated with either a broth slurry of the mycorrhizal fungus or with sterile broth, were exposed to aluminum (0, 10, or 20 mg/L) in nutrient solution. After 66 days, mycorrhizal (M) and nonmycorrhizal (NM) roots were prepared by conventional methods (aqueous fixation, ethanol dehydration, and epoxy resin embedding) for transmission electron microscopy. Additional roots were quench-frozen in liquid propane and freeze-substituted in chromium trioxide prior to resin embedding for examination by x-ray microanalysis (EDS). A thick mycorrhizal fungal mantle (mean = 8 hyphae) was observed in roots exposed to 0 or 10 mg/L Al, whereas a thinner (mean = 4 hyphae) mantle showing cellular deterioration was observed at 20 mg/L Al. Meristem cells of NM roots exposed to 20 mg/L

Al were more disrupted (showing cellular vacuolation and invaginations) than meristem cells from M roots exposed to the same Al concentration. Aluminum was detected by EDS in outer root cells of NM roots and in dead root cells between mantle hyphae in M roots. Little Al was detected within mycorrhizal hyphae.

4:00. OBJECTIVE-BASED EVALUATION EDUCATION FOR WATER QUALITY PROTECTION IMPLEMENTATION PROJECT PERSONNEL. E. BONAR-BOUTON, L.C. BROWN, C.F. LEEDS AND R.P. LEEDS. AGRICULTURAL ENGINEERING DEPT., OHIO STATE UNIVERSITY, 590 WOODY HAYES DRIVE, COLUMBUS OH 43210-1057.

In 1994, 5 evaluation workshops were conducted for existing, new and proposed water quality implementation and educational projects in Ohio. The overall goal was to increase the knowledge of project personnel about conducting objective-based evaluations of project impact. Pre-workshop survey results indicated that participants had little experience with evaluation overall, but 81% of respondents considered evaluation to be an important part of their project. Post-workshop survey results indicated an overall mean score of 4.2 (5-point scale) on the usefulness of all topics presented; developing measurable objectives as related to water quality project activity was most useful (4.8). 55% of respondents mentioned "writing objectives" as a valuable aspect of evaluation that they learned; 50% of all respondents in each workshop mentioned "writing objectives" as the one aspect they valued. Post-workshop respondents mentioned 13 different aspects of evaluation that they found valuable, ranging from "project development" to "reporting". Learning about Bennett's Hierarchy was of value to only 10% of respondents, but they indicated 17 different aspects of evaluation that they would like to learn more about, including Bennett's Hierarchy. Based on pre- and post-workshop survey results, participants perceived a gain in their knowledge about evaluation after attending the workshop; mean score of 4.5 before workshop and 7.2 after workshop (scale from 1 to 10), suggesting a dramatic increase of perceived knowledge. The participant's perceived ability to carry out an evaluation plan before and after a workshop increased by 62%. Follow-up survey to detect participants' evaluation activities after the workshops is in progress.

4:15. BASIS FOR A COMPREHENSIVE AGRICULTURAL WATER MANAGEMENT GUIDE FOR THE CENTRAL GREAT LAKES REGION. L.C. BROWN, M.T. BATTE, N.R. FAUSEY, H.W. BELCHER, J.D. EIGEL AND A.L. SPONGBERG, AGRICULTURAL ENGINEERING DEPT., OHIO STATE UNIVERSITY, 590 WOODY HAYES DRIVE, COLUMBUS OH 43210-1057.

The 8 Great Lakes and Corn Belt states account for nearly 80% of U.S. agricultural production. These 8 states include the top 4 states (Indiana 2nd, Ohio 4th), plus the 7th, 11th (Michigan), 13th and 16th in terms of total drained cropland, accounting for over 20.6 million ha of agricultural land presently under artificial drainage. The framework for intensive research and extension/outreach education on water table management (WTM) strategies (subirrigation and controlled drainage) for application on existing agricultural land use areas in the central Great Lakes Region (Lake Erie and Huron watersheds draining Indiana, Michigan, Ohio) has been established within the scope of a comprehensive program of research and education on modern agricultural water management to help balance environmental and economic goals. Hydrologic and water quality impacts and benefits of WTM on benchmark soils are being evaluated with the computer models DRAINMOD and ADAPT, using long-term climatic record. Mathematical programming techniques will be used to provide an economic evaluation of WTM strategies in conjunction with best management practice recommendations, using externally imposed pollution limits on nitrate and phosphorus discharges. State-of-the-art knowledge of WTM technologies is being developed into a comprehensive technical and educational guide on the design, operation and management of subirrigation and controlled drainage systems that enhance water quality and sustain productivity. Focus is being placed on WTM demonstrations at benchmark sites in Michigan and Ohio.

4:30. ECOLOGICAL SURVEY REQUIREMENTS FOR FEDERALLY FUNDED TRANSPORTATION PROJECTS. KAREN M. WISE AND JAY ABERCROMBIE. ACRT, INC. PO Box 219, KENT OH 44240.

The Ohio Department of Transportation (DOT) Ecological Manual outlines the regulations and laws that affect all federally funded projects. Ecological surveys are required to evaluate the impacts of project construction and operation on the natural environment. Ecological surveys were conducted for the proposed realignment of U.S. 30 through 17 miles of Crawford and Richland Counties, and through 20 miles of Carroll and Columbiana Counties, Ohio. The study corridors in Crawford and Richland Counties lie within the Till Plains, except for the eastern terminus which is in the Allegheny Plateau. The study corridors in Carroll and Columbiana Counties are in the Allegheny Plateau. ACRT biologists conducted surveys of aquatic, terrestrial, and wetlands communities. Aquatic studies evaluated stream crossings and impound-

ments for habitat, water chemistry, benthic macroinvertebrates, and fish. Terrestrial studies included plant communities and terrestrial vertebrates. The possible impacts of the project on rare, threatened, and endangered species were addressed. Field studies determined the locations of jurisdictional wetlands. Ecological Survey Reports were prepared to evaluate the geological impacts of this type of transportation project. The ecological survey is used by Ohio DOT along with other environmental data to select a preferred alternative alignment for more detailed study and design. ACRT, Inc. was a subconsultant to Adache-Ciuni-Lynn Associates, Inc., Cleveland, Ohio and McCoy/Fok Associates Akron, Ohio during the Preliminary Design Phase of these Ohio DOT projects.

4:45. DISTRIBUTION OF ODONATA (DRAGONFLIES & DAMSELFLIES) OF OHIO, SPECIFICALLY WASHINGTON COUNTY. DIRK WESTFALL AND DR. DAVE MCSHAFFREY, MARIETTA COLLEGE, MARIETTA OH 45750.

The Ohio Odonata Survey database contains over 14,000 records of dragonflies and damselflies. At Marietta College we have designed computer programs that allow us to analyze the database for distribution, number of specimens, and collection effort (the number of records per species) for each county in Ohio. When collection effort is plotted it shows that many counties in Ohio are severely under collected, including Washington county. To correct this, increased collections were made in the county this past summer (1994) at over thirty different locations. Collections ran from June 14th through November 29th. Several of the sites were collected repeatedly in order to begin construction of a chart detailing time of flight for the different species in the county. We have effectively increased the number of recorded species in the county from 18 to over 25 (determination and verification of specimens is still ongoing). With expanded collection efforts in Washington county it is now possible to more accurately compare the distribution of Odonata in glaciated and non-glaciated counties in Ohio. Preliminary examination of the records show that glaciers have had some impact on the distribution of some species throughout the state. This is similar to what has already been shown for Ohio Trichoptera (caddisflies).

EDUCATION DIVISION

9:00 AM SATURDAY, APRIL 29, 1995

ROUSH HALL 210

C. WAYNE SHIRBISH - PRESIDING

9:00. THE GLOBE PROGRAM AND GLOBAL ENVIRONMENTAL CHANGE EDUCATION. CAROL E. LANDIS, ERIC/CSMEE, 1929 KENNY RD., COLUMBUS OH 43210-1080.

The GLOBE program (Global Learning and Observations to Benefit the Environment) is an international science and education partnership proposed by Vice President Gore that promotes stewardship of the Earth and international collaboration in monitoring global environmental conditions. Student participants will collect, analyze, and interpret data through processes that have been identified by teams of scientists and educators as being important to improved understanding of the global environment and appropriate for the students' grade level. These data will: 1) contribute to an international dataset, 2) be utilized by the scientific research community, and 3) be distributed to the schools in the form of vivid environmental images of the world. The objectives of GLOBE are to enhance the collective awareness of individuals throughout the world concerning the environment and impacts of human activities on it, and to increase the scientific understanding of the earth by collecting data that supports the international community of environmental scientists. Student measurements of biological, physical and chemical observations from around the world will, in effect, provide groundtruthing information from previously data-sparse regions. A selection of other instructional materials that encourage global change education as a vital component of science education are cited. Information is provided about global change education materials that are being developed, as well as sources for data and inexpensive global education materials appropriate for all levels of public education.

9:15. PERSPECTIVES ON POPULATION: POPULATION AND RESOURCES IN THE EARTH SYSTEM. GARRY D. MCKENZIE AND CAROL E. LANDIS, GEOLOGICAL SCIENCES, OHIO STATE UNIVERSITY, COLUMBUS OH 43210-1308.

Geoscientists' interest in the human aspects of the Earth System stems from our traditional objectives of providing society with adequate geological resources, reducing risk from geological hazards and pollution from waste

management activities, and our more recent understanding of potential limits to the biogeosphere and the nature and history of global environmental change. Flawn (1965) clearly recognized the role of human population growth, stating, "The problems of cities are the problems of population growth," and "We have reached the point where growth is not...necessarily a good thing." Humans have been recognized as a geologic agent on a global scale and our life support system is being threatened with continued growth in population and human activity. The Bretherton diagram provides a model for the biogeochemical aspects of the Earth system, the Social Process diagram adds interactions from the human sciences. As scientists and educators, our efforts must be directed to melding these models to provide a Total Earth System Science (TESS) approach to understanding change in the biogeosphere. In an experimental course for precollege teachers we investigate human population growth, its relations to hazards and resources, and its long-term implications for global change. Although human population is briefly covered in many courses at OSU, we are focusing on it as the most important factor in TESS. The course includes brief lectures, critical review and discussion of selected readings, and problem solving exercises.

9:30. SCIENCE EDUCATION ENHANCEMENT--THE SCIENCE RESOURCE CENTER. ARTHUR L. VORHIES, MATH/SCIENCE DIVISION, OHIO UNIVERSITY AT CHILlicothe, 571 WEST FIFTH ST., CHILlicothe OH 45601.

As part of a strategic plan developed by Ohio University-Chillicothe (OUC) to serve as a regional resource center, a science education resource center for area students and faculty has been in operation for the past several years. This center is funded with an Ohio Board of Regents Academic Challenge grant. The center serves our region by providing a link with a major university--its faculty and equipment to assist area science instructors at all levels in the common goal of educating today's science students. The major features of this resource center include: sharing expertise, the delivery, set-up, and pick-up of equipment, and other items not readily available to public schools. Popular items requested have included microscopes, various models, and various pieces of laboratory equipment. Workshops for area educators have also been part of the center's program. The center is integrated with the education and language arts resource centers on campus to meet the goal of holistic education for area students and teachers. In this age of rising expectations for science education and diminishing dollars this resource center might serve as a model for enhancing science education in other regions of Ohio.

9:45. EVOLVING EARTH SYSTEM SCIENCE AT THE OHIO STATE UNIVERSITY. GARRY D. MCKENZIE, GEOLOGICAL SCIENCES, OHIO STATE UNIVERSITY, COLUMBUS OH 43210-1308.

Changes in the geosciences are reflected in course content. The plate tectonic revolution of the 60s was followed by the resource/hazard/planning emphasis of the 70s, the pollution/hydrogeology focus of the 80s, and now the global change/Earth system focus of the 90s. Changes are driven by: global change, technology, science education reform, and funding. Earth systems I: Geological Environment has evolved from the introductory physical/historical course. Suitable textbooks are only now matching this change. Earth Systems II: the Atmosphere, is in geography. Other courses cover: environmental geology, geological resources, and oceanography. Beyond lithosphere, atmosphere, hydrosphere, and paleobiosphere, the bio- and human spheres are covered in capstone courses that focus on issues of the contemporary world with emphasis on critical thinking. Sample course titles include: Integrated Earth Systems (Geography), Population and resources in the Earth System (Geological Sciences), and Problems and policies in World Population, Food, and Environment (Agricultural Economics). Science education efforts at OSU have provided a model for pre-college Earth systems Education nationally.

10:00. INTERDISCIPLINARY APPROACHES TO THE STUDY OF SCIENCE: USING ENVIRONMENTAL TOPICS FOR THEMATIC STRUCTURE. THOMAS B. COBB, DEPT. OF PHYSICS AND CENTER FOR ENVIRONMENTAL PROGRAMS, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403.

Advantages and disadvantages of using environmental topics as a thematic approach to the study of science will be discussed. Because of their heightened awareness and general interest in environmental issues, students often have increased motivation to improve their understanding of the related science. This situation provides a "teachable moment" which can be used to advantage by the instructor. For instance, environmental topics such as global warming, ozone depletion, acid rain, electromagnetic field effects, and radiation can be used to provide incentives for further personal study of related scientific topics such as greenhouse effect, black body radiation, atmospheric chemistry, thermodynamics, and atomic and nuclear physics. Although environmental issues provide increased motivation, at least temporarily, the lack

of a coherent and fundamental science basis restricts the extent to which the science can be developed. Experiences derived from using this procedure in two college classes for undergraduate nonscience students and in a summer workshop with forty science teachers will be described. Based on classroom evaluations, student response to such an approach is positive overall, but pre- and post-classroom testing indicated that material comprehension was only marginally improved - at least in the short term. On the other hand, the method seems to provide increased confidence and personal motivation for certain individuals. Concepts from different disciplines were introduced by guest lectures and through varied laboratory and field trip experiences, but all were integrated by one instructor. The techniques employed may be replicated at any grade level. Sample lessons and laboratory experiments will be shared.

10:15. ALTERNATIVES TO MULTIPLE CHOICE EXAM TESTING FORMATS IN LARGE INTRODUCTORY UNIVERSITY LEVEL LIFE SCIENCE CLASSES. GEORGE E. KLEE, DEPT. OF BIOLOGICAL SCIENCES, KENT STATE UNIVERSITY-STARK CAMPUS, 6000 FRANK AVE., N.W., CANTON OH 44720-7599.

One of the most serious barriers to the academic success of university life science students is the extensive use of multiple choice examinations in entry level courses. This exam format, primarily used to facilitate grading in large lecture sections of both majors and non-majors courses is rarely used in other countries and may be one of the main reasons for the high rate of failures and drop-outs in these courses at many colleges and universities. This paper will review a number of alternate means of academic assessment that have been used by the author in both majors and non-majors courses in over 100 sections of these classes taught at Kent State University since 1971, and also examine how these may contribute to the increased emphasis to writing across the curriculum seen in many secondary schools and universities.

10:30. SCIOTO RIVER WATER QUALITY PROJECT, THIRTEEN SCHOOL DISTRICT COLLABORATION OF LEARNING SCIENCE BY DOING SCIENCE. DAVID E. TODT AND ARTHUR VORHIES, PROJECT DISCOVERY, SHAWNEE STATE UNIVERSITY, PORTSMOUTH OH 45662-4303.

This project is an OBR/Eisenhower funded project involving 13 southern Ohio school districts, Shawnee State University and Ohio University-Chillicothe. Each school completed monthly sampling of 11 water quality parameters on the Scioto River through Ross, Pike and Scioto counties. Results were reported electronically on Project Discovery's Network, so all participants could compare their results with other locations along the River. In addition, teachers and students participated in a two week Water Quality Institute, a canoeing event on the River, a Scioto River Water Quality Congress, and the production of a Scioto River Newsletter. A canoe trip to collect data on the River and a Scioto River Water Quality Congress, capped off the project. This summary of the project will focus on what we learned, how we plan to extend, expand and continue the project, and suggestions for implementing such a project in other watersheds.

10:45. VITAL SIGNS: A SUMMER WORKSHOP FOR HIGH SCHOOL BIOLOGY TEACHERS AND THEIR STUDENTS. DAVID W. KRAMER AND ANN M. ACKERMANN-BROWN, OHIO STATE UNIVERSITY AT MANSFIELD, 1680 UNIVERSITY DR., MANSFIELD OH 44906.

With funding from the National Institutes of Health we have developed a Summer Workshop for High School Biology Teachers and a Summer Institute for 11th grade participants from OSU's Young Scholars Program. Using hands-on activities, "Vital Signs" explores what it means to be "alive" and what is required to maintain a healthy body. Each lesson is firmly grounded in the basic biology of vision, speech and hearing, the circulatory system, genetics, nutrition, etc. and not merely about "good health." Each unit was designed by OSU faculty members and presented to the teachers in their workshop, first with a lecture covering the basic biology and then followed by the hands-on exercise that was later shared with the students. In this presentation we will provide an outline of program content, describe the presentation techniques, funding, and discuss the implementation process so that others will be encouraged to develop similar programs.

EDUCATION DIVISION

1:30 PM SATURDAY, APRIL 29, 1995

ROUSH HALL 210

C. WAYNE SHIRBISH - PRESIDING

1:30. INSTITUTIONAL POSTER PAPER SESSIONS - A MEANS OF COMMUNICATING RESULTS OF UNDERGRADUATE RESEARCH PROJECTS TO THE BROADER COLLEGE/UNIVERSITY COMMUNITY. JACK KOVACH, GEOLOGY DEPT., MUSKINGUM COLLEGE, NEW CONCORD OH 43762.

Students majoring in the sciences at Muskingum College have traditionally been required to complete a senior research project, culminating in a written report - the senior thesis. Historically, the results of these projects have been formally communicated by way of 10- to 15-minute oral presentations to an audience typically composed only of fellow students and faculty in the department in which the work was done. To gain greater exposure both within the Science Division and throughout the broader college community for the many interesting projects undertaken by senior science majors and to provide a measure of recognition for our students more commensurate with the effort put forth by them in completing these projects, the author in 1990 initiated the Muskingum College Science Division poster paper session (MCSDDps) in which senior majors in all of the departments in the Science Division present the results of their research projects as poster presentations at a single meeting held locally one evening during National Science and Technology Week (generally observed in late April). The 1990 MCSDDps was so well-received by students, faculty and the broader college community that the MCSDDps has become an annual event and a highlight in the academic calendar of the Muskingum College Science Division.

1:45. PROVIDING INFORMATION ON RADIATION AND LOW-LEVEL RADIOACTIVE WASTE TO THE PUBLIC. AUDEEN W. FENTIMAN, JOSEPH E. HEIMLICH, KAREN M. MANCL, BRIAN K. HAJEK, RICHARD N. CHRISTENSEN, OHIO STATE UNIVERSITY, 240 HITCHCOCK HALL, 2070 NEIL AVENUE, COLUMBUS OH 43210.

Low-level radioactive waste has been generated for decades and has been buried at national disposal facilities. Now those facilities are closed, and states are responsible for disposal of their own low-level waste. Citizens of Ohio want to know about low-level waste in this state and about the radiation that this waste emits. A team of faculty members from The Ohio State University Extension and the OSU Nuclear Engineering Program have developed a statewide educational program to provide unbiased, research-based information on low-level radioactive waste. The education program consists of 27 fact sheets, five exhibits, a slide/tape presentation, and newspaper and magazine articles on various aspects of radiation and low-level waste. An extensive review system was developed for the fact sheets to ensure that they were accurate, complete, easy to understand, and unbiased. Information in the fact sheets was used as the basis for the other material. These materials have been distributed through the County Extension Offices in all 88 Ohio counties. They have been provided to interested civic organizations, local and state elected officials, departments of health, hospitals, and libraries. Methods have been developed for effectively presenting information on science, and in particular, radiation, to the public in a variety of formats.

2:00. A COMPARISON OF THE OPINIONS OF SCIENCE EDUCATION PROFESSORS AND HIGH SCHOOL DEPARTMENT CHAIRPERSONS CONCERNING SCIENCE PROJECTS AND SCIENCE FAIRS. MICHAEL G. GROTE, DEPT. OF EDUCATION, OHIO WESLEYAN UNIVERSITY, DELAWARE OH 43015.

A 20-question Likert Scale and a brief questionnaire concerning science projects and science fairs were sent to approximately 600 science teacher educators at universities across the country and 600 high school science department chairs in Ohio. Slightly over 30% of each group returned the surveys. There was a very high degree of agreement between the groups on their responses to the Likert items with most response sets showing a correlation of over 0.9. Four items showed the greatest divergence; these still showed a moderate positive correlation in the range of 0.4-0.6: 1) Independent science research projects are not compatible with constructivist views of science education, 2) Cash and scholarship prizes detract from the real purposes of science fairs, 3) Science fairs promote interest and enthusiasm about science, 4) science projects are equally valuable at all grade levels. Perhaps more surprising than these slight differences was the remarkable degree of agreement between the groups on the other statements. For example, compare the percentage of each of the responses (strongly agree, agree, no opinion, disagree, strongly disagree) from the two groups on the statement "The opportunity to explain one's research to an outside observer (judge) enhances a student's interest in the research he/she has done." 35-39-13-11-1 and 37-41-12-8-1 (correlation = 0.998).

2:15. USING MAGNETS TO TEACH THE METRIC SYSTEM TO ELEMENTARY SCHOOL SCIENCE STUDENTS. KENNETH A. LASOTA, DEPT. OF NATURAL SCIENCES, AND REBECCA A. STANHOPE, SCHOOL OF APPLIED SCIENCES AND EDUCATION, ROBERT MORRIS COLLEGE, 600 FIFTH AVENUE, PITTSBURGH PA 15219.

Elementary students master a topic most readily when they can experience the topic tactually. Exercises centering on systems of measurement are ideally suited for the incorporation of tactile activities. Reviewed here is a lesson plan that utilizes small magnets to teach linear measurement, in both English and metric equivalents, to third, fourth and fifth grade students. The exercise requires one hour of science class time over three consecutive days. Required materials include meter and yard sticks, 20 to 30 small magnets (3cm/6cm/10cm) and assorted paper clips, metal pens and metal ball bearings. In supervised activities, students measure the distances over which the magnets, and combinations of the magnets, interact with the various objects and with each other. Measurements are recorded, a journal kept and students present their data in both graphical and pictorial displays. Student comments concerning their interest level in systems of measurement before and after the project indicate that the use of magnets as a manipulative worked to engage the students in learning. Students repeatedly expressed the fact that because the magnets produced a variety of motions among the objects, the exercises seemed to "come alive" and made the learning about measurement fun.

2:30. EXPOSING THE EARTH: GEOLOGY COVERS. GARRY MCKENZIE AND STEPHEN JACOBSON, GEOLOGICAL SCIENCES, OHIO STATE UNIVERSITY, COLUMBUS OH 43210-1308.

Attracted by aesthetics, memories, or the unknown, geologists scrutinize covers of *GEOLOGY*. What and where is it? What does it tell me? Some covers trigger emotion: nostalgia for the familiar, awe for the spectacular, appreciation for complexity. Covers appreciated for their aesthetics often rely on inner knowledge peculiar to geoscientists. Before reading the caption, we play a mental game in knowing the site or function artfully depicted. It whets one's appetite to delve deeper for more profound information in visual treasures. How are covers chosen? Aesthetics and precision play a role, but rarity and informational richness must stand tall. Our analysis has defined groupings of our choice of high impact covers. Our objective was to place the best available covers into collages to ignite the enthusiasm of observers, to attract students, colleagues, and aesthetes to the beauty of science art, and to explain interesting concepts, processes, materials, perspectives, and forms contained in the art of earth science. The recent growth of imaging technology and object display has led to many advances in how we know our earth. It has also raised science art to higher levels. This procedure can be spread to other scientific disciplines.

2:45. CAN MIDDLE SCHOOL STUDENTS' OPINIONS ABOUT WOMEN'S SCIENTIFIC ABILITIES BE CHANGED BY A TRAVELING SCIENCE SHOW. STACEY E. PANAGOTOPULOS AND MICHAEL G. GROTE, DEPT. OF EDUCATION, OHIO WESLEYAN UNIVERSITY, DELAWARE OH 43015.

In an attempt to change the opinions of middle school students on women in nontraditional careers, particularly math and science, a Traveling Science Show was developed by students from Women in Science and an elementary science methods class. Five person teams created a fun, hands-on science project to present at a local middle school. The college students, mostly female, served as positive role models, i.e. women succeeding in math and science. Before attending the science exhibit, the middle school students were given a Likert scale survey that assessed their opinions toward women in math and science. Students were surveyed again after participating in the exhibit. The survey results were compared using a t-test for paired samples to determine if the activity had any effect on the students' opinions concerning the gender issue. The test results showed that the difference in mean change in opinion (before-56.7, after-57.3) was not statistically significant. Attitudes about this issue can not be changed in a one hour activity such as the science exhibit. One positive aspect noted was the students enthusiasm about the exhibit and apparently acquiring a more positive attitude toward science.

3:00-3:30 BREAK

3:30. EARTH SYSTEMS EDUCATION IN OHIO MIDDLE SCHOOLS. VICTOR J. MAYER, DEPT. OF EDUCATIONAL STUDIES, OHIO STATE UNIVERSITY, 1945 N. HIGH ST., COLUMBUS OH 43210.

The Earth Systems Education Program (ESE), centered at The Ohio State University and Northern Colorado University, provides a model for the integration of all sciences in K-12 curriculum. It has been especially well-received by middle school teachers. Ten central Ohio school districts were involved in an Eisenhower funded program designed to acquaint key teachers with the ESE approach to curriculum restructure. As a result, four schools in different districts have developed complete two or three year middle school science programs. They include Bexley Middle School, Clinton Middle School in Columbus City School District, Marysville Middle School and Park Middle School in South Western City School District. Examples of each of the curricula

integrated will be discussed along with the development and implementing processes.

3:45. USING SYMBOLIC COMPUTATION SOFTWARE (MAPLE) TO ILLUSTRATE AND ANIMATE ACID-BASE SPECIES WITH pH. WILLIAM A. HOFFMAN, DEPT. OF CHEMISTRY, DENISON UNIVERSITY, GRANVILLE OH 43023.

The molecular form of soluble compounds is often determined by solution acidity. The ability to protonate and deprotonate molecules, including amino acids, is a particularly important characteristic. As pH changes from about 1.5 in the stomach, to about 8.3 in the intestine, to around 7.4 in blood and most body fluids, the form and charge of these molecules change. Whether a molecule is neutral or charged often is one of the primary determinants of its reactivity and transport. These programs use mass and charge balance equations and corresponding equilibrium constants to graph and animate the way mono-, di-, and triprotic species are distributed in solution with varying pH.

4:00. TECHNOLOGY IN SUPPORT OF INTEGRATED LEARNING: AN EXAMPLE OF PIONEERING PARTNER AWARD SCHOOLS NADINE K. HINTON, LINDA ORLICH AND ALL TEACHERS AND ADMINISTRATORS AT EMERSON ELEMENTARY AND CENTRAL COLLEGE ELEMENTARY SCHOOLS, c/o EMERSON ELEMENTARY MAGNET SCHOOL, 44 N. VINE ST., WESTERVILLE OH 43081.

Emerson and Central College Elementary Schools were recently named as one of Ohio's 1994 Pioneering Partners Schools for our innovative use of technology in instruction. Pioneering Partners is sponsored by the Great Lakes Governors Association and GTE. We will describe how hands-on activities, real life problem solving, integration across disciplines are supported by technology. Recognizing that students learn in diverse ways, varied instruction and assessment methods will be discussed.

4:15. WATER RESOURCES EDUCATION IN-SERVICE STRUCTURE FOR OHIO COUNTY EXTENSION PERSONNEL. K.T. RICKER, L.C. BROWN AND K.M. BOONE, AGRICULTURAL ENGINEERING DEPT., OHIO STATE UNIVERSITY, 590 WOODY HAYES DR., COLUMBUS OH 43210-1057.

The Ohio Water Resources Education Project (OWREP) addresses the need for Ohio citizens to be knowledgeable about water resources, and the importance of water to the quality of life. The overall goals of OWREP are to help local citizens improve their lives through better understanding of the physical nature of water resources, and to enhance public access to water resources information. The project targets existing networks of local educators and technical resources specialists, particularly county Extension agents within Ohio State University. OWREP is coordinated by Extension in cooperation with a coalition of state and federal agencies. It is divided into 3 phases: (1) conducting in-service programs, (2) producing fact sheets, (3) disseminating information. In-service programs for county Extension agents are the major component of OWREP. During in-service, agents are taught technical information about water resources and how to assess this information. The agents incorporate this information into two factsheets about water resources specific to their county: one factsheet is a general overview of their water resources; the second is specific to the county's ground water. OWREP's second major phase is fact sheet production, which includes extensive outside review. Disseminating information to the public is the third major phase. Currently, fact sheets for 40 counties have been produced; 7 additional counties are completing fact sheets, and another 8 counties are in the beginning stages of production. By late 1995, 55 counties will have successfully participated in OWREP. The goal is to educate agents and develop water resources fact sheets for all 88 Ohio counties by 1996.

4:30. TEACHING NUTRITION IN SCIENCE WORKSHOP. KELLY J. KOHLS, ASSISTANT PROFESSOR, DEPT. OF PHYSICAL EDUCATION, HEALTH AND SPORTS STUDIES AND AFFILIATE IN THE DEPT. OF ZOOLOGY, MIAMI UNIVERSITY, OXFORD OH 45056.

Miami University offers students enrolled in the Masters of Arts and Teaching (MAT) program a lecture/application course which utilizes information from nutrition lectures, text, computer programs and other materials which is then applied to concepts taught in secondary science courses. Nutrition content can easily be incorporated into many areas of science making content of both nutrition and other science areas more applicable to daily life. Many topics are introduced by questions commonly asked by secondary school students. Students enrolled in this workshop develop lesson plans incorporating nutrition concepts into their particular curriculum.

4:45. MASTER OF ARTS IN TEACHING IN THE BIOLOGICAL SCIENCES AT MIAMI UNIVERSITY. ROBERT G. SHERMAN, PROFESSOR OF ZOOLOGY AND DIRECTOR OF MAT BIOLOGICAL SCIENCE PROGRAM, MIAMI UNIVERSITY, OXFORD OH 45056.

The departments of Botany, Microbiology and Zoology jointly offer a part-time, non-thesis, masters degree program in biology designed for those certified to teach secondary school biology. Thirty-two graduate semester hours are required. Of these, 18 must be in so-called formal courses in biology, including at least one formal course in each of the three departments. The remaining hours may be taken in additional formal courses, workshops, and special off-campus field courses. The only stipulation is that the remaining 14 hours must be taken in subject areas pertinent to the teaching of biology. The vast majority of program offerings are taught in the summer months. Participants are expected to complete the degree in no more than four years. All participants receive a waiver of the instructional fee, and those who complete eight or more graduate hours per year receive a \$900 stipend each year. Room and board is provided at no charge to those who reside 60 or more miles from Oxford. Currently, there are 53 participants in the program, with the vast majority of them residing in southern Ohio. Funding is provided by a grant from the Howard Hughes Medical Research Institute and by Miami University.

ENGINEERING

1:30 PM SATURDAY, APRIL 29, 1995

ROUSH HALL 208

TOM T. HARTLEY - PRESIDING

1:30. LINEAR STATE SPACE SYSTEM IDENTIFICATION A NEW MATHEMATICAL FORMULATION. TAAN EL-ALI AND EDWARD ASIKEKE, WILBERFORCE UNIVERSITY, DIV. OF ENGINEERING AND COMPUTER SCIENCE, WILBERFORCE OH 45384.

In certain control systems the plant is well studied and well characterized. While the plant is in its intrinsic configuration, the control system is well suited to the plant. Unfortunately, if and when a sudden change to the plant occurs due to an unforeseen event, the plant must be re-identified. The article will present a new mathematical technique that can be used to identify the "new" plant. Assumptions include: (1) the original plant parameters were known to a reasonable degree of accuracy, (2) an observer for the original system exists, (3) the system order is unaffected by damage, (4) the disturbed plant can be reasonably modeled as a linear system, (5) the state space matrices have constant entries, and (6) the damage is instantaneous. The proposed technique is applicable to any dynamic system. The approach utilizes an observer to assist in the identification process. The general solution for the problem is $[\Delta F] = ([X]^T[X])^{-1}[X]^T Y$ where $[F]$ is the dynamic matrix, $[X]$ is a rectangular matrix of input and output measurements, and $[Y]$ is a vector of entries that came from the transition matrix. The above equation is unique and new in the literature of Estimation.

1:45. ION IMPLANTATION FOR OBTAINING HIGH-RESISTANCE LAYERS IN INDIUM PHOSPHIDE. RAVI K. NADELLA, DIV. OF ENGINEERING AND COMPUTER SCIENCE, WILBERFORCE UNIVERSITY, WILBERFORCE OH 45384.

Indium phosphide (InP) is an attractive semiconductor because of its properties like high frequency response, high radiation tolerance, and high breakdown voltage. High-resistance layers in InP are needed for inter-device isolation, current confinement layers in lasers, and compensation of the implant tail for abrupt doped layers. Light ion bombardment and transition metal implantation are the two ways of obtaining these high-resistant layers. Light ions create damage that trap the carriers and hence same light ion can be used to compensate both n- and p-type layers. Transition metal ions, on the other hand, create either donor or acceptor levels to trap the carriers. Hence different ions are needed for compensating n- and p-type layers. We have studied B, Fe, and Co implants to compensate n-type InP and Ti implants to compensate p-type InP. The resistivity obtained with B implantation disappeared for annealings after 500 °C. After suitable annealing, Fe and Co implanted samples gave resistivities of the order of 10^3 Ohm-cm. Ti implanted samples gave higher resistivities. Detailed results will be presented at the conference.

2:00. FILTERING FOR COMPRESSION AND RECONSTRUCTION OF NOISY SPATIALLY-INVARIANT IMAGE SEQUENCES. YONG-GAB PARK AND JAMES B. FARISON, DEPT. OF ELECTRICAL ENGINEERING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606-3390.

Spatially-invariant (SI) image sequences are generated when some variable in the object or imaging system changes as a sequence of images is taken (with no relative motion of the object and imaging system). SI images arise in medical imaging (nuclear medicine, MRI, x-ray, etc.), in multi-spectral imaging (airborne or satellite), and other areas. Each image contains unique information about the object but such images are also quite redundant.

Because of the considerable amount of data required to represent an image sequence, it is often desirable to compress (reduce) the image data for transmission and/or storage. To be satisfactory, the compression must be accomplished in a way that permits effective reconstruction of the original images from the compressed image data. Using a mathematical model for SI image sequences, image sequence compression/reconstruction algorithms (filters) are derived for noisy image sequences. The derivation is based on the properties of projection operators in linear algebra. The compressions/reconstructions take advantage of the inherent compression potential (redundancy) of SI image sequences while maintaining effective reconstruction even in the presence of higher noise levels. These new algorithms are evaluated by actual application to noisy image sequences.

2:15. SIMULATION AND CONTROL OF THE CONVECTIVE-CONDUCTIVE CHUA MEDIUM. SHEFALI SANGHANI, TOM T. HARTLEY, AND FARAMARZ MOSSAYEBI, DEPT. OF ELECTRICAL ENGINEERING, UNIVERSITY OF AKRON, AKRON OH 44325-3904.

A chaotic medium in the form of a spatially distributed convective-conductive Chua system is studied. Although a hypothetical nonlinear spatially distributed system, its simplicity of forms approximate realization with circuit components, and relative ease of study make it a good prototype for understanding the fundamental dynamic processes in many more complicated systems, such as turbulent flows, combustion, and plasma physics. The equations have the following form;

$$\begin{aligned} (\partial u / \partial t) + c(\partial u / \partial x) &= a(v + ((u - 2u^3)/7)) + d(\partial^2 u / \partial x^2); \quad (\partial v / \partial t) = u - v + w; \\ (\partial w / \partial t) &= (-100/7)v + f \end{aligned}$$

where u, v , and w are the local spatial dynamic variables, t is time, x is a spatial variable, f is a local control input, c is the convection weighting, d is the conduction weighting, and (a) is a variable that controls the local instability of the medium, or equivalently, the amount of chaos in the system. These equations can have a variety of interesting boundary conditions, including fixed $(u(x, t) = g(t))$, free $(du(x, t)/dx = g(t))$, and lossy $(du(x, t)/dx + ku(x, t) = g(t))$; where k is a constant, $g(t)$ is a forcing function, and these equations are evaluated at a particular boundary. A ring of material can also be formed. Note that with $c=0$, the conduction, or diffusion, could be in 2 or 3 spatial dimensions. After presenting the very complicated dynamics of this system, it is shown that the system can be stabilized using classical or modern methods of control design, depending upon the location and distribution of the sensors and actuators.

2:30. SIMULATION OF LATERAL MOTION IN MOVING WEBS JOHN B. YERASHUNAS, 602 SHERMAN ST. APT. 21, AKRON OH, 44311.

The lateral motion of a moving web is described by the following equation, $E(\partial^2 y / \partial x^2) - T(\partial^2 y / \partial x^2) + (w/g)(\partial^2 y / \partial t^2) = 0$, where E is the modulus of elasticity of the web material, I is the lateral moment of inertia of the web, w is the weight per unit length of the web, x is longitudinal distance, y is lateral distance, and g is acceleration due to gravity. This equation is discretized using finite differences, and the lateral position at a given point x is simulated as time is varied. Once the simulation is made, a controller is designed to reduce oscillations in lateral position.

2:45. ENHANCEMENT OF RADIONUCLIDE LUNG SCANS. PUSPA I. KHALID AND JAMES B. FARISON, DEPT. OF ELECTRICAL ENGINEERING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606-3390 AND FRANK E. ZINK AND MICHAEL J. DENNIS, DEPT. OF RADIOLOGY, MEDICAL COLLEGE OF OHIO, TOLEDO OH 43699-0008.

This paper presents the results of a preliminary study for the enhancement of a radionuclide lung scan, a very sensitive test for pulmonary embolism. Comparison of the lung perfusion and ventilation scans is an important diagnostic guide for detection of lung abnormalities. Although it would be desirable diagnostically to reverse the order, it is preferred clinically to do the Tc-99m perfusion scan then the Xe-133 ventilation scan. This is because a pulmonary embolism has little or no effect on the lung ventilation. Therefore, if no abnormality is found in the images of the perfusion scan, the ventilation scan can be omitted. However, since the 140 keV Tc-99m will scatter into the Xe-133 energy window (80 keV), if the ventilation scan is needed after the perfusion scan, its quality is reduced. Image enhancement of the perfusion-ventilation scan sequence to upgrade the ventilation image quality has been developed and evaluated. After an abnormality has been determined by the perfusion study (images from the Tc-99m window), an image of the scattered Tc-99m radioactivity in the 80 keV Xe-133 window is acquired. Then, the ventilation image is acquired. By subtracting the 80 keV scattered Tc-99m image data from the Xe-133 image, pure ventilation information is obtained, giving the diagnostically desirable results with the clinically preferred method.

3:00. AVIRIS IMAGE PROCESSING USING SD FILTER. BO MA CORDELL AND JAMES B. FARISON, DEPT. OF ELECTRICAL ENGINEERING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606-3390.

This project investigates the application of the simultaneous-diagonalization (SD) filter technique for spatially-invariant image sequences to Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) images. AVIRIS is a relatively new remote sensing digital image acquisition instrument. It acquires 224 contiguous digital images, each with a spectral bandwidth of 0.096 μ m in the spectral region extending from 0.4 to 2.45 μ m. When flown at an altitude of 20km, AVIRIS covers a ground swath 10km wide with 20m resolution cells. The image sequence used in this project is part of the AVIRIS images of the Lunar Crater Volcanic Field in Nevada. In this image sequence, there are five geologic endmembers (features): red cinders, playa lakebed, rhyolite, vegetation and shade. AVIRIS images form a spatially invariant multispectral image sequence. By using the SD filter and the unique signature of each feature, the separate spatial distribution (image) of each endmember is generated, from which the original image sequence is reconstructed. The error analysis is done by comparing the original and reconstructed image sequences. Because the number of endmembers (5) is much less than the number of images in the sequence (224), significant data compression is achieved. Thus, the SD filter can be used to compress AVIRIS image sequences, to extract and analyze the end members and to reconstruct the original sequence.

ENVIRONMENTAL ISSUES

9:00 AM SATURDAY, APRIL 29, 1995

ROUSH HALL 114

EVA A. SEBO - PRESIDING

9:00. NEWSPAPER COVERAGE OF ZEBRA MUSSELS IN NORTH AMERICA: A CASE OF "AFGHANISTANISM"? DONALD ROUSH JR., SCHOOL OF NATURAL RESOURCES, OHIO STATE UNIVERSITY, 2021 COFFEY RD., COLUMBUS OH 43210.

A content analysis of 218 newspaper stories mentioning zebra mussels was conducted. All appeared between June 1, 1988, and May 31, 1993, in five selected newspapers: *Cleveland Plain Dealer* (N=88), *Columbus Dispatch* (N=72), *Cincinnati Enquirer* (N=23), *Louisville-Courier Journal* (N=21), and *Memphis Commercial Appeal* (N = 14). The research questions were two: How much zebra mussel information has been disseminated through large metropolitan newspapers?; and, 2. Is Afghanistanism-a term for a portrayal of a newspaper's own metropolitan area's environmental issues as less severe or less negative than those occurring elsewhere-influencing coverage of zebra mussels? Findings show more extensive coverage near the site of worst infestation, as would be expected by news' geographic proximity property. There was more early coverage in Columbus and Louisville, than Cleveland, however, the percentage of stories stating urgency and mentioning adverse effects was found to decrease over time, with the greatest change in those papers granting the problem the most coverage. The most pervasive use of urgent words was found in Columbus, Cincinnati, and Louisville. Overall, data provide patchy support on the question of Afghanistanism's occurrence. Integration of findings into a theory of distortion in environmental communications is suggested. Fertile areas of linkage may be found in risk perception, uses and gratifications, and stochasticity.

9:15. A METHODOLOGY FOR ASSESSING EFFECTS OF AN INTRODUCTORY ENVIRONMENTAL HISTORY COURSE ON STUDENT WORLDVIEWS. JENNIFER L. TOMSEN AND JOHN F. DISINGER, SCHOOL OF NATURAL RESOURCES, OHIO STATE UNIVERSITY, 210 KOTTMAN HALL., 2021 COFFEY RD, COLUMBUS OH 43210-1085.

This paper describes a study that developed a methodology for assessing effects of an environmental history course on student environmental worldviews. This methodology can be adapted for use in other courses. A focus of the study was the development, in collaboration with students enrolled in the course, of a grounded survey instrument which was later administered. Triangulation of method was a crucial component of the study methodology: interview data supplemented inferences from survey data obtained from Likert-type, categorical, and open-ended questions. Quantitative analysis of Likert-type and categorical survey questions consisted primarily of correlation analysis and analyses of variance. Content analysis was used to classify and analyze qualitative data from open-ended survey questions and interviews. The methodology proved effective in addressing the seven research questions developed for the study each of which addressed a component of students' environmental world views. Results demonstrated that the course had a significant effect on the environmental world views of students by increasing their recognition of the relevance of the past to the present and their ability to articulate and support their positions with regard to resource and environmen-

tal issues. Results also indicated that the course helped students clarify their environmental perspectives, increased their optimism about resource and environmental issues, and caused shifting of their positions on a continuum of perspectives regarding the environment. Study results were inconclusive for two components of environmental world views examined: recognition of the complexity of resource and environmental issues and understanding of the historical context of past actions and attitudes regarding the environment. Future research should address the issue of permanence of demonstrated effects on student worldviews as well as refinement of the study methodology.

9:30. ENVIRONMENTAL EDUCATION: SOCIOLOGICAL APPROACHES. EVA A. SEBO, DEPT. OF SOCIOLOGY, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

Environmental problems often come to the attention of the public, including the educated and concerned public, one issue at a time. Indeed, we often focus attention on one geographic location, one industrial company, one state regulation, or even one molecule at a time: the one involved in a crisis at the moment. The public needs increased awareness of underlying, persistent social and cultural processes to acquire increased understanding of environmental issues. The field of sociology, which is a study of patterns of human behavior through social institutions and cultural belief systems brings useful, systematizing insights to our understanding of problems in the natural environment. With useful frameworks of analysis at our disposal, we become better equipped intellectually and in terms of attitudes, as we search for effective solutions. Of particular relevance are 1) economic and political institutions, and the way in which the distribution of power influences their operations, 2) dominant cultural values involved in permanence or change, and 3) regulatory or social movement sources of conflict around environmental issues. This podium presentation explores selected sociological insights on the above three topics, contrasts them with widely held beliefs on the same topics, suggests lines of critique and comparison, and offers examples of how to apply sociological insights to more effective solutions to problems in the natural environment.

9:45. OHIO'S ROLE IN THE NATIONAL CONSERVATION ORGANIZATION FRIENDS OF THE LAND (1940-1959). JENNIFER A. RUDGERS, JULIANA C. MELROY, AND JOHN B. KIRBY, DENISON UNIVERSITY, GRANVILLE OH 43023.

Friends of the Land (FOL), founded in Washington, D.C. in 1940, was a national conservation presence for two decades; at its height the group claimed 21,000 members. We have used the group's papers, deposited at the Ohio Historical Society, to examine the relationship between the conservation activism and academic ecology. Major FOL activities included publication of the quarterly *The Land* (later *Land and Water*), annual conferences and "field meets", the Home Management Watershed project, National Home Acres Clinics, and several books. FOL also supported Ohio Conservation Laboratories for Teachers, the Muskingum Watershed Conservancy, and the National Watershed Conference. The group's activities were consistently informed by an ecological perspective; in later years FOL attempted to facilitate direct linkage of ecological research and conservation efforts by developing a national Ecological Institute at Malabar Farms. Although national conservation leaders were active in FOL founding and leadership, Oberlain ecologist Paul Sears, the Muskingum Conservancy District's Bryce Browning, Ohio Conservation Supervisor Ollie Fink, novelist Louis Bromfield, and Columbus physician Jonathon Foreman were among Ohioans deeply involved in setting the organization's agenda. This agenda foreshadowed both concerns of the environmental movement of the 1970s and of contemporary ecologists. Financial problems related to purchase of Malabar Farms after Louis Bromfield's death caused FOL to become inactive in 1959 and merge with the Izaak Walton League in 1961; the promise of a national institute of ecology has yet to be realized.

10:00. FROM THE MUD OF LAKE OKOBOJI TO THE PEAT OF THE DISMAL SWAMP: THE ORIGINS OF PALYNOLOGY IN NORTH AMERICA. JULIANA MULROY, DEPARTMENT OF BIOLOGY, DENISON UNIVERSITY, GRANVILLE OH 43023.

Palyнологy (pollen analysis) allows study of past vegetation and climates; current global change research has increased interest in the subject. I investigated the introduction and spread of palynological techniques in North America through examination of personal and institutional archival material as well as publications. Palyнологy had its origins in studies of European peatlands; most authors consider modern palyнологy to date from von Post's 1916 presentation in Sweden. The first U. S. publication of data using von Post's techniques was presented by Phyllis Draper, a student of Paul B. Sears, at an Oklahoma Academy of Science meetings in 1928 and 1929; her work focused on Ohio bogs. By 1930 data from North American sites included more or less simultaneous publications by Draper and Sears on Ohio material, Lewis and Cooke on Dismal Swamp peat, and Bowman and Auer on Canadian deposits. It appears that Sears was the first to actually try out palynological techniques in North America, at Iowa's Lake Okoboji (1925); he discussed the methods, but

did not present data, at American Association for the Advancement of Science Meetings in 1926. Sears' interest in von Post's methods came from his experience in mapping prairie and forest boundaries in presettlement Ohio and efforts to explain the presence of prairie vegetation so far east of the main expanse. Thus the origins of palynology in North America can be considered to be firmly rooted in Ohio, although early work ranged from Iowa and Oklahoma to Virginia and eastern Canada.

10:15. FATE AND TRANSPORTATION OF PETROLEUM SPILL IN THE VADOSE ZONE. EMMANUEL M.J. VIGGESWARAPU, CIVIL & ENVIRONMENTAL ENGINEERING DEPT., YOUNGSTOWN STATE UNIVERSITY, YOUNGSTOWN OH 44555.

The presence of a non aqueous liquid phase in the subsurface often controls the rate and magnitude of ground water contamination. This paper is focused on the one dimensional infiltration of a non aqueous phase liquid through an unsaturated zone. Laboratory experiments were conducted in order to evaluate non aqueous phase liquid (NAPL) transport in the subsurface. The experiments were performed in a 17.5" long, 14.25" width and 9" depth Plexiglas box. Two experiments described here were conducted in homogeneous sand. The porosity of the sand was approximately 41%. Two different oils have been spilled in the center of the box for certain time and the behaviors of the oils have been recorded. It is observed from the experiments that non aqueous phase liquid migration in the subsurface is affected by the characteristics of the release scenario (volume of release, area of infiltrations, duration), properties of both the non aqueous phase liquid and subsurface media and subsurface flow conditions. A computer model called HSSM (Hydrocarbon Spill Screening Model) model which has been developed to study transportation of light non aqueous phase liquid (LNAPL) in the vadose zone is being adopted for the calibration. A case study of #2 diesel oil spill was considered to study the fate and transportation of #2 diesel oil in the vadose zone and the impact of the spill on the ground water, using HSSM model. Concentration of TRPH (Total Residual Petroleum Hydrocarbons) at different receptor well locations are predicted with the application of HSSM and compared with the available data.

10:30. BIOREMEDIATION FOR TREATMENT OF PETROLEUM CONTAMINATION. LI-TONG LI AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., HOWARD H. LO, GEOLOGY DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

The purpose of the study was to determine the effect of moisture and nutrient augmentation on the biodegradation of petroleum hydrocarbons in aerated soils. Nutrients and oxygen or nitrate were added contaminated soil. For fully mineralization of hydrocarbon ratio of 3.1 to 3.5 was required. Experimental conditions included soil contamination with 10,000 mg/kg of benzene, and oxygen concentrations of 8 mg/L for air saturated water, 40 mg/L for pure oxygen saturated water, and 250mg/L for hydrogen peroxide at 500mg/L. For contaminated site soil the concentration of hydrocarbon degrading microorganisms was about 1,000,000 CFU (colony forming unit)/g at depth of 20 m, while there was contaminated site soil. The results indicated that hydrocarbon degrading microorganisms are present in unsaturated soil and that forced aeration, coupled with addition of nutrients and moisture, stimulates degradation of hydrocarbons by those microorganisms.

10:45. BIOREMEDIATION OF PETROLEUM CONTAMINATED SOILS AND GROUNDWATER. EMMANUEL M.J. VIGGESWARAPU, CIVIL & ENVIRONMENTAL ENGINEERING DEPT., YOUNGSTOWN STATE UNIVERSITY, YOUNGSTOWN OH-44555.

Bio-remediation is the process that uses naturally occurring microorganisms to decompose toxic substances. The screening protocol for evaluating and implementing bioremediation involves several distinct phases. Information regarding the contamination and the contaminated media must be gathered during the site characterization and feasibility study stages. This paper outlines the site characterizations and methodology for obtaining kinetic and equilibrium parameters from treatability study data. The factors to be examined in the site characterization include the chemical characteristics of the contaminants and the chemical, physical, and microbiological characteristics of the site. Two fundamental studies are used for treatability study. Phase I determines if bioremediation is an appropriate remedial activity and Phase II is appropriate after bioremediation has been selected as the technology of choice. For the collection of site characterization and contamination treatability data, various data interpretation and modeling approaches are available. By using a simple mathematical model which was developed by using Monod equation, rate and extent of contaminant removal can be estimated. These model results can be used to estimate the time required to achieve cleanup standards, assess the relative importance of biological versus physical/chemical reaction mechanisms, and compare expected performance of alternative bioremediation methods.

EXPLORATION OF CULTURE: FROM TEXTILES TO TELEVISION 3:15 PM SATURDAY, APRIL 29, 1995 ROUSH HALL 214 MATTHEW T. CRAWFORD - PRESIDING

3:15. PLANT FIBERS IN PREHISTORIC TEXTILES OF EASTERN NORTH AMERICA. KATHRYN A. JAKES, 1787 NEIL AVE., COLUMBUS OH 43210-1295.

A comparative collection of plant materials has been established to aid in the identification and characterization of textiles from prehistoric native American sites. The collection includes plant stem fibers of herbaceous plants and inner bark fibers of woody plants, as well as plant stems, nut hulls, or roots used as dyes. The fibers have been categorized based on the observations made in processing the fibers from the plants and in macroscopic and microscopic examination. Fiber samples from textiles from several prehistoric sites have been examined including those from the Hopewell sites Seip Mound, Ohio, and Mount Vernon Mound in southwestern Indiana, and from the Mississippian site Etowah Mound, Georgia. The plant collection provides a means to identify fibers beyond the categories of "vegetal" or "bast" typically employed. Finely twined textiles made of fine yarns are made from particular categories of plant fibers. More coarse textiles are made of other categories of fibers and these show evidence of minimal processing in production of the yarns while the finer yarns required more processing. Study of fibers from textiles can further our understanding of the use of fiber by peoples of the past including inferences concerning collecting and processing behavior and technological expertise in the production of yarns and fibers.

3:30. WORLD SYSTEMS, CULTURAL EVOLUTION AND THE TRANSITION FROM THE LATE NEOLITHIC TO THE EARLY BRONZE AGE IN ANCIENT MESOPOTAMIA. DR. BARRY E. THOMPSON, 20 WILLOW DR., GALLIPOLIS OH 45631.

An alternative and new model of cultural evolution and sociocultural development is proposed for the Greater Mesopotamian region between the sixth and fourth millennia B.C. The model is based on a combination of archaeological, geographical and environmental data. Settlement pattern, ecological and material culture evidence is used to indicate the existence of sophisticated political and economic networks in the form of earlier regional systems. Recent "World System" theories are critically examined as applied to Early Bronze Age states. Previous hypotheses of Wallerstein, Frank, Edens and Algaze are evaluated in the context of the new model.

3:45. THE HISTORICAL AND CONTEMPORARY ROLE OF WOMEN WITHIN THE FAMILY IN NAVAJO CULTURE. GARLENA A. BAUER, DEPT. OF SOCIOLOGY, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

This study examines data obtained from the Doris Duke Collection which included the life history interviews of Navajo women, as well as data which was obtained by this researcher who conducted interviews focused on the role of mothers and grandmothers in contemporary Navajo culture. Findings reveal that Navajo mothers and grandmothers have a lot of power within their families. For example, grandmothers are referred to as "Saani" and are given the highest respect. Navajo families often rely upon grandmothers for child care and for teaching Navajo culture, values, and language to their grandchildren, including Navajo family philosophy which focuses on maintaining harmony and balance while moving forward and having good thoughts. Consequently, findings indicate that women within the family in Navajo culture both historically and in contemporary society are given both power and respect and provide a direct traditional cultural link between the past and the future by encouraging both respect for and direct involvement with traditional Navajo culture by grandchildren.

4:00. THE DIFFUSION OF COMMERCIAL TELEVISION STATIONS IN THE UNITED STATES: 1970-1990. JOHN S. COLBURN, 325 COLLEGE CT. KENT OH 44240.

The diffusion of innovations across the landscape has been an important area of economic and cultural geography. One innovation that has had a significant impact on American society has been commercial television. Over the years commercial television has become more influential and pervasive within our society than any other form of communication. Americans watch television more than they interact with any other medium. This research expands upon observations by Berry, Hudson, and others. It examines the diffusion process and the factors responsible for the spread of television over time and the resultant distributional pattern.

4:15. POLITICAL THOUGHT IN THE SCIENCE FICTION OF ORSON SCOTT CARD. LEE BRADFORD, DEPT. OF HISTORY AND POLITICAL SCIENCE, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

Using a textual analysis of the novel *Ender's Game*, Card's political thinking is examined. Special emphasis is placed on how Card's political ideas are consistent with the biblical, republican, and liberal traditions of American political thought. While Card's allegorical description of contemporary society is rather bleak, his prescription is hopeful. The structure that will promote the remarriage of religion, science, and community is outlined and critically evaluated.

GEOGRAPHY

9:00 AM SATURDAY, APRIL 29, 1995

ROUSH HALL 424

THOMAS W. SCHMIDLIN - PRESIDING

9:00. CLIMATIC PERSPECTIVES ON THE EXTREME COLD OF JANUARY 1994 IN OHIO. THOMAS W. SCHMIDLIN, DEPT. OF GEOGRAPHY AND WATER RESOURCES RESEARCH INSTITUTE, KENT STATE UNIVERSITY, KENT OH 44242.

The morning 19 January 1994 was the coldest known in Ohio with a minimum of -38.3°C at Logan and record minima at many sites. A greater area cooled below -35°C than during the Great Arctic Outbreak of February 1899 when the state minimum of -39.4°C was established. Impacts included closure of schools for the week; disruption of transportation, business, and fuel delivery; failure of heating systems; thousands of frozen water lines; and death of ornamental landscaping and grape vines. Based on records of the past 65 years, return periods of the temperatures recorded during January 1994 were estimated to be 10 to 30 years in northwest Ohio but 100 to 200 years in much of eastern and southern Ohio. Extreme return periods of about 1000 years were estimated for Ashtabula, Portsmouth, and Greenville.

9:15. THE POTENTIAL FOR PARALLEL PROCESSING IN AUTOMATED CARTOGRAPHY AND GIS. JOSEPH S. SZAKAS, OHIO STATE UNIVERSITY, CENTER FOR MAPPING, 1216 KINNEAR RD., COLUMBUS OH 43212.

This paper addresses the potential for improving current cartographic production times utilizing advancements in parallel processing. Parallel processing, or the organization of multiple processing units (CPUs) used for solving a specific problem, has begun to be more affordable and has great potential for reducing production times, when the amount of data to be processed is large. Digital topographic maps carry a large amount of information, and offer a favorable environment to explore parallel processing. Using The Ohio State University Center for Mapping's GISOM project methodology for performing analog to digital conversion of USGS 7.5 minute 1:24,000 scale topographic maps for the entire state of Ohio, as a model for exploration, significant improvements can be realized. Issues, such as speedup, hardware, processor organization and cost concerning the application and implementation of parallel processing techniques, in cartography will be discussed.

9:15. MEDIATED IMAGES OF SIMILAR LANDSCAPES: DIFFERENTLY PERCEIVED AND PORTRAYED. JAY D. GATRELL, DEPT. OF GEOGRAPHY AND PLANNING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

The purpose of this research is to understand the process by which the film portrayal of landscape influences the personal image of place. Using Zonn's Four Point Approach to examine the media image, landscape portrayal will be examined within two African-American films, *Boyz 'N The Hood* and *Straight Out Of Brooklyn*. Images examined within this research support and maintain societal structures, as well as locate the depicted landscape and characters within space. Furthermore, the paper will examine transactions between the perceiver and film image within the context of the geographic truths depicted in the film and cultural landscapes. The research concludes belief systems create truth, while transactions create, modify, and challenge beliefs.

9:45. APPLICATION OF THE CONCEPTS OF NATION-STATE, POLYETHNIC-STATE, AND PLURAL-STATE TO ALL COUNTRIES: A PRELIMINARY REPORT. THOMAS D. ANDERSON, DEPT. OF GEOGRAPHY, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403.

In political geography a State is a recognized government which controls a populated territory with defined borders, whereas a nation is a group of people with a distinctive self-identity derived from a common historical

experience. A nation-state exists when the two circumstances occupy the same space. Both polyethnic and plural states include two or more different ethnic groups (or nations) within their borders but differ in that the respective national homelands of the ethnic groups lie within polyethnic states and outside of plural states. This study constitutes an effort to classify the countries of the world on the basis of these three categories. In addition, several sub-categories are suggested with the aim of further clarification of the complex realities of world politics. The potential effects of various degrees of ethnic diversity on the political cohesiveness of a number of countries are examined briefly in summary remarks.

10:00 POSTER BREAK

10:15. INDIA IN THE NATIONAL GEOGRAPHIC. NEELA THAPAR AND GOPAL KRISHAN, DEPT. OF GEOGRAPHY, KENT STATE UNIVERSITY, KENT OH 44242.

An attempt at weaving an Indian story through a perusal of relevant articles published in National Geographic from August 15, 1947 to August, 1993, has been made in this paper. The precise question posed was: Did this great educational journal follow its guiding principle of accuracy, effective illustration, no bias, and nothing derogatory or controversial in its coverage of India? The findings are: (i) India did receive a generally fair representation through 76 articles during the period under review. (ii) The ethnic (*maha kumbh Mela*), royal (feudal splendor), and quaint (cobra) themes received special attention, thereby reinforcing the traditional image of the country. (iii) What fascinated the western audience rather than what was crucial to the Indian psyche today was targeted more, (iv) The avowed standards of accuracy, attractive portrayal and no bias are duly met but a sympathetic understanding of the evolving scene is not necessarily reflected. On the whole, the articles can be a valuable input for any writing on regional geography of India.

10:30. GEOGRAPHY AND THE GREAT WITCH HUNT OF 1692. JENNY M. GRABEL, DEPT. OF GEOGRAPHY AND PLANNING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

Through "community reconstruction", geographers and historians are better able to understand Salem, Massachusetts during the 1600s, including more accurate explanations of witchcraft accusations. This paper integrates these basic geographical and historical concepts to more comprehensively explain the conditions that led up to the witchcraft trials of 1692. This explanation is based on the European influence, prevalent psychological factors, the geography of Salem, and the sociology of two populations that lived there. Since Salem Town was located in the east, it benefited from an elaborate system of waterways and revenues largely from the fishing industry. However, residents of Salem Town greatly depended on nearby Salem Village (an agricultural area) for an adequate food supply. The issue of village autonomy initiated the problems that developed between townspeople and villagers. Consequently, the geographical location of these people is a key element in understanding how and why witchcraft trials took place. Those who owned land or lived near the border of Salem Town tended to be wealthy capitalists while those who lived at the periphery were mostly poor farmers. These two different economic lifestyles ultimately led to the destruction of the traditional Puritan community. Today, researchers draw on these early American experiences to address Japanese incarceration during World War II, McCarthyism, and modern-day allegations of child abuse.

10:45. A SURVEY OF STUDENT IN-MIGRATION INTO A RURAL OHIO SCHOOL DISTRICT. HENRY MOON, DEPT. OF GEOGRAPHY AND PLANNING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

This research was carried out by the Principal Investigator for the Archbold (Ohio) Area School District. During Academic Year 1992-1993, the school board funded an initial investigation of the district's changing demographics, an investigation reported on at the 1994 Annual Meeting of the Ohio Academy of Science. The follow-up investigation presented here is a direct result of that demographic analysis. The initial demographic study had found a less than expected pre-school population, and a great deal of concern was raised about the district's future enrollment levels. Consequently, a second study was sponsored to examine the role of in-migration into the school district. A written, two page survey (including a map) was issued through the district's K-6 teachers to each of the districts 835 K-6 students, aiming for a 100% returns. However, only 91.38% of the surveys were returned in a useable form. Results indicate that 39.1%, a very large share, of K-6 students migrated into the district as opposed to being born into the district. Additional results indicate: most in-migrators moved into the district during 1992, summer is the most popular migration period, roughly one-half of the respondents' parents were employed in the district prior to in-migration, 94% of the respondents have siblings, and that there is a distance decay function at work affecting in-migrator location.

GEOGRAPHY
1:30 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 424
JOSEPH G. SPINELLI - PRESIDING

1:30-2:00 EARTH AND SPACE SCIENCE MEETING

2:00. BIKE NETWORK INTEGRATION IN METROPOLITAN TOLEDO. THOMAS GROVER, DEPT. OF GEOGRAPHY AND PLANNING, UNIVERSITY OF TOLEDO, TOLEDO OH 43606

The passage of ISTEA (Intermodal Surface Transportation and Efficiency Act of 1991) mandates that intermodal integration be incorporated into regional transportation planning processes. The integration of various transportation systems has been a neglected component in transportation planning. In fact, the history of transportation policy and planning in the U.S. primarily has been unimodal, focusing on particular modes during specific eras. In general, U.S. policy and planning have been driven by the automobile. ISTEA represents an attempt to shift the dominant paradigm of transportation planning to intermodal integration. As a case study, the current transportation system in metropolitan Toledo provides little integration of bikeways with highways, mass transit systems, railroads, pedestrian walkways, waterways or airports. Key intersections with existing and proposed bikeways serves as the foci of this study. The methodology utilized in this study employs 502 acre spherical study areas. A land use analysis of the 502 acre areas around each of these nodes determines existing and potential nodes which may facilitate integration. Effective integration of bike ways with other transportation systems should logically occur at these areas of spatial confluence. The successful integration of bike networks into the metropolitan Toledo transportation system can provide safe, efficient means of transportation as well as reduce traffic congestion, improve air quality, and augment access to key traffic generators.

2:15. ECONOMIC DEVELOPMENT AND OHIO STATE UNIVERSITY EXTENSION: AN EXAMPLE OF APPLIED GEOGRAPHY. JEROLD R. THOMAS, OHIO STATE UNIVERSITY EXTENSION, 117 E. MANSFIELD ST., BUCYRUS OH 44820.

When one thinks of Ohio State University Extension (formally Ohio Cooperative Extension Service), one does not think of applied geography. Yet OSU Extension has several state and county faculty members that participate actively in community and economic development. In doing so, they are participating in the field of applied geography. This paper discusses the responsibilities of OSU Extension, some of the work currently being carried out, and explain how the author has used his geographic training to solve development problems.

2:30. ECONOMIC DEPENDENCY AMONG OHIO'S ELDERLY POPULATION: THE WAGES OF AN AGING SOCIETY, 1980-1990. JOSEPH SPINELLI, DEPT. OF GEOGRAPHY, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403.

The increasing burden of economic dependency among America's elderly population has been well documented and discussed. With prospects of an expanded life expectancy, and earlier retirement, and more time spent outside of the active labor force, the nation's elderly pose a dilemma for those in the working-ages who will be called upon in one way or another to provide the wherewithal to handle this older population. This is compounded by the burgeoning psychological and social problems attendant upon an older-age group of citizens who will see more years spent in need of health care and supervision. Taken as an integral part of nation's picture of the elderly, Ohio's aging population reflects the same situation found nationwide, but within the borders of the state, at the micro-level, there is considerable spatial variation among the eighty-eight counties in their individual burdens of dependency. As in the past, rural, agricultural counties continue to experience out-migration of younger working-age adults, leaving behind both the very young and elderly to be cared for by those still working. Even some densely-settled metropolitan counties are experiencing growing dependency ratios among their elderly as aging parents, many widowed, are forced to remain in or return to larger cities to be near medical treatment facilities.

2:45. ECONOMIC DEVELOPEMNT OF PACIFIC ASIA: PROCESS AND PROSPECT. STEPHEN S. CHANG, DEPT. OF GEOGRAPHY, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403

Pacific Asia is a dynamic region with rapid economic growth and importance. Japan is the world's second largest economy. The Republic of Korea (South Korea), Taiwan, Hong Kong, and Singapore can now be classi-

fied as developed countries. Indonesia, Malaysia, and Thailand are in the ranks of the newly industrialized countries. China is growing rapidly in recent years and Vietnam is attracting increasing attention of foreign investors. This paper intends to examine some characteristics common to the economies that experienced rapid economic growth, including the strategy of exporting manufactured products, the encouragement of private initiatives, and suitably educated work forces. With economic growth come the challenges of the need to upgrade the technologies and skills and to modernize the economic and business structures upon which future prospects lie. The introduction of market economies by some of the slow-growing countries will be discussed.

3:00. A GEOGRAPHICALLY CORRECT NATIONAL FOOTBALL LEAGUE: SOME SUGGESTIONS FROM CULTURAL GEOGRAPHY. DENNIS J. EDGELL, FIRELANDS COLLEGE, BOWLING GREEN STATE UNIVERSITY, 901 RYE BEACH RD., HURON OH 44839.

The National Football League (NFL) is composed of two conferences, each divided into three "geographic" divisions, East, Central, and West. The divisional structure of the NFL is not geographically correct. For example, the Atlanta, Georgia, franchise is in the west Division of the National Conference. Each season, that team must play a game in Los Angeles, New Orleans and San Francisco, and each of those teams must travel to Atlanta for a divisional game. Many other examples exist. League expansions have provided opportunities for reorganization, but these were never taken advantage of. Expansion to the current divisional set up has only brought more geographic inaccuracies. The great distances between many inter-divisional cities may also have reduced inter-city rivalry and other potential regional rivalries. This project provides a more rational geographic divisional structure for the recently expanded NFL. New, "geographically correct" divisions are suggested, utilizing the unique perspectives of cultural and regional geography. Distances between inter-divisional teams are minimized, and better regional representation is produced. At the same time, many old rivalries are preserved, while new regional rivalries are created.

GEOLOGY
9:00 AM SATURDAY, APRIL 29, 1995
ROUSH HALL 426
RICHARD J. STORCK - PRESIDING

9:00. THE AVERAGE DISTANCE OF THE EARTH FROM THE SUN. DAVID L. DEEVER, DEPT. OF MATHEMATICS, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

In astronomy texts one sometimes finds the description of an Astronomical Unit as the "average distance of the Earth from the Sun." In this paper we investigate the concept of average distance of a point on an ellipse from a focus and show that it is dependent on the choice of metric, or parameter, used to describe the ellipse. Four plausible alternatives for the parameter are considered: average with respect to the angle of revolution, average with respect to distance traveled, average with respect to time, and average with respect to projection onto the major axis. Numerical results show that for an ellipse of positive eccentricity the average with respect to the angle of revolution is less than the length of the semi-major axis, average with respect to distance is always equal to the length of the semi-major axis, average with respect to time is greater than the length of the semi-major axis, and average with respect to projection is very slightly less than the length of the semi-major axis. Numerical results are given for ellipses representing Earth, Pluto, and Halley's Comet. The more eccentric the ellipse the greater the difference. A mathematical proof that average with respect to distance is always equal to the semi-major axis is given.

9:15. SATELLITE CAPTURE PROCESSES AND POSSIBLE EFFECTS ON TERRESTRIAL PLANET EVOLUTION. ROBERT J. MALCUIT, DEPT. OF GEOLOGY AND GEOGRAPHY, DENISON UNIVERSITY, GRANVILLE OH 43023.

One of the mysteries of solar system science is the great contrast in the present environmental conditions of the sister planets, Venus and Earth. Earth is a safe haven for a multitude of life forms while Venus has persistent surface temperatures in the range 450-600 ° C. Other special features of Venus are (1) the presence of a dense CO₂ atmosphere (which is the result of extreme degassing of the mantle), (2) a slow retrograde rotation rate (-5832 hr/day), and (3) a geologically young surface (not older than 0.5 billion years and indicating a geologically recent resurfacing event). Specific angular momentum vs. mass plots of the outer planets and Mars suggest primordial prograde rotation rates

of 14.5 hr/day and 10 hr/day for Venus and Earth, respectively. The significant change in rotation rates as well as many of the special features of Venus and Earth can be explained by gravitational satellite capture and associated post-capture orbital evolution processes. A lunar-mass planetoid captured into a prograde elliptical orbit with major axis of 183 earth radii and 0.81 eccentricity can explain the angular momentum content of the earth-moon system. The system then evolves in time to the present conditions of the earth-moon system (rotation rate of 24 hr/day and lunar orbital radius of 60 earth radii). Retrograde capture of a 0.5 lunar-mass satellite by Venus into an orbit with major axis of 140 venus radii and 0.86 eccentricity and subsequent orbital evolution (prograde rotation for planet and retrograde motion for the satellite) results in a coalescence of the two bodies after an extended orbital evolution during which the upper mantle of the planet is heated by rock tidal processes as the satellite orbit decays to 1.6 venus radii. The satellite then breaks up and falls to the surface via atmospheric drag.

9:30. PALEOECOLOGY OF THE SHERIDEN PIT SITE, INDIAN TRIAL CAVERNS, WYANDOT COUNTY, OHIO. KENNETH M FORD, III, J. ALAN HOLMAN AND ANDREA BAIR, CINCINNATI MUSEUM OF NATURAL HISTORY, FREDERICK AND AMEY GEIER RESEARCH CENTER, 1720 GILBERT AVE., CINCINNATI OH 45202-1401.

The study of the 11,500 year old vertebrate fauna at Sheridan Pit continues to progress. The number of species identified has grown to sixty. This total includes nine species of fish, eight species of amphibians, ten species of reptiles and thirty-three mammals. The lower vertebrates are typical of the area around the site before its drainage for agriculture. Eight species of mammals, however, are no longer found in Ohio and three additional species are not now found near the site. Four species of large mammals in the fauna are now extinct. Species can be divided into those associated with ponded water surrounded by marsh and the streams feeding it, those associated with moist woodlands, and those preferring dry, open woodland. Mammals are generally indicative of boreal conditions. Several species are now restricted to ranges with southern boundaries in the northern Great Lakes basin or well north of the basin. Low diversity of mice and bats are also indicators of cooler conditions in this and other faunas. Because the reptile fauna contains many egg-laying species that can not reproduce in cold climates it is not compatible with the mammal fauna. The fauna, therefore does not suggest that boreal conditions prevailed in Ohio at the end of the Pleistocene. Differences in seasonal temperature may account for the mixing of cold tolerant mammals and cold intolerant reptiles and amphibians.

9:45. MORPHOLOGICAL VARIATION IN THE CORNULITIDS FROM THE WALDRON AND SILICA SHALES. SHANAN E PETERS, DEPT. OF GEOLOGY & GEOGRAPHY, DENISON UNIVERSITY, GRANVILLE OH 43023.

Ridged, conical epizoans resembling *Cornulites* occur on some fossil forms in the Waldron (Silurian) and Silica (Devonian) shales. In each case, the infestation is restricted in choice of host and mode of attachment. Cornulitids from the Waldron Shale occur primarily on the platyceratid gastropod *Naticonema* sp. Collective, intraspecific, aperture orientation of the epizoans with respect to host is random, but common, interspecific orientation of cornulitids on the same host frequently occurs. Marked morphological variation is observed. The Silica cornulitids occur on spiriferid brachiopods, primarily *Paraspirifer bowenkeri*. These epizoans show a preference for a common aperture orientation with respect to host, this being perpendicular to the line of commissure along the lateral margin of the shell, 1-2 cm from the hinge line. Scarring occurs at the point of attachment, forming a pair of opposing grooves on both valves, one empty, one containing the epizoan. Significant morphological variation has not been observed. Waldron cornulitids seem to use their host for little more than an elevated point of attachment, and probably fed from the water table independently of life processes of the host. A possible increase in evolutionary activity and/or the opportunity for niche exploration gave rise to successful morphological variation. Silica cornulitids, however, seem to be dependent on the spiriferid host, benefiting from its life processes in some fashion. As a result, the range of successful morphologic variation is restricted.

10:00 BREAK

10:15. THE BELLEFONTAINE OUTLIER: EROSIONAL OR STRUCTURAL? MICHAEL C. HANSEN, E. MAC SWINFORD, LAWRENCE H. WICKSTROM, JOHN P. WEAVER, AND HALLAN C. NOLTIMIER, OHIO GEOLOGICAL SURVEY, 4383 FOUNTAIN Sq. DR., COLUMBUS OH 43224

The Bellefontaine Outlier is an oval-shaped area of elevated topography in Logan and Champaign Counties. It rises about 500 feet above the general elevation of the surrounding region to 1,549 feet above sea level at Campbell Hill, the highest point in Ohio. Bedrock consists of Silurian Salina (undifferentiated), and Devonian Columbus-Lucas (undifferentiated) and Ohio

Shale. The outlier is about 25 miles west of the nearest contiguous outcrop of similar rocks. Previous cursory speculation on the origin of the outlier suggested that it may be a result of favorable location in regard to preglacial erosion or that a cap of resistant Ohio Shale protected underlying carbonates. Recent structure mapping suggests that the outlier lies within a graben bounded by a series of northeast-southwest and northwest-southeast-oriented normal and reverse faults that are associated with the East Continent Rift Basin and the Greenville Front. Recent gravity and magnetic surveys of the outlier seem to confirm the presence of faulting and grabenlike features. Reprocessing of the Ohio-1 COCORP line similarly indicates deep-seated basement faults that form a grabenlike structure. Recent analysis of sparse oil and gas well data does not reveal significant near-surface vertical offset of key beds. We suggest that the outlier may have been formed by concentration of erosion along graben-related fault and fracture zones that form the outlier boundaries. We do not rule out the possibility that the outlier is an erosional remnant in which Devonian rocks have been preserved.

10:30. THE CLAY INDUSTRY OF WEST CENTRAL INDIANA. MARK J. CAMP, DEPT. OF GEOLOGY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

West central Indiana lies on Wisconsinan and Illinoian sediments and Carboniferous bedrock providing a wide range of clay materials including tills, underclays, mudstones, and shales. The region has seen the rise and fall of numerous concerns specializing in the manufacture of face, fire, and paving brick; ceramic, drain, and roofing tile, and pottery. Records indicate potteries were in operation by the 1840s at Annapolis, Bloomingdale, and Clay City. In the early days of statehood, itinerant masons peddled their skills from town to town using available clays to make bricks at each construction site. Most towns had their own brick yard by the mid-1800s. These were replaced by larger operations in the late 1800s and early 1900s - the most notable being at Attica, Brazil, Cayuga, Clay City, Clinton, Crawfordsville, Martinsville, Mecca, Medora, Montezuma, Terre Haute, and Veedersburg. Brazil became the center of the clay industry - at least ten major tile and brick plants were operating by 1904. The peak of the clay industry was reached by 1910 and since that time the number of plants decreased, while the value of products increased. A number of companies continue to operate in the Brazil area, including the Clay City Pottery.

10:45. COAL MINING HISTORY OF THE MAHONING VALLEY. ANN G. HARRIS, DEPT. OF GEOLOGY, YOUNGSTOWN STATE UNIVERSITY, 410 WICK AVENUE, YOUNGSTOWN OH 44555-0001.

Coal mining in the Mahoning Valley of Ohio began in the 1850's when Michael Ohl of Weathersfield Township in Trumbull County discovered coal on his property. He began to deep mine it using the room and pillar method. Soon other individuals started mining coal. The plunging anticlinal structure of the coal bed (Sharon #1) caused the community to be named Mineral Ridge. Until the 1870's a 12-18" seam of material on the floors of the mines was left in place or discarded. It was called "bastard coal" because it wouldn't burn. When Welch miners started working in the mines, they realized it looked like the "Black Band Iron Ore" of Wales. Testing proved that they were correct. Therefore, steel was manufactured, called "American Scotch" and was exported to Europe. Soon the entire Mahoning Valley was dotted with coal mines and steel mills, such as the mines operated in the "Briar Hill district" of Youngstown owned by Governor Tod. Most mines were modest in size, but many of the mines were large, employing as many as 400 miners. By the 1900's most of the mines were worked out.

**IMMUNOLOGY: VIRUSES, THERAPY AND
RESEARCH; HORMONES:
PHYSICAL, EMOTIONAL,
DEVELOPMENTAL EFFECTS
1:30 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 330
LEE A. MESERVE - PRESIDING**

1:30. MESSAGE THERAPY: EFFECTS ON QUALITY OF LIFE, ANXIETY, DEPRESSION AND PAIN IN ONCOLOGY PATIENTS WITH METASTATIC DISEASE. ANDREA J. BEDWAY, PH.D., RN. RIVERSIDE METHODIST HOSPITALS, 3535 OLENTANGY RIVER RD., COLUMBUS OH 43214.

Pain, anxiety, depression and diminished quality of life (QOL) are significant problems for cancer patients as they attempt to cope with their disease. It has been hypothesized that massage therapy may have a beneficial effect on all of these, but this has yet to be shown conclusively in a controlled clinical trial. Forty eligible patients with metastatic cancer are being enrolled in a 6 week program involving twice weekly, 30 minute massages by a licensed therapist using a specific massage regimen. Prior to beginning the program, patients are asked to fill out several instruments which provide measures of pain, anxiety, depression and QOL at baseline. Vital signs are recorded immediately before and after each massage session. Patients record their perceived pain at the same times as well as one and two hours after massage using a visual analog scale. Instruments administered at baseline are repeated at week 3 and upon completion of the 6 week program. An interim analysis, performed after the first 15 patients, revealed a trend towards decreased anxiety and depression and increased QOL, but minimal effect on perceived pain.

1:45. RC IS THE ONLY PROTEIN BINDING TO THE V(D)J RECOMBINATION SIGNAL SEQUENCES IN FILTER HYBRIDIZATION ASSAYS. CHI-HO MAK AND LAI-CHU WU, DEPT. OF MEDICAL BIOCHEMISTRY AND DEPT. OF INTERNAL MEDICINE, OHIO STATE UNIVERSITY, 480 W. NINTH AVENUE, COLUMBUS OH 43210.

The variable region gene segments of the immunoglobulin and T cell receptor genes are assembled by site-specific DNA rearrangement events which occur during the differentiation of B and T cells, respectively. Apparently, the event is mediated by the V(D)J recombinase and the recombination signal sequences flanking the germ line V, D, and J gene segments. By screening an expression library constructed with thymocyte poly(A)⁺ RNA, we have identified a cDNA clone for a zinc finger protein Rc. Recombinant Rc fusion proteins bind specifically to the heptamer consensus sequence of the V(D)J recombination signal sequences. To identify protein species that interact with the signal sequences, mouse proteins isolated from various organs, tissues, or cells were resolved by SDS-PAGE, transferred to nitrocellulose filters, and hybridized to [³²P]-dATP labeled signal sequences. Hybridization signals of ~31 and 32 kDa were observed in the spleen, thymus, and bone marrow, but not in any other tissues, such as the brain, liver, and kidney. Proteins comigrating with these signal sequence binding proteins reacted with antibodies against an Rc fusion protein. Hence, the data suggest that Rc is the predominant protein which binds to the signal sequence.

2:00. MEASUREMENT OF IN VITRO LYMPHOKINE PRODUCTION IN BONE MARROW SUPPRESSION OF AN ANTI- CD3 RESPONSE: IMPLICATIONS FOR NS CELL SPECIFICITY. RONALD SMELTZ, JAMES HOLDA, DEPT. OF BIOLOGY, UNIVERSITY OF AKRON, AKRON OH 44325.

Natural Suppressor cells (NS) are large granular lymphocytes found in environments of hematopoiesis and in the spleens of mice undergoing Graft Versus Host disease. NS cells have been shown to suppress the proliferative responses of lymphocytes in an antigen non-specific manner. NS cell-associated suppression has been shown to depend upon the presence of IFN- γ , which is secreted by Th-1 cells, and can be enhanced by the addition of lymphokines from a Th-2 hybridoma (D9C1). Here, we examined the ability of bone marrow (BM) NS cells to suppress mitogen-induced Th-1 proliferation (Con A, PHA), as well as mixed Th-1/ Th-2 proliferation (PWM, anti- CD3). NS cell suppression of PHA and Con A responses was similar in that 2.5×10^5 BM NS cells marginally suppressed 2.5×10^5 spleen cells. After addition of Th-2 lymphokines (i.e. D9C1 supernate) suppression was increased to near 100%. NS cell suppression of PWM and anti- CD3 responses was 50%, with no increase in suppression upon addition of Th-2 lymphokines to the cultures. The results indicate a specificity in NS cell suppression. To confirm this, ELISAs were performed to measure lymphokine production after suppression of an anti- CD3 response. 48 hour culture supernates were collected and the amounts of IFN- γ and IL-4 (Th-1 and Th-2 lymphokines, respectively) determined. IFN- γ production was reduced by 60% (corresponding to cultures where proliferation was suppressed 70%). The data suggest that NS cells preferentially suppress Th-1 cells as opposed to Th-2 cells. This could have important implications for various pathogenic conditions, particularly AIDS.

2:15. THE EFFECT OF W-7 ON HSV-L REPLICATION. TERRI D. STONER, JENNIFER LEE AND DARLENE G. WALRO, DEPT. OF BIOLOGY, UNIVERSITY OF AKRON, AKRON OH 44325-3908.

N-(6-aminohexyl)-5-chloro-1-naphthalene-sulfonamide (code name = W-7) selectively inhibits calmodulin-dependent protein kinases. Previously we have shown that W-7 inhibited herpes simplex virus (HSV) production in a dose-dependent manner and at concentrations which were not cytotoxic to uninfected Vero cells. The objective of this study was to characterize the anti-herpetic mechanism of W-7. There was no detectable difference in the time of appearance or the amount of the early viral protein, ICP8, and the late viral

protein, glycoprotein C, produced in drug-treated, infected cells compared to untreated, infected cells. These results suggested that the drug may inhibit virus assembly or release. The ratio of intracellular to extracellular virus was approximately three-fold higher in W-7 treated, infected cells compared to untreated, infected cells. Electron microscopic analysis demonstrated the presence of a large number of nucleocapsids forming in the nucleus but relatively few enveloped particles in the cytoplasm or extracellular space of cells treated with W-7 compared to untreated cells in which the majority of particles were enveloped and present in the cytoplasm or extracellular space. Collectively, these results suggest that calmodulin-dependent protein kinases may be required for virus assembly or release during HSV replication and that W-7 may inhibit this process.

2:30. CURRENT STATUS OF THE HANTAVIRUS IN THE UNITED STATES. ROBERTA ASHBY AND DAVID MASON, WITTENBERG UNIVERSITY, SPRINGFIELD OH 45501.

In May 1993 an outbreak of a peculiar human illness struck the southwestern United States. The Centers for Disease Control soon tracked the cause of the illness to infection by a hantavirus distinct from other hantaviral strains predominant in Asia and Europe. The newly-discovered hantaviral strain causes pulmonary edema in victims who are infected indirectly from the deer mouse, the rodent host which inhabits most of the U.S. The resultant illness has been official labeled as Hantavirus Pulmonary Syndrome (HPS) which progresses quickly, and in most cases proves fatal within days or even hours. This presentation will consider the background on and the current status of this infection in the United States.

2:45. FATE OF CELLULAR PROTEIN KINASES FOLLOWING INFECTION WITH HERPES SIMPLEX VIRUS TYPE 1. CARLOS A. HENDERSON AND DARLENE G. WALRO, UNIVERSITY OF AKRON, DEPT. OF BIOLOGY, AKRON OH 44325-3908.

The synthesis of several host cell proteins is up-regulated whereas the synthesis of other proteins is down-regulated following infection with herpes simplex virus type 1 (HSV-1). Phosphate cycles on and off viral and cellular proteins at different times following HSV infection, suggesting that protein kinases are required at different times during the replication cycle. The objective of this study was to determine whether the levels of cellular kinases change during infection. Lysates of HSV-infected or mock-infected cells were prepared at hourly intervals beginning at 0 and continuing until 12 h post-infection (p.i.). The presence of viral proteins and cellular kinases was determined by ELISA. The viral β protein (ICP8) appeared at 4 h p.i. and remained at high levels throughout the infection cycle; the viral γ protein (gC) appeared at 8 h p.i. and increased throughout the remainder of the infection cycle. The level of cellular enzyme, protein kinase C (PKC), increased approximately ten-fold immediately following infection and decreased to background levels after 2 h p.i. compared to the level of PKC in mock-infected cells which remained fairly constant. The level of cellular enzyme, casein kinase II, increased approximately twenty-fold immediately following infection and remained approximately three-fold higher after 2 h p.i. throughout the remainder of the infection cycle compared to the level in mock-infected cells. These results suggest that the expression of cellular protein kinases is differentially regulated during HSV infection.

3:00. EFFECTS OF AGE, SEX, GROWTH HORMONE, DIET, AND PEROXISOME PROLIFERATORS ON FATTY ACID BINDING PROTEIN IN LIVERS OF HOLTZMAN RATS. M. M. BARKER, A.M. DEUCHER, AND S.S. SINGER, CHEMISTRY DEPT., UNIVERSITY OF DAYTON, 300 COLLEGE PARK, DAYTON OH 45469.

The first half of this research examines the mechanism behind the growth hormone (GH) reversal of debilitating effects of aging including the loss of bone, muscle, and lean body mass and the increase of adipose tissue. Fatty acid binding protein (FABP), believed to be involved in the intercellular transport of fatty acids and lipid metabolism, has been linked to GH action. The initial study confirmed that FABP levels were diminished in livers of old rats of both sexes, suggesting that GH can act through FABP. FABP levels were also measured in old male rats treated with GH but these results were inconclusive. In the second half of the project, we tested four FABP altering treatments to determine which one doubles male liver FABP levels. High fat and low fat diets had no significant effect upon FABP levels while gemfibrozil and clofibrate, peroxisome proliferators, were shown to double and triple respectively, the FABP levels. The clofibrate study was extended to old males and demonstrated that the FABP-increasing effect still occurs. (Support came from the U.D. Research Council and Honors Program).

3:15. EFFECTS OF LONG-TERM HYPOTHYROIDISM AND THYROID HORMONE REPLACEMENT ON HPA AXIS FUNCTION IN MICE. L.A. MESERVE, AND E.V. RUSS, III., DEPT. OF BIOLOGICAL SCIENCES, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403-0212.

Previous work has shown that hypothyroidism induced by maternal ingestion of thiouracil delays development of the hypothalamus-pituitary-adrenal (HPA) axis response to stress. The effect upon this axis of hypothyroidism prolonged into adulthood, however, has not been studied. The present investigation was done to surmise whether prolonged hypothyroidism further depresses HPA axis function and whether thyroid hormone replacement augments HPA response. Hypothyroidism was induced by feeding female Swiss-Webster mice diet containing 0.25% thiouracil from mating. Controls received diet without thiouracil. After weaning, pups were continued on the maternal diet to 3-4 mo. of age. At that age, thyroid hormone was replaced by subcutaneous injection of T_4 (50 ng/g bw) or T_3 (25 ng/g bw) for 14 d. After thyroid hormone injection, mice were either rapidly decapitated or subjected to a 1 min. ether stress and decapitated 15 min. later. Thyroid glands were weighed to determine goitrogenesis, and serum was collected for determination of corticosterone, T_4 , and T_3 concentrations by RIA. Hypothyroidism was evidenced in thiouracil-fed mice by T_4 levels that were <20% of normal, while T_3 concentrations were elevated. Replacement of T_4 reduced the goitrous thyroid mass by nearly 50%, but T_3 injection had no effect. All animals, regardless of thyroid status, demonstrated a normal increase in circulating corticosterone in response to ether stress. This response was not altered by T_4 , but T_3 injection augmented stress response. These data suggest that prolonged depression of T_4 does not prevent maturation of HPA response. Furthermore, this is likely the result of maintained T_3 levels, since injection of T_3 enhanced stress activation of the HPA axis.

3:30. INFLUENCE OF ACUTE HYPOTHYROIDISM AND VOLUME EXPANSION ON INTRACELLULAR AND CIRCULATING ATRIOPEPTIN-III IN MICE. W.T. NOONAN and L.A. MESERVE, DEPT. OF BIOLOGICAL SCIENCES, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403-0212.

Hypothyroidism is known to influence both synthesis and metabolism of protein, and cardiovascular efficiency. A number of studies have been done to determine whether these seemingly diverse effects of depressed thyroid status are related, since several peptides are involved in the endocrine regulation of blood pressure. Among these are members of the atrial natriuretic peptide (ANP) family, including the various atriopeptins. Much of the previous work has been done in large experimental animals. The objectives of the present study were two-fold: to determine whether the mouse is amenable to study of the influence of acute hypothyroidism on atriopeptin III (AP-III) economy; and to determine whether acute hypothyroidism and volume expansion alter intracellular or circulating AP-III levels. For two weeks, adult mice were fed control lab mash, or mash with 0.2% thiouracil to induce hypothyroidism. For the second week, half the animals in each group received 1.0% saline (NaCl) solution to drink to serve as a volume expander. After two weeks, blood was collected, and serum levels of thyroid hormones and AP-III were determined. Atrial muscle was immediately fixed for electron microscopic observation of changes in atrial natriuretic peptide storage granules. Sufficient sample for the commercial AP-III kit required pooling of serum from several mice, constituting a drawback to their use. Thiouracil depressed thyroxine to less than half normal, but neither hypothyroidism nor volume expansion altered triiodothyronine or circulating AP-III. Qualitative changes occurred in atrial ANP storage granules, as in larger animals. Thus, mice may be appropriate for ultra structural studies of hypothyroidism and ANP, but present difficulties in measurement of related circulating hormones.

3:45. THE EFFECT OF VASOPRESSIN ON THE ACTIVITY OF A SYNTHETIC GLUCOCORTICOID. JASON P. ROW, HELEN M. MURPHY, AND CYRILLA H. WIDEMAN, DEPTS. OF BIOLOGY AND PSYCHOLOGY, JOHN CARROLL UNIVERSITY, CLEVELAND OH 44118.

To investigate the role of the hormone vasopressin (VP) in mediating the response of the body to stress, corticosterone levels of VP-containing (LE) rats and VP-deficient (DI) rats were compared following administration of the dexamethasone suppression test under stressed and non-stressed conditions. The stress utilized was immobilization, an acute physical stress or. Dexamethasone (DEX), a synthetic glucocorticoid, was injected subcutaneously at a dose of 0.025 mg/kg. This dose of DEX was found to suppress plasma corticosterone in the non-stressed animal (both DI and LE) via feedback inhibition of the hypothalamic-pituitary-adrenocortical (HPA) axis. In the stressed situation, however, LE animals exhibited escape from DEX suppression; whereas, DI animals did not. Thus, in the absence of corticotropin releasing factor (which is inhibited by DEX), VP alone appears to be sufficient to elicit significant corticosterone release. These results support the hypothesis that VP plays an important role in the regulation of glucocorticoid release in stress via the HPA axis.

4:00. POWDERED NUTRIENT SUPPLEMENTS USE: AFFECTS ON EMOTIONS. ALICIA LONG AND KELLY KOHLS, MIAMI UNIVERSITY, OXFORD OH 45056.

Many different types of powdered nutritional supplements are sold over the counter of retail markets. Many of these supplement manufacturers make health claims such as "energy sustaining, completely nutritious, advanced natural source of energy, low fat, and high-fiber." The purpose of the study was to assess the physical feelings/emotions of subjects while they consume a common commercial powdered nutritional supplement over a four week period. Two powdered nutritional drink mixes, *Slim Fast* and *Sustain*, were fed at breakfast to sixteen assumed healthy adults for two weeks each. Preliminary results indicate that subjects reported feeling more energetic, moderately more full of pep and less negative emotions while consuming the *Sustain* brand of powdered nutritional supplement versus the *Slim Fast* brand. However, two of the 16 subjects experienced gastrointestinal discomfort while consuming the *Sustain* brand.

4:15. ANTIOXIDANT EFFECTS ON ELAM-1, ICAM-1 & VCAM-1 EXPRESSION IN HUMAN UMBILICAL VEIN ENDOTHELIAL CELLS (HUVE). G. E. MAKROGLOU, D.A. KNIGHT, D.D. SEDMAK, D.T. WITIAK & H.A.I. NEWMAN, DEPT. OF PATHOLOGY, COLLEGE OF MEDICINE, OHIO STATE UNIVERSITY, COLUMBUS OH 43210 & SCHOOL OF PHARMACY, UNIVERSITY OF WISCONSIN, MADISON WI 53706.

Decreasing adhesion molecule expression (AME) may reduce mononuclear cell binding to endothelium. The antioxidants probucol, 4-(4-chlorophenyl)-2-hydroxytetronic acid (CHTA), 4-(4'-biphenyl)-2-hydroxytetronic acid (BPTA), Vitamin C & Vitamin E acetate were tested for their ability to inhibit Endothelial Leukocyte Adhesion Molecule-1 (ELAM-1), Intracellular Adhesion Molecule-1 (ICAM-1) & Vascular Adhesion Molecule-I (VCAM-I) induction on HUVE cells. AME was measured by indirect flow cytometry with GAM-FITC. LPS induced ELAM-I in a dose-dependent manner with initial maximal expression at 30 ng/mL. TNF α induced ICAM-1 & VCAM-1 in a concentration dependent manner with initial maximal expression at 40 & 300 U/mL, respectively. Ethanol, the carrier solvent, did not alter AME in cells. TNF α induced ICAM-I expression was unaffected by all agents and Vitamin C had no effect on any AME. However, probucol, CHTA & BPTA inhibit both VCAM-1- & ELAM-induced expression in a concentration-dependent manner. Vitamin E acetate inhibits VCAM-I-induced expression in a concentration-dependent manner with IC₅₀ [the concentration (μ M) of inhibitor for 25% inhibition], for probucol, CHTA, BPTA & Vitamin E acetate of 20.4 \pm 2.3, 8.1 \pm 4.0, 117 \pm 46 & >500 μ M respectively with ELAM-1. With VCAM-1, IC₅₀s for probucol, CHTA, BPTA & Vitamin E acetate were 22.5 \pm 4.8, 186 \pm 16.5, 22.7 \pm 2.3 & 122 \pm 19 μ M, respectively.

**JUNIOR ACADEMY
2:45 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 336
SMITA DE - PRESIDING**

2:45. BIOREMEDIATION OF THE HERBICIDE ATRAZINE. LISA S. SCHLATER, 4833 MERCER DARKE RD, ST. HENRY OH 45883.

The objective of this project was to locate a microorganism native to the Ohio-Indiana area that is able to use the herbicide atrazine as a food source. A microorganism was located and proven to degrade atrazine. The purpose of this research is for the use in the clean-up of highly contaminated atrazine spills. This process of using microorganisms to reduce contaminants is known as bioremediation and is a promising technique in environmental clean-up.

3:00. A STUDY OF THE ROLE OF THE SPORES OF *BACILLUS THURINGIENSIS* ON *TRICHOPLUSIA NI* (CABBAGE LOOPER). RUSSELL A. BLAIR, 2737 TWP. RD. 182, BELLEFONTAINE OH 43311-9427.

The purpose of this work was to determine the role of the spores of *Bacillus thuringiensis* in the overall toxicity to *Trichoplusia ni*. Bioassays have been run using three bacterial strains: M33, PHP13, and PHP13/1002. M33 carries the spores of B.t. PHP13/1002 is an E. coli vector that carries the crystal of B.t. PHP13 was used to make sure the vector carried no toxic properties. Preliminary bioassays have been run performed demonstrating that the spores of B.t. do have some toxic value to *Trichoplusia ni*. Further bioassays will be run using purified spores and crystals.

3:15. RECYCLING PLASTICS, POLYCARBONATES, PROGRESS: A THREE YEAR STUDY. MARIANELA E. ZYTKOWSKI, 27527 LAURELL LANE, NORTH OLMDST OH 44070.

The first year of my project demonstrated, through testing, that the six basic types of plastic were not compatible. In the second year, I focused on developing a better method for sorting plastics and devised a color coded bar scanning system to separate the plastics. The third year of study was devoted to analyzing and controlling the effects of moisture on polycarbonate resin. I chose polycarbonate because it is hygroscopic in nature and is considered one of the strongest and most useful plastics. Three groups of polycarbonate were tested with differing amounts of moisture content. The three groups were melted down in an injection molding machine. Stock temperatures and observations were recorded as air shot samples were taken from the machine. Test data indicated that the greater the percentage of moisture content in the polycarbonate during the molding process, the more likely the polycarbonate resin would become defective. The obvious application of this project is in recycling. If the color bar code system of sorting plastics is used, the moisture level will be lower and less energy will be needed to heat the recycled plastics in the molding process. This procedure will lead to recycled plastics that are strong, flexible, and versatile.

3:30. EFFICIENTLY STORING HEAT BY VARYING MASS POSITION.
MATTHEW E. MOWRER, 67610 AIRPORT RD., ST. CLAIRSVILLE OH 43950.

The purpose of my research is to determine if there is an optimal position to place the major portion of a structure's mass. To determine this, I constructed two model structures with the same dimensions and the same relative mass. The structures are controlled by a thermostat with a remote sensor. To calculate the efficiency of the structures, the amount of energy used is measured in Watt-hours, thus giving simple data collection and analysis. These structures are bi-layered; house number one has the major portion of its mass located on the inside of the structure, and house number two has the major portion of its mass located on the outside. On both houses the second layer is Dow Extruded Polystyrene Foam Insulation. This insulation has an R value of 9. The material used as the major portion of the structure is one-half inch quarry tile (available at outlet stores such as Color Tile). This tile has a mass of 19.73 grams per square inch. After conducting my test several times, I came to the conclusion that the structure with the major portion of its mass on the inside was more efficient than the structure with the insulation on the inside. I attribute these results to the fact that the tile absorbs the heat and holds it, while the insulation's mass traps heat but does not store it as effectively; thus, after a short time, the air cools and the heater comes back on.

3:45. TECHNIQUE DEVELOPMENT FOR KNEE STABILIZATION IN THE POST LATERAL COLLATERAL LIGAMENT INJURY ATHLETE. ROBERT C. MABE, 105 EAST MAIN STREET, ASHVILLE OH 43103.

The presence of an effective taping technique which supports an injured lateral collateral ligament (LCL) while an athlete returns to active participation in a sport is an integral facet of player knee rehabilitation program. Some of the more common procedures in an athletic training department includes supportive taping. This also applies to the support of the LCL, for which the American Academy of Orthopedic Surgeons (A.A.O.S.) recommends a procedure which places six strips of elastic tape over the lateral aspect of the knee to aid in prevention of varus opening of the knee joint. This procedure allows some gaping of the joint when applied. The Mabe procedure applies eight strips of elastic tape over the lateral joint line along with an additional three strips of non-elastic tape. This leads to a stronger procedure which reduces gaping when compared to the A.A.O.S. method. The Mabe procedure then applies a three inch elastic support over the knee to re-enforce the procedure. A study ran by designer Robert Mabe included volunteer athletes in a double-blind study to provide their opinions on the support, warmth, stabilization, flexibility, and comfort of the Mabe and AAOS procedures. After running a National Athletic Trainers Association recommended activity checklist, subject opinion data projected that the Mabe procedure provided more support, warmth, and stabilization of the LCL area with comparable overall comfort and flexibility to the A.A.O.S. method.

4:00. DO THE GENERIC BRANDS OF MOUTHWASH WORK AS WELL AS THE NAME BRANDS? RICH BAYER, 1700 HUNTINGTON DR., MANSFIELD OH 44906

I chose this project because there are so many commercials advertising that their generic brand is as good as the name brand, but costing less. To investigate this question, I performed two tests for each mouthwash. I took bacteria samples from my mouth, then rinsed my mouth with a mouthwash, then calculated the amount of bacteria killed. My hypothesis was that the name brands would in fact kill more bacteria than the generic brands. I believed that it was worth the extra money to buy the name brands instead of the generic brands. I hypothesized that Listerene would kill the most bacteria out of the five mouthwashes tested. Next I hypothesized that Peridex would kill a lot of bacteria but not as much as Listerene. Then I hypothesized that Scope, Meijer,

and Equate would tie for last. My results were very surprising. In first place was Peridex, killing seventy three percent of the total bacteria. In second place was Scope, killing seventy percent of total bacteria. The next mouthwash was the one that surprised me most, it was Meijer just edging out Listerene, killing forty nine percent of total bacteria. Listerene killing forty eight percent of total bacteria. In last was Equate, killing forty one percent of total bacteria.

4:15. A COMPARISON OF HIGH SCHOOL ENVIRONMENTS: THE INFLUENCE OF PREJUDICE ON PERCEPTIONS OF INTERRACIAL RAPE.
JESSICA H. HARDIE, 6780 STONYRILL LANE, FRANKLIN OH 45005.

For four years I have investigated various aspects of students attitudes towards rape, gender, and race. My latest research examined high school environments' effects on students' perceptions of rape. I used a survey to test my hypotheses. Each survey proposed three rape cases: marital, date, and stranger. Respondents received one of two versions of the questionnaire in which I varied the race of the victim and suspect (that is, African American or white). The survey also included some questions which reflected respondents' attitudes towards race and gender issues. Finally, I included a number of demographic items to determine if other independent variables influenced students' perceptions of rape, race, and gender. To examine differences in school atmospheres, I distributed my surveys to three high schools, which differed in parental socioeconomic status (SES) and level of community and school racial integration. I used an SPSSX program to analyze my results. First I performed frequencies on all items and then used chi square analyses across tabulations to test my hypotheses. Finally, I performed correlations on my attitudes items to determine if racial and gender opinions were related. My results substantiated past research. My findings indicated that of the three schools I tested, students in the school which was less racially integrated were more likely to hold racist attitudes. In addition, I found that in the school where the children's parents had higher levels of SES, students were less biased in their views of women and African Americans.

4:30. DO SPECIFIC AMBIENT ODORS ENHANCE SHORT-TERM MEMORY?
BRETT T. PERALA, 600 EASTWOOD ST., GENEVA OH 44041.

It was hypothesized that short-term memory would be enhanced when subjects were exposed to a specific ambient odor which was perceived as pleasant by the test subject as determined in a previously administered smell survey. Previous experimentation demonstrated that exposing test takers to the ambient odor of the essential natural oil of peppermint, lemon, and rosemary has a measurable positive effect on both short and long-term memory. The procedure included administering one set of memory tests with no odor present, one set of tests while in the presence of an odor which the subject found pleasant, one set of tests while in the presence of an odor which the subject found unpleasant, and finally, one set of tests while in the presence of the ambient odor of peppermint, lemon, and rosemary. Odors which individuals perceived as pleasant or unpleasant neither enhanced nor retarded short-term memory, however, the specific odor of peppermint, lemon, and rosemary did have an identifiable, positive effect on short-term memory.

4:45. SECOND HAND SMOKE. CRAIG C. W. HUGHES, 13659 SINKING SPRING RD., PEBBLES OH 45660.

New research has shown that both carbon monoxide and tar can be just as harmful to the involuntary smoker as to the person who is actually smoking the cigarette. In order to investigate my hypothesis, that children of smokers will have less lung capacity than children of non-smokers, I tested my fellow students using a Miniwright Peak Flow Meter. Each subject filled out a questionnaire determining their height, whether or not their parents smoke, and that they have been totally free of any illness for at least the past two weeks. Each subject then took a sterile mouthpiece, inhaled a deep breath, and exhaled forcefully through the mouthpiece of the Peak Flow Meter. The Peak Expiratory Flow was measured in liters per minute (PEF l.p.m.). Each subject repeated the test and I based my results on their best PEF. The findings, which supported the hypothesis, show that the children of non-smokers tested had better lung capacity than the children of smokers by a margin of 35.3 l.p.m.. The three most dangerous chemical substances related to smoking are carbon monoxide, tar, and nicotine. The Surgeon General said in 1993, that each cigarette takes seven minutes off the life of the smoker as well as the involuntary smoker.

JUNIOR ACADEMY

2:45 PM SATURDAY, APRIL 29, 1995

ROUSH HALL 116

BRIAN R. DULIN - PRESIDING

2:45. EFFECTS OF FREE RADICALS ON BIOLOGICAL SUBSTANCES. AMY A. CAUDY, 5797 PLANTATION ROAD, SUNBURY OH 43074-9412.

Free radicals, commonly produced in biological systems, are molecules with unpaired electrons. Cases of enzyme inactivation, DNA damage, and cell death have been linked to free radicals. Plasmid DNA carrying genes for antibiotic resistance was treated with a system of xanthine and xanthine oxidase for varying periods of time. This enzyme system is a source of superoxide anion radical (O_2^-). The free radical-treated plasmids were inserted in *E. coli*, a process known as transformation. Transformation rates from treated plasmids were compared to control DNA. Transformation rates dropped sharply with increased exposure to the enzyme system, even though calculations show that all free radicals were produced within the first minute. Damage was complete within thirty minutes of free radical exposure. Electrophoresis revealed that free radical exposure caused strand breaks in the plasmid DNA. This data indicates that free radicals adversely affect DNA function. Current investigation considers the effect of plant pigments in this free radical system. In addition, the effect of superoxide anion on *E. coli* T4 virus was tested. Free radical treatment had negligible effect on virus infectivity. Other classes of viruses are under study.

3:00. COLIFORM BACTERIA'S EFFECT ON MAN MADE LAKES. SARAH E. PIERSON, 5125 TWITCHELL ROAD, SPRINGFIELD OH 45502.

When sewage pollution occurs, enteric diseases such as cholera and typhoid fever can be transmitted through water. To detect sewage pollution, the coliform group of bacteria is used. Coliform organisms are defined as any bacteria that are nonspore-forming, rod-shaped, gram negative, and that make gas and acid from lactose at 35 degrees Celsius within 48 hours. The purpose of this research is to compare the effects the coliform bacteria had on the ecosystems of two man-made lakes, C.J. Brown Reservoir in Clark County and Indian Lake in Logan County. Both lakes have been subjected to the coliform bacteria through sewage pollution. Just as the bacteria in sewage effects humans, I believe it will also have a profound effect on the microorganisms inhabiting the lakes. To test my hypothesis, dissolved oxygen, photometric measurements and conductivity will be standardized to determine optimal living conditions. Coliform testing will be done to determine the amount of sewage pollution, if any, is in the lakes, and after this water samples will be collected to determine the different species of microorganisms inhabiting the waters and the population of each. These findings will be compared to research collected about how many and what species of microorganisms should flourish in the determined conditions if the water was not contaminated by sewage.

3:15. MUTATIONS OF *E. COLI* BASED ON ENVIRONMENTAL STRESS. AARON GENE STEMEN, P.O. Box 575, RUSSELLS POINT OH 43348.

This project dealt with observing the phenomena of spontaneous mutation in *E. coli* in response to environmental stress. Five xenobiotic chemicals were added to the growing environment of *E. coli* strain ATCC-23858. The five xenobiotic chemicals were streptomycin, ampicillin, tetracycline, nalidixic acid, and phenol. Separate strains of *E. coli*, resistant to 1.4 ug/ml phenol, 25 ug/ml streptomycin, .75 ug/ml ampicillin, and approximately 4 ug/ml nalidixic acid were produced. These strains will be tested for their retention of these newly obtained characteristics. It would seem likely that the percentage of cells that will retain this newly acquired characteristic will decline during the time period that it is removed from the xenobiotic chemical environment. The degree of retention of these newly acquired characteristics will have implications for utilization of antibiotics in clinical, agricultural, and laboratory applications.

3:30. REDUCTION OF *PROTEUS MIRABILIS* ADHERENCE THROUGH FIMBRIAL MODULATION CAUSED BY EXPOSURE TO SUBINHIBITORY CONCENTRATIONS OF QUINOLONE ANTIBIOTIC. SCOTT M DAMRAUER, 4332 CANDLEWOOD, SYLVANIA OH 43560.

The effect of quinolone antibiotics on the adherence of *Proteus mirabilis* to latex urinary catheters was examined. Adherence assays were performed in a model of the urinary tract and demonstrated the ability of ciprofloxacin and PD 131628 to significantly reduce bacterial adherence. Hemagglutination assays and electron microscopy revealed that this reduction in adherence was mediated by reduction in the length of the fimbriae, a previously unrecorded phenomenon.

3:45. BIOREMEDIATION: BIOSTIMULATION VERSUS BIOAUGMENTATION. ADRIENNE L. MENNITI, RR 4 Box 62, PROCTORVILLE OH 45669.

Biostimulation and bioaugmentation are the choices to enhance bioremediation activity at hydrocarbon contaminated sites. Although both are

equally effective, bioaugmentation should produce a higher reduction of petroleum hydrocarbons in a shorter amount of time than biostimulation. This project was conducted over a seventy-one day period using four soil pans. Each pan had approximately the same amount of hydrocarbon contamination. The first pan was the soil control pan in which no bioremediation was done. On the second pan, aeration only was used. In addition, each pan was aerated evenly. Pan number three was the biostimulation pan. Nutrients were added to the soil to enhance the naturally occurring bacteria which remediate the contamination. Soil pan number four was the bioaugmentation pan. A bacterial culture was added to this pan to remediate the hydrocarbon contamination. Bioaugmentation came out ahead by reducing the contamination from 250 PPM to 52 PPM, as compared to biostimulation which reduced the amount of hydrocarbons from 240 PPM to 60 PPM. Although this difference is only minimal, the rate at which the change occurred took place much quicker dropping drastically in the beginning and leveling out at the end. Biostimulation made the reduction gradually over the entire duration. The main reason for such a drop in these last two pans is probably due to the aeration. This point can be shown by looking at the reduction of hydrocarbon in the aeration pan. It went from 210 PPM to 68 PPM. A Photoionization Analyzer was used to measure hydrocarbon content in units of parts per million (PPM).

4:00. THE EFFECT OF NITRATE ON STAGES OF THE LEGUME-RHIZOBIA SYMBIOSIS. SARAH E. BORK, 7235 CLOISTER RD., TOLEDO OH 43617.

Fixed nitrogen, such as nitrate or ammonia, is essential for the growth and productivity of crops. Growing Legume crops is one way in which dependence on chemical fertilizers can be reduced. Research has shown that nitrate has an inhibiting effect on the legume-Rhizobia symbiosis. The purpose of this project is to pinpoint the stage of the symbiosis during which the symbiosis is most vulnerable to inhibition by nitrate. Alfalfa, *Medicago sativa*, was grown with and without symbiosis with Rhizobia. Nitrate was added at several critical stages in the symbiotic development. The hypothesis is that plants which received nitrate at germination will show no signs of symbiosis, while plants receiving nitrate at 16 days will nodulate more effectively than those receiving nitrate at 10 days. The study is continuing and final conclusions are unavailable at this time; however, preliminary results indicate that inoculated plants, as expected, grow the most when exposed to nitrate at 16 days after germination, while uninoculated plants grow the most when receiving nitrate at 0 or 10 days.

4:15. ULTRAVIOLET RADIATION INDUCED DNA DAMAGE: QUANTITATION OF DNA DAMAGE INDUCED BY UVA, UVB, AND UVC RADIATION. STEVEN E. TUTTLE, JR., 419 HINSDALE CT., WORTHINGTON OH 43085.

Samples of calf thymus DNA were exposed to Ultraviolet (UV) Radiation in the UVA, UVB, and UVC spectra to quantitate UV induced DNA damage. Equivalent amounts of DNA were exposed to 25, 50, 100, 200, and 400 Joules/cm² in each radiation spectra. Antibodies to thymine dimers were used to quantitate T-T dimer formation, using an ELISA technique. DNA damage, as measured by T-T dimer formation, was more significant for UVC than UVB or UVA radiation, respectively. At 50 Joules/cm² UVC induced 52, UVB 22, and UVA less than 1 thymine dimer per 12.5ng of calf thymus DNA. UVC and UVB radiation therefore induced a significant amount of damage in the DNA, while UVA did not show any significant damage at the exposures studied.

4:30. DETERMINATION AND IDENTIFICATION OF *BACILLUS THURINGIENSIS* DELTA-ENDOTOXIN RECEPTOR SITES OF *MANDUCA SEXTA* AND *TRICHOPLUSIA NI* MIDGUT EPITHELIAL CELLS. VALERIE S. KERNS, 2881 Co. Rd. 5 NORTH, BELLEFONTAINE OH 43311.

Bacillus thuringiensis is a gram positive soil bacteria which produces a crystal protein upon sporulation. The crystal protein, known as the delta-endotoxin, is toxic to insects which have an alkaline pH in the midgut. The toxin subunits bind to specific receptor sites on the midgut membrane and integrate to form potassium ion channels. An osmotic balance disruption results in 3 basic harmful reactions in the insect. In order to determine the specific protein receptors a cDNA library was constructed and inserted into the expression vector lambda gt 11. The *B. thuringiensis* endotoxin will be used to probe for the binding protein and the resulting toxin-receptor complex will be identified using an enzyme linked anti-toxin antibody.

PHYSICAL AND MATHEMATICAL SCIENCES
9:00 AM SATURDAY, APRIL 29, 1995
ROUSH HALL 336
FREDERICK J. THOMAS - PRESIDING

9:00. SYNTHESIS AND STRUCTURAL ASPECTS OF BIS-BENZENEDITHIOLATO COMPLEXES OF GROUP 15. DIRK PFEIFFER, KRISTIN KIRSCHBAUM, AND DEAN GIOLANDO, DEPT. OF CHEMISTRY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606-3390.

We have been investigating the synthesis, structural chemistry and spectroscopic data of 1,2-benzenedithiolate complexes of group 15. An anaerobic treatment of AsCl_3 with two equivalents of 1,2- $(\text{LiS})_2\text{C}_6\text{H}_4$ in THF gives, after metathesis with $[\text{NBu}_4]\text{Br}$ in ethanol, $[\text{NBu}_4][\text{As}(\text{S}_2\text{C}_6\text{H}_4)_2]$ (monoclinic, P21/c, $Z=4$, $a=8.578(1)\text{\AA}$, $b=19.170(4)\text{\AA}$, $c=18.713(3)\text{\AA}$, $\beta=96.01(1)^\circ$). The central As(III)-atom is surrounded by four S-atoms of the 1,2- $\text{S}_2\text{C}_6\text{H}_4$ -ligands resulting in a distorted trigonal bipyramidal AsS_4 -core. Distortion from ideality is manifested by significant reduction of the S-As-S angles $\{\text{S}_{\text{ax}}\text{-As-S}_{\text{ax}}: 168.51(2)^\circ$ and $\text{S}_{\text{eq}}\text{-As-S}_{\text{eq}}: 103.70(5)^\circ$ compared to 180° and 120° in the ideal polyhedron; $\phi\text{A}=95.7^\circ$, $\phi\text{B}=126.2^\circ$) attributable to the stereo activity of the As lone pair electron. Compared to the $[\text{NEt}_4][\text{Sb}(\text{S}_2\text{C}_6\text{H}_4)_2]$ ($\text{S}_{\text{ax}}\text{-Sb-S}_{\text{ax}}: 158.95(3)^\circ$ and $\text{S}_{\text{eq}}\text{-Sb-S}_{\text{eq}}: 105.08(3)^\circ$; $\phi\text{A}=100.5^\circ$, $\phi\text{B}=127.5^\circ$) both compounds show values characteristic of the $[\text{M}(\text{unsymetric-bidentate})_2(\text{lone pair})]$ class of complexes. We have also prepared the $[\text{NBu}_4][\text{Bi}(\text{S}_2\text{C}_6\text{H}_4)_2(\mu\text{-}(\text{S}_2\text{C}_6\text{H}_4)_2)]$. Under anaerobic condition BiCl_3 reacts with a methanolic solution of $\text{NaOMe}/1,2\text{-(HS)}_2\text{C}_6\text{H}_4$ to give after metathesis with $[\text{NBu}_4]\text{I}$ and recrystallisation from hot acetone, crystals suitable for x-ray (monoclinic, P21/n, $Z=4$, $a=17.477(3)\text{\AA}$, $b=10.267(2)\text{\AA}$, $c=17.794(4)\text{\AA}$, $\beta=96.70(2)^\circ$). The dimeric anion can be viewed as an edge sharing bi-square-pyramid.

9:15. SYNTHESIS OF FIRST ROW TRANSITION METAL TRIS(1,2-BENZENEDITHIOLATE): $[\text{M}(1,2\text{-S}_2\text{C}_6\text{H}_4)_3]^{2-}$, WHERE $(\text{M}, z) = (\text{V}, 2)$, $(\text{Cr}, 3)$ AND $(\text{Mn}, 2)$. DEAN M. GIOLANDO, ARNOLD FELDMAN, KLAUS LAUE, KIRK PFEIFFER, KRISTIN KIRSCHBAUM, DEPT. OF CHEMISTRY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606-3390.

A variety of methods were employed to prepare the title compounds, which were fully characterized by spectroscopic, electrochemical and crystallographic data. The V-complex was prepared in modest yield by the reaction of VCl_3 and 1,2- $(\text{NaS})_2\text{C}_6\text{H}_4$ and in a high yield from the reaction of $[\text{VO}(1,2\text{-(HS)}_2\text{C}_6\text{H}_4)_2]^{2-}$, 1,2- $(\text{HS})_2\text{C}_6\text{H}_4$ and Et_3N . The Cr-complex was prepared in good yield by the reaction of $[\text{CrMe}_6]^{3-}$ and 1,2- $(\text{HS})_2\text{C}_6\text{H}_4$. The Mn-complex was prepared in good yields employing two methods: the first was the reaction of $[\text{MnMe}_6]^{2-}$ and 1,2- $(\text{HS})_2\text{C}_6\text{H}_4$; and, the second was from the reaction of MnO_2 , 1,2- $(\text{Me}_3\text{SiS})_2\text{C}_6\text{H}_4$, 1,2- $(\text{HS})_2\text{C}_6\text{H}_4$ and Et_3N . Details related to the above reactivity will be discussed with emphasis on the novel use of hexakis(peralkyl) metallates and metal oxides to prepare homoleptic thiolate complexes.

9:30. MASS SPECTRAL STUDIES OF STERICALLY CONGESTED STILBENES. P. SEKHER AND JAMES E. GANO, DEPT. OF CHEMISTRY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

Sterically crowded stilbenes have received more attention very recently after realizing their importance as novel materials in applied research. We have synthesized 2,2,5,5-tetramethyl-3, 4-diphenylhex-3-ene (DTBS) and its derivatives in high yields. These compounds showed characteristic fragmentation patterns in their mass spectra, different from the fragmentation seen from normal stilbenes, in addition to the distinctive fragmentations expected from the added functional groups. The characteristic fragmentation for DTBS's is shown to be a tendency to lose big pieces of the molecular ion, relieving steric strain, leading ultimately to ions which can be identified as diaryl- or arylalkylacetylenes. Mass spectra of these compounds and the fragmentation observed with respect to the structure and functional groups will be presented.

9:45. pH EFFECTS ON PHENOL-FORMALDEHYDE RUNAWAY REACTIONS. ENJO KUMPINSKY AND JOHN E. CORN, R&D DEPARTMENT, ASHLAND CHEMICAL, PO Box 2219, COLUMBUS OH 43216.

Phenol-formaldehyde reactions have many industrial applications in the areas of foundry binders, wood composites, fiber bonding, coatings and adhesives, just to name a few. These reactions are very exothermic, and certain circumstances can lead them to uncontrollable self-heating. To prevent disasters, chemical reactors are usually equipped with emergency relief lines whose design is based on small-scale tests with the field formulation. Phenol-formaldehyde reactions have the unusual ability to run away at any pH, but the extent of the runaway phenomenon is pH-dependent. A number of experiments

were performed in the Reactive System Screening Tool (RSST) for phenol-formaldehyde compositions, to study how pH affects these reactions. It was observed that the runaway reactions are intense only at $\text{pH} < 1$ and $\text{pH} > 8$. This finding can help develop an emergency procedure to neutralize a phenol-formaldehyde reaction with lost controls, before the peak exotherm occurs.

10:00. ON CLOSED CYCLES IN $\text{GF}(2^n)$. DEDA ZHENG, DEPT. OF MATH AND COMPUTER SCIENCE, SOUTH CAROLINA STATE UNIVERSITY, ORANGEBURG SC 29117, AND ZENGXIANG TONG, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

Let $\text{Cn}=(V,E)$ be a cycle of length n with vertex set V and edge set E . A vertex-labeling is a map $f: V \rightarrow \text{GF}(2^n)$. Any such vertex-labeling induces an edge-labeling $f^*: E \rightarrow \text{GF}(2^n)$ given by $f^*[u,v]=f(u)=f(v)$ for every edge $[u,v]$ in E . Such a pair of labeling f and f^* corresponds to an embedding of Cn into $\text{GF}(2^n)$ with its Boolean edge coloring. We call a vertex labeling admissible if both f and the induced edge labeling f^* are one to one. Thus, admissible labelings correspond to polychrome embeddings of Cn . We say a vertex labeling f is closed if f is admissible and the set of vertex labels $\{f(V)\}$ coincides with the set of edge labels $\{f^*(E)\}$. Our goal is to investigate which cycles Cn admit closed labelings. We will show that for $n=3, 7, 9, 10, 12, 13$ and $n>15$ closed labelings always exist. By refining the Maamoun-Meyniel argument, we can show that for $n=4, 5, 6, 8$ there is no closed labeling of Cn . For $n=11$ we have a lengthy case analysis along the lines given here showing that C_{11} does not admit a closed labeling. The case of C_{14} remains open.

10:15. USING THE INNOPAC SYSTEM TO OBTAIN LIBRARY STATISTICS. DALE EBERSOLE, JR., CARLSON LIBRARY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

The INNOPAC system contains a method for easily creating statistical reports. Using the "Create statistical lists" menu these reports can be generated. It is the other sources of statistics that will be noted in this presentation. Statistics are generated by the system any time a search is conducted. For example, word searches tell the user how many times the word is used in the database (indexed portions only). The same information is displayed for author and subject searches. The list creation ability of the INNOPAC system can be utilized to generate a list of unique periodical bibliographic records. Call number searches can also be utilized to generate title and item number statistics for any specific portion of the collection. Results will be constrained only by the ingenuity of the individual in creating a Boolean search strategy or using existing sources to obtain the desired information.

10:30. THEORY OF HYDROGEN-ATOM AND PROTON TUNNELING IN LARGE MOLECULES AND IN CONDENSED PHASES. VASIL K. BABAMOV, PHYSICAL-INORGANIC-ANALYTICAL CHEMISTRY DEPT., CAS, 2540 OLENTANGY RIVER Rd., COLUMBUS OH 43202-1505.

The dynamics of the tunneling motion of a hydrogen atom or a proton in presence of coupling to other predominantly heavier atoms in the environment is studied. The system is modeled by a particle moving in a double-well potential coupled to a bath of harmonic oscillators. The theory is developed on the example of tunneling in a symmetric intramolecularly hydrogen bonded molecule, such as malonaldehyde or tropolone. Three distinct kinds of coupling that contribute significantly to the suppression of the tunneling by the environment are identified, namely the bilinear, linear-quadratic, and biquadratic coupling. For bilinear coupling analytical solutions derived earlier for limiting cases of to slow bath (V. K. Babamov, Chem. Phys. Lett. 217, 254 (1994)) are generalized to a wider range of conditions. Another treatment is given for linear coupling to a fast bath. For linear-quadratic coupling, the treatment of collinear proton transfer in scattering problems derived earlier (V. K. Babamov and R. A. Marcus, J. Chem. Phys., 74, 1790 (1981)) is adapted for treating the linear-quadratic coupling to a slow bath. The treatment is shown to be accurate by comparison with exact numerical results on model problems in the literature. For biquadratic coupling, a new treatment based on the generalized Condon approximation is derived for the case of a slow bath. The accuracy of this treatment is also tested against numerical calculations in the literature. The application of the treatments derived to calculation of the tunneling splittings in malonaldehyde and tropolone is outlined.

PLANT SCIENCES - ECOLOGY
9:00 AM SATURDAY, APRIL 29, 1995
ROUSH HALL 204
AMY J. SCHERZER - PRESIDING

9:00. SUGAR MAPLE ECOPHYSIOLOGY IN RELATION TO GENOTYPIC, SITE AND AGE FACTORS. R. P. LONG AND A. J. SCHERZER, USDA FOREST SERVICE, 359 MAIN ROAD, DELAWARE OH 43015.

A 36-year-old grafted sugar maple (*Acer saccharum* Marsh.) seed orchard (Site 1) with trees selected for high sap sugar concentration from VT, MA, NY, and OH was used to evaluate genetic variability in relation to 1994 growth, leaf mass, water potential, photosynthetic rate, and soil moisture. An 8-year-old half-sib progeny planting (Site 2) with trees from the 4 sources in the seed orchard was similarly evaluated and compared. Monthly measurements (June through September) on 15 trees at Site 1 (n=3, 4, 4, 4 for VT, MA, NY, and OH sources, respectively) and 16 trees at Site 2 (n=4 for each half-sib family) were analyzed. Preliminary analyses indicate September leaf mass (oven-dried) differed significantly ($P<0.05$) for Site 1 clones with the NY trees having the greatest leaf mass (0.94 g) and the VT trees the least (0.46 g). For the Site 2 trees (half-sib progeny) September leaf mass did not differ with regard to family, but did differ significantly ($P=0.06$) with regard to the crown position sampled, with leaves from the upper crown weighing less than leaves sampled in the lower crown. Leaf water potential (MPa) was significantly ($P<0.01$) lower (more negative) for Site 1 trees compared to Site 2 trees in both August (Site 1=-0.52, Site 2=-0.36) and September (Site 1=-0.73, Site 2=-0.41) probably owing to significant differences in soil moisture. Branch growth (1994 increment) differed significantly ($P<0.05$) in August with Site 1 trees averaging 16.7 cm of growth and Site 2 trees 12.2 cm.

9:15. ALLELOPATHY: ONE OF THE KEYS TO SUCCESS FOR THE INVASIVE SHRUB, *LONICERA MAACKII*? DONALD E. TRISEL AND DAVID L. GORCHOV, DEPT. OF BOTANY, MIAMI UNIVERSITY, OXFORD OH 45056.

Lonicera maackii (Rupr.) Maxim., native to eastern Asia, was introduced to North America ca. 1920 as an ornamental plant. Non-cultivated shrubs of *L. maackii* now occur in Ontario and at least 23 states of the eastern US, growing at densities of up to 6800 shrubs/ha in secondary forests. Because there is a reduced herb layer under dense stands of this shrub, *L. maackii* may be disrupting the natural succession of forests and old fields through allelopathy and/or competition. Laboratory experiments were conducted to test for the presence of allelopathic compounds in *L. maackii* using *Lactuca* and *Lepidium* as sensitive indicator species. Compared to the water control, *L. maackii* leaf leachate significantly reduced time to germination and radicle elongation for both *Lactuca* and *Lepidium*, and percent germination in *Lepidium*. The effects of the *L. maackii* leaf leachate were comparable to the 10^{-4} aqueous juglone treatment. Additional experiments test for an allelopathic effect of *L. maackii* on seed germination and seedling growth of native tree species.

9:30. REPRODUCTION OF TREE SPECIES IN FOREST STANDS AT BLANNERHASSETT ISLAND. NANCY E. DEW AND IRWIN A. UNGAR, DEPT. OF PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

Blannerhassett Island, located in the Ohio River 186 miles downstream from Pittsburgh PA, was used extensively for agriculture until the late 1960's. Now a state park of approximately 200 ha, the island has nearly 155 ha of forest. Forest stands were sampled using the point-quarter method. Nested quadrats at each point were used to determine density of seedlings and saplings. Stands were compared using an unweighted pair group mean cluster analysis (UPGMA), and the results were used to define woody communities in the park. Within four of the five communities in the unmanaged areas of the park, one or more of the dominant canopy trees is not present in the sapling size class. In three of the forest stands, the canopy dominants are also absent in the seedling class. Species present as saplings include shade-tolerant species such as *Asimina triloba*, but these occupy only a small proportion of available subcanopy space. The result is a distinctly bilayered community, such as those found by researchers in other riparian communities.

9:45. SUCCESSIONAL DYNAMICS OF SECOND-GROWTH AND OLD-GROWTH FOREST ECOSYSTEMS IN SOUTHEASTERN OHIO. P. CHARLES GOEBEL AND DAVID M. HIX, SCHOOL OF NATURAL RESOURCES, OHIO STATE UNIVERSITY, 2021 COFFEY RD., COLUMBUS OH 43210-1085.

To determine which compositional and structural features are characteristic of old-growth forests in southeastern Ohio, and what age these features become important, seventeen relatively-undisturbed second-growth forest stands and four old-growth forest stands were examined during 1993-94. Increment cores were taken from four or five dominant or codominant trees in each area to determine the average stand age. All stems ≥ 10.0 cm dbh and coarse woody debris (standing and fallen dead trees) were inventoried by species. Saplings (< 9.9 cm dbh) and seedlings (< 1.37 m tall) were tallied by species. Canopy coverage was measured using a spherical densiometer. Oak

Importance Value (IV) [(relative dominance + relative density)/2] was 72% in the younger second-growth stands (70-109 years old), 65% in the older second-growth stands (110-149 years old), and 70% in the old growth stands (≥ 150 years old). Shade-tolerant species totaled 16%, 15%, and 21% of the overstory IV, respectively. The sapling layer in all three age classes was dominated by shade-tolerant species, with as few as 13 oak saplings/ha in the old-growth forest stands. However, oak seedlings were numerous in the under story of all stands (> 4400 seedlings/ha). Average canopy coverage was not different among the three age classes. Volume of coarse woody debris tended to increase as age increased. These combined traits (species composition, canopy coverage, and the amount of coarse woody debris) may be good indicators of old-growth forests in southeastern Ohio.

10:00. RESPONSE OF QUAKING ASPEN (*POPULUS TREMULOIDES*), TO ELEVATED CO_2 IN HIGH AND LOW FERTILITY SOILS. KENNETH M. MAYS AND PETER S. CURTIS, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, 1735 NEIL AVE., COLUMBUS OH 43210.

This study was conducted to determine the photosynthetic response of quaking aspen to elevated CO_2 with and without nutrient stress. Trees were grown under 35 Pa or 70 Pa CO_2 in open top chambers and in soil of high or low fertility at the University of Michigan Biological Station. Light saturated net CO_2 assimilation (A) was measured in situ with a portable IRGA. There was a significant increase in A under elevated CO_2 in the high fertility soil but not in the low fertility soil. There was no significant fertility effect on A under ambient CO_2 . However, high fertility did stimulate A under elevated CO_2 . We also found evidence for negative adjustment of A to elevated CO_2 in the low fertility soil. Response of aspen to CO_2 was therefore highly dependent on soil fertility.

10:15. A TEN YEAR STUDY OF HICKORY (*CARYA* spp.) DYNAMICS IN A SOUTHEASTERN OHIO FOREST. BRIAN C. MCCARTHY, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

A long-term demographic study of hickory (*Carya* spp.) was initiated in 1984 at the Waterloo Wildlife Experiment Station, Athens County, Ohio. All *Carya glabra*, *C. ovata*, and *C. tomentosa* trees (DBH > 10 cm) in an opposing north- and south-facing cove were censused and mapped. The resulting 183 trees were re-censused in 1994. DBH was measured, growth rates determined, and trees were scored for survival and condition. An outbreak of the Hickory Bark Beetle (*Scolytus quadrispinosus*) in 1987 resulted in substantial changes to the population. Secondary infection by the fungus *Armillaria mellea* was also noted. A 50% mortality rate was observed at the genus level and appeared to be evenly distributed amongst diameter classes. However, a more detailed analysis at the species level indicated differential mortality. The DBH structure of *C. glabra* and *C. tomentosa* changed significantly ($P < 0.05$) over the ten year period while that of *C. ovata* did not. The different microenvironments present on north- and south-facing slopes are likely a contributing factor. *Carya* spp. were found to decompose rapidly. All standing and dead trees were in an advanced decay state. Because of the decay rate, almost no trees were wind thrown after death, resulting in little pit-and-mound topography and minimal soil disturbance. Most trees died standing or snapped at the root collar. Many trees < 20 cm DBH in 1984 decomposed past recognition in < 7 years. Due to their rapid decay rate, standing dead snags of *Carya* spp. may not make the longest lasting or highest quality wildlife trees for cavity nesting species.

10:30. SECOND YEAR EFFECTS OF OZONE AND ELEVATED CARBON DIOXIDE ON THE PHYSIOLOGICAL RESPONSE OF WHITE PINE AND YELLOW-POPLAR. JOANNE REBBECK, KEN V. LOATS, AND AMY J. SCHERZER, U.S.D.A. FOREST SERVICE, 359 MAIN RD., DELAWARE OH 43015.

To address the long-term impact of ozone and ozone plus elevated carbon dioxide on eastern U.S. forests, two separate plantations of white pine (*Pinus strobus*) (WP) and yellow-poplar (*Liriodendron tulipifera*) (YP) were established in Delaware OH. Seedlings were fumigated in 1992 and 1993 in standard 3 m diameter open top chambers with levels of ozone ranging from sub-ambient to twice ambient. Treatments were each replicated 3 times and included: charcoal-filtered air (CF), 1X ambient ozone (1X), 2X ambient ozone (2X), 2X ambient ozone + 350 ppm carbon dioxide (2X+ CO_2), and an open-air/chamberless plot. In 1993, ambient daylight summer ozone concentrations averaged 45 ppb. Photosynthesis (PS) and total chlorophyll content (CHL) were measured every 4 weeks from late June to late August 1993. Diurnal PS rates of YP in late June were significantly reduced by 2X ozone while carbon dioxide additions to ozone tended to ameliorate any negative effects. In late July and late August, YP mid-day PS was not affected by ozone. However, carbon dioxide additions to ozone-treated trees significantly increased PS by 28-48%. In late August, CHL of YP leaves grown in 2X+ CO_2 -air was reduced 33% compared with all other treatments. Ozone did not affect WP current-year and one-year needle PS throughout the summer. Additions of carbon dioxide

to ozone-treated trees did, however, result in increased PS rates of 60 to 70%. In late August, current-year WP needle CHL was not affected by ozone or $2X+CO_2$. However, one-year-old needles of WP grown in $2X+CO_2$ -air had 41 to 52% lower CHL compared with other treated trees.

10:45. EFFECTS OF TWO YEARS OF EXPOSURE TO OZONE AND ELEVATED CARBON DIOXIDE ON FOLIAR N AND P DYNAMICS OF YELLOW-POPLAR. AMY J. SCHERZER AND JOANNE REBBECK. U.S.D.A. FOREST SERVICE, 359 MAIN ROAD, DELAWARE OH 43015.

Yellow-poplar seedlings established in a plantation in Delaware OH, were fumigated in 1992 and 1993 in standard 3-m-diameter open-top chambers during their second and third years of growth. Treatments included charcoal-filtered air, 1X ambient ozone, 2X ambient ozone, 2X ambient ozone + 350 ppm carbon dioxide, and an open-air/chamberless plot. Ambient ozone concentrations (24-hr mean) averaged 35 ppb in 1992 and 32 ppb in 1993. Foliar nutrient dynamics were studied in 1993 by collecting leaf tissue from a new, fully expanded leaf and an older leaf in June, July, August and October (prior to leaf senescence) and analyzing for total nitrogen and phosphorus. Overall, ozone had no apparent effect on the N concentrations within the foliage. However, elevated ozone + CO_2 decreased nitrogen 32-38% compared to the other treatments. Ozone and CO_2 had no apparent effect on phosphorus concentrations. Leaf age did affect nutrient concentrations in all treatments with an overall decrease in N and P of 29% in old leaves as compared to new leaves. Thus, while actual concentrations dropped, the N/P ratio was not affected by leaf age. N concentrations dropped significantly each month from a high of 2.75% N in June to 1.50% N in October. Seasonal P concentrations were much more variable and monthly patterns depended on treatment. Foliage sampling will continue to be collected each year during the growing season to determine if these patterns continue and how they correlate with the overall growth and physiology of these trees.

PLANT SCIENCES - ECOLOGY

9:00 AM SATURDAY, APRIL 29, 1995

ROUSH HALL 213

BRIAN C. MCCARTHY - PRESIDING

9:00. A PRELIMINARY ECOLOGICAL CLARIFICATION SYSTEM FOR THE MARIETTA UNIT OF THE WAYNE NATIONAL FOREST. DAVID M. HIX AND JEFFREY N. PEARCY, SCHOOL OF NATURAL RESOURCES, OHIO STATE UNIVERSITY, 2021 COFFEY RD., COLUMBUS OH 43210-1085.

Ninety-eight sample points were used as the basis for a preliminary landscape classification. Each sample point consisted of concentric 500 m² and 100 m² sample plots with eight regularly-spaced 2 m² quadrats within the outer plot, which were used to measure woody overstory, understory and herbaceous vegetation, respectively. Soils data was collected at four points just outside the inner 100 m² plot and by description of soil pits to a depth of 1 m. Soils and topography are more stable over time and were used as the primary basis for developing the classification. Twelve ecological land types (ELT) may be described that are not readily apparent from current vegetation. Ridge and ravine ELTs are distinct from each other based on landform as well as vegetation, but sideslope ELTs have generally similar vegetational strata (*Quercus* spp. / *Acer* spp. / *Galium* spp., *Carex* spp., *Acer* spp., and *Smilax* spp.) that show gradations of relative abundance. However, upper southerly and westerly slope ELTs with thin (< 10 cm) A soil horizons underlain by sandstone bedrock can be discerned by *Quercus coccinea*/ *Amelanchier arboreum* / *Vaccinium* spp. communities. Similarly, lower slope ELTs with intermediate (10-15 cm) A and intermediate (40-60 cm) B soil horizons commonly have *Quercus alba* / *Acer* spp. / *Viburnum acerifolium*, *Galium triflorum* communities. Mesic site communities such as (*A. saccharum*, *Aesculus octandra* / *Lindera benzoin* / *Polystichum acrostichoides*, *Trillium* spp.) have deep (> 20 cm) A and intermediate to deep (> 80 cm) B soil horizons underlain by shale and siltstone parent material. Separate multi-factor classifications will ultimately be finalized for all three units of the Wayne National Forest.

9:15. PATTERNS OF VERTICAL DISTRIBUTION OF PLANTS IN OHIO WETLANDS. J.G. KOOSER¹, R.J. GARONO², B.L. KOOSER³, & A. GRAY⁴, ¹RETTEW ASSOCIATES, INC., 5010 RITTER RD., SUITE 102, MECHANICSBURG PA 17055, ²TILLAMOOK BAY NATIONAL ESTUARY PROJECT, 4000 BLIMP BLVD., TILLAMOOK OR 97141, ³CHESAPEAKE BAY FOUNDATION, 214 STATE STREET, HARRISBURG PA, ⁴UNIVERSITY OF TEXAS, AUSTIN TX.

During earlier studies in Ohio and Texas, we noticed that there seemed to be more caddisfly individuals collected at emergent wetlands than in forested or shrub-dominated wetlands. Therefore, we examined the relationship between Trichopteran populations and wetland vegetation cover in Ohio wetlands. We found that Trichopteran populations, collected in light traps, could be used to predict general wetland cover type. In order to further clarify the relationship between caddisflies and vegetation structure, we sampled both the caddisfly populations, and the composition and vertical structure of vegetation in eight Ohio wetlands. At each wetland we sampled vegetation along two 60 m long line transects, oriented along cardinal compass directions, and centered on a light trap used to collect Trichopterans. At 2 m intervals along these line transects we used a 2 m long pole, marked in cm, to record the species and height of each plant part which touched the pole. Sites sampled included bog and fen state nature preserves, Lake Erie coastal marshes, and wetlands designed for compensatory mitigation. Plant community species richness was greater in a mitigation area and shrub fen than in a Lake Erie coastal marsh. The number of exotic plant species was greatest in a mitigation wetland. Shrub dominated sites had a greater number of intersection points than did emergent wetlands. We determined differences in mean height, surface roughness coefficient, and vertical density of intersection points. This work was supported by the Ohio Biological Survey.

9:30. SPECIES DIVERSITY AND COMMUNITY STRUCTURE OF FLOODPLAIN FORESTS. EMILY J. NORLAND AND ROGER H. LAUSHMAN, BIOLOGY DEPT., OBERLIN COLLEGE, OBERLIN OH 44074.

Riparian forests in Northern Ohio were once continuous corridors of vegetation along river channels; however intensive human activity has fragmented these habitats into biological islands. Little is known about the processes influencing the community structure and functional dynamics of floodplain forests in this region. We examined the species composition and structure of the floodplain forests of the Black, Vermilion, Rocky, Huron, and Kokosing Rivers to determine patterns of diversity within and among these watersheds. Habitat quality ranges from the relatively unpolluted waters and protected floodplains of the Vermilion and Kokosing Rivers to the polluted waters of the Black River. Preliminary studies of the floodplain forests of the Black River revealed little variation among individual communities within a single watershed. The current study examines landscape diversity within and among watersheds utilizing species richness values, Simpson's diversity index, Bray-Curtis ordination, and Pelou's J. We will discuss the relationships between floodplain diversity, size, and stream order. This investigation, in conjunction with single species studies, will help to develop a more comprehensive portrait of the factors affecting regional riparian ecology.

9:45. VEGETATION ANALYSES OF THE PTERIDOPHYTE COMMUNITY OF STROUD'S RUN STATE PARK, OHIO. GARY K. GREER, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

The goals of this study were to describe the pteridophyte community of Stroud's Run State Park, and to develop hypotheses regarding the influence of environmental gradients on species distribution and community structure. Stream bank, mid-slope, and upper slope transects were established within each of three ravines. Ten circular, five meter radius, plots were established along the length of each transect. Within each plot, pteridophyte presence/abundance and nine environmental variables were assayed. *Polystichum acrostichoides*, *Botrychium virginianum*, and *Deparia acrostichoides* dominated the seventeen species encountered, with relative importance values of 48.6, 11.1, and 9.8 respectively. Multivariate analyses were used to identify four associations, and indicate species segregate along light, moisture, soil pH, and nutrient gradients.

10:00. THE EFFECTS OF SALINITY ON GROWTH AND ION ACCUMULATION OF FIVE HALOPHYTE SPECIES. CAROLYN KIEFFER AND IRWIN A. UNGAR, DEPT. OF PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

Five salt-tolerant halophytes were screened as part of a soil remediation program for saline contaminated soils. To determine their relative salt tolerance and ability to accumulate inorganic solutes, 60-day old seedlings of *Atriplex prostrata*, *Hordeum jubatum*, *Salicornia europaea*, *Spergularia marina*, and *Suaeda calceoliformis*, were grown in environmental chambers in saline hydroponic solutions (0%, 2%, and 3% NaCl) for 30 days. Plants were harvested and the biomass of roots and shoots, height, leaf production, ash, and ionic content were determined for each species. Shoot biomass for all species except *S. calceoliformis* and *S. europaea* was significantly reduced under saline treatments when compared to the control. *A. prostrata* and *S. marina* root biomass was significantly reduced in the saline treatments; however, *H. jubatum* root biomass in the 2% NaCl treatment and *S. calceoliformis* root biomass in both saline treatments were significantly greater when com-

pared to the control. The ash and ion content increased with increasing salinity for all plant species, with *S. europaea* having the greatest percent ash in shoots and roots. Therefore, plants growing in higher salinity soils will accumulate greater amounts of inorganic solutes. *S. marina* was the least salt tolerant plant, since it had 40% reduction in height and 65 reduction in leaf production in the saline treatments. *S. calceoliformis* was the most salt tolerant, since it obtained greater biomass and height under both saline treatments. Based on these data, we would expect *S. calceoliformis* to perform better than *S. marina* under high salinity field conditions.

10:15. THE EFFECT OF SALINITY ON GROWTH AND SURVIVAL OF POLYGONUM AVICULARE. MARGARET A. FODERARO AND IRWIN A. UNGAR, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

Polygonum aviculare is an annual weed that was found densely growing at a recent brine spill near Athens, Ohio. Hobbs (1992) has stated that *P. aviculare* may be found in saline habitats; however, little work has been done to determine the salt tolerance of this species and it is not currently clarified as a true halophyte. Two transects were laid down parallel to each other on upper and lower gradients with 10 (10 cm x 10 cm) control plots on each transect, with the lower plots being closest to the area of greatest salinity. In order to monitor competition, two additional 10 cm x 10 cm plots were placed on either side of the 10 upper control plots only. Plants within these plots were thinned to a density of 1 and 10 plants per plot. Survivorship was monitored monthly in all plots from June-September, 1994. Specific conductance (ms/cm) of the soil from each of the 20 control plots was measured every 7-10 days from June-October, 1994 and then monthly thereafter. The specific conductance was higher for the plots on the lower transect than plots on the upper transect. There was zero mortality in the plots thinned to a single individual, with additional plants having invaded 50% of these plots by September. The control plots that were not thinned had approximately 30% mortality. *Polygonum aviculare* could be used to revegetate moderately saline contaminated areas by reducing soil erosion since this species tends to form dense mats.

10:30. VEGETATIVE REPRODUCTION IN LYTHRUM SALICARIA AND ITS IMPLICATIONS FOR MANAGEMENT. BEVERLY J. BROWN AND CONRAD E. WICKSTROM, KENT STATE UNIVERSITY, PO Box 5190, KENT OH 44242-0001.

Lythrum salicaria is a non-indigenous plant which invades wetlands creating monocultures and degrading wildlife habitat. Much emphasis has been placed on sexual reproduction but few references in the literature discuss vegetative reproduction. We investigated vegetative reproduction of roots and shoots of 21 plants selected from three habitats representing a natural moisture gradient. Five, ten, and fifteen cm segments of roots and shoots were grown in greenhouse flats for a period of 2 days. Roots exhibited no growth under these conditions, while 80% of shoots grew. Shoots produced adventitious roots and axial shoots. Mean root biomass was 0.03889 for all plants and ranged from .0008 to .1550 g. Root biomass was positively related to stem length. These results suggest that when plants are removed care should be taken to remove all stem segments. Roots may not play an important role in vegetative reproduction and recolonization. However, since all roots studied were fibrous and less than 2 mm in diameter, removal of large tap roots may still be advisable.

10:45. VARIATIONS IN LEAF CHEMISTRY OF TWO OAK SPECIES (QUERCUS PRINUS AND Q. VELUTINA) WITH RESPECT TO GENOTYPE AND SLOPE ASPECT. JENNIFER L. REED AND BRIAN C. MCCARTHY, DEPT. OF PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

Plants produce a variety of secondary chemical compounds which deter feeding by herbivores. Phenols are the most abundant anti-herbivore compounds present in the oaks (*Quercus*, Fagaceae). Specifically, tannins are the most important phenolics in oak, influencing herbivore and frugivore feeding patterns. Based on the carbon-nutrient hypothesis, trees growing on stressful sites would be expected to have higher proportions of carbon-based defensive compounds such as tannins. Slope aspect (North vs. South) has been shown to be a major determinant of site quality and is a useful indicator of environmental stress. The purpose of our study was to examine the effects of slope aspect and tree genotype on foliar tannin content in *Quercus prinus* and *Q. velutina* leaves. Three individuals of each species, on opposing north- and south-facing slopes, at three sites, were selected for study at the Waterloo Wildlife Research Station, Athens County, Ohio. Leaves were collected from the 36 trees in July of 1994 and analyzed for protein precipitating ability (PPA), a direct indicator of biological activity relative to tannic acid concentration. Using analysis of variance, significant differences were detected between species, between slope aspects, and amongst individuals. Significant interactions were also detected. *Q. velutina* exhibited a greater PPA than *Q. prinus*. Leaves from South-facing slopes exhibited a greater PPA than those from

North-facing slopes. Significant differences among individuals suggests that either genotype or local microenvironment may also be important in determining leaf chemistry.

PLANT SCIENCES - PHYSIOLOGICAL ECOLOGY 2:00 PM SATURDAY, APRIL 29, 1995 ROUSH HALL 213 PETER S. CURTIS - PRESIDING

2:00. GENOTYPIC VARIATION FOR CONDENSED TANNIN PRODUCTION IN TREMBLING ASPEN (POPULUS TREMULOIDES) UNDER ELEVATED CO₂. JENNIFER L. WASOWSKI AND PETER S. CURTIS, DEPT. OF PLANT BIOLOGY, 1735 NEIL AVE., OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

The Carbon/Nutrient Balance Hypothesis suggests that leaf C:N ratios influence the synthesis of secondary compounds such as condensed tannins. Plants grown under elevated CO₂ often have higher C:N ratios and should therefore increase production of carbon-based secondary compounds. Six genotypes of *Populus tremuloides* were grown under elevated and ambient CO₂ partial pressure in field open-top chambers at the University of Michigan Biological Station. Leaves were harvested after 53 days growth and analyzed for condensed tannin production. Overall, there was no CO₂ effect on tannin production. There were, however, significant differences among genotypes in tannin production and a significant genotype x CO₂ interaction. Five genotypes showed no response to CO₂ enhancement, but one genotype showed a significant decrease in tannin production. These results do not support the Carbon/Nutrient Balance Hypothesis and suggest that other factors may regulate secondary compound synthesis. These data do, however, suggest that genotypic variation in tannin production may be of evolutionary importance under rising atmospheric CO₂.

2:15. ROOT FORAGING BEHAVIOR OF C₃ AND C₄ GRASSES GROWN IN A HETEROGENEOUS SOIL ENVIRONMENT UNDER ELEVATED CO₂ CONDITIONS. SUSAN M. WADKOWSKI AND PETER S. CURTIS, DEPT. OF PLANT BIOLOGY, 1735 NEIL AVE., OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Plants exposed to increased CO₂ levels typically respond by increasing carbon allocated to roots. Additionally, some species increase lateral root production in localized areas of high nutrients. Three perennial grass species were grown in 30 L pots containing heterogeneous soil medium and exposed to either ambient (35 Pa) or elevated (70 Pa) CO₂. *Poa pratensis*, *Agropyron smithii*, both C₃ species, and *Andropogon gerardi*, a C₄ species, were chosen due to their differences in carbon assimilation patterns and relative growth rates. A minirhizotron system was used to monitor root growth, root turnover, and fine root production of each species within a nutrient rich soil pocket and within the surrounding nutrient poor sand-soil matrix. Species with high relative growth rate (*P. pratensis* and *A. gerardi*) exhibit plasticity in response to nutrient availability. Therefore, root relative growth rate and fine root proliferation into nutrient rich areas is greater. Response to an enriched CO₂ environment is greater in C₃ species, therefore, *P. pratensis* and *A. smithii* allocate additional carbon to fine root production and turnover. Species capable of responding to patches of high nutrients may have greater competitive ability in an enriched CO₂ environment.

2:30. KINETICS OF DARK INDUCED SENESCENCE AND RECOVERY IN COMMON BEANS, PHASEOLUS VULGARIS. DENNIS BISHOP AND ARTHUR TRESE, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, 317 PORTER HALL, OHIO UNIVERSITY, ATHENS OH 45701.

Dark induced nodule senescence in the soybean has been well documented in the literature. Placing nodulated plants in total darkness leads to nodule senescence after approximately 8 days. Senescence is noted as the transition of pink nodules to green, as the leghemoglobin is altered. We have determined that dark induced nodule senescence in common beans is accelerated, occurring in 4 days. Additionally, the literature indicates that soybean nodules can recover from dark induced senescence when the plants are returned to light. We have found that this is not the case with common beans, suggesting that the response is distinct in these two genera. We have also examined the kinetics of dark induced senescence in cowpea, *Vigna unguiculata*, nodules and found that it is very similar to soybeans. We are currently

examining the influence of nitrate fertilization, ethylene, and physical wounding on nodule senescence in these three legume genera.

2:45. THE EFFECTS OF COLD AND CHILL STRESS ON THE CONCENTRATION OF A RADICAL-SCAVENGING PLANT COMPOUND, GLUTATHIONE, IN A COLD SENSITIVE PLANT SPECIES, SOYBEAN (*GLYCINE MAX*). SANFORD D. KOHORST, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

Some of the symptoms of cold and chill stress in plants result from membrane damage caused by superoxide radicals. These radicals are formed when electrons released during the reactions of photosystems I and II (whose reaction rates are temperature independent) bond with oxygen molecules. Normally, these electrons are bound into organic molecules in the Calvin cycle, however the cold reduces the enzymatic rates (and therefore the electron binding capacity) of this cycle. Glutathione, which is normally found in its reduced state in nonstressed plants, is a radical scavenger that can remove excess electrons from superoxide radicals. This study found that the glutathione concentrations are higher under the conditions of cold (5°C) versus chill (10°C) stress. This study also found that the ratio of oxidized to reduced glutathione was higher in cold stressed versus chill stressed plants.

3:00. THE EFFECT OF LIGHT AND MALIC ACID ON THE SENSITIVITY OF NORMAL AND TEXAS MALE STERILE CYTOPLASM MAIZE LEAVES TO *BIPOLARIS MAYDIS* RACE T TOXIN. D-S. PARK AND M. O. GARRAWAY, DEPT. OF PLANT PATHOLOGY, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Leaf segments from Texas male sterile (Tms) cytoplasm maize isolines that were exposed to light (10,000 lux) before, during or/and after infiltration with *Bipolaris maydis* race T (BMT) toxin, leaked significantly less electrolytes into a DW bathing solution, than did similar toxin-treated segments not exposed to light. In contrast, leaf segments from Normal (N) cytoplasm maize isolines were relatively insensitive to BMT-toxin and revealed no inhibitory effects of light on electrolyte leakage in either the presence or absence of toxin. Tms cytoplasm leaf segments that were exposed to intermittent 12 hr periods of light and dark, following toxin treatment in the dark showed decreases and increases, respectively, in sensitivity to toxin but with a 6 hr lag. Tms, but not N, cytoplasm leaf segments infiltrated with 25 or 50 µM of malic acid showed a decrease in their sensitivity to BMT-toxin in the dark that was comparable to that seen when leaf segments were incubated in the light without malic acid. Based on these observations, and because the potency of the toxin appears to be unaffected by its exposure to light, we concluded that C₄ metabolites like malic acid could play a mediating role in the light induced inhibition of the sensitivity of Tms cytoplasm maize leaf segments to BMT toxin.

3:15. EFFECTS OF BARK WOUNDING ON CONCENTRATIONS OF TAXOL & BACCATIN III IN *TAXUS MEDIA* CV HICKSII. TODD P. EGAN, NEIL D. DANIELSON, AND DAVID L. GORCHOV, BOTANY DEPT., MIAMI UNIVERSITY, OXFORD OH 45056-1176.

Taxol is an anti-cancer chemical that can be extracted from the bark and needles of yew trees. However, it is found only in minuscule quantities. We have been investigating whether higher concentrations of taxol and baccatin III (a taxane that is used in the hemi-synthesis of taxol) can be induced by simulating insect damage. We previously reported an increase in concentration of taxol and baccatin III in the bark of rooted *Taxus media* cv. Hicksii cuttings one week after cutting, but these increases were not statistically significant. In order to test whether induction was significant after a longer interval, we repeated the experiment, but allowed some trees to grow for 3 weeks after cutting. In the second experiment, taxol levels decreased significantly due to the effects of cutting the bark, but changes in taxol concentration due to week of harvest (1 vs. 3) and the interaction of week and harvest were not significant. Baccatin III concentration was not significantly affected by cutting, week of harvest, or their interaction. The conflicting results of the two experiments may be due to differences in the greenhouse environment, as the second experiment was carried out earlier in the year, under shorter days and lower temperatures.

3:30. THE EFFECT OF LEAF AREA ON GRAVITY-INDUCED LEAF INVERSION IN *IPOMOEA NIL*. KATHY SMITH, DANIEL REPICZ AND MORRIS CLINE, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Leaves of most plants tend to orient themselves in a position to maximize photosynthesis. When a potted Japanese Morning Glory (*Ipomoea nil*) plant was totally inverted, the leaves reoriented themselves via twisting of the petiole so that the topside was up. This occurred in the light or the dark. In order to evaluate the effect of leaf area on gravity-induced leaf inversion, the leaf was subjected to equal irradiance (cool white fluorescent) from above and

from below in a growth room. Leaf orientation was monitored with an AG-6040 Panasonic time lapse video system. The time for complete leaf inversion following plant inversion ranged from 4 to 6 hours. When the leaf area was decreased by removal of two lateral portions of the blade, the inversion time was lengthened about 2-fold. When the leaf blade was entirely removed, the remaining petiole responded gravitropically by bending up but did not twist as when the blade was present.

3:45. THE EFFECTS OF BIOINTENSIVE CULTIVATION METHODS ON THE YIELD OF GREEN BEANS (*PHASEOLUS VULGARIS*) GROWN IN SOUTHEASTERN OHIO. BEN F. HOLT, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

The biointensive method of organic gardening emphasizes a number of unique cultural practices, including the loosening of the plant bed by spade and fork to ~60 cm (double digging). This study examined the responses *Phaseolus vulgaris* (cv. Tendercrop) to this type of cultivation. Seeds were sown in 1.5 m² double dug, single dug (soil loosened to ~30 cm), and surface dug (soil loosened to 5-6 cm) beds in June of 1994. There were 10 replicate beds for each treatment. The surface dug beds were only loosened to the depth necessary to provide a suitable seed bed. On three separate occasions, the beans from 300 randomly selected plants (100 per cultivation type) were harvested with fresh and dry weights taken on a per plant basis. On the third harvest date, the entire above-ground plant was harvested and fresh and dry weights were taken for the leaves and stems. On the second harvest, the productivity of the plants (fresh weight of harvested beans) grown in the single dug beds was significantly higher than the surface dug beds, but not the double dug beds. The leaves of the surface dug plants had significantly less chlorophyll than the other treatments. There were no other significant differences. The unusually high rainfall during the growing season (soil water potential rarely dropped below -0.10 MPa) appears to have moderated any differences expected from the deep cultivation techniques.

4:00. FINE ROOT PRODUCTION AND TURNOVER IN TWO PRAIRIE GRASS SPECIES WITH CO₂ ENHANCEMENT AND CLIPPING. JOSEPH M. CRAINE AND PETER S. CURTIS, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, 1735 NEIL AVENUE, COLUMBUS OH 43210.

Root longevity in grasses may be either predetermined and fixed or a function of source-sink relationship to the whole plant. To better understand the patterns and magnitude of root production and test these alternate hypotheses, 16 individuals of *Agropyron smithii* (C₄) and *Andropogon gerardii* (C₄) were grown in 20 cm by 90 cm cylinders under ambient and twice ambient CO₂ partial pressure. After two months, half the individuals were clipped to a height of 5 cm and the remaining half left unclipped. Mini-rhizotron tubes were installed at depths of 10, 35, 50 cm and roots were videotaped at two week intervals. Images were digitized and fine root length and longevity were estimated. It is hypothesized that clipping and CO₂ treatments will show positive effects on fine root production and turnover. In accordance with the source-sink hypothesis, those individuals grown under enhanced CO₂ should show higher root production and turnover. Clipping should produce an initial wave of root mortality, positively correlated with depth, due to loss of photosynthate source and translocation of stored carbon to above-ground growth.

4:15. HOST PLANT AND INSECT HERBIVORE INTERACTIONS UNDER NEXT CENTURY ATMOSPHERES. J. H. BARGER, W. N. CANNON, JR., U.S.D.A. FOREST SERVICE, 359 MAIN RD., DELAWARE, OH 43015, AND R. W. HALL, DEPT. ENTOMOLOGY, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Doubling atmospheric carbon dioxide (CO₂) in the presence of elevated ozone (O₃) may affect host plant and insect herbivore interactions. Elms were fumigated with ambient air (AA) at 1X, or O₃ at 2X, or CO₂ at 2X, or both at 2X, in open-top chambers from 1992-94 to determine effects on host nutritional quality and elm leaf beetle (ELB) performance. Mean O₃ concentrations (ppm) for 1992 (1993) [1994] were 32 (39) [31], 49 (66) [58], 32 (39) [33], 52 (65) [57]; CO₂ mean concentrations (ppm) were 354 (423) [439], 346 (423) [438], 632 (751) [772], and 643 (743) [776] for AA, O₃, CO₂, and O₃ + CO₂, respectively. Leaf nitrogen, water content, and stress ethylene were assayed. Leaf bioassays were conducted in petri dishes for ELB herbivory, fecundity, and mortality and in cages on elms for fecundity and mortality. For all years, nitrogen and water content significantly decreased and leaf weight increased at 2X CO₂ and 2X O₃ + CO₂. In 1992, tree growth increased significantly at 2X CO₂ and 2X O₃ + CO₂ but was unaffected in 1993 and 1994. In 1993 and 1994, herbivory and fecundity were significantly lower on foliage at 2X CO₂ and 2X O₃ + CO₂ but both were variable in 1993. For all years, ELB mortality was unaffected but leaf stress ethylene was variable. Results suggest insect herbivores and host plant interactions may change under "next century" atmospheres.

4:30. ECOLOGICAL RESPONSES OF *CARYA OVATA* SEEDLINGS TO EXPERIMENTAL LIGHT REGIMES. SCOTT A. ROBISON AND BRIAN C. MCCARTHY, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

Understory light environments in eastern hardwood forests are characterized by dynamic light patches of varying size and duration. These patches result from a heterogeneous overstory derived from asymmetric crowns, branch losses, and canopy gaps of various sizes. Thus, intervals of direct solar irradiance of tree seedlings may last from several seconds to many minutes. *Carya ovata* is a major constituent of the oak-hickory forest and is ranked as intermediate in shade tolerance. We designed an experiment to explore how *Carya ovata* responds to changes in both the amount and duration of light received. Seedlings were transplanted into experimental shade houses where they experienced one of five light environments: 20% light (short & long duration), 80% light (short & long duration), and 100% light (control). Height and survival were monitored at bi-weekly intervals. At the end of the growing season, 250 seedlings were harvested and analyzed for a variety of morphological and physiological traits. While there was no significant difference in survival among treatments, seedlings responded morphologically and physiologically to increased amounts of light (20, 80, 100%) via changes in mean stem weight, basal diameter, 1 degree and 2 degree root weight, and specific leaf mass. Chlorophyll content and stem height was inversely related to the amount of light. Light duration (long vs. short) resulted in more subtle differences, primarily in stem weight and length. Our results indicate that both the amount and duration of light may affect seedling establishment and growth.

**PLANT SCIENCES - PLANT SYSTEMATICS
2:00 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 212
MARILYN W. ORTT - PRESIDING**

1:30 BOTANY INTEREST GROUP BUSINESS MEETING

2:00. A TAXONOMIC STUDY OF *EUPATORIUM ROTUNDIFOLIUM* L. SENSU LATO IN PENNSYLVANIA. ERICA A ARMSTRONG, A. E. SCHUYLER, AND JOHN A. HENDRICKSON, JR, OHIO STATE UNIVERSITY, DEPT. OF PLANT BIOLOGY, 1735 NEIL AVE., COLUMBUS OH 43210.

Eupatorium rotundifolium L. s.l. is a group of plants that has been treated in various ways by different authors. In this study, we conducted a multivariate analysis of 21 characters associated with leaves and flowers to determine whether the current recognition of *Eupatorium pilosum* Walt. as a species and *Eupatorium rotundifolium* var. *rotundifolium* L. and *E. rotundifolium* var. *ovatum* (Bigel.) Torr. as varieties is supported by morphological evidence. We conclude that all populations should be considered as part of a single polymorphic species, *Eupatorium rotundifolium*, and no varieties should be recognized. The agamosperous nature of these plants, indicated by their lack of pollen, may contribute to their variability in leaf characteristics.

2:15. *PLATANThera ciliaris* (L.) R. BR. (ORCHIDACEAE) IN WASHINGTON COUNTY, OHIO. MARILYN ORTT, DIV. OF NATURAL AREAS AND PRESERVES, O.D.N.R., 701 COLEGATE DR., MARIETTA OH 45750.

Platanthera ciliaris (L.) R. Br. (Yellow Fringed Orchid) is designated Threatened in Ohio. The range given is Mass. to Mich., Wis., and Mo., O, s. to Fla. and Tex. in bogs, fields and woods. The widely-scattered occurrences belie the apparent generality of habitat. In Ohio, populations are known from Adams, Lucas, Scioto and Washington Counties. The orange flowers are quite showy and unlikely to be overlooked or confused with any other wildflower. Individuals of a roadside population in Washington County have been numbered and followed since 1986. The number of flowering plants has varied from 0 to 19 in an annual census ranging from 15 to 101 plants.

2:30. A PRE-CONSTRUCTION VASCULAR FLORA OF THE STARK CAMPUS OF KENT STATE UNIVERSITY. STEVEN J. SCHOTT, 3724 ARNOLD N.W., CANTON OH 44709.

The 200 acre tract of the study area is in the northeast corner of Jackson Township, Stark County, Ohio. The boundaries are Frank Road to the west, Dressler Road and U.S. 77 to the east, 100 feet south of University Drive to the south and the edge of the wooded area separating the gravel pit on Portage Road and the woods being the northern boundary. Habitats found during this study include: Floodplain Forest, mixed Mesophytic Forest, Marshes, and

Disturbed Sites. Within this area 285 species of vascular plants were identified over a three year span between April of 1991 and October 1993. This survey was done prior to major construction on the site and is intended as base line data for a study on the impact of construction on the flora.

2:45. ASSESSING GENETIC VARIATION IN *TRIFOLIUM STOLONIFERUM* USING RANDOM AMPLIFIED POLYMORPHIC DNA (RAPDs). ELIZABETH J. ESSELMAN, CAROL S. PABIN AND DANIEL J. CRAWFORD, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Trifolium stoloniferum (running buffalo clover) is an endangered species that was considered possibly extinct a decade ago. Several populations have been discovered in Ohio, Kentucky and West Virginia in recent years. Hickey et al. (1991) detected low genetic variation in *T. stoloniferum* using allozymes. In the present study, 360 plants from 20 populations were examined for RAPD variation. One 10-mer primer revealed variability at three different "loci". One polymorphism occurs in all populations examined. The second variable "locus" shows a band that only occurs within five populations in Kentucky, where its frequency varies from 10% to 50%. A third variable "locus" exhibits a high frequency in three Ohio populations and two West Virginia populations. The preliminary results indicate that the level of RAPD diversity in running buffalo clover is low compared to other species that have been examined and this is concordant with the low level of genetic diversity detected with allozymes. The preliminary results from RAPDs show that most populations of *T. stoloniferum* do not reinitiate a single genotype propagated by the extensive systems of stolons. Secondly, variation at one locus is correlated with geographic distribution. Despite low diversity in running buffalo clover, RAPDs appear promising for detecting genetic variation within and among populations of this rare plant.

3:00. GENETIC ANALYSIS OF SYCAMORE POPULATIONS USING RAPD AND ALLOZYME MARKERS. NOAH FIERER AND ROGER H. LAUSHMAN, DEPT. OF BIOLOGY, OBERLIN COLLEGE, OBERLIN OH 44074.

The American sycamore (*Platanus occidentalis* L.) is wind pollinated with seeds dispersed by water. Sycamores are abundant in riparian habitats throughout the eastern United States, however, little is known about their population genetics. In this study, sycamore populations from four Ohio river systems (Huron, Black, Vermilion, and Kokosing) were sampled and levels of genetic variation assessed using both enzyme electrophoresis and the random amplification of polymorphic DNA (RAPD). The levels of genetic differentiation between watersheds and the genetic structure of sycamore populations along each river corridor were determined. We expect that populations at the mouth of each river will have greater genetic variability than those further upstream because of the directional water flow. This study also directly compares the newly developed RAPD technique to the more established technique of enzyme electrophoresis in terms of their ability to estimate genetic diversity. Previous studies indicate that RAPD analysis may be a useful tool for population geneticists because it can detect a greater number of genetic polymorphisms than observable by enzyme electrophoresis. We will present data based on 22 enzyme loci and 12 decamer primers.

3:15. EVOLUTION OF PEONIES (*PAEONIA*) IN THE MEDITERRANEAN REGION. TAG SANG, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, 1735 NEIL AVE. #108, COLUMBUS OH 43210-1293.

The Mediterranean region is a distributional center of the genus *Paeonia* (*Paeoniaceae*). Taxonomy of the Mediterranean peony species has long been difficult due to possible speciation via hybridization. The present study, using sequences of the internal transcribed spacer (ITS) of nuclear ribosomal DNA, documented extensive reticulate evolution of peony species in the Mediterranean region. Twelve of eighteen Mediterranean species were found to have originated presumably via three independent hybridizations. It is also hypothesized that the hybridizations may have occurred during Pleistocene glaciation. One or both parents of the Mediterranean species of hybrid origin are currently restricted to eastern Asia, suggesting that the eastern Asiatic species were distributed historically in the Mediterranean region.

3:30. A PRELIMINARY CLADISTIC ANALYSIS OF MORPHOLOGICAL FEATURES IN *BIDENS* L. (*COMPOSITAE* - *HELIANTHEAE*). MESFIN TADESSE AND D. J. CRAWFORD, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Bidens L. is a genus with a world-wide distribution occurring chiefly in tropical and subtropical countries. *Bidens* of oceanic islands have particularly been the subject of biosystematic and evolutionary studies since about 1970. Similar studies on mainland species are rare. The latest monographic work on the genus is more than 50 years old (Sherff 1937). The few modern-day revisions of the genus follow geographic subdivisions of major continents. In order to

contribute towards a modern revision of the genus, the morphology of representative species from North, Central, and South America was studied. Characters from the African taxa useful in the cladistic analysis were collated. A cladistic analysis was performed on about 74 species. A few species of *Coreopsis* sect. *Pseudoagarista* were used as the sister group in the analysis. The preliminary results are indicative of the following scenarios: a) *Bidens* and *Coreopsis* are not monophyletic, and can be differentiated using a combination of morphological features apart from those used traditionally to differentiate these genera; b) a number of monophyletic groups or clades can be recognized in *Bidens*; c) the African species of *Bidens*, by virtue of their achene morphology and habit, form a group distinct from the species in the western hemisphere; d) the African taxa that were kept in *Coreopsis* (Sherff 1936) form distinct clades in *Bidens*; and e) the North American species of *Bidens* are most probably derived from a Mexican/Central American stock.

3:45. THE ORIGIN AND GENETIC DIVERSITY OF A RARE KENTUCKY ENDEMIC, *SOLIDAGO ALBOPILOSA*. BETSY J. ESSELMAN. OSU DEPARTMENT OF PLANT BIOLOGY, 1735 NEIL AVENUE, COLUMBUS OH 43201.

Solidago albopilosa is a rare, tetraploid goldenrod endemic to the Red River Gorge in eastern Kentucky. Levels of genetic diversity will be measured using RAPD (random amplified polymorphic DNA) and isozyme markers. RAPD markers indicate that *S. albopilosa* has genetic diversity both within and between populations with the greatest levels of diversity found within populations. These results are expected because it is unlikely that there is gene flow between the small, isolated populations of *S. albopilosa*. Another purpose of this study is to examine possible origins for *S. albopilosa*. RAPD markers will be used to determine if the tetraploid *S. albopilosa* has arisen by allo- or autopolyploidy. Previous morphological studies have found similarities between *S. albopilosa* and the more common *S. flexicaulis*. *Solidago flexicaulis* has been reported to cross with only one other goldenrod species, *S. caesia*. Preliminary RAPD markers have indicated that there is no relationship between *S. albopilosa* and *S. caesia*. *Solidago flexicaulis* and *S. albopilosa* do share markers and may be closely related.

4:00. THE GEOGRAPHIC DISTRIBUTION OF *ERYTHRONIUM ROSTRATUM* W. WOLF (LILIACEAE), AN OVER-LOOKED SPRING EPHEMERAL IN THE SOUTHEASTERN FLORA. ALLISON W. CUSICK, DIVISION OF NATURAL AREAS AND PRESERVES, OHIO DEPARTMENT OF NATURAL RESOURCES, FOUNTAIN SQUARE, COLUMBUS OH 43224.

Erythronium rostratum W. Wolf is a showy spring ephemeral native to a broad area of the southeastern U.S. The geographic distribution of this species has not been accurately known until recently. This species is missing from many standard regional manuals. It also has been confused with two other yellow-flowered trout lilies in the southeastern flora, *E. americanum* Ker-Gawler and *E. umbilicatum* Parks and Hardin. The ranges of these three species overlap, though they are not completely sympatric. *Erythronium rostratum* grows in similar habitats to the other species, but blooms one to two weeks earlier than they. *Erythronium rostratum* has been documented from ten states: Alabama, Arkansas, Kansas, Kentucky, Louisiana, Missouri, Ohio, Oklahoma, Tennessee and Texas. A county dot map has been prepared detailing the geographic range of this species.

4:15. BIOGEOGRAPHY OF THE CHILEAN SPECIES OF *MALESHERBIA* (MALESHERBACEAE) OF THE PACIFIC COASTAL DESERT. KARLA M. GENGLER, MUSEUM OF BIOLOGICAL DIVERSITY, OHIO STATE UNIVERSITY, 1315 KINNEAR RD., COLUMBUS OH 43212.

The distribution of Malesherbiaceae, an angiosperm family endemic to the Pacific coastal desert of Chile and Peru, is divided today into two groups by the Atacama Desert in northern Chile. The morphology of the southern group and the geological history of the region suggest that the southern group began to radiate after isolation from the Peruvian group by humid Pleistocene periods. Morphology also indicates that the group continued to be heavily influenced by glacial and interglacial climates during the Pleistocene. During cool, wet periods, the distribution of *Malesherbia* probably shrank to the region between 27°S and 30°S, which remained dry. Molecular data will be used to determine if the groups found in this region are older than those clustered on the edge of areas of Pleistocene humidity or in the Andes, which would suggest post-Pleistocene expansion of distributions and speciation. Molecular analysis will further be used to test the hypothesis that *Malesherbia* is now speciating into the Andes.

4:30. EDGAR N. TRANSEAU AND HIS NATURAL VEGETATION MAPS OF OHIO. RONALD L. STUCKEY, HERBARIUM, MUSEUM OF BIOLOGICAL DIVERSITY, OHIO STATE UNIVERSITY, 1315 KINNEAR ROAD, COLUMBUS OH 43212.

Edgar N. Transeau, who for 28 years (1917-1946) was chairman of the Department of Botany at The Ohio State University, had a lifelong interest in the mapping of vegetation. This interest began while studying under Henry C. Cowles at the University of Chicago (1900-1901), while writing on bogs as a graduate student at The University of Michigan (1902-1904), mapping his two original concepts--the center of forest distribution and the rainfall-evaporation ratio--while teaching at Alma College (1904-1906), and promoting the development of a state ecological survey for Illinois while at Eastern Illinois Teachers College (1907-1915). After coming to Ohio in 1915, Transeau launched a project of mapping Ohio's natural vegetation, and enlisted the help of several colleagues and many students. From records of witness trees by the early surveyors, written accounts in county history books, and their own field reconnaissance's in certain counties of the state, Transeau and Homer C. Sampson prepared several preliminary unpublished map versions of Ohio's natural vegetation, first in 1926 by using different symbols for different trees and later by different colors or black and white patterns of shading for various natural forest types prepared in 1927, 1934, and 1950. The 1927 version with modifications was published by D.E. Sherman (1932), the 1934 one was published in mimeograph by Transeau and Sampson in J.H. Sitterley et al. (1935), and the 1950 one representing a version revised by Transeau was printed separately for distribution at 8 1/2 by 11 inch size. Other Ohio maps of Transeau similarly printed and distributed in 1950 were beech, hemlock, prairies. Those maps not completed or distributed were of chestnut, oaks, southern pines, and a combination of bogs, marshes and swamps. Transeau's mapping project was considered incomplete until Transeau's student, Robert B. Gordon, prepared a 35"x 38", eight-colored comprehensive map of the *Natural Vegetation* ... published by the Ohio Biological Survey (1966).

4:45. HISTORICAL EVIDENCE FOR HUMAN IMPACT ON VEGETATION OF THE ROBINSON CRUSOE ISLANDS, CHILE. TOD F. STUESSY AND CLODOMIRO MARTICORENA, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, 1315 KINNEAR RD., COLUMBUS OH 43212, AND DEPARTAMENTO DE BOTANICA, UNIVERSIDAD DE CONCEPCION, CONCEPCION, CHILE.

The Robinson Crusoe Islands (= Juan Fernandez Islands), found off the coast of continental Chile at 33° S. latitude, contain a vascular flora of more than 360 species. Although no aboriginal people inhabited the islands, considerable human impact has occurred since their discovery in 1574. The islands became an important stopping place for ships to take on fresh water, meat, and vegetables before continuing across the Pacific. They also served as a staging location for British privateering raids along the coast of the colonial Spanish empire. Forests were cut, foreign plants and animals were introduced, and fires were started. Modern aerial photographs in connection with ground truth give evidence of substantial loss of native vegetation. Although the first botanical collections were not made until 1823, historical records from diaries of seaman aboard ships and officials stationed in the islands give clues to original vegetation and human impact over more than four centuries.

PLANT SCIENCES - REPRODUCTIVE BOTANY

9:00 AM SATURDAY, APRIL 29, 1995

ROUSH HALL 212

LAZARUS W. MACIOR - PRESIDING

9:00. FACULTATIVE DELAYED AUTONOMOUS SELF-POLLINATION IN THE SMOOTH ROSE-MALLOW, *HIBISCUS LAEVIS*. ROBERT A. KLIPS, DEPT. OF PLANT BIOLOGY, OHIO STATE UNIVERSITY, 1735 NEIL AVE., COLUMBUS OH 43210.

Autonomous self-pollination by plants that are also capable of outcrossing often supplements low levels of vector-mediated pollination without precluding outcrossing when pollinators are abundant. In most instances this facultative quality is a result of timing, wherein self pollination is delayed until after the normal activity period of pollinators. Style recurvature progressive with flower aging occurs in *H. laevis* and may effect selfing by pressing stigma lobes against the uppermost stamens. In a pollinator-free greenhouse all 12 plants from a Delaware County, Ohio population proved capable of selfing in this manner. The selfing was facultative not only through late timing but also because stylar movements were effectively absent if stigmas received pollen early in the day. Mean levels of autonomous fruit and seed set were substantially below those of hand-pollinated controls, possibly due to the absence of any wind disturbance in the greenhouse. The population exhibited a modest level of inbreeding depression in one of 3 tested components of fitness, consistent with the evolution of a mixed mating system favoring xenogamy while assuring the potential to reproduce when pollinators are scarce. Tests of 10 additional populations revealed substantial variation in the ability to set fruit in the absence of pollinators.

9:15. GENETIC AND SEX RATIO VARIATION IN *VALLISNERIA AMERICANA* POPULATIONS OF THE UPPER CUYAHOGA RIVER. ROGER H. LAUSHMAN AND K. ROMAN MARECEK, BIOLOGY DEPT., OBERLIN COLLEGE, OBERLIN OH 44074.

Vallisneria americana Michx. (Hydrocharitaceae) is a dioecious hydrophilous aquatic plant, occurring in lake and rivers of our region. Previous research on the population genetics of Ohio populations of *V. americana* revealed high variation among populations (Wright's $F_{ST}=0.457$). Genetic variation within populations is only slightly less than the average for terrestrial plant species. Studies on the basic reproductive ecology of *V. americana* are based on lake populations, even though *V. americana* also grows in fast moving streams. Water pollination would seem much less likely in a unidirectional flow regime. In summer 1994, we surveyed 16 populations along approximately ten miles of the upper Cuyahoga River in northern Ohio, including the upper- and lower-most populations we could locate. The two uppermost-most sites were 100% male, the lowest-most site was 100% female. Intermediate sites were mixed, and varied in a gradient that was consistent with the end population extremes: male biased upstream and female biased downstream. We will present hypotheses for explaining the sex ratios, as well as associated patterns of genetic variation.

9:30. POLLINATION ECOLOGY OF *PEDICULARIS* IN THE GRAND TETON AREA. LAZARUS MACIOR, DEPT. OF BIOLOGY, UNIVERSITY OF AKRON, AKRON OH 44325.

In the summer of 1994, the pollination ecology of *Pedicularis bracteosa*, *P. contorta*, *P. groenlandica*, *P. procera*, and *P. racemosa* was studied at elevations from 2100m to 3100m amsl. A total of 875 pollinating bumblebees (*Bombus* Latr.) was collected on *Pedicularis* and on *Aconitum columbianum*, *Epilobium angustifolium* and *Mimulus guttatus* growing in the research area. Corbicular pollen loads from 575 queens and workers were microscopically examined for pollen constituents. A phenological record of anthesis was kept. Nine *Bombus* species were identified, and pollinator behavior was recorded. *Pedicularis* bloomed from mid-June until early August. Earlier species (*P. bracteosa*, *P. groenlandica*) were over 26% queen-pollinated, and the later species were over 93% worker-pollinated. On *Pedicularis*, pollen-foraging constancy ranged from 59% (*P. racemosa*) to 85% (*P. bracteosa*), and overall 74% for *Bombus* queens and 66% for workers. Frequency of *Bombus* species on plant species ranged widely; highest frequencies ranged from *B. occidentalis* workers on *Epilobium* (84%) to *B. mixtus* workers on *P. racemosa* (50%). In foraging behavior of pollinators, insect tongue length corresponded with tube depth and nectariferity of *Pedicularis* corollas. The association of these plants and their bumblebee pollinators is considered a product of close reciprocal natural selection.

9:45. SEED BANK REGENERATION IN A WESTERN LAKE ERIE WETLAND. JAMES S. MCCORMAC, OHIO DEPT. OF NATURAL RESOURCES, DIVISION OF NATURAL AREAS AND PRESERVES, 1889 FOUNTAIN SQUARE, COLUMBUS OH 43224.

The composition of plant communities within wetlands bordering the shore of western Lake Erie has changed dramatically since pre-settlement times. Introduction of non-native species has greatly reduced the diversity and abundance of native wetland plants. A thoroughly studied marsh in this region is in East Harbor State Park. The flora of this area was initially reported in 1899. This wetland is currently dominated by non-native species, and native wetland species have declined by approximately 50% since the 1899 survey. A 1.5 acre site within the East Harbor wetland was selected for this study. The flora was sampled using a fixed interval transect method. Dominant species were reed canary-grass, (*Phalaris arundinacea*) and giant reed, (*Phragmites australis*). In March of 1992 the substrate was disturbed using a Case 850LGP bulldozer and Link belt 2800LC excavator. The site was cleared of vegetation and the soil was overturned, exposing dormant seed banks. Surveys throughout the 1994 growing season documented a dramatic shift in the composition of the plant community. Members of the Cyperaceae and Juncaceae families increased in both diversity and abundance, whereas alien species declined. Nine state-listed rare plant species have appeared on the site. The overall abundance and diversity of the native flora have increased.

10:00. THE RELATIONSHIP BETWEEN SEED SIZE AND ROSETTE ALLOCATION PATTERNS IN *ALLIARIA PETIOLATA* (GARLIC MUSTARD). J. FORREST MEEKINS AND BRIAN C. MCCARTHY, DEPT. OF ENVIRONMENTAL AND PLANT BIOLOGY, OHIO UNIVERSITY, ATHENS OH 45701.

While seed size within a population generally follows a normal distribution, the variation of seed size within this distribution can be great and often influences mature plant size. Larger seeds frequently produce larger seedlings, and in turn larger mature plants. Under competitive field conditions, the effect of seed size on establishment, survival, and growth may be pronounced. The maintenance of a range of seed sizes may be of great importance to

invasive exotic plants. The purpose of our study was to examine the relationship between seed size and rosette allocation patterns in an invasive biennial weed, *Alliaria petiolata* (Garlic mustard; Brassicaceae). Seeds were collected from a population in western Maryland in the summer of 1993. Seed mass was determined to be normally distributed and ranged from 1.4 to 3.1 mg (Mean = 2.1 +/- 0.48 SD; N = 2000). Seeds were stratified at 4 degreesC for 4 months and moved to a growth chamber to initiate germination. Germinated seeds were then individually potted and grown in a greenhouse for 120 days. A stratified random sample of 150 rosettes was harvested and separated into roots and shoots, dried, and weighed. Regression analyses indicate that seed size is positively related to total rosette biomass, shoot biomass, root biomass, and root:shoot ratio (all $P < 0.01$). Thus, larger seeds produce more robust rosettes. Studies are continuing so that we may evaluate the ultimate effects of seed size on plant fitness as the biennial matures.

10:15. EFFECTS OF INTERPLANT DISTANCE ON MATING SUCCESS OF LAKESIDE DAISY (*HYMENOXYS HERBACEA*). PEDRO MORAN-PALMA AND ALLISON A. SNOW, OHIO STATE UNIVERSITY, DEPT. OF PLANT BIOLOGY, 1735 NEIL AVE., COLUMBUS OH 43210-1293.

We investigated large and fine scale effects of distance on compatibility and seed set, and large scale effects of distance on seed germination, in a rare, self-incompatible perennial, Lakeside daisy (*Hymenoxys herbacea* = *H. acaulis* var. *glabra*). Plants were collected at the Marblehead Peninsula, Ohio, and transplanted to a greenhouse where they were hand-pollinated. For large scale analysis, 110 crosses were classified in three categories: near crosses (0.75-6.70 m), far crosses (17-72 m), and very far crosses (>300 m). There was no significant effect of distance on compatibility, seed set or seed germination in these crosses. For fine scale analysis, 44 crosses were used and interplant distances ranged from 0.75 m to 10 m. There was no significant effect of compatibility at this scale, but interplant distance explained 13.6% of the variance of the ratio seed/florets, suggesting that local genetic structure may result in biparental inbreeding. For all distance classes, >80 % of the crosses were compatible, indicating that lack of compatible between mates is not likely to limit seed production in this population.

10:30. THE EFFECTS OF LEAF HARVESTING ON SURVIVORSHIP AND POPULATION GROWTH OF THE UNDER STORY PALM. *C. RADICALIS*. IN EL CIELO BIOSPHERE RESERVE IN TAMAULIPAS, MEXICO. HAROLD A. RICHARDS, 107 BRANDON HALL, MIAMI UNIVERSITY, OXFORD OH 45056.

Sustainable harvest of rain forest products has become an important model in rain forest conservation. Leaves of many species of *Chamaedorea* palms have been collected by people in Mexico for decades and have international markets as floral greenery. Leaves of *C. radicalis* are harvested extensively in El Cielo Biosphere Reserve. There is concern that this is not a renewable resource and that the palm is in danger of extinction within the Reserve. Leaf collection is currently regulated by the Mexican government, but before serious restrictions are placed on leaf harvesting, field research needs to document the actual status of the palm and the effect leaf collection has on the species. We censused five *C. radicalis* populations in 1993 and 1994 and used these data to construct stage transition matrices of the population growth. We also subjected 40 palms to one of four levels of defoliation (zero, one, two, or all leaves removed) in 1993 and recensused them in 1994. We found no significant effect when only one or two leaves were removed; however complete defoliation increased leaf production and tended to increase flowering. This may indicate that low levels of leaf removal do not significantly impact the palm.

**QUATERNARY AND ENVIRONMENTAL
GEOLOGY
2:00 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 426
C. SCOTT BROCKMAN - PRESIDING**

1:30 EARTH AND SPACE SCIENCE DIVISION MEETING

2:00 . PLANT DISTRIBUTION AS A FUNCTION OF CATION AVAILABILITY IN RESIDUAL SOILS IN ADAMS COUNTY, OHIO. ALICE J. MICHELS, SUSAN M. CHARLS, STEVEN C. HEDRICK, MARY M. RIESTENBERG, DEPT. OF CHEMISTRY AND PHYSICAL SCIENCES, COLLEGE OF MT. ST. JOSEPH, CINCINNATI OH 45233.

A geobotanical study of a wooded ridge in Adams County suggests that the composition and distribution of its woody plant communities are strongly influenced by the soluble, exchangeable inorganic cations in its residual soils.

Point-quarter transects, parallel and normal to the long-axis of the ridge, show that plant communities associated with the soils derived from the Silurian dolomitic Bisher-Lilly and Peebles Formations are distinct from those growing on soils associated with the Devonian Ohio Black Shale Formation. For instance, blueberry is exclusively found in the ridge's acidic soil and spice-bush in the basic soil. Analyses of aqueous extracts from soil show that there are strong differences in pH, calcium, magnesium, iron, and aluminum. For instance, the iron detected in the strongly acidic shale soil is one hundredfold that in the slightly alkaline dolomitic soil; whereas, the magnesium and calcium levels in the dolomitic soil are ten-fold that found in the shale soil.

2:15. STRATIGRAPHY AND MINERALOGY OF TILLS FROM THE PINE GROVE REGIONAL FACILITY, MADISON TOWNSHIP, FAIRFIELD COUNTY OHIO. THOMAS L. HITE AND JOHN P. SZABO, GEOLOGY DEPT., UNIVERSITY OF AKRON, AKRON OH 44325-4101.

Analysis of seven cores from the Pine Grove Regional Facility has differentiated three till units to a maximum depth of 50 meters. Six of the cores were sampled every meter and one core, 367, every half meter. Matrix texture, carbonate content, and clay mineralogy were determined for all samples. Coarse sand lithology was determined for samples from core 367. The three tills are tentatively named A,B,C, and have variable thickness in the area. Till A is the youngest and exhibits a high carbonate content of 21% (3% calcite and 18% dolomite). The matrix texture of Till A is 34% sand, 35% silt, and 31% clay and the diffraction intensity ratio (DI) is 1.9. Analysis of the coarse-sands indicate that the till is composed of 22% carbonate, 65% clastics, and 13% crystallines. Till B has a similar total carbonate content. It is composed of 39% sand, 28% silt, and 33% clay and has a DI of 1.3. Coarse-sand values are very similar to Till A. Till C, the oldest, is a low carbonate till, exhibiting only 3% total carbonate. Till C contains more sand, less silt, and similar amounts of clay than the above two tills (46% sand, 22% silt, 32% clay). The DI is less at 0.7. Coarse-sand is enriched in elastics and contains 7% carbonate, 71% elastics, and 22% crystal lines. These tills may correlate to tills in southwest Licking County.

2:30. ANALYSIS OF SOIL PARENT MATERIALS ON THE WESTERN DEFIANCE MORaine, HANCOCK COUNTY, OHIO. RICK A. ROBBINS, OHIO DEPT. OF NATURAL RESOURCES, DIVISION OF SOIL AND WATER CONSERVATION, 7710 COUNTY ROAD 140, FINDLAY OH 45810.

The western Defiance Moraine lies within the Erie Lobe of the Ohio-Indiana Till Plain region of northern Ohio. The moraine within the study area is defined by the relict beaches of Glacial Lake Maumee to the north, and the Findlay Embayment to the south. Topographically, the northern part of the moraine is pitted, suggesting glacial ablation, whereas the southern part is more typically end moraine. Surficial hydrology is oriented north to south revealing extensive water modification by Glacial Lake Maumee. Evidence has been obtained to establish pre-Maumee-age lacustrine sediments above 800 feet mean sea level. These sediments are relatively thin (1.5 to 2 meters) reflecting a temporary lake setting. Particle size analysis and physical examination of the basal till from the 2 morainic components reveal different till sources. The results of the study will provide a better understanding of the Defiance moraine and the relationship between geologic components and corresponding soil catenas. This information will furnish local users with the most current soils information to make wise land use decisions.

2:45 POSTER BREAK

3:00. OBSERVATIONS SINCE 1963 ON THE ORIGIN OF CALCUTTA SILT IN COLUMBIANA COUNTY, OHIO. TIMOTHY D. GERBER AND LINN E. ROTH, ODNR, DIV. OF SOIL AND WATER CONSERVATION, 1939 FOUNTAIN Sq. DR., COLUMBUS OH 43224.

The term Calcutta Silt was introduced in 1963 in a paper written by the pedologist who was in charge of conducting the soil survey in Columbiana County, Ohio. He used the term to identify silty material that mantles land surfaces at elevations of 1080 to 1180 feet in the county. The silty material was attributed to sediment from Lake Monongahela, which was created when the outlet for the preglacial, northward-draining Steubenville River, an ancestor of the upper Ohio River, was dammed. References to Calcutta Silt have appeared in geology literature as recently as 1988, but pedologists have been identifying the silty material in the upper part of soils on stable landscapes at similar elevations in the other eastern Ohio counties as loess for decades. Field studies by pedologists currently working in Columbiana County to update information in the *Soil Survey of Columbiana County, Ohio* suggest that Calcutta Silt is loess also. The particle size distribution and thickness of the silty material are consistent with loess observed elsewhere in eastern Ohio. This silty material was observed at elevations as high as 1380 feet on summits along Ohio Route 45 south of West Point. The scarcity of the material at elevations above 1180 feet can be attributed to downslope movement in a

periglacial environment on landscapes that already reflected bedrock stratigraphy.

3:15. SIGNIFICANT SMALL-SCALE GLACIAL LANDFORMS OF SOUTHWESTERN OHIO. THOMAS R. WEAVER, CONSULTING GEOLOGIST, 2156 ALPINE PLACE, CINCINNATI OH 45206.

Few major land forms in southwestern Ohio were produced directly by glacial ice, or in its immediate presence. Glaciers did divert predecessors of the Ohio River and tributaries cutting gorges through preglacial divides. Valleys were partly filled with long trains of glaciofluvial and lacustrine sediments. Shingle-like overlapping tills of at least three glaciation covered the area (Durrell, 1961; Goldthwait, 1981) but added little form to the pre-existing topography. Through global effects on climate and sea level, each Pleistocene glaciation caused deep incision of major valley troughs and tributaries before glacial ice approached. Relict preglacial interfluvies were less involved. Local land form development was primarily controlled by the flat-lying, thin limestone and calcareous mudstone bedrock - itself reflecting the global influence of late Ordovician glaciation (Weaver, 1974, 1975). A plateau-like landscape was met by each advancing glacier near its terminus. Till ramps were deposited against knobs and valley sides facing up-ice; plucking dominated down-ice facing slopes. Those paralleling ice flow were steepened by glacial scour. Basal scour is not evident - fragile substrates show only striae. Smaller ice contact features include: eskers, kames, kame terraces, marginal lake terraces, end moraine segments and drumlinized forms. Numerous marginal channels define terminal ice positions. Proglacially, drainage diversions and reversals created: through valleys, flared valley mouths, hanging and barbed tributaries. Valley train terraces line valley sides with occasional slack water deltas. Valley floor recession forms are subtle, but their lower colluvial slopes are still landslide-prone. Karst topography developed where relief and limestone were sufficient

3:30. ORIGIN AND DELINEATION OF THE ANCESTRAL EAST FORK LITTLE MIAMI RIVER IN SOUTHWESTERN OHIO. GREGORY SCHUMACHER, O.D.N.R., DIV. OF GEOLOGICAL SURVEY, 4383 FOUNTAIN Sq. DR., COLUMBUS OH 43224.

Recent geologic mapping revealed that much of the ancestral East Fork Little Miami River drainage basin is buried by pre-Wisconsinan glacial drift. The drift-filled main channel of the ancestral East Fork extends from eastern Clermont County through the panhandle of Brown County, into southern Highland County. The modern channel of the East Fork flows northward through the ancestral valley in Clermont County before joining the Little Miami River. The majority of the recognized tributaries are drift-filled in Brown and Highland Counties, whereas the modern East Fork and Stonelick Creek occupy major tributaries in Clermont and Brown Counties. The ancestral East Fork was created by entrenchment of shallow, preglacial, joint-controlled drainage by ice-margin melt waters flowing westward and southward into the developing Ohio River. Later pre-Wisconsinan glacial advances buried much of the ancestral East Fork. Melt waters from these glaciers created the modern White Oak and Straight Creeks in Brown County which now drain the head waters of the ancestral East Fork, reexcavated part of the ancestral East Fork valley in Central Clermont County, and cut the gorges occupied by the modern East Fork and Stonelick Creek. The Wisconsin glacier stopped short of the East Fork drainage basin, but the damming of adjacent north-flowing streams produced lakes which over time breached the drainage divide between these streams and the East Fork. The gorge of the modern East Fork in the tri-county region of Brown, Clinton, and Highland Counties was cut and much of the drainage of southern Clinton County was captured to form the head waters of the modern East Fork Little Miami River.

3:45. PHYSICAL AND CHEMICAL ANALYSIS OF THE MAD RIVER AND ADJOINING OUT WASH AQUIFERS, CHAMPAIGN COUNTY, OHIO. A. WAYNE JONES, MICHAEL C. SCHIEFER P.E., LYDIA J. CUMMING, AND MICHAEL P. ANGLE. OHIO DEPT. OF NATURAL RESOURCES, DIV. OF WATER, 1939 FOUNTAIN Sq. DR. E-1, COLUMBUS OH 43224.

Water quality variations within the Mad River watershed have led to an investigation of Non-Point Source contamination within the ground water system. Multiple rounds of water quality data show certain wells consistently approach or exceed the safe drinking water standard for nitrate. Statistical methods are being employed to determine the source of contaminated waters. Cation/anion balances of these samples will determine if the contaminated wells have a similar background water quality type. Water quality data from both wells and the Mad River System, in concert with use of established ground water flow fields, will establish the relationship between ground water and surface water chemistry. A Hec1 model of the surface water flow is being calibrated to allow a basin-wide water balance of inflow/outflow. Hydrograph separation and gain/loss studies for all tributaries of the Mad River by the USGS has determined the median annual contribution of base flow to total

stream flow to be 76.1 percent near Urbana (Koltun, in review). With this amount of ground water contribution, it is clear how important the understanding and protection of the ground water resource is.

4:00. QUANTIFYING INTERACTIONS BETWEEN AN ALLUVIAL VALLEY AQUIFER WELLFIELD AND THE SCIOTO RIVER, PIKETON, OHIO. PATRICK E. NORTZ, ANDREW WARD, E. SCOTT BAIR, AND DALE WHITE, BURGESS AND NIPLE, LIMITED, 5085 REED ROAD, COLUMBUS OH 43220.

Data from wellfields located in the Scioto River valley aquifer near Piketon, Ohio, enabled evaluation of ground-water quantity and quality to develop management concepts for future use of alluvial aquifers. The percentage of induced river infiltration being pumped from near-river wells is estimated using a finite-difference ground-water flow model and chemical mass-balance techniques. The flow model and chemical mass-balance indicate that 50-80 percent of the wellfield water is derived from induced river infiltration. Model simulations correlate the percentage of well water from induced infiltration to well field abstraction rates, river stage, proximity of wells to the river, river bottom hydraulic conductivity, and aquifer hydraulic conductivity. The model helps quantify net areal recharge, tributary stream losses, and bedrock underflow. Induced infiltration of well field water has influenced ground water, making the quality of the ground water at the wells more similar to that of the river water. Calculations helped determine advective traveltimes between the wells and the Scioto River. Under 1990 simulated hydrologic conditions, the median advective traveltime between the river and wells, a 400 to 800 foot distance, is 64 days.

4:15. HOW DEEP ARE THE FRACTURES IN OHIO'S FINE-GRAINED MATERIALS? JULIE P. WEATHERINGTON-RICE, B&W, 2700 E. DUBLIN-GRANVILLE RD., COLUMBUS OH 43231.

GSA's 1994 Penrose Conference "Fractured Unlithified Aquitards: Origins and Transport Processes", was held in June in Racine, WI., with field trip to Bender Park on Lake Michigan shore. Here, 130+ foot bluffs of late Wisconsin till and lake sediments are eroding 40 ft/10 yr. These deposits are similar in lithology and age to northern Ohio. Examination of Racine deposits revealed vertical fractures extending from top of bluffs to wave-cut terrace at base. Fractures had oxidation/reduction halos in bands along sides and 2nd mineral precipitation patterns in joints, indicating great age. These features are found at shallower depths (to 30 feet) in Ohio. Fractures were open and active, serving as sources of springs or seeps along the face of bluffs. Current research indicates rapid creation due to dessiccation, presence of secondary features indicate fractures were created during regional lowering of ground water, possibly beginning of Holocene. Such a regional ground water lowering also took place in northern Ohio about same time. Ohio geologists should be aware of the potential for connected vertical fractures at great depth and conduct their research accordingly. Angled borehole drilling is the recommended investigative procedure.

4:30. INTERACTIONS BETWEEN URANIUM OXIDES AND THE CLAY MINERALS. P. ANDREW KARAM, DEPT. OF GEOLOGICAL SCIENCES, OHIO STATE UNIVERSITY, 104 WEST 19TH AVE., COLUMBUS OH 43210.

A number of sites in Ohio are contaminated with uranium, typically in the oxide form. Some of these sites may be remediated utilizing burial in an on-site clay closure cell. Others are in the vicinity of public and private water supplies. Owing to the great abundance of clay in Ohio soil, the mobility of uranium through the environment is largely dependent upon the interactions of uranium oxides with the clay minerals found in Ohio. The physical, structural, and chemical properties of the clay minerals have a great impact on their ability to impede the transport of uranium through the environment. This paper will examine the properties of several of the clay minerals and will discuss the way in which they interact with uranium oxide. Understanding these mechanisms may help us to better understand the mobility of uranium in the vicinity of uranium-contaminated sites and, therefore, to better understand the risk posed by this contamination.

4:45 CAVE RESOURCE INVENTORY: CASE STUDIES IN THE SOUTHEASTERN UNITED STATES. HORTON H. HOBBS III, DEPT. OF BIOLOGY, WITTENBERG UNIVERSITY, PO Box 720, SPRINGFIELD OH 45501-0720.

With passage of the Federal Cave Resource Protection Act in November 1988, all caves on Federal lands must be inventoried and management protocols must be established to protect all resources. Eight caves at Russell Cave National Monument, Alabama and 13 within the Lookout Mountain Unit of Chickamauga-Chattanooga National Military Park, Georgia and Tennessee were visited during 1992 and 1993. Physical, chemical, and biological samples

were obtained and at least 102 species of cavernicoles were noted. Physico-chemical data from streams and drip/flood pools indicate no particular problems. Yet, threat to ground water quality (thus cave ecosystems) from septic and other possible sources is great on Lookout Mountain. There is much potential for damage to the Russell Cave ecosystem from the proposed chip mills industry. Assessment of resources of these two areas has resulted in recommendations for management of the caves and their hydrological recharge areas. Protection and preservation of unique resources, including cave fauna (some known from a single locality), are major parts of the management recommendations.

SOCIAL INFLUENCES ON COGNITIVE BEHAVIOR:

FROM PERCEPTION OF SELF TO SELECTION OF HABITAT

1:30 PM SATURDAY, APRIL 29, 1995

ROUSH HALL 214

MATTHEW T. CRAWFORD - PRESIDING

1:30. THE INS AND OUTS OF A CULT: A THEORY OF THE PROCESSES OF RELIGIOUS MOVEMENT RECRUITMENT, RETENTION, AND DEFECTION. THOMAS G. LANE, DEPT. OF SOCIOLOGY, UNIVERSITY OF CINCINNATI, CINCINNATI OH 45221-0378.

Radical change in an individual's sense of identity and values is a phenomenon which challenges conceptions of socialization and social stability. The inducement of such change is a goal of many religious, self-help, and other groups. A variety of models has been proposed to account for significant personal world view change. Many of these models look at individuals' susceptibilities, paying little attention to the influence of the social setting upon a potential convert. Other theories stress the importance of interpersonal networks in facilitating or thwarting affiliation with a religious or social movement, but fail to consider the necessity of personal need or attraction factors. In the present study, interviews and direct observation of an authoritarian religious sect yielded data which was interpreted according to the canons of grounded theory, in order to elucidate the whole panoply of factors leading to conversion and commitment. Conversion was seen to involve a series of stages in which the influence of a missionizing community is of great salience. The course of individual-group interplay was framed into a holistic model of the life-span of a convert's odyssey: recruitment into, maintenance of membership within, and exit from a religious group.

1:45. DOES DILIGENCE IN SOCIAL INFORMATION PROCESSING ENHANCE RECENCY EFFECTS IN IMPRESSIONS? TAMARA A. ORR, JOHN J. SKOWRONSKI, AND MICHELLE D. MONROE, OHIO STATE UNIVERSITY AT NEWARK, 1179 UNIVERSITY DR., NEWARK OH 43055.

A recent study (Gannon, Skowronski & Betz, 1995) demonstrated that mild to moderate depressives show enhanced recency effects in social judgments. It has been suggested that this effect is caused by depressives' adoption of an accuracy goal in thinking about others, which causes them to exhibit heightened diligence in social information processing. Despite the plausibility of this idea, there is no independent evidence that processing diligence, by itself, causes increased recency. The present study attempted to provide such evidence. Subjects in this study were asked to form impressions of the same hypothetical targets, and under the same recency-inducing circumstances, employed by Gannon, et al. One group of subjects in this study was given no special instructions prior to forming impressions, while a second group of subjects was given such instructions. That is, these diligence subjects were told not to jump to conclusions about each target, but instead, that it was important that they wait to make a judgment until all the behaviors describing a target had been read. The impression responses of each group were examined to see if the diligence-instructed subjects showed greater evidence of recency in their trait judgments of the targets than uninstructed subjects. The results are discussed in terms of notions of depressive diligence, and in terms of the mechanisms underlying primacy and recency effects in impressions.

2:00. NEED FOR COGNITION AND STEREOTYPE USE: THE ROLE OF ATTENTION AND ELABORATION IN PERSON PERCEPTION. MATTHEW T. CRAWFORD AND W. RICHARD WALKER, OHIO STATE UNIVERSITY AT NEWARK, 1179 UNIVERSITY DR., NEWARK OH 43055.

The way in which social information is processed depends on numerous individual and environmental factors. The studies presented here examine the effect of Need for Cognition (the tendency to engage in and enjoy thinking) on person perception. The hypothesis of study one is that persons high and low in need for cognition differ in how they process information about people. More specifically, it is proposed that persons low in cognitive need are more likely to use peripheral cues (such as stereotypes) to organize social information than persons high in need for cognition. To test this idea, subjects were presented with behavioral information pertaining to different targets. To assess the possible use of peripheral and central cues at encoding, the amount of time subjects spent looking at each item of information was recorded. The information consisted of equal numbers of stereotype-consistent, stereotype-inconsistent, and irrelevant sentences. Later, in a sentence verification task, subjects were asked whether the sentences presented were old or new, and the time it took to respond to each item was recorded. We also explored whether any relation between the need for cognition measure and the verification measure could actually have been caused by other relevant personality variables. More specifically, we assessed whether racism, as measured by the Modern Racism Scale (McConahay, 1986), or social desirability concerns, as measured by The Responding Desirably on Attitudes and Opinions (RD-16) scale (Schuessler, Hittle & Cardascia, 1978) may have mediated the effects observed for the need for cognition measure.

2:15. ON UNDERSTANDING THE ROLE OF ENCODING AND ASSOCIATION IN SOCIAL INFERENCE. MATTHEW T. CRAWFORD AND JOHN J. SKOWRONSKI, OHIO STATE UNIVERSITY AT NEWARK, 1179 UNIVERSITY DR., NEWARK OH 43055.

A continuing debate exists in the social psychology literature concerning whether, and when, people make spontaneous inferences about others in the course of observing the others' behaviors. The primary problem involves developing a paradigm that measures inference-making without directly asking subjects to report their inferences. In a series of studies (Skowronski & Carlston, 1994) evidence of inferences was obtained using a savings (or re-learning) task. Subjects were first exposed to photo-behavior pairs in which they were given an opportunity to spontaneously draw an inference about the person in the photo from the behavior descriptions. Subjects later showed a savings effect in their learning of trait words relevant to these descriptions. This enhanced performance cannot be explained by subjects' ability to recall the behaviors, suggesting that a person-trait link is formed at behavior encoding. Results further demonstrate that subjects do not evince savings effects unless their initial inference is 'correct'. This suggests that inferential links are formed. To test this idea further, in study two, the paradigm was modified to investigate whether other dependent measures (specifically a trait rating task) would be sensitive to these inferences, and whether the effects would be specific for to actor, or would generalize to others associated with an event.

2:30. PERCEPTIONS OF SELF-AFFECT NOW AND IN THE FUTURE: DO MILD DEPRESSIVES AND NON-DEPRESSIVES DIFFER? MICHELLE D. MONROE AND JOHN J. SKOWRONSKI, OHIO STATE UNIVERSITY AT NEWARK, 1179 UNIVERSITY DR., NEWARK OH 43055.

Individuals construct possible (i.e., future) selves, just as they construct current self-structures, and both of these self-structures contain information about affective states. Staats and Skowronski (1992), obtained evidence suggesting that current self-conceptions incorporate both specific positive and negative affect information, but that one's future self-conceptions incorporate only positive affect information. The present research attempted to replicate and extend this outcome. After two time-lagged administrations of the Beck Depression Inventory, subjects were divided into two groups: mildly depressed and non-depressed. These subjects were asked to provide timed self-appraisal ratings for positive (e.g., happy) and negative (e.g., distressed) affect items from the PANAS (Watson, Clark, & Tellegen, 1988), in either a present time frame ("How do you feel now?") or a future time frame ("How will you feel five years from now?"). Response latencies to the affect items were not affected by the depression factor. Instead, the latency data simply replicated earlier findings: prototypicality effects (fast responses to highly applicable items and fast rejection of inapplicable items) were found in all conditions, except for negative affect items in the future time frame. Examination of the applicability ratings themselves indicates that, in the present time frame, depressives feel both less positive affect and more negative affect than non-depressives. However, in the future, depressives expect to feel more negative affect than non-depressives, but also expect to feel as much positive affect. These results are discussed in terms of how thinking about the self in a future context might affect self conceptions.

2:45. REPRESENTATION OF SERIAL ORDER IN MONKEYS (CEBUS APPELLA) AS EXHIBITED THROUGH INFERENTIAL TRANSITIVITY. REBECCA D. BOATRIGHT, BOX C-1161, COLLEGE OF WOOSTER, WOOSTER OH 44691, AND CLAUDIA THOMPSON, DEPT. OF PSYCHOLOGY, COLLEGE OF WOOSTER, WOOSTER OH 44691.

Discussion of the ability of nonhuman primates to represent abstract concepts imaginably has led to further research on the capacity of nonhuman primates to similarly represent more complex concepts, such as serial ordering, ordinality and transitivity. To test the presence of such representational constructs three male subadult *Cebus apella* monkeys were tested on discrimination problems involving serial learning and transitivity. The solution of a transitivity problem requires that one be able to represent and deduce relationships among events in a series. For example, given $B > A$ and $C > B$, what is the relationship between C and A ? The correct answer, $C > A$, depends on the ability to represent the series A, B, C , and to infer from this sequence the relationship between the nonadjacent events C and A , although it was never stated explicitly. The monkeys were trained on a series of problems involving colored blocks. They were trained to a criterion of 90% correct responses in two consecutive sessions on the pair red-yellow ($R-Y$), with yellow consistently rewarded. Once the animals reached criterion, the pair yellow-blue ($Y-B$) was presented in which blue was the rewarded color. The pairs blue-green ($B-G$) and green-orange ($G-O$) were presented accordingly. After the animals reached criterion on the $G-O$ pairing, the pairs in the series were mixed randomly within a testing session, and as a final training measure three blocks were presented at a time. For example, red, yellow, and blue were presented with blue, as the "higher" color, being rewarded. To test for transitive inference, the novel pair yellow-green ($Y-G$) was presented. This pair was nondifferently rewarded. All of the monkeys reached criterion on the successive pairs of blocks in the ordered series. One of the monkeys also performed successfully both when the pairs in the series were mixed randomly within a testing session and when three blocks were presented. This monkey also performed significantly above chance when the novel, nonadjacent $Y-G$ pair was presented. The results indicate that the species *Cebus apella* can infer transitive transitive relationships among nonadjacent stimuli in an ordered series. To date, inferential transitivity has been previously reported only for great apes (Boysen et al., 1993).

3:00. HABITAT SELECTION AND AGONISTIC BEHAVIOR IN WHITE-FOOTED MICE (PEROMYSCUS LEUCOPUS). CYNTHIA L. HULL AND STEPHEN H. VESSEY, DEPT. OF BIOLOGICAL SCIENCES, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403.

The hypothesis that dominant mice occupy more preferred habitat than the subordinate mice in a natural population of white-footed mice (*Peromyscus leucopus noveboracensis*). Individuals were identified as being either winners or losers in agonistic interactions, and measure habitat variables within home ranges. Two animals of the same sex and similar weight were placed in a bottomless area outside both animals' home ranges. The frequency of specific behaviors were scored to determine whether an animal was a winner or a loser in each area trial. Habitat variables centered on each mouse's point of capture were measured by the quarter method. Sites were divided into those occupied by winners and those occupied by losers for discriminate function analysis. The analysis classified winners and losers correctly more often than could be explained by chance. When sites were analyzed separately by sex, the predictability of mouse classification increased, indicating differential habitat use by sex. Whether dominance causes or is caused by habitat selection could not be discovered.

WASTE REMEDIATION

1:30 PM SATURDAY, APRIL 29, 1995

ROUSH HALL 117/118

YUNG-TSE HUNG - PRESIDING

1:30. TRANSPORT OF ORGANIC CHEMICALS FROM SURFACE WATER TO GROUND WATER. MAJID ZARRINAFSAR AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115, RUTH YU-LI YEH AND JACK KUEI-CHUNG SHIH, MING HSIN ENGINEERING COLLEGE, HSINCHU, TAIWAN.

The infiltration of organic pollutants from surface water to ground water is a matter of interest to environmental engineers. For the low concentration of organic compounds, which is typical of environment, the sorption of organic compound is reversible, and a linear isotherm equation of $S = K_p C$ is appropriate, where S is the concentration in the solid phase, C is the concentration in the liquid phase, and K_p is the partition coefficient. In case of pesticides or heavy metals, the absorption isotherm will be nonlinear as: $\log S = \log K_p + n \log C$ where, $0 < n < 1$ and, $Q(dC/dT) + (dS/dT) = Q.D.(dC/dZ)/dZ - dC/dZ$. In this paper, the effects of particle size, composition and fluid velocity on the transport of organic compound from surface to ground water is discussed.

1:45. DEVELOPMENT OF A SUB-SURFACE SAMPLER FOR IN SITU PURGE AND TRAP ANALYSIS. TAMMI R. JAMES, JOSEPH H. ALDSTADT, PAUL V. DOSKEY, CHARLES H. BATSON, AND MITCHELL D. ERICKSON, ENVIRONMENTAL RESEARCH DIVISION AND TECHNOLOGY DEVELOPMENT DIVISION, ARGONNE NATIONAL LABORATORY, 9700 SOUTH CASS AVE., ARGONNE IL 60439.

Methods are currently being developed to analyze sub-surface contamination with higher efficiency and lower cost than traditional techniques. With growing concern over assessment and clean up of volatile organic compound (VOC) contamination, a device is needed that can collect, transfer, and analyze samples while maintaining sample integrity. Our objective is to design, construct, and test an in situ purge device (ISPD) which can be coupled with a cone penetrometer truck (CPT) and field deployable gas chromatograph/mass spectrometry (GC/MS) instrumentation. The intent of the design is to maintain sample integrity and improve the accuracy of the results by eliminating the manipulation of samples that usually occurs before analysis using traditional methods. A laboratory scale version of the ISPD was tested to gain information for designing the miniaturized CPT-scale prototype, designed to fit inside a cone penetrometer. Sample carry-over, purging efficiency, head space to sample ratios, and the materials for constructing the vessel (Teflon vs. stainless steel) were studied using a laboratory-scale ISPD.

2:00. ACCELERATED CLEANUP AT WRIGHT-PATTERSON AFB: APPLICATION OF A PRESUMPTIVE REMEDY. BERNARD J. FRANKS, DEBORAH L. MCKEAN, AND CYNTHIA A. HASSAN, IT CORPORATION, 11499 CHESTER ROAD, CINCINNATI OH 45246-4012 AND JOHN C. WOLFE, WRIGHT-PATTERSON AFB, FAIRBORN OH 45433-5332.

USEPA has initiated a presumptive remedy initiative under the Superfund Accelerated Cleanup Model (SACM). SACM is an attempt to streamline the Superfund program by eliminating the distinction between removal actions and remedial actions. During the conventional PA/SI/RI/FS assessment process, early, short-term presumptive remedies can now be implemented to reduce the majority of potential risk to human health and the environment. WPAFB, which has been on the National Priorities List (NPL) since 1989, has initiated Basewide application of landfill capping for early reduction of risk. A Basewide Remedial Action Plan (BRAP) reviewed landfill capping as a remedy of choice over other remedial alternatives for similar contamination situations at other NPL sites. The BRAP standardized a decision process for landfill capping actions at WPAFB and streamlined administrative requirements for subsequent actions. The BRAP concluded that 13 landfills at WPAFB may be suitable for early action, with the short-term goals of reducing risk by minimizing infiltration and generation of landfill leachate, and limiting overland runoff and airborne contamination. Although hot spot remediation or ground water and leachate control may be necessary at a given landfill, any capping action will be compatible with long-term remedial actions. Based on detailed studies of Landfill 5 (LF5), located in Operable Unit 5 at WPAFB, risk-based criteria for groundwater under a residential use scenario have been exceeded. In addition the landfill is subject to final closure by Ohio regulatory authority. Consequently LF5 has been recommended for a presumptive capping. The cap is expected to be completed in FY95.

2:15. BENZENE DEGRADATION WITH ACIDOGENIC FERMENTATION. MEI-LUN SUN AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

The objective of this study is to investigate the kinetics of removal of hazardous substances by suspended growth culture of organic solid beds under anaerobic acid fermentation. Biodegradation of benzene was tested in the presence of leachate obtained from an experimental solid bed reactor operating in the acidogenic phase. For biotic reactor, biodegradation of 100 mg/L of benzene was nearly completed in about 60 days by the suspended-growth culture. Disappearance of 99% of the original concentration of benzene was observed when the redox potential in the batch system ranged from -125 to -300 mV and the pH remained constant at pH 5.2. Acidogenic biodegradation of benzene could be described by a simple kinetic model based on the Monod equation relating growth rate to concentration of these substances. The rate constants were $C = 1 \text{ mg/L-day}$ and $K = 8 \text{ mg/L}$.

2:30. CASE HISTORY: SODIUM BENZOATE/BENZOIC ACID PROCESS WASTEWATER TREATMENT AT A SMALL MUNICIPAL WASTEWATER TREATMENT PLANT. KEITH A. RADICK, FBA ENVIRONMENTAL, INC., 107 N. MAIN ST., STE. 200, MARION OH 43302-3029 AND WILLIAM A. NEWTON III, P.E.

An Organic Chemicals, Plastics and Synthetic Fibers (OCPSF) industry petitioned the local Publicly Owned Treatment Works (POTW) for permission to discharge process wastewater into the sewer system. The principle pollutant of concern was a sodium benzoate/benzoic acid mixture. Following

reviews of the process wastewater characteristics and recommendations to the municipality, permission was granted to discharge. The discharges resulted immediately in repeated serious upsets of the POTW's extended aeration activated sludge process. Subsequent determinations were that the process wastewater was not amenable to biological treatment, and consequently, the industry was ordered to cease discharging to the sewer system. The industry commissioned studies to determine whether or not the process wastewater was biologically treatable and, if so, the operational protocol required to accomplish satisfactory treatment. Initial bench-scale investigations using oxygen uptake rate provided the basis for establishing and pursuing a program proving treatability on scales expanding from bench scale to extended full-plant scale treatment. Once the full-plant scale studies were initiated, numerous operational concerns had to be addressed. The combination of bench-scale and pilot studies, plant-scale trials, municipal/industrial coordination, regulatory approval and plant scale implementation spanned an eight year period with the end result being a cost-effective pollution prevention program.

WASTEWATER MANAGEMENT 9:00 AM SATURDAY, APRIL 29, 1995 ROUSH HALL 117/118 YUNG-TSE HUNG - PRESIDING

9:00. REMOVAL OF IRON FROM WATER. YOUSSEF N. MEHTAR AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

This paper discussed iron removal from water supply. A pilot study composed of a constant flow head regulator, aerator, reaction sedimentation basin, and a bank of 4 rapid sand filters with a down flow rate of 2 gpm/ft² was used for iron removal. Bacterial slime growth in the filters was observed. An excessive high chlorine dosage of 50 mg/L was required to remove bacterial slime. Pilot plant experiments with filter aid supplemented with MgO produced effluent with very low iron concentrations of less than 0.05 mg/L. Filter media of bituminous coal of 1 mm size was used to remove groundwater without preaeration. A comparison of coal and sand filters over a 48 hour period indicated that coal filter had better removal for iron. The coal filter can be operated at 8 gpm/ft², compared to sand filter (2 gpm/ft²) with similar effluent quality and head loss. Results indicated coal filter is suitable for iron removal from water supply.

9:15. EFFECT OF PHENOL ON POWDERED ACTIVATED CARBON ACTIVATED SLUDGE TREATMENT OF POTATO WASTE WATER TREATMENT. JAE CHOUN YOU AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115, RUTH YU-LI YEH AND JACK KUEI-CHUNG SHIH, MING HSIN ENGINEERING COLLEGE, HSINCHU, TAIWAN.

The objective of this batch reactor study is to determine the effect of phenol on the treatment of potato waste water with powdered activated carbon activated sludge process. Factors investigated included dosages of powdered activated carbon (PAC), dosages of bacterial culture product addition, and types and dosages of simple phenol. LLMO dosages included 1000, 2500, and 5000 mg/l. PAC dosages included 0, 500, 1000, and 1500 mg/l. A total of 10 batch activated sludge reactors were used in the study. Results indicated that the amount of TSS increased drastically in reactors with PAC addition compared to the control reactor without PAC addition. The TOC removal efficiency increased with increasing PAC dosages. The bioaugmented reactors had higher TOC removal compared to the control reactor without LLMO addition, while increase in LLMO dosage had little effect on increasing TOC removal efficiency. The TOC removal efficiency decreased with increasing phenol concentration.

9:30. PHENOL WASTEWATER TREATMENT WITH CHEMICAL OXIDATION AND SOIL TREATMENT. ISWAHYUNI AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., HOWARD H. LO, GEOLOGY DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

The objectives of this bench-scale laboratory study are to determine TOC removal efficiency of phenol wastewaters by Fenton's reagent oxidation, and soil absorption with bioaugmentation. Various dosages of soil adsorbents with three combinations (25% clay + 75% fly ash; 50% clay + 50% fly ash; 75% clay + 25% fly ash) and bacterial culture product, LLMO S1 type were used in the study. Complete mixing was carried out for 24 hours by using a shaker. The results showed that the TOC removal was mainly achieved by physical adsorption, and adsorbent ratio of 25% clay and 75% fly ash achieved the best treatment efficiencies. Biotreatment did not contribute significant TOC removal since the pH values were inappropriate for microorganism growth. The highest percent TOC removal is 54.23%, while the lowest percent TOC removal is 11.37%.

9:45. COAGULATION TREATMENT OF POTATO WASTEWATERS.
SATYANARAYANA VELLANKI AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

The objective of this study is to determine the effect of coagulation on the removal of turbidity and TOC (total organic carbon) of different types of potato wastewaters. The wastewater used in this experiment are potato juice, mashed potato and potato starch at three concentrations: high (1000 mg/L, medium (550 mg/L, and low (100mg/L). FeCl_3 was used as coagulant at concentrations ranging from 25 to 150 mg/L. The coagulant dosage was determined by jar test. Turbidity was measured by Hach turbidity meter, while TOC was measured by OI TOC analyzer. Results indicated that TOC removal efficiency was 70%, 60%, and 45%, for potato starch, mashed potato, and potato juice wastewater, respectively. The TOC removal efficiency was found depended on pH, coagulant dosage, coagulant aid dosage such as nonionic polymer.

10:00. ACTIVATED CARBON ADSORPTION TREATMENT OF COMBINED INDUSTRIAL WASTEWATERS. PIYUSH MAHESHWARI AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

The main objective of this study is to investigate the feasibility of the treatment of combined industrial wastewaters collected from Jeedimatta Effluent Treatment Limited, Hyderabad, India, by activated carbon. A large quantity of JETL consists of waste generated from 65-70 industries in the chemical and pharmaceutical sector. The objectives of the study are to determine whether adsorption by activated carbon is feasible and to determine whether the adsorption process should be applied before or after the biological treatment, to determine the correct dose, contact time, and pH for the maximum adsorption, and to determine the color reduction after carbon adsorption. The results show that activated carbon adsorption treatment can be carried out before biological treatment, but it may not be economically viable. The economic suitability of this treatment for the untreated waste needs further investigation.

10:15. HAZARDOUS WASTE TREATMENT WITH SEQUENCING BATCH REACTORS. PEER JOY AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

This paper discussed the biological treatment of hazardous waste in Sequencing Batch Reactors (SBR). Sequencing batch reactors were utilized to treat phenol and o-cresol aerobically at a hydraulic detention time of 1 day and a solids residence time of 14 days. The reactors achieved greater than 99.5% removal of phenol and o-cresol at toxicant loadings in the ranges of 0.1-0.8 kg phenol/m³.d and 0.1-0.6 kg o-cresol/m³.d. The average BOD₅ and COD removal efficiencies were approximately 99% and 94%, respectively. High toxicant loadings were not observed to hinder the biodegradability of other waste constituents, reflected by the effluent BOD₅, being consistently less than 5 mg/L, or impair the ability of the sludge to settle because the effluent total suspended solids and sludge volume index were consistently approximately 12 mg/L and 80 mL/g, respectively.

10:30. TREATMENT OF HIGH STRENGTH MIXED INDUSTRIAL WASTEWATER WITH CHEMICAL OXIDATION AND BIOOXIDATION. PRADEEP MENON AND YUNG-TSE HUNG, CIVIL ENGINEERING DEPT., CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

A laboratory study of treatment of a mixed high strength industrial wastewater, containing solvents, oil and grease, trace amounts of metals, and 18,000 mg/L COD, 8000 mg/L TOC and pH of 7.5, was conducted. Completely mixed activated sludge batch reactors with LLMO bioaugmentation was used following coagulation and chemical oxidation by hydrogen peroxide, catalyzed by ferrous ion was also studied. The highest TOC reduction by coagulation was observed to be 18.64% after 24 hours settling time, and by chemical oxidation to be 9.61% after 24 hours reaction time. The highest overall reduction in TOC after pretreatment and bio-oxidation was in excess of 60%. Comparison of the TOC removal for the untreated wastewater with that of the pretreated systems indicated that bio-oxidation was enhanced after both coagulation and chemical oxidation.

10:45. SAW DUST AND POWDERED ACTIVATED CARBON AS ADSORBENTS FOR TREATMENT OF WASTEWATER. HOWARD H. LO, DEPT. OF GEOLOGICAL SCIENCES AND YUNG-TSE HUNG, DEPT. OF CIVIL ENGINEERING, CLEVELAND STATE UNIVERSITY, CLEVELAND OH 44115.

The objective of this study was to determine the effect of saw dust and powdered activated carbon (PAC) as adsorbents in removing turbidity and total

organic carbon (TOC) from potato and dye wastewaters. Parameters used in the investigation included wastewater strength, dosage of adsorbent and shaking time. Oak saw dust and PAC were used for wastewater treatment study. Feed strength levels of potato wastewater were 125, 250, 500, 1000 and 2000 mg/L TOC and strength levels of dye wastewater were 10, 25, and 50 mg/L. The shaking time for adsorbent study were 1, 2, 4, 8, 12, and 24 hours. Results indicated that the saw dust was relatively ineffective in removing TOC but was quite effective in removing turbidity from potato wastewater with turbidity removal range of 75 to 87%. PAC proved to be effective in removing both turbidity and TOC from wastewater. For the dye wastewater treatment, saw dust appeared to be ineffective while PAC was highly effective in turbidity removal. Removal efficiency ranged from 78 to 99%.

POSTER SESSION - SOCIAL - ECOLOGY-BIOMEDICAL

9:00 - 10:00 AM

SATURDAY, APRIL 29, 1995

ROUSH HALL

POSTER A. A COMPARISON OF TWO SCORING METHODS FOR PROJECTIVE MEASURES OF FUTURE TIME PERSPECTIVE. RILEY CRANDELL, JENNIFER TURNES, SHERRIE STAMPER AND SARA STAATS, 2044 FOUNDERS HALL, OHIO STATE UNIVERSITY AT NEWARK, 1179 UNIVERSITY DR., NEWARK OH 43055.

Cottle's Circle Test is a projective measure of future time perspective that has considerable merit. Temporal dominance (past, present, future) and temporal relatedness (atomistic, related, integrated, projected) are key constructs. However, Cottle's scoring system presents problems in that different key constructs are not uniquely mapped by persons' scores. We present an alternative scoring system that separates the measures of temporal relatedness into categories or sub scales, thus insuring accurate sorting of Cottle's four temporal relatedness measures. We used both scoring systems on the responses of 135 undergraduates (48 males and 82 females). The Staats scoring yielded inter-rater reliability coefficients for the relatedness measures with a mean average of .85. Differential correlations of temporal dominance with measures of present and future mood provide evidence of the validity of the Circles Test as a measure of temporal dominance.

POSTER B. AUDITORY PERCEPTIONS OF ROCK MUSIC. DONALD FUCCI, LINDA PETROSINO, MOLLY BANKS, SCHOOL OF HEARING AND SPEECH SCIENCES, LINDLEY HALL 219, OHIO UNIVERSITY, ATHENS OH 45701.

The purpose of the present study was to examine the effect of the personality trait of extraversion/introversion as related to music preference on magnitude estimation scaling behavior of complex auditory stimuli. Two groups of subjects, one which preferred rock music and one which did not, were instructed to assign numerical values to a random series of nine suprathreshold intensity levels of a 10 sec. sample of rock music. Analysis indicated a relationship between preference for rock music and extra version/introversion, but preference and personality type did not have an effect on magnitude scaling of the rock music stimuli. Gender may have been an influential factor in the results of this study. In the random selection of subjects more males served as subjects than females. It has been shown in earlier research that women are more likely to allow preference to influence their magnitude scaling responses than men. Had more women been utilized as subjects, scaling results might have been different between the two groups of subjects.

POSTER C. PERSONALITY CHARACTERISTICS PLACED ON THE THREE DIFFERENT SOMATO TYPES. KIMBERLEE SHAFER AND DR. DIANE SPILLMAN, MIAMI UNIVERSITY, 18 PHILLIPS HALL, OXFORD OH 15056.

A theory developed by Sheldon 50 years ago links body image and personality characteristics together. This theory allowed us to lump people into one of three very distinct groups. The first group are known ectomorphs (thin build). The second group are known as endomorphs (having a larger portion of fatty tissue versus lean tissue). The third grouping is known as mesomorphic. Upon first observation certain characteristics are assigned to each body type whether they are true or not. The objective of this research was to test these preconceived notions and find out if people really do have them or not. The study involved 142 subjects (48 male and 94 female) from a large southwestern Ohio university. A questionnaire was constructed to gather the subjects views on body type and "applied" characteristics. The questionnaire consisted of 21 different characteristics along with a schematic diagram of the three body

types. Also included was a question asking subjects to rate their own body type. The subjects we asked to assign a body type (i.e. ectomorph, endomorph, or mesomorph) to each characteristic. They were allowed to assign more than one body type to a characteristic if they felt strongly. Most individuals considered themselves to be mesomorphic, 89.4%, while only 4.2% felt they were endomorphic and 4.9% felt they were ectomorphic. Only one individual out of 142 felt that they fell somewhere in between mesomorph and ectomorph. Ectomorphic individuals were viewed as most likely to engage in safe sex by only 4.2% of the subjects. Only 11.3% viewed the endomorphic individuals to most likely partake in safe sex. By far, the individuals viewed as engaging in safe sex most were mesomorphic. Subjects chose this response 63% percent of the time. There were 20 subjects who felt there was no difference between body images and the engaging in safe sex. This is interesting in light of the fact that most individuals see themselves as being mesomorphic.

POSTER D. CORRELATION OF SERUM PROGESTERONE AND URINARY PREGNANEDIOL IN A WIDE RANGE OF MAMMALIAN SPECIES. KERRY L. CHEESMAN, BIOLOGY DEPT., CAPITAL UNIVERSITY, COLUMBUS OH 43209.

The ability of zoos to breed endangered or exotic species requires knowledge of reproductive cycle events, particularly those related to ovulation and cycle length. Invasive procedures, including blood sampling and ovulatory induction, are not always feasible or warranted, and often require animals to be removed from public display. Thus, noninvasive assays, such as urinary pregnanediol (a progesterone metabolite), are of tremendous value in ascertaining reproductive status of female animals. In this study serum samples from a variety of mammalian species were assayed for progesterone intent. Urine specimens obtained at the same time were assayed for pregnanediol content. The correlation coefficient for all samples (comparing serum progesterone and urinary pregnanediol from the same animal) was 0.87. In several animals daily urine samples were obtained and assayed to determine estrous cycle length. These data were compared with that previously published for primates and large hoof stock. It appears from these data that noninvasive urinary assays are reliable predictors of serum progesterone activity, and can provide information on the timing of estrous cycle events in mammals.

POSTER E. MODELING THE ROLE OF PRESSURE DRAG IN THE EVOLUTION OF BIRD FLIGHT WITH *PROPTHECUS* (PRIMATES, LEMURIDAE). STEVEN A. EDINGER, DEPT. OF BIOLOGICAL SCIENCES, OHIO UNIVERSITY, ATHENS OH 45701.

The sitakas' (*Propithecus*) arms have an airfoil-like shape due to the hair on the arms. This increases the arms' surface area and therefore the arms' skin friction drag. Some suggest increased skin friction drag could improve parachuting performance. Theoretical calculations suggest streamlining increases surface area and skin friction drag, but causes a larger decrease in pressure drag, yielding a net decrease in total drag. Wind tunnel testing of simple, unrefined models of cylindrical and streamlined *Propithecus*-like arms covered with synthetic fur also showed a decrease in total drag due to decreased pressure drag. Streamlining arms could increase jumping distance by decreasing drag on the arms. Also, altering the arm position would alter the amount of drag the arms produce, which could be used to control the body position during landing. The amount of pressure drag produced by a streamlined arm can be varied widely, from very little when the arm is parallel to the wind to a great deal of drag when the arm is perpendicular to the wind. The evolution of bird flight from an arboreal ancestor can be modeled with two central tenets: A lift producing airfoil evolved from streamlining originally directed as drag reduction, and the fine motor control of the arm needed for controlled lift production evolved from improved motor control of the arm used to improved drag control.

POSTER F. HUMIC INHIBITION OF BACTERIOPLANKTON PRODUCTIVITY IN THE OTTAWA RIVER, TOLEDO, OHIO. CHRISTINE M. FOREMAN AND ROBERT L. SINSABAUGH, DEPT. OF BIOLOGY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

While it is known that DOC represents a major portion of the trophic base of aquatic ecosystems, little is known about its utilization by microorganisms. Most DOC is composed of refractory humic materials, which may inhibit microbial activity. Tests with model phenols and humus extracts indicate that the addition of polyvinylpyrrolidone (PVP) to water samples effectively mitigates phenolic inhibition of bacterial activity. Using this technique, we monitored the effects of phenolic DOC on bacterioplankton productivity in the Ottawa River, which runs through the University of Toledo campus. During the summer, vanillin and syringaldehyde inhibited bacterial productivity by 11 and 45%, respectively. By early autumn the model phenols appear to have no effect on productivity, and in mid-autumn actually stimulate productivity. These results reflect the dual role, substrate and inhibitor, of phenolic substance in the trophic dynamics of bacterioplankton, and form the basis of our investigation into the spatial and temporal patterns of bacterial productivity.

POSTER G. ENHANCING CRITICAL THINKING SKILLS USING PLANT ANATOMY RESEARCH. JOHN L. FROLA AND DAVID J. STROUP, DEPT. OF BIOLOGY, UNIVERSITY OF AKRON, AKRON OH 44325-3908.

A seasonal study of three plant species is under investigation. Observations of the shoot apices are described based on an analysis of the theories on shoot apical organization. Measurements and descriptions of apical dome height and width of the species were obtained to serve as a basis for classroom discussions concerning the changes in apical organization over a one-year period. A multi-media presentation was prepared for students to make observations and generate hypotheses about shoot development. During classroom discussion fundamental anatomical and morphological questions were generated to be used as the basis for independent student laboratory projects. This research was designed to improve identified thinking skills, and our current understanding of shoot apical development.

POSTER H. SURVIVAL OF INTRODUCED BACTERIA IN AQUATIC MICROCOSMS. ANURADHA JANAKIRAMAN AND LAURA LEFF, KENT STATE UNIVERSITY, DEPT. OF BIOLOGICAL SCIENCES, PO Box 5190 KENT OH 44242-0001.

Bacteria can enter aquatic environments through sewage effluents, industrial wastes, and agricultural runoff. The impact of introduced bacteria on native species has not been well studied. The purpose of this study was to examine the persistence of introduced bacteria in microcosms. Microcosms contained water, leaves and sediments from Northeastern Ohio streams. Bacteria were introduced into the water of microcosms and were enumerated by plating and microscopy. A native aquatic species (*Aeromonas hydrophila*) was introduced and it rapidly colonized the sediments and leaves. The abundance increased a hundred fold in one week. Survival of the native species was compared to introduced coliform bacteria (*Citrobacter freundii* and *Escherichia coli*).

POSTER I. FALL DIETARY PREFERENCES OF BLUEGILL, *LEPOMIS MACHROCHIRUS*, IN A CENTRAL OHIO FARM POND. GRANT L. LEWIS AND MICHAEL H. LAMONT, Box 1175, CAPITAL UNIVERSITY, COLUMBUS OH 43209.

This study was done to determine whether the diet of bluegills changed significantly between early and late fall seasons, as food supplies changed. Secondly, potential variation in food preference among individuals within a single size and age-class was explored by comparing stomach contents of fish gathered at a single site, depth and date. Fifteen 11.5-15.0 cm bluegills were collected monthly from a Canal Winchester, Ohio, farm pond, Sept-Nov, 1994. Stomach contents were analyzed and divided into four categories, plants and algae; *Helisoma anceps* (orb snails); *Hexagenia* s. (Mayfly larvae); and miscellaneous invertebrates. Individuals within the size class studied were found to exploit a variety of foods, such that no single food was found to be uniformly present within any monthly sample. Mixed invertebrates and plant materials, collectively, made up the largest portion of the stomach contents across all months. Individuals within samples were found to have significantly different proportions of specific animal materials in their stomach contents. This was an indicative of selective feeding patterns, or resources partitioning, each fish specializing in a single prey species at a given time.

POSTER J. COMPARATIVE STUDY OF AMPHIPOD AND ISOPOD POPULATION DENSITIES IN TWO TEMPERATE COLD-WATER SPRINGS, GREENE COUNTY, OHIO. MEGAN L. PORTER, WITTENBERG UNIVERSITY, DEPT. OF BIOLOGY, SPRINGFIELD OH 45501.

The impounded springheads of two temperate cold-water springs, Spring #1 and OZ Spring, located in John Bryan State Park, Greene County, Ohio, are compared in terms of population densities of the amphipod *Synurella dentata* Hubricht and the isopod *Lirceus fontinalis* Rafinesque. Between the springs, population densities of *L. fontinalis* are significantly different while densities of *S. dentata* are not. However, within the separate spring communities, the population densities fluctuate significantly. Physiochemical parameters examined indicated that the springheads maintain thermal and chemical stability. In Spring #1 temperature varied 2.5°C (10.4 - 12.9°C), pH ranged 0.27 (7.74 - 8.01), and alkalinity changed 9mg/l (247 - 256mg/l CaCO₃). In Oz Spring, temperature ranged 2.1°C (10.8 - 12.9°C), pH varied .44 (7.73-8.17), and alkalinity changed 8.6mg/l (248.6 - 257.2mg/l CaCO₃).

POSTER K. ALGAE FROM A SEASONAL POND, TOLEDO DISTRICT, BELIZE, C.A. MELINDA S. TETZLAFF, AND SUSAN CARTY, HEIDELBERG COLLEGE, DEPT. OF BIOLOGY, 310 MARKET STREET, TIFFIN OH 44883.

Freshwater algae from a seasonal pond were collected near the end of the dry season as whole water and squeezings of aquatic vegetation. Species were primarily in the Chlorophyta, in particular, desmids (*Closterium*, *Euastrum*, *Staurodesmus*, *Cosmarium*, *Gonatozygon*, *Penium*, *Netrium*, *Xanthidium*).

Staurostrum). Other taxa identified include *Spirogyra*, *Scenedesmus* (Chlorophyta), *Oscillatoria* (Cyanobacteria), *Pinnularia* (Chrysophyta), *Euglena* and *Trachelomonas* (Euglenophyta). This is a preliminary report from a large collection of freshwater samples which may represent the first work done on freshwater algae in Belize.

POSTER L. PHYSICAL MAPPING OF MAIZE rRNA GENE BY IN SITU PCR. TARA T. VANTOAI, USDA-ARS, SOIL DRAINAGE RESEARCH UNIT, OHIO STATE UNIVERSITY, 590 WOODY HAYES DR., COLUMBUS OH 43210.

The polymerase chain reaction (PCR) procedure has been widely used to synthesize specific DNA fragments or genes in test tubes. We have successfully applied the technique to locate genes on corn chromosomes. Protoplasts isolated from maize seedling roots were dropped onto microslides to spread out chromosomes. After the chromosomes were denatured and dehydrated, they were treated with DNA ligase to reduce non-specific signals. The microslides were placed in microcentrifuge tubes containing primers for the rRNA gene, labeled nucleotides, Taq polymerase enzyme and its antibody. They were then subjected to 20 PCR cycles in a thermocycler where the rRNA gene was amplified exponentially while remaining on the chromosome. The microslides were washed extensively and treated with fluorescent-tagged antibodies that reacted specifically to the newly synthesized gene. The chromosomes were then stained with a different fluorescent dye for visualization using both fluorescent and laser confocal microscopes; the latter is equipped with an image analyzer. The rRNA gene was mapped to the NOR of corn chromosome #6. The sensitivity necessary for the mapping of single-copy genes will be presented.

POSTER M. A SURVEY OF CADDISFLIES IN SILVER CREEK AT THE HIRAM COLLEGE BARROW FIELD STATION IN N. E. OHIO. JOYCE VONEMAN AND MARTIN K. HUEHNER, BIOLOGY DEPT., HIRAM COLLEGE, HIRAM OH 44234.

Silver Creek is a small third order stream located in southern Geauga and northern Portage counties. It is part of the Ohio River drainage and has been classified as a coldwater stream by the Ohio EPA. At the Hiram College Field Station, Silver Creek flows through swampy floodplain forest and receives several small springbrook tributaries, providing an environment suitable for many caddisfly species. Caddisfly larvae, pupae, and adults were collected from the beginning of July through the middle of October, 1994. Larvae were collected every two weeks by Surber sampler, hand picking and dip net; three sets of Hester-Dendy samplers were also placed in three different stream locations to observe colonization during the study period. Additionally, night time light trapping was conducted every two weeks to capture adults. The Hester-Dendy samplers provided very little useful information about caddisfly numbers and diversity but Surber sampling and hand picking were much more successful. Light trapping of adults provided the greatest amount of information about species present. A total of 1629 individuals from 23 species, 18 genera and 12 families were found. Identity of specimens was provided by Dr. Brian Armitage, and support was provided by the Howard Hughes Medical Institute.

POSTER N. EFFECTS OF LONG-TERM CO₂ ENRICHMENT OF WHITE OAK ON GYPSY MOTH PUPAL WEIGHT. W. N. CANNON, JR., J. H. BARGER, U.S.D.A. FOREST SERVICE, 359 MAIN ROAD., DELAWARE OH 43015, AND R. W. HALL, DEPT. OF ENTOMOLOGY, OHIO STATE UNIVERSITY, COLUMBUS OH 43210.

Effects of CO₂ fumigation on 9-yr-old white oak (*Quercus alba* L.) foliage and gypsy moth (*Lymantria dispar* L.) pupal weight were investigated. Fumigation treatments of ambient air or ambient air plus 2X ambient concentration (ca. 650 ppm) of CO₂ were applied in open-top chambers. Larvae (from the 2nd instar on) were allowed to complete development on foliage fumigated from May to October 1992 and 1993, and from May until pupation in July 1994. Each year, leaf water and total nitrogen content were determined at the time of pupation and related to pupal weight. For 1992 and 1993 we found significantly less leaf nitrogen and water content per unit of leaf dry weight in CO₂-enriched foliage; there were no significant differences between treatments in 1994. Mean gypsy moth pupal weight for both sexes was similar for the ambient and 2X-ambient CO₂ treatments for each year. The results suggest that gypsy moth larvae compensated for differences in leaf nutritional quality produced by these treatments.

POSTER O. INSECTS OF THE KILLBUCK MARSH WILDLIFE AREA: 1994 SURVEY. R. N. WILLIAMS, M. S. ELLIS, AND D. S. FICKLE, DEPT. OF ENTOMOLOGY, OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, OHIO STATE UNIVERSITY, 1680 MADISON AVENUE, WOOSTER OH 44691.

In an effort to expand our knowledge of the insect fauna in the Killbuck Marsh Wildlife Area, a survey was conducted in 1994 to inventory a wide range of species from this wetland. This is the second year of ongoing collections

from this area to establish benchmark information on insect diversity for future reference. One major addition to this years trapping regime was an underwater light trap. Other collecting methods utilized include: aerial black light traps, flight intercept (window) traps, bait traps, carrion bait sampling, and aquatic sweep netting. Emphasis was placed on butterflies and moths (Lepidoptera) and aquatic insects including predaceous diving beetles (Dytiscidae), water scavenger beetles (Hydrophilidae), and crawling water beetles (Haliplidae). Also, click beetles (Elateridae), sap beetles (Nitidulidae), water bugs (Hemiptera), leafhoppers (Homoptera), and grasshoppers and crickets (Orthoptera) were secondary points of interest. A total of 319 species in 77 families and subfamilies in 13 orders have been captured over the 1994 season. A consolidated list of both 1993 and 1994 collections should provide a list in excess of 800 different insect species from the Killbuck Marsh Wildlife Area.

POSTER SESSION-BIOMEDICAL 10:00 - 11:00 AM SATURDAY, APRIL 29, 1995 ROUSH HALL

POSTER A. CLEAVAGE OF RNA MOLECULES BY THE ENEDIYNE ANTICANCER ANTIBIOTICS. JEAN-MARC BATTIGELLO AND BARBARA J. CARTER, DEPT. OF CHEMISTRY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

The enediynes are a relatively new class of compounds that cleave double-stranded DNA substrates through chemical mechanisms that involve abstraction of hydrogens at several positions on the deoxyribose ring of a DNA molecule. There is no question that the DNA cleavage exhibited by enediynes is primarily responsible for the extremely potent antitumor activity seen with this compounds. But RNA molecules represent another obvious cellular target for antitumor activity, and there is nothing in the chemical mechanism of cleavage that precludes RNA as a substrate for the enediyne antibiotics, although to date there is no literature article showing enediyne cleavage of an RNA substrate. We wish to report highly selective, site specific cleavage of a *B. subtilis* tRNA^{His} precursor by the enediyne neocarzinostatin. Dynemicin A and esperamicin A, also cleave this RNA molecule, but the cleavage is very inefficient and there is no site-specificity observed. RNA cleavage by neocarzinostatin requires no thiol activation, and a kinetic analysis shows that the dissociation constant for the tRNA^{His} neocarzinostatin complex is approximately 30 μM. Other RNA molecules such as RNA hairpins are also cleaved specifically by the enediynes, and a preliminary analysis of the cleavage products indicates that the cleavage chemistry for RNA resembles that observed for DNA, although more definitive studies are ongoing to determine the exact chemical nature of the cleavage products.

POSTER B. COMPUTER SIMULATION OF TETRACHLOROETHYLENE EXPOSURE AND CANCER RISK ASSESSMENT FOR BREAST-FED INFANTS. JANUSZ Z. BYCZKOWSKI AND JEFFREY W. FISHER, TRI-SERVICE TOXICOLOGY CONSORTIUM, BLDG. 79, WRIGHT-PATTERSON AFB OH 45433-7400.

In this presentation, a step-by-step process is described that allowed us to link a physiologically based pharmacokinetic (PBPK) model for tetrachloroethylene (PCE) for lactating mothers with the estimate of extra cancer risk in breast-fed infants, according to the U.S. Environmental Protection Agency (EPA) method. If inhaled by a lactating woman, PCE may partition to breast milk and may be transferred to the breast-fed infant. We have developed and validated experimentally a PBPK model for lactational transfer of PCE in rats, including a quantitative description of milk compartment and the nursing pup. Subsequently, our model has been scaled to describe human physiology, and was validated with human literature data for PCE exposure cases. The model predictions were in good agreement with both the measured values and those reported in the literature. Further, we have applied our model to scenarios of occupationally and nonoccupationally exposed mothers, simulating PCE concentrations in breast milk and the infant exposure. Finally, we linked the dosage predictions with equations used by EPA to estimate the cancer risk from PCE. Comparison of our predictions with those from the literature confirms the usefulness of PBPK modeling in risk assessments. Supported in part by Dept. of the Air Force Contract #F33615-90-C-0532.

POSTER C. CHARACTERIZATION OF RNA PSEUDOKNOTS IN *E. COLI* 16S rRNA AND IN HIV-1 GENE. MEI CUI AND BARBARA J. CARTER, DEPT. OF CHEMISTRY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

To better understand RNA pseudoknot conformational stability and biological functions, the RNA pseudoknot formed between the 5' terminal and

915 regions in *Escherichia coli* 16S rRNA was studied through synthesized model RNA sequences. We are interested in this RNA sequence because this pseudoknot is involved in Streptomycin binding and was proposed to undergo a conformational switch to form another pseudoknot upon Streptomycin binding. Several RNA sequences from 30 to 69 bases long were made as model RNA pseudoknots to mimic the original 16S rRNA pseudoknot. The structure of these model RNA sequences were studied by computer prediction, enzymatic and chemical modification mappings UV thermal melting studies and Laser Raman spectroscopy. Among the model RNA sequences we have studied, most of them formed common hairpin/bulge structures. However, we are now using a computer-assisted FOLD program to design a model pseudoknot which folds correctly into the desired pseudoknot structure, and several new sequences look promising. In addition, two novel potential pseudoknots sequences in HIV-1 gene were also studied using model RNA sequences. Enzymatic mapping results for the 35-mer HIV model RNA pseudoknot sequence suggests that it does form a pseudoknot structure, which supports the theoretical prediction.

POSTER D. THE EFFECTS OF GLUTAMATE ON THE MORPHOLOGY OF SPINAL CORD CELL CULTURES. KIMBERLY W. HEYM, DOUGLAS K. ANDERSON AND LLOYD A. HORROCKS, BIOLOGY DEPT., CAPITAL UNIVERSITY, COLUMBUS OH 43209.

Glutamate is a major excitatory neurotransmitter in the brain. Glutamate neurotoxicity has been demonstrated in vivo, in vitro, and in cell culture. Glutamate toxicity has been well established in cortical cell cultures, however little is known about glutamate's effects in spinal cord cultures. We studied glutamate neurotoxicity in murine whole dissociated spinal cord cell cultures containing neurons and astrocytes. The morphological changes seen in cortical cell cultures are associated with early Na^+ and Cl^- dependent acute neuronal swelling followed by a late Ca^{2+} dependent cell death. We observed similar morphological changes in our spinal cord cell cultures. Within minutes after exposure to 500 micromolar glutamate, neuronal cell bodies began to undergo shape changes and lose their sharp outline. Cell processes began to develop slight vacuolization. After 24 hours of exposure to glutamate the neurons showed massive degeneration, however, the underlying astrocytes appeared to be viable. Finally, we confirmed morphological findings with ethidium bromide and acridine orange staining.

POSTER E. WEIGHT LOSS RATES OF PARTICIPANTS IN LIFE STEPS PROGRAM. KELLY J. KOHLS, LAURE A. INSLEY AND SUZANNE M. HAGAN, MIAMI UNIVERSITY, OXFORD OH 45056.

Many weight loss programs have been criticized for incorporating minimal behavior modification techniques. The Life Steps weight loss program has been developed by the National Dairy Council. This program, available through local dairy councils, is administered by local qualified personnel. Life Steps program stresses behavior modification over sixteen classes. Ten participants in the local Life Steps program submitted food intake logs for analysis on this project. Preliminary results suggest an average loss for weeks one through three of 2 lbs., weeks four through six 5.6 lbs., weeks seven through nine 2 lbs and in the last period 1 lbs. Total average weight loss by the end of the program was 11.56 lbs. Changes in exercise and food intake of participants was gradual and included modifications of: fat level, increased water consumption and incorporated increased daily exercise. Eighty percent of participants did not maintain instructed consumption and exercise patterns over weekend days during the program.

POSTER F. PHASE TRANSITION OF STARCH AS INFLUENCED BY PROTEIN HYDROLYSATES. MOHAMED MAHMOUD, TIMOTHY SCHENZ AND BRADY ISRAEL, ROSS PRODUCTS DIV., ABBOTT LABORATORIES, 625 CLEVELAND AVE., COLUMBUS OH 43215.

The effect of the degree of hydrolysis (DH) of whey protein and casein hydrolysates on the phase transition of tapioca and waxy corn starches in excess water ($>60\%$) was studied by differential scanning calorimetry (DSC). The endothermic onset and peak temperatures (T_o, T_p) and gelatinization enthalpy (ΔH) of unmodified and cross-linked tapioca starch increased with increasing DH and hydrolysate:starch ratio. Cross-linked tapioca starch, however, exhibited higher ΔH than the unmodified starch. The whey protein hydrolysates resulted in an increase in starch retrogradation enthalpy (ΔH_r), in contrast to the extensively hydrolyzed casein, suggesting accelerated starch recrystallization by the former. All protein hydrolysates exhibited a plasticizing effect on the starch. The glass transition temperature (T_g) of unmodified tapioca and waxy starches (-2.7° and -2.0° C, respectively) decreased in a linear manner with the increase in hydrolysate:starch ratio and DH. A linear relationship was also observed between T_g and molecular weight of the protein hydrolysates.

POSTER G. IDENTIFICATION OF HORMONES IN HUMAN TUMORS BY MEANS OF IMMUNOELECTRON MICROSCOPY. DAVID L. MASON, MIGUEL A. PEDRAZA, FERIDUN A. DOSLU AND JOHN P. BOBLETT, WITTENBERG UNIVERSITY AND COMMUNITY HOSPITALS, SPRINGFIELD OH 45501.

Hormones can be readily identified in tumor cells by means of immunoconjugated colloidal gold or Protein A-conjugated colloidal gold. Antigens are preserved for antibody binding by fixation in neutral buffered formalin (NBF). Paraffin embedded tissues, previously fixed in NBF, can be dewaxed and reembedded in epoxy resin (Spurr) with no loss of antibody binding. A variety of human tumors are presented, showing colloidal gold bound to specific hormonal granules. They include: an insulinoma and glucagonoma of the pancreas, medullary carcinoma of the thyroid, two pituitary adenomas, and a carcinoid of the colon.

POSTER H. DEVELOPMENT OF RT-PCR CLINICAL DIAGNOSTIC TESTS FOR THE DETECTION OF TRANSLOCATIONS $t(11;22)$ IN EWING'S SARCOMA AND PRIMITIVE NEUROECTODERMAL TUMORS (PNET) AND $t(2;13)$ IN ALVEOLAR RHABDOMYOSARCOMA (ARS). MARGARET K. ROTH¹, GAIL D. WENGER², AND JAY W. MOORE², DEPT. OF BIOLOGY, UNIVERSITY OF DAYTON, DAYTON OH 45409 AND ²CYTogenetics Laboratory, Children's Hospital, Columbus OH 43205.

Classification of certain tumors is difficult when the microscopic appearance of the tumor is non-specific. Detection of characteristic chromosomal translocations can facilitate diagnosis in some tumors. Cytogenetic studies of such tumors are not always possible due to the difficulty in successfully growing tumor cultures. The tests described focus on the $t(11;22)$ translocation characteristic of Ewing's sarcoma and PNET and on the $t(2;13)$ characteristic of ARS. Tumor cell lines were used as models. Each was karyotyped to confirm the translocations. Total RNA was isolated, and reverse transcription was performed. Primers designed to amplify the $t(11;22)$ and $t(2;13)$ fusion transcripts were used, and polymerase chain reaction (PCR) was performed. Agarose gel electrophoresis was used to evaluate PCR products. Products of appropriate nature and size were found for each cell line. Six tumor samples have been tested; four are positive for the $t(11;22)$ translocation. This method of detecting fusion transcripts can form the basis for rapid, specific, sensitive diagnostic testing of selected tumors.

POSTER I. ISOLATION OF TOPOISOMERASE II FROM THE BLOOD STREAM FORM OF *TRYPANOSOMA BRUCEI* *BRUCEI*. ANURADHA SEKHAR, VASANTHI R. VITTAL, AND BARBARA J. CARTER, DEPT. OF CHEMISTRY, UNIVERSITY OF TOLEDO, TOLEDO OH 43606.

Trypanosomes are parasitic protozoa which cause several major diseases (ex., sleeping sickness) in humans and also cattle, as a result crippling millions of people and limiting agriculture in developing countries. In *Trypanosoma equiperdum*, which infects horses, it has been shown to be a target for several antitrypanocidal drugs target a novel mitochondrial topoisomerase II. In addition, mammalian type II topoisomerase has been shown to be a target for several antitumor drugs. These drugs inhibit the enzyme by trapping it as a DNA-bound covalent intermediate, thereby arresting replication, leading to cell death. Type II topoisomerases are enzymes that control the conversion of various topological states of DNA and are hence involved in numerous genetic processes. Alteration of the topology of DNA by this enzyme is achieved by breaking two complementary strands of DNA followed by the passage of a double stranded fragment through the break, and finally resealing of the broken bonds. The enzyme is known to form an intermediate complex during the reaction whereby the enzyme becomes covalently attached to the 5'-ends of the DNA substrates. We wish to report progress towards isolation of type II topoisomerase from the blood stream form of *Trypanosoma brucei brucei*, which is the primary cause of sleeping sickness among cattle. This species is very closely related to the species that causes sleeping sickness in humans, viz., *Trypanosoma brucei*. Our ultimate goal is to identify a new chemotherapeutic target for treatment of diseases caused by trypanosomes.

POSTER J. INHIBITORY EFFECTS OF IBUPROFEN ISOMERS ON HUMAN PLATELETS AND CYCLOOXYGENASE ISOZYMES. MELISSA SUTTON, GAMAL SHAMS, DENNIS FELLER AND KARL ROMSTEDT, BIOLOGY DEPT., CAPITAL UNIVERSITY, 2199 E. MAIN STREET, COLUMBUS OH 43209-2394.

Cyclooxygenase (COX) is an inflammatory enzyme which exists as 2 isozymes. COX₁ is expressed in most tissues, whereas COX₂ is absent but inducible in some cells. Ibuprofen (e.g. MOTRIN) relieves inflammation by inhibiting COX. The purpose of these experiments is to examine the selectivity of R(+) and S(-)-ibuprofen isomers against the COX isozymes. COX activity was assayed by monitoring O_2 consumption in the presence of purified enzyme and its substrate, arachidonic acid (AA, $10\mu\text{M}$). The effect of ibuprofen isomers

on COX₁ was also examined by measuring aggregation and secretion of human platelets activated by AA. IC₅₀ values for ibuprofen isomers against purified COX₁ and platelet aggregation were 1600/25 (R/S) and 66.1/1.4 μM, respectively. The isomeric activity ratio (IAR, R/S) of 64 on COX₁ closely corresponds to the relative inhibitory potencies against platelet aggregation (IAR = 47) and secretion (IAR = 77). No difference in isomers was found with regard to inhibition of COX₂ (R/S = 1000/993 μM). The data indicates that S(+)-ibuprofen is selective for COX₁ and that R(-)-ibuprofen is equipotent against either isozyme.

POSTER K. MULTIDRUG-RESISTANT (MDR) HUMAN LEUKEMIC CELL LINE IS RESISTANT TO NATURAL KILLER (NK) CELL CYTOTOXIC MECHANISMS. ROBIN S. TREICHEL, DEPT. OF BIOLOGY, OBERLIN COLLEGE, OBERLIN OH 44074-1082.

N6/ADR, an adriamycin-selected MDR variant of the human leukemia line NALM6, is less susceptible than NALM6 to killing by activated NK cells. To investigate the underlying basis for NK resistance, NALM6 and N6/ADR, precoated with rabbit IgG, were evaluated by antibody-dependent cellular cytotoxicity (ADCC). Under these conditions IgG-FcγR interactions mediate effector-target binding and stimulate the NK cytotoxic pathway. N6/ADR exhibited less ADCC killing than N6 ($p < 0.01$); this indicates that resistance is due, at least in part, to reduced susceptibility to NK cytotoxic mechanism(s). N6/ADR does not exhibit a generalized resistance to lysis because rabbit antibody and complement mediated effective and equivalent lysis in both lines. NK effectors may kill via release of toxic molecules such as tumor necrosis factor (TNF)-α and interferon (IFN)-γ. Although no significant difference in growth inhibition was observed following 3 day treatment with TNF-α or IFN-γ, N6/ADR cells exhibited increased resistance to a crude NK-cell factor preparation obtained by incubating effectors with the NK sensitive target K562. An alternative mechanism of NK killing involved induction of apoptosis in targets. Treatment with antibodies to the apoptosis ligand fas plus cycloheximide did not reveal a difference between the parental and MDR lines. However, the markedly reduced sensitivity of N6/ADR to growth inhibition in 0.5% serum suggests that alterations in apoptosis signaling may play a role in the resistance of these cells to NK killing. Supported by NIH CA60018.

POSTER L. PROVISION OF RISK MANAGEMENT AND RISK ASSESSMENT INFORMATION BY PHARMACISTS AND PHYSICIANS: A PATIENT PERSPECTIVE. MARCIA M. WORLEY, R.Ph., AND JON C. SCHOMMER, Ph.D., OHIO STATE UNIVERSITY, COLLEGE OF PHARMACY, 500 W. 12TH AVE., COLUMBUS OH 43210.

The Omnibus Budget Reconciliation Act of 1990 mandated patient counseling by pharmacists effective January 1, 1993. There has been controversy about whether pharmacists will infringe upon the physician-patient relationship if they provide this service. The purpose of this study was to assess if patients believe that the pharmacists' role is providing risk management information (counseling related to drug use), while the physician's role is providing risk assessment information (counseling related to drug choice). A sample of 279 patrons of the Ohio State University Hospital and Clinics was given a questionnaire to obtain their views about pharmacists' and physicians' roles in providing risk information. Six forms were developed, each containing one of six situations. Three situations showed the provision of risk management information and the other three showed the provision of risk assessment information. Patients were asked who they believed should be responsible for providing information for the particular situation contained in their questionnaire. Twenty percent (58) of the individuals responded. Most patients reported that their physician should be responsible for providing risk assessment information and that the pharmacist and physician share an equal responsibility for providing risk management information. In a previous study, pharmacists reported that they are primarily responsible for providing risk management information and physicians are primarily responsible for providing risk assessment information. It appears that pharmacists and patients agree on which practitioner should be responsible for providing risk assessment information, but differ about which practitioner should be responsible for providing risk management information.

POSTER M. EXPRESSION OF TUMOR ASSOCIATED ANTIGENS ON HUMAN ESOPHAGEAL TUMOR CELL LINES. TAO XIN, ROUDABEH J. JAMASBI, DEPT. OF BIOLOGICAL SCIENCES, BOWLING GREEN STATE UNIVERSITY, BOWLING GREEN OH 43403.

A monoclonal antibody (mAb), designated mAb-9, was produced against a human esophageal carcinoma cell line, TE-2, in our laboratory. mAb-9 reacted strongly with three human esophageal carcinoma cell lines, TE-2, YES-1 and YES-3, but did not react with any other human esophageal and non-esophageal cell lines tested. Satisfactory immunoperoxidase stainings using mAb-9 were achieved with different fixatives (ethanol, formalin and methanol) and the quality of staining was not affected by the exposure times. The antigen

reactive with mAb-9 was found to be expressed on the cell surface at all stages of cell growth (24, 48, 72, 96 and 120 hours in culture). mAb-9 was found to react with carbohydrate epitopes present on glycolipid and glycoprotein molecules. When lipid extracts from TE-2, YES-1 and YES-3 cell lines were applied and examined by TLC and immunoperoxidase staining, several antigen bands with slightly different R_f values were detected. Transmission electron microscopy and immunogold labeling methods were applied to localize the antigen. The results confirmed that the antigen is cell membrane associated. Due to its high specificity, mAb-9 may be a useful reagent for studying biological and immunological properties of some human esophageal carcinomas.

POSTER N. CHARACTERIZATION OF MONOCLONAL ANTIBODY PRODUCED AGAINST HELIOBACTER PYLORI. JEFFREY D. YUENGER AND ROUDABEH J. JAMASBI, BOWLING GREEN STATE UNIVERSITY, DEPT. OF BIOLOGICAL SCIENCES, BOWLING GREEN OH 43403.

Hybridomas producing monoclonal antibodies (mAbs) against *Helicobacter pylori* was produced by fusion of SP2/0 myeloma cells with spleen cells from mice immunized with *H. pylori*. Fusion products were tested against several strains of *H. pylori* by ELISA. These strains included 133C, IID, 43629, 11638, RSBG, WW30, 86-388, TX30A, and 60190. A hybridoma producing mAb against *H. pylori* was selected and cloned by limiting dilution. A cloned hybridoma producing mAb designated mAb-37 was chosen for this study. mAb-37 reacted with 133C, IID, 11638, WW30, TX30A, and 60190 strains of *H. pylori* in ELISA. mAb-37 did not react with other gram negative or gram positive bacteria tested. However, some degree of cross-reactivity was demonstrated with some strains of campylobacter. Immunofluorescence assay and Western blot analysis confirmed the ELISA results. mAb-37 might be a useful reagent for a rapid detection of *H. pylori*.

POSTER SESSION-JUNIOR ACADEMY 1:30 - 2:30 PM SATURDAY, APRIL 29, 1995 ROUSH HALL

POSTER A. AQUARIUM CLEANING METHODS; AN EXPERIMENT ON WATER PURIFICATION. ANNIE S. YU, 230 CROSSE RD., AMHERST OH 44001.

An aquarium was used as a "test model" to observe the different concentrations and amounts of chemicals (Formalin, Copper Sulphate and Simazine) as well as Nitrofication bacteria (Fritz zyme) which contains Nitrosomas and Nitrobacter Bacteria, which destroys part of the algae and convert the toxic condition of the water (contains lots of toxic Ammonia and Nitrites) in the aquarium into the relatively non-toxic Nitrates status. Sequence of potency of algicides' effect among the three(3) chosen reagents are: Copper Sulphate, Simazine, and Formalin. Nitrofication Bacteria's (Fritz zyme) effect on various ammonium sulfate solution concentrations at 1:1 mixture with Trypticase Soy Broth medium showed: 50% reduction of ammonia concentration, 90% reduction of ammonia concentration at mixture with Thioglycollate medium. Their effect on various sodium nitrite solutions, at 1:1 mixture with Trypticase Soy Broth and Thioglycollate medium, both reduce nitrites concentration to <1/20 (that is: reduced to less than 5%) of its original control (N.S.) level. Thioglycollate medium seems to be more effective than Trypticase Soy Broth medium by 9:5 ratio.

POSTER B. THE INFLUENCE OF HANDWRITING QUALITY ON TEACHER ASSESSMENT OF WRITING SAMPLES. EMILY J. HANNA, 2161 ARLINGTON AVE., UPPER ARLINGTON OH 43221.

This research investigates the influence of handwriting quality on writing assessment scores assigned to two essays (higher and lower quality) presented in three writing formats (typed, good handwriting, and poor handwriting). For each essay, the typed version was the control variable and the good and poor handwriting versions were the treatment variables. One hundred ten certified middle and high school teachers scored the essays using a holistic scale with a range of 2 to 9. Each teacher scored a typed version of one essay and a handwritten version of the other essay. T-tests determined the significance levels of differences in scores. For the lower quality essay, the typed version received the lowest mean score and the poor handwriting version received the highest mean score (2.88 compared to 3.69, $p < .05$). There was no significant difference between poor and good handwriting (3.69 compared to 3.46, $p < .05$). For the higher quality essay, the typed version received the lowest mean score and the good handwriting version received the highest mean score (7.24 compared to 7.72, $p > .05$). There was no significant difference between

poor and good handwriting (7.46 compared to 7.72, $p > .05$). The research suggests that a typed paper most clearly presents an essay's qualities; poor handwriting masks the flaws of a lower quality essay; good handwriting enhances a higher quality essay; and typed essays generate better feedback, increasing the quality of writing education.

POSTER C. WTS GENE REGULATION IN *ERWINIA STEWARTII*. ELIZABETH H. STOVER, 2140 LANE ROAD, UPPER ARLINGTON OH 43220.

Erwinia stewartii is a phytopathogenic bacterium that causes the disease Stewart's wilt in sweet corn. The genes that enable *E. stewartii* to cause disease are called wts genes, for water-soaking, one of the disease symptoms it produces. In previous research, the gene wtsA was found to regulate wtsB, a non-regulatory gene. WtsC was also a potential regulatory gene, but its function was unclear. The purpose of this study was to determine if wtsC is regulatory and to model the pattern of regulation of wts genes. Strains of *E. stewartii* were constructed which contained combinations of mutations and multiple copies of wtsA, wtsB, and wtsC. β -galactosidase assays and pathogenicity tests in corn were performed to measure expression of the strains and determine the effect of wtsA and wtsC on each other and wtsB. The results produced several conclusions, including: wtsC is a regulatory gene, and is required for wtsB expression; wtsC also regulates wtsA; wtsA can increase wtsC expression, but is not required by wtsC. These conclusions and other findings were used to form a model for wts regulation. In the model, wtsC activates wtsA, which in turn activates wtsB and other wts genes. WtsA can also increase expression of wtsC by activating a secondary wtsC promoter (wtsC also has a promoter controlled by environmental signals or another wts gene). This forms a regulatory loop which rapidly amplifies expression of wtsA and the other wts genes. Understanding of gene regulation is useful in studies of plant diseases and comparison to gene systems in similar phytopathogenic species.

POSTER D. EXACERBATION OF VALPROIC ACID TERATOGENICITY WITH A Na^+/H^+ TRANSPORTER SYSTEM INHIBITOR. SMITA DE, 7955 FAWNCREEK DR., CINCINNATI OH 45249.

The Na^+/H^+ transporter system is a major mechanism by which cells regulate intracellular pH including cells of the developing embryo. If this system is perturbed during development, malformations could result. Valproic acid (VPA), known to accumulate in the embryo and acidify embryonic cells, causes limb and skeletal malformations in mice. If the Na^+/H^+ transporter system is involved in the embryo's ability to recover from an acid loading, as in the case of VPA, then inhibiting the transport system would lead to an increase in the malformation rate and more severe abnormalities. To test this hypothesis, 24 pregnant animals of the C57BL/6 strain of *Mus musculus* were injected twice with VPA (300mg/kg) followed immediately by an injection of Ethylisopropylamiloride (EIPA). EIPA, a more potent analogue of the drug amiloride, was used to inhibit the Na^+/H^+ transport system. The doses of EIPA used were 1.0mg/kg, 2.5mg/kg, 5.0mg/kg, and 7.5mg/kg. A dose response was observed (malformation rate increased as the dose of EIPA increased). The total malformation rate was 60% with VPA alone to almost 95% with the addition of 2.5 mg/kg EIPA. This suggests that the Na^+/H^+ transporter system is involved in the embryo's ability to recover from an acid load and that this ability is essential in normal development.

POSTER E. INFLUENCING THE CHIRALITY OF CRYSTALS, IN WHICH THE NONSYMMETRY OCCURS IN THE LATTICE. STEVEN RODENBAUGH, 6770 THOREAU LANE, BALTIMORE OH 43105.

The goal of this investigation is to ascertain if there are ways to influence the chirality of euhedral and subhedral crystals, in which the dissymmetry occurs in the lattice, not in the compound (namely, NaClO_3 and NaBrO_3 , at this point). Discovering techniques to influence chirality could modify some racemic medications to become optically pure, and the results may assist in the understanding of biomolecular chirality. Sodium chlorate will normally crystallize in a 50:50 ratio of dextrorotatory to levorotatory crystals. An optical pure sample was attained through stirring. It is hypothesized that the motion in the solution caused the optic axes to possess the same orientation by initiating the autocatalytic production of secondary nuclei and the suppression of the enantiomorph by dispersing the solute to the nuclei. The ability to obtain optical purity is mainly related to the volume and stirring speed. For example, a 300 ml solution was optically pure above a threshold of 7.3 RPM, but a 500 ml solution with a RPM of 7.4 yielded mixed results. Also, allowing a melt of NaClO_3 to slowly crystallize by gradual cooling produces a pure sample, while quickly cooling it generates a non-pure sample. Sodium Bromate does not exhibit the same properties as sodium chlorate. It is optically active, but through experimentation, it was concluded that it is not influenced by stirring, even though it possesses the same structure.

POSTER F. THE DIVERSITY OF SHORT INTERSPERSED REPETITIVE ELEMENTS IN RABBIT LUNG TISSUE DNA. JEREMY D. OLSON, 308 BEACON CT. CENTERVILLE OH 45458.

Short Interspersed repetitive Elements (SINES) are small segments of DNA surrounded by two to twenty nucleotides of a repeated sequence. SINES may create polyadenylation signals that help to stabilize mRNA. As a first step in discovering the SINES' function, the number and diversity of these repetitive elements were measured. To do this, DNA was extracted from a number of different species in the genus *Oryctolagus* (Rabbit). These segments were then infected into *Escherichia Coli* (*E. Coli*) using M13 strain 216. Individual infected *E. Coli* clones were grown on LB Agar. The SINES were identified within the *E. Coli* using a radioactive SINE-specific oligonucleotide sequence. Of approximately 600 *E. Coli* clones, about 40% were SINE positive. These results suggest that there are more SINES than thought previously. Further analysis will indicate the total number and diversity of SINES in rabbits.

POSTER G. EXAMINING THE VISUAL PERCEPTION SKILLS OF JAPANESE AND AMERICAN CHILDREN. MARIBETH M. ELUS, 800 ALLISON ROAD, BELLEFONTAINE OH 43311.

This project examines the visual perception skills of American and Japanese children. Testing was completed with groups of children from Bellefontaine, Ohio and Suzuka, Japan. Forty 4 and 5 year olds were administered the MTVP motor-free visual perception test (Colarusso and Hammill). One hundred 6th grade students were given a visual perception test constructed by Edward M. Reeve, and sixty 15 and 16 year olds completed the MRT test of three-dimensional spatial visualization based on the Shepard-Metzler "mental rotation" study. Also, original artwork was gathered from Japanese and American students and critiqued by five art instructors. The results of the data were used to support the hypothesis that Japanese children will show a greater preference for visual perception than American children.

POSTER H. BRIDGES: CONSTRUCTION TECHNIQUES VS. MATERIAL STRENGTH. MATTHEW A. HANSON, 266 S. 2ND ST., BYESVILLE OH 43723.

When building any type of support structure, it can be demonstrated that the techniques used in its construction are of much more value than the quantity of material used. It is advantageous to use the strongest construction components available in real life, but by using the same material (balsa), as a base-line, the variables were eliminated as per the scientific method in this project. To establish relative increases in the weight supported by the structure, construction of the bridge was divided into stages. Each stage represented a different bridge building technique. At the completion of each stage, weight was placed upon the road bed of the bridge until there was a one half inch deflection or until the bridge began to make stress cracking sounds. The results were then measured, recorded, and graphed. Evaluation of the graphs established the increase in supported weight compared to material weight. These graphs showed a marked increase in the weight bearing capabilities of the bridge. This increase dramatically illustrates that in construction, technique is much more valuable than the amount of materials used in the project.

POSTER I. PHYSICS FINGERPRINTS THE UNDERGROUND WORLD. BRIAN R. DULIN, 207 REO DRIVE, CHILLICOTHE OH 45601.

Nuclear decays produce radiations of characteristic energies. Determination of these energies and the activity of a given sample allow both qualitative and quantitative analyses of the makeup of the sample. Samples were analyzed using Passive Gamma Analysis (PGA) and Instrumental Neutron Activation Analysis (INAA). Passive Gamma Analysis involves the analysis of gammas from naturally occurring radionuclides such as K-40 found in many rocks, materials, and even our bodies. Instrumental Neutron Activation Analysis is a two step process in which certain otherwise stable isotopes in a sample are activated (made radioactive) by neutron absorption in a reactor. The gamma(s) from the resulting isotope(s) are then analyzed to determine the presence of the original isotope(s)/element(s). The oil shales contained activity concentrations of Ti-208, Pb-210, Pb-214, Bi-214, and uranium order(s)-of-magnitude greater than were detected in the limestones. This proved to be a highly sensitive method for identifying these geological materials in the laboratory and in the field.

POSTER SESSION-EDUCATION-GEOLOGY- ENVIRONMENTAL 3:30 - 4:30 PM SATURDAY, APRIL 29, 1995 ROUSH HALL

POSTER A. ASSESSMENT OF NUTRITIONAL KNOWLEDGE OF COLLEGE STUDENTS CONCERNING THEIR AWARENESS OF DOMESTIC AND INTERNATIONAL FOOD ISSUES. MATTHEW R. FOGARTY AND DR. DIANA M. SPILLMAN, PHILLIPS HALL, MIAMI UNIVERSITY, OXFORD OH 45056.

Although researchers in nutrition are learning more about eating patterns in special population groups, there has been little descriptive research in the area of nutritional knowledge of college-aged subjects. De La Garza (1985) documented that, "The primary cause of hunger today, wherever it exists, is a combination of poverty and a failure that is essentially a political issue- a failure in some parts of the world to make proper use of existing natural, technological, and economical resources." In order to gauge the nutritional knowledge of college students, a 26 question survey (24 multiple choice, and 2 short essay questions) was formulated and distributed. The subject sample is made up of 340 undergraduate students at Miami University, in Oxford, Ohio. Miami University is made of primarily white, middle class students from the Midwest. Miami University attracts students that have been very successful academically, as indicated by high school grades, class rank, high school curriculum, and participation in service organizations. Students demonstrated: a lack of knowledge on crop use and imports in the Middle East and Russia, and an understanding of marasmus. The students did demonstrate knowledge concerning domestic food issues such as pregnancy, overweightness, and undernourishment.

POSTER B. EDUCATIONAL OPPORTUNITIES AT THE PALEONTOLOGICAL EXCAVATION NEAR CAREY, OHIO. KENNETH M. FORD, III AND RON BOWERMAN, CINCINNATI MUSEUM OF NATURAL HISTORY, FREDERICK AND AMEY GEIER RESEARCH CENTER, 1720 GILBERT AVE., CINCINNATI OH 45202-1401.

During the summer of 1994, many educational groups took advantage of the hospitality of the Cincinnati Museum and Indian Trial Caverns to assist in the on going paleontological excavation at the Sheriden Pit site. Other groups took advantage of tours through the excavation. Fossils of many Ice Age animals have been found at the site since it was discovered by Indian Trial Caverns in 1990. Four of the sixty species found as fossils became extinct at the end of the Ice Age, an event which wiped out most of the large animals of North America. Fossils of these and other larger animals were scarce this summer, so students learned the art of patience as well as the need for care in science. Fossil bearing sediment scraped from the cave was washed and the gravel sorted for the bones of small animals such as frogs, snakes, bats and mice. Lessons were also learned about the formation of limestone rocks and caves and how they are uplifted, the accumulation of fossils in a cave, and the environment of ancient Ohio.

POSTER C. DEVELOPMENT AND USE OF A TEACHING COLLECTION OF FOSSIL MOLLUSKS FOR THE LIBERAL ARTS COLLEGE. A MODEL SYSTEM OF USE WITH INTEGRITY. DIANA M. LEE AND MICHAEL A. HOGGARTH, DEPT. OF LIFE AND EARTH SCIENCES, OTTERBEIN COLLEGE, WESTERVILLE OH 43081.

It is not practical for a four year liberal arts college to maintain separate study and teaching collections. Nor would it be desirable to prevent students from using a study collection simply for the sake of the integrity of the arrangement of specimens. Instead, the collections housed by many of our four year undergraduate institutions must and should be used to teach students paleontology, geology, evolution and the importance of order and arrangement in a study collection. A system of organization was developed in such a way as to meet the demands of the freshman level undergraduate student while promoting the importance of systematics. This system is structured around a strict formula of color bar codes and decimal numbers which are affixed permanently to the specimen, the specimen tray, and the specimen cabinet. These codes assist a student who has minimal experience in systematics in retrieving the correct specimen as well as alerting the student to the geological time period in which the specimen belongs. The code then serves to preserve the integrity of the collection by assisting the student in easy replacement of the specimen. Integrity of the system of arrangement of specimens is not only important as a means to develop a sense of geologic period, etc., but is also worth exploring in its own right as a valuable lesson in science.

POSTER D. ELECTRONIC STRUCTURE AND VIBRATION OF INTRAMOLECULARLY HYDROGEN-BONDED SYSTEMS: AB INITIO CALCULATIONS OF MALONALDEHYDE AND METHYL SALICYLATE. MORTON J. KANTER, ORGANIC CHEMISTRY DEPT., VASIL K. BABAMOV, PHYSICAL INORGANIC DEPT., DONALD P. GIESCHEN, NEW PRODUCT DEVELOPMENT, AND ALEXANDER D. GOCHEV, PHYSICAL INORGANIC DEPT., CAS, 2540 OLENTANGY RIVER RD., COLUMBUS OH 43202.

Ab initio calculations of the electronic structure, geometry, and vibrational properties of malonaldehyde and methyl salicylate were performed. Basis set up to 6-311G** = p were used with 2nd-order Moeller-Plesset perturbation theory and CI refinement. Malonaldehyde and methyl salicylate represent prototypes of a symmetric and nonsymmetric intramolecularly hydrogen-bonded systems and have been subject to state-of-the art experimental studies and numerous calculations. Particular attention is paid to the reorganization of the electronic structure and geometry of the system accompanying the proton transfer. For malonaldehyde, for which there have been many ab initio electronic structure studies, the calculations focus on the features of the potential energy surface needed for implementing new dynamical methods being developed concurrently. For methyl salicylate this is the first high-level ab initio electronic structure calculation. The calculated geometry of methyl salicylate is in closer agreement with experimental structural data than those of previous semiempirical calculations. The calculations are intended to be used as input into dynamical calculations of the hydrogen transfer that can be compared to experimental data. The recent femtosecond-resolved measurements of proton transfer in malonaldehyde in the literature are discussed in view of the present results. All calculations were performed on a Hewlett Packard 9000 computer at CAS.

POSTER E. GEOCHEMICAL SURVEY OF SILVER CREEK METRO-PARK, SUMMIT CO. OHIO. L. BENNER, B. BERNET, C. BUCKHOLZ, M. BURNS, S. CHOWDHURY, N. CROASMAN, M. DROPS, J. HALE, D. HETHERINGTON, R. HILTON, T. HITE, C. HITTLE, P. LONGMIRE, T. MCCLAIN, D. PRUCHENSKI, D. SAWICKI, T. ST. JOHN, M. VANBROCKLIN, A. WOLFF, M. YOHIO, A. FOOS, GEOLOGY DEPT., UNIVERSITY OF AKRON, AKRON OH 44325.

Silver Creek Metro-Park is an example of a late 19th century coal mine area that was reclaimed and developed into a park. A 50 acre reservoir is supplied by spring water from abandoned coal mines, small tributary streams and local surface runoff. Samples from 16 sites were analyzed for temperature, pH, specific conductance (SC), dissolved oxygen (DO), total dissolved solids (TDS), alkalinity, Ca, Na, Mg, K, Fe, Si, Cl and SO_4^{2-} using standard methods. Results indicate a diverse water chemistry for the park. Samples can be grouped into four distinctly different water chemistries which are dependent on their source. Lake samples are characterized by mixed-cations and anions. Samples from streams supplied by run-off have low TDS, high DO and are Ca and HCO_3^- rich. Samples from streams with visible iron precipitation have higher TDS values and indicate a decreasing TDS and increasing DO with increasing distance from the source, a spring flowing from an abandoned coal mine. Finally three samples with extremely high TDS value are characterized by low levels of DO and unnaturally high concentrations of Cl and Na caused by contamination, most likely from road salt or a near-by oil well.

POSTER F. SOCIETAL INDICES OF SNOW REGIONS IN THE EASTERN UNITED STATES. MICHAEL BINKLEY AND THOMAS SCHMIDLIN, DEPT. OF GEOGRAPHY, KENT STATE UNIVERSITY, KENT OH 44242.

We propose a boundary between a 'transitional snow region', where society has adjusted to snow that falls each winter but a reliable snow cover does not develop, and a 'no snow region' where snow is so rare that society does not prepare for its occurrence. The position of the boundary was explored using indices of societal response to snow. Indices included fitting of state trucks with snow plows, use of snow fences, and retail sales of snow shovels and snow-blowers. The boundary extends from southern Arkansas through northern Mississippi and Alabama and south of Atlanta to coastal North Carolina. This boundary is related to climatic variables of snow depths and snow frequency and may be used to explore cultural adaptations to winter hazards and to monitor shifts due to changing winter climates.

POSTER G. LATE QUATERNARY DRAINAGE EVOLUTION IN THE LITTLE MIAMI RIVER AND MAD RIVER WATERSHEDS, WEST CENTRAL OHIO. JOHN B. RITTER, DEPT. OF GEOLOGY, WITTENBERG UNIVERSITY, PO Box 720, SPRINGFIELD OH 45501.

Preliminary analysis of present drainage patterns and the terrace remnants of paleodrainage patterns in the Little Miami River (LMR) and Mad River (MR) watersheds indicates that stream drainage in western Ohio has changed dramatically since the beginning of the most recent deglaciation, approximately 18k yrs B.P. The most apparent change is diversion of Buck Creek discharge from the LMR watershed to the MR watershed. Remnants of

the highest terrace preserved along Buck Creek are correlated and physically continuous with remnants along North Fork River, presently a tributary of LMR, and indicate the first meltwater drainage occupied the present valleys of Buck Creek, North Fork River, and LMR. A second meltwater drainage formed parallel to the first, occupying the present valley of MR. Lower terrace remnants along Buck Creek are correlated and physically continuous with terrace remnants along MR. Degree of soil development and presence of a loess cap on the highest of these latter terrace remnants suggest diversion occurred during or immediately following establishment of MR drainage. Piracy occurred due to differential rates of downcutting resulting from the variable resistance of geologic materials underlying each of the trunk streams. LMR, in the area of Clifton Gorge, is underlain by resistant Niagaran dolomites; whereas MR is underlain by 200-300 ft of sand and gravel in the area of its gorge, flowing through a paleotopographic low in the Niagaran bedrock. As a result, MR forms the regional base level and piracy of adjacent drainage at higher elevations is possible. Diversion of Buck Creek meltwater discharge from LMR has important implications for the development of Clifton Gorge.

POSTER H. AN INDICATOR GEOSTATISTICAL ANALYSIS OF THE SPATIAL DISTRIBUTION OF SAND IN THE UPPER TILL AT THE SITE OF THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT IN SOUTHWESTERN OHIO. JOEL R. SMINCHAK, DAVID F. DOMINIC, ROBERT W. RITZI, NATHAN R. BROWN, AND DONALD L. PAIR, CENTER FOR GROUND WATER MANAGEMENT AND DEPT. OF GEOLOGICAL SCIENCES, WRIGHT STATE UNIVERSITY, DAYTON OH 45435.

Several indicator geostatistical methodologies were used to characterize the distribution of hydrofacies, focusing on the interconnectedness of sand lenses within till that might serve as preferential flow pathways for contamination. A binary indicator random variable was used to represent the presence or absence of high permeability material. Accordingly, 800 lithological logs that penetrate the till were coded at 0.6 m vertical increments. From the data, declustered means for 0.6 m slices were computed, giving an estimate of the percentage of low permeability material at each horizon. Spatial correlation of the sand at specific 0.6 m horizons was examined through the indicator variogram, which had pronounced anisotropy. Indicator point kriging provided a probability map for high permeability material, which was used to analyze sand body interconnectedness, identify potential offsite migration risks, and make inferences about depositional processes.

POSTER I. REVISITING THE GLACIAL BOUNDARIES IN THE HOCKING VALLEY OF OHIO. JOSEPH R. STEIGER, FAIRFIELD SOILS, 402 COURTHOUSE, 210 E. MAIN STREET, LANCASTER OH 43130.

A project by the Natural Resources Conservation Service has updated the Soil Survey of Fairfield County, completed in 1951. The new soils maps reflect advances in soil science, geomorphology, and new techniques in photogrammetry. Significant adjustments of boundaries between Wisconsinan, Illinoian and unglaciated landscapes appear to be warranted based on patterns of soil. New soil maps utilized infrared imagery in an orthophoto mylar transparency format at a scale of 1:12000. The USGS 7.5 minute topoquad data was overlaid for landform analysis. Original soil maps were checked at 300 meter intervals with soil borings to 1 meter depth. Each landform was explored with multiple 2 meter depth soil borings spaced at 30 meter intervals. Soil samples were collected at 50 locations. Soils are classified into 60 series and 125 map units using the latest soil taxonomy. Margin of Illinoian glacial advance are marked by recognition of colluvium on hillslopes and loess on summits. Some high elevation of residuum have no glacial or eolian deposits. The northward shift in the boundary is about 1-5 km. Illinoian till and outwash materials are very similar to Wisconsinan materials and the boundary is recognized by the abrupt absence of loess and thinner weathering of soils.

POSTER J. JOINTING AND BEDDING PLANE CONTROLS ON CAVE PASSAGE DEVELOPMENT, CANYON CAVE, CARTER COUNTY, KENTUCKY. ANNETTE M. SUMMERS AND HORTON H. HOBBS III, DEPTS. OF GEOLOGY AND BIOLOGY, WITTENBERG UNIVERSITY, PO Box 720, SPRINGFIELD OH 45501.

In contrast to the Mammoth Cave area in southwestern Kentucky, minimal research regarding structural and stratigraphic controls on speleogenesis has been conducted for cave systems in northeastern Kentucky. Surface joint orientations and subsurface passage orientations and bedding plane features were used in this study to determine the dominant controls on cave passage development for Canyon Cave, located in north-central Carter County. Canyon Cave is developed in the Ste. Genevieve Limestone Member of the Mississippian-age Newman Limestone and consists of approximately 3 km of passage. The Ste. Genevieve Limestone is a white to light gray, crossbedded, medium to coarse-grained, silty, sandy, and oolitic limestone. The orientation of surveyed passage in Canyon Cave shows a strong correlation with joint measurements taken from surface outcrops of the

Newman Limestone. Passages occur along two conjugate joint sets, N-S/E-W and NW-SE/NE-SW, which parallel the surface measurements. Anastomoses, a network of small tubes or conduits, are one of the few indicators of bedding plane control; they are abundant along nearly horizontal bedding planes throughout Canyon Cave. Consequently, the overall speleogenesis of Canyon Cave is controlled by water movement along joints and bedding planes.

POSTER K. THE BEDROCK GEOLOGY OF THE BELLEFONTAINE 30 X 60 MINUTE QUADRANGLE. E. MAC SWINFORD AND ERNIE R. SLUCHER, O.D.N.R., DIVISION OF GEOLOGICAL SURVEY, 4383 FOUNTAIN SQUARE DR., COLUMBUS OH 43224.

The Bellefontaine 30 x 60 minute bedrock geologic quadrangle, located in west-central Ohio, is the third in a series to be released as part of the cooperative effort between the Ohio Department of Natural Resources, Division of Geological Survey and the U.S. Geological Survey, STATEMAP program to prepare a modern bedrock geologic map of Ohio. This 1:100,000 scale map is part of the USGS National Geologic Map Database. The Bellefontaine geologic map shows the distribution of 10 rock-stratigraphic units of Ordovician, Silurian, and Devonian age, as well as the distribution of the ancient Teays River valley and its tributaries. The text provides discussion of mapping methods, geologic setting, and bedrock, economic, and environmental geology. The bedrock geology and origin of the Bellefontaine Outlier also are discussed. Openfile mapping products available for the Bellefontaine 30 x 60 minute quadrangle include: (1) bedrock topography maps at a scale of 1:24,000, (2) bedrock geology maps at a scale of 1:24,000, and (3) computer generated structure-contour maps of the top of each mapped unit at scales of 1:24,000 and 1:250,000. The published 30 x 60 minute quadrangle and the associated open-file products will assist planners in properly developing and utilizing the mineral resources, ground water, and fossil fuels of west-central Ohio and in minimizing the impact of geologic hazards.

POSTER L. PHYSICO-CHEMICAL TRENDS OF YELLOW SPRING, GREENE COUNTY, OHIO. E. R. JOSEFIN TITELMAN AND NATALIE H. WADDELL, BIOLOGY DEPT., WITTENBERG UNIVERSITY, SPRINGFIELD OH 45501.

Physicochemical parameters were examined in Yellow Spring, a temperate cold-water spring, and its run in Glen Helen Nature Preserve, Greene County, Ohio. Yellow Spring flows west approximately 100m before joining Yellow Springs Creek. Eight sites were sampled on seven occasions between September and November 1994. Significance of trends were found with polynomial regression analysis. Mean CO₂ concentrations, hardness, and specific conductance, of 360 mg/l, 370 mg/l CaCO₃, and 790 umhos/cm, respectively, were high due to a dolomite bedrock, without significant changes over distance. High total iron concentrations at the upwelling were due partially to infiltration through glacial till. Iron concentrations decreased significantly from 0.5 to 0.2 mg/l along the spring run. Oxygen saturation exhibited an inverse trend, compared to Fe, increasing from 16 to 106%. Temperature ranged from 11.8 to 13.1°C, with a significant increase along the springrun. pH also increased significantly. The mean concentration of PO₄-P, SO₄-S, and NO₃-N were 0.05, 55, and 0.05 mg/l, respectively, with no significant trends over the springrun. The springhead maintained thermal and chemical stability, while the springrun was less stable.

POSTER M. UTILIZATION BY RYEGRASS OF NUTRIENTS RELEASED FROM SEWAGE SLUDGE COMPOST AND COW MANURE COMPOST. L CHEN, W A DICK, AND J G STREETER, HORTICULTURE & CROP SCIENCE DEPT., OHIO STATE UNIVERSITY, WOOSTER OH 44691.

The use of composts as a soil amendment to enhance crop growth requires a knowledge of the rate and amount of nutrient released. A greenhouse study was conducted, using rye grass (*Lolium multiflorum* Lam.) as test plant, to evaluate nutrient release from composts. The experimental design consisted of four blocked replicates in a complete factorial with two types of compost (sewage sludge and cow manure), four application rates (1, 2, 5, and 10% by weight in sand), and three fertilizer treatments (0, 100 mg N/kg mixture, and 100 mg P/kg mixture). Ryegrass top growth was harvested after 21 days and the regrowth harvested three additional times. Initial N uptake was highly correlated with the mineral N composition in the compost. Total N uptake was correlated with the organic C/N ratio of the compost and application rate. Release of nutrients especially N, can be predicted using simple chemical tests applied to the compost. In addition to nitrogen, the composts also supplied other major and micro nutrients required for plant growth.

POSTER N. EFFECTS OF DANIS-CLARKCO LANDFILL ON LOTIC COMMUNITIES OF CHAPMAN AND STORMS CREEKS. CHAMPAIGN AND CLARK COUNTIES, OHIO. DEBORAH A. GOLDSTEIN, ROSEMARIE HINKEL, REBECCA A. O'FLAHERTY, KATHERINE J. PIERSON AND JEFFREY C. RICKS, BIOLOGY DEPT., WITTENBERG UNIVERSITY, SPRINGFIELD OH 45501.

A noticeable decline in the fish populations of Chapman Creek prompted a study of the lotic ecosystems surrounding the Danis-Clarkco Landfill, in Champaign and Clark counties, Ohio. Monthly sampling of water chemistry, fishes, and macroinvertebrates was conducted at six sites on Storms Creek, nine sites on Chapman Creek, and two sites on Mad River over a one-year period. Physicochemical values demonstrated no obvious anthropogenic impacts, yet benthic macroinvertebrate and fish species diversity indices were reduced in the proximity of the landfill. Although the lowered diversity may be in response to increased siltation, no direct causal relationships can be made with the presence of the landfill.

POSTER O. AQUATIC ECOLOGICAL SURVEY FOR THE RIVERVIEW TRAIL, AKRON, OHIO. MICHAEL D. JOHNSON, LAURA R. MATARAZA, KARNYN GIVENA, JAY ABERCROMBIE, AND BEVERLY J. BROWN, ACRT INC., PO Box 219, KENT OH 44240.

The City of Akron is extending the Ohio & Erie Canal Towpath Trail south through the city from its present southern terminus in the Cuyahoga Valley National Recreation Area. The 3-km Riverview Trail will parallel the Cuyahoga River and cross Sand Run. An aquatic ecological survey was conducted as part of ODOT's Preliminary Design Phase process to identify any environmentally sensitive areas and to determine potential ecological impacts. This ecological study was performed by ACRT for the City of Akron. ACRT, Inc. was a subconsultant to Environmental Design Group, Stow, Ohio. Biotic and chemical parameters were quantitatively measured to determine overall quality of the Cuyahoga River and Sand Run. Fish communities were analyzed using the Index of Biotic Integrity (IBI) developed by the Ohio EPA. Macroinvertebrate communities were analyzed using the River Continuum Concept of Vannote, *et al.* (1980) and other indices. Water chemistry sampling and analysis followed Ohio EPA guidelines. Data were compared to historical data collected by the Ohio EPA from a nearby reference site on the Cuyahoga River. All water chemistry parameters fell within acceptable limits established by the Ohio EPA, but total phosphorus and turbidity values were high in Sand Run and nitrate and turbidity levels were high in the Cuyahoga River. IBI values for both Sand Run and the Cuyahoga River fell below the acceptable minimum scores established by the Ohio EPA. Macroinvertebrate communities were dominated by collectors, indicative of an impacted ecosystem. This ecological survey and other environmental data will be used to design a preferred alignment for the Riverview Trail.

POSTER P. THE EFFECTS OF SAMPLING INTENSITY ON MEASURES OF SPECIES IMPORTANCE AND DIVERSITY AND ON COMMUNITY CLASSIFICATION IN A BEECH-MAPLE FOREST. ALISON M. KELLY, MARY BENNINGER-TRUAX, AND MATTHEW H. HILS, BIOLOGY DEPT., HIRAM COLLEGE, HIRAM OH 44234.

In 1993, the structure and composition of a beech-maple forest at Hiram College's J. H. Barrow Field Station was examined. Woody stems >3 cm dbh were surveyed in four 10 x 10 m subplots in each of 67 50 x 50 m plots. Species importance values, evenness, and heterogeneity were calculated, and the forest was classified using Bray-Curtis polar ordination with Euclidean Distance. In 1994, a follow-up to the study was initiated to examine differences in species importance percentages, diversity, and forest classification due to changes in sampling intensity. Four plots were selected in each of three areas differentiated by the 1993 ordination: mature beech-maple forest, early successional forest, and a disturbed area once dominated by American chestnut. All woody stems >3 cm dbh were surveyed. Findings indicate that classification of the twelve plots varied with increased sampling until 28% of each plot was sampled. When comparing surveys using four subplots with full plot surveys, a greater difference in importance values scored in plots which experienced past disturbance. Increased sampling had little effect on diversity values. We will continue this study and survey all 67 plots to further examine effects of sampling intensity on plant community parameters. We gratefully acknowledge grant support from the Howard Hughes Medical Institute.

POSTER Q. EARLY SUCCESSIONAL CHANGES IN A THREE YEAR OLD POND AT HIRAM COLLEGE'S J.H. BARROW BIOLOGY FIELD STATION IN NORTHEAST OHIO. MARY K. RAPIEN AND MARY BENNINGER-TRUAX, BIOLOGY DEPT., HIRAM COLLEGE, HIRAM OH 44234.

This research is part of a long-term successional study of a 1 ha pond which was completely dredged during the fall of 1991. Chemical and physical data were collected twice-weekly between 28 June and 5 November 1994 at .5 m depth intervals at three locations in the pond. These data were compared with data collected during the summer and fall of 1992. Phytoplankton were collected once weekly at 1 m depth intervals in each of the three locations. Preliminary results indicate that the amounts of phosphates, nitrate, and sulfate available in the water column were greater in 1992 than 1994, perhaps due to increased storage in plant and animal biomass. Unexpectedly, pH levels were also lower in 1994. Water temperatures were consistently lower and fall

turnover occurred earlier in 1994 than in 1992. Several species of phytoplankton were found in the samples. The number of individuals per species, the time of occurrence, and correlation's with chemical and physical parameters will be presented. This research was supported by funds from the Howard Hughes Medical Institute.

POSTER R. USING ERROR PROPAGATION TECHNIQUES TO EVALUATE UNCERTAINTIES IN ESTIMATES OF HUMAN EXPOSURES TO CHEMICALS IN THE ENVIRONMENT. MICHAEL A. STAFFORD, PH.D., P.E., FBA ENVIRONMENTAL INC., 107 N. MAIN ST. SUITE 200, MARION OH 43302-3029 AND KENNETH R. PENDLEY, METCALF & EDDY INC.

A health risk assessment is commonly performed to evaluate the potential effects on human health associated with chemical exposures from a particular waste disposal site or an active industrial site. In such risk assessments, several exposure pathways (e.g., inhalation of airborne chemicals, ingestion of chemicals in the ground water or soil, etc.) are evaluated, and the results are used to estimate health effects. Typically, each of these pathway analyses is evaluated using an algebraic expression to relate concentration of a chemical in the environment at the site to a human exposure rate either at the site or at some distance from it. These algebraic exposure equations can be quite complex for some pathways, depending primarily on how chemical transport mechanisms are handled. Whether simple or complex, though, each term in an exposure equation has uncertainty associated with it, which means that the resulting exposure rate also has uncertainty. It is not only important to understand the uncertainty in the result, but it is also useful to understand how that uncertainty relates to the uncertainties in each of the terms in the exposure equation. Several statistical techniques are available for evaluating uncertainties. This paper examines the use of error propagation techniques for such purpose and compares error propagation to Monte Carlo methods for several different exposure equations. The paper also discusses the effects of exposure uncertainties on the final health effects calculations for several real-world risk assessments.

POSTER S. THE POTENTIAL ROLE OF VIRTUAL REALITY IN ENVIRONMENTAL EDUCATION. GREGORY L. TAYLOR AND JOHN F. DISINGER, SCHOOL OF NATURAL RESOURCES, OHIO STATE UNIVERSITY, 210 KOTTMAN HALL, 2021 COFFEY ROAD, COLUMBUS OH 43210-1085.

The purpose of this study was to determine the acceptability and possible role of virtual reality (VR) in the field of environmental education. A survey instrument was developed and administered to environmental education practitioners and virtual reality developers. The study surveyed two sample populations: 400 environmental educators belonging to the North American Association for Environmental Education (NAAEE) and 40 Virtual Reality developers located over the internet, a computer network. The study's three research questions were: 1) What is the current level of acceptance of VR as a teaching tool in environmental education by environmental educators? 2) What are perceived as the most beneficial roles and applications of VR to the field of environmental education? 3) What areas concerning the application of VR to environmental education should be studied in order for VR to become an effective tool in environmental education? The principal findings of the study were: 1) the sample population of environmental educators indicated an acceptance of VR as a teaching tool in environmental education; 2) VR applications that allow students to have experiences unobtainable in the physical world are perceived as being the most beneficial to environmental education; 3) VR applications that use anthropomorphism and personification were perceived as non beneficial to environmental education and; 4) studying what constitutes an effective VR learning environment was rated as the most important in developing VR for environmental education.

POSTER T. EFFECTS OF OVER-HARVESTING ON MEAN SIZE OF QUEEN CONCH (*STROMBUS GIGAS*). CHRIS D. CARMEN, BRIAN M. MCCLUSKEY, DAVID W. SMITH, 484 N. WITTENBERG AVE., SPRINGFIELD OH 45501.

The Queen Conch (*Strombus giga*) has been and remains a staple food in the diets of many Caribbean islanders. With increases in human population and commerce, a rise in demand for *S. giga* has resulted in areas of over-harvest. Due to over-harvest, a lack of restrictive management, and no fishing limitations, a hypothesis was formed that the mean size of Queen Conch tests have decreased over time because of increasing pre-mature harvesting. The survey of Queen Conch tests was conducted in relation to size and estimated age of shells harvested on San Salvador Island, Bahamas. Length was measured from tip of siphonal canal to apex and width from outer lip to the edge of the body whorl. One hundred fifty shells of estimated age were measured along with fifty random aged and fifty freshly harvested shells to serve as the control. Statistical analysis revealed a decrease in mean size in accordance with age at harvest. This information indicates that a correlation

can be found between the size of the shell versus maturity at harvest. The correlation supports the hypothesis that lack of fishing restrictions and poor aquaculture techniques directly affects the size of harvested *S. gigas*.

INTERDISCIPLINARY SESSION
2:00 PM SATURDAY, APRIL 29, 1995
ROUSH HALL 429
RICHARD STORCK-PRESIDING

To implement the new objective of the Ohio Academy of Science -- **to encourage interaction among and between scientific, engineering, technological and educational fields** -- The Ohio Senior Academy of Science Council has reviewed all abstracts and selected these six for special recognition and presentation at this time. Each of these reports is being given in discipline-related sessions, but since the reports involve *more than one discipline* the authors have been invited to present their work again in this interdisciplinary session.

Please see the Author Index to locate the full abstracts of each presenter.

INTERDISCIPLINARY APPROACHES TO THE STUDY OF SCIENCE: USING ENVIRONMENTAL TOPICS FOR THEMATIC STRUCTURE. Thomas B. Cobb, Department of Physics and Center for Environmental Programs, Bowling Green State University, Bowling Green OH 43403.

EVOLVING EARTH SYSTEM SCIENCE AT THE OHIO STATE UNIVERSITY. Garry D. McKenzie, Geological Sciences, The Ohio State University, Columbus OH 43210-1308.

CORONARY ARTERY ATHEROSCLEROSIS: HISTOCHEMICAL ANALYSIS USING NEAR-INFRARED RAMAN SPECTROSCOPY. Tjeerd J. Romer, James F. Brennan III, Yang Wang, Anna M. Tercyak, Robert S. Lees, John R. Kramer Jr., Ramachandra R. Dasari and Michael S. Feld. C/O J.R. Kramer, Dept. of Cardiology, Desk F 25, The Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland OH, 44195 and Massachusetts Institute of Technology, Cambridge MA.

SCIENCE EDUCATION ENHANCEMENT--THE SCIENCE RESOURCE CENTER. Arthur L. Vorhies, Math/Science Division, Ohio University-Chillicothe, 571 West Fifth St., Chillicothe OH 45601.

PLANT DISTRIBUTION AS A FUNCTION OF CATION AVAILABILITY IN RESIDUAL SOILS IN ADAMS COUNTY, OHIO. Alice J. Michels, Susan M. Charls, Steven C. Hedrick, Mary M. Riestenberg, Dept. of Chemistry and Physical sciences, College of Mt. St. Joseph, Cincinnati OH 45233.

ENVIRONMENTAL EDUCATION: SOCIOLOGICAL APPROACHES. Eva A. Sebo. Dept. of Sociology, Otterbein College, Westerville OH 43081.

PLANNING FORM

8:00 A.M.

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11:15 -- All-Academy Lecture (Saturday, April 29)

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