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FLORA AND VEGETATION OF IRONDEQUOIT CREEK WETLANDS.

Number 2

HERMAN LEROY FAIRCHILD: An Early Promoter and Defender of Meteorite Impact Cratering

Number 3

Fall Scientific Paper Sessions: 1991 through 1997 Titles, Authors, Abstracts

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VOLUME CONTENTS

Vol. 18 November 1998 Number 1

PROCEEDINGS OF THE ROCHESTER ACADEMY OF SCIENCE, INC.

FLORA AND VEGETATION OF IRONDEQUOIT CREEK WETLANDS

by

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ABSTRACT

General reconnaisance, collection of plants and sampling along transects were used to characterize the vegetation of the upper and lower wetlands of Irondequoit Creek, located between Browncroft Blvd. and Empire Blvd. We found a total of 60 species, nineteen occurring in deep water sites, 33 in dry sites and another eight along the entire wet-dry gradient. The levees along the stream channels had the highest species diversity (30 species).

The reconnaisance indicated different areas of the two wetlands varied, probably because of differences in water depth. The wetland areas of deep water mostly had submerged and floating aquatic plants, dryer sites had various grasses, shrubs and some weeds. By far the greatest area was dominated by cattails which grew over a wide range of water depth.

Multivariate analyses were used to determine vegetation pattern. Two-Way Indicator Species Analysis (TWINSPAN) divided the samples into two divisions, one characterized by dry sites in the upper wetland, the other by wet sites of both the upper and lower wetlands. Detrended Correspondence Analysis (DCA) was correlated with water depth, with submerged, floating aquatics and deep water macrophytes on one side of the ordination, reed canary grass, some weeds and shrubs characteristic of dry levees at the other.

INTRODUCTION

Large wetland ecosystems have been recognized for many years as important landscape features. These systems serve as important fish breeding areas, provide wildlife habitat, water fowl nesting sites and migration stops. They may also provide significant outdoor recreational areas for people who enjoy fishing, birdwatching, hunting and canoeing. Hydrologically, wetlands can be a source of groundwater discharge or recharge. Depending on the relation between surface water and ground water, wetlands can provide areas for flood wave attenuation and storage of flood waters. If dispersal of storm waters is possible, wetlands can facilitate sediment and nutrient removal (Adamus and Stockwell 1983).

The use of wetlands for improvement of downstream water quality through sediment and nutrient removal has been documented. Strecker *et al.* (1992) listed the mechanisms which play a role in the removal of pollutants in storm water, including sedimentation, adsorption, precipitation and dissolution, filtration, biochemical interactions, volatilization and aerosol formation, and infiltration. These mechanisms are inter-related and the importance of any one mechanism will vary from wetland to wetland. The balance between nutrient removal through these mechanisms and nutrient export through leaching, decomposition and plant-facilitated transfer of nutrients from sediments to overlying waters determine the net effect that a wetland has on water quality. Removal and export depend on season, the type of vegetation and sediment-water nutrient exchange rates (Adamus and Stockwell 1983).

Between 1979-1981, the Irondequoit Creek basin in Monroe County was studied to assess the impact of stormwater runoff and its associated nutrient and contaminant load on water quality of Irondequoit Bay. The quality of runoff into the Creek is typical of that expected for an urbanized watershed. The annual load of phosphorus coming from nonpoint sources in the watershed and entering Irondequoit Bay was calculated to be 15.7 megagrams (Kappel et al. 1989). After evaluating many best-management practices for control of contaminants in urban runoff, O'Brien and Gere (1983) suggested use of the wetlands near the mouth of Irondequoit Creek as the most cost-effective control measure to reduce phosphorus loads to the Bay. After studying the feasibility of other recommendations to reduce phosphorus loads, the Monroe County Department of Health, in cooperation with the U. S. Geological Survey, began to pursue the O'Brien and Gere recommendations. The storm-water treatment would be accomplished by installation of a flow-control structure midway in the wetland at a point locally referred to as the Narrows (Fig. 1). This structure will operate at peak flows between about 700 and 1,500 cubic feet per second. It will increase dispersal of storm flows through the wetlands and detain storm waters for slightly longer periods than would otherwise occur. The control structure will be operated on a storm-by-storm basis.

Above normal water levels and durations of inundation are expected to last from less than one day to several days for targeted storm flows.

As part of the overall project to document the effect of storm-water dispersal and detention on the wetlands, a preliminary analysis of the existing ecological conditions of the wetlands was desired. The purpose of this study, carried out during the summer of 1991, was to describe the plant communities in the wetlands. The information gathered will be used as a base line for future studies to identify any impact that operation of the flow-control structure might have on the wetland plant communities.

The wetlands of concern are located near the mouth of Irondequoit Creek in the Towns of Brighton, Irondequoit and Penfield. They are bounded on the north by Empire Boulevard, to the south by Browncroft Boulevard, and to the east and west by steep slopes of gravelly and sandy soils (Fig. 1). The natural constriction at the Narrows divides the wetlands into two distinct areas, which for ease of discussion are identified as the upper wetlands to the south and the lower wetlands to the north. A previous study by DeGasperi and Bannister (1983) determined that the lower wetland was 65 ha in area and that the upper wetland was approximately 60 ha.

METHODS

A general reconnaisance of the upper and lower wetlands, aided by air photos and topographic maps, was carried out by boat, canoe and on foot. During the reconnaisance, we identified all plants encountered and, using the air photos and topographic maps, constructed a map of the plant communities in the two sites.

We also established a permanant transect line in each of the wetlands (Fig. 1). Both proceeded from the southwest and extended to the northeast with a plot established every 10 m along the line. Each-square meter plot was marked permanently by driving a 1/2 inch PVC pipe into the soil in the northeast corner of the plot. We established 31 plots in the upper and 26 plots in the lower wetland during late June-early July. In each we identified every species and determined their percent cover. In addition, we recorded the number and height of cattail shoots present. The plot height above sea level referenced to the current water level in the wetland and depth of water at the corner pipe was recorded. We also identified plants and classified the upland vegetation at the dry ends of each transect line.

Plot cover data were used to construct a species by sample data matrix. This was used to analyze community composition using TWINSPAN, a two-way indicator species analysis (Hill 1979b) and to determine species distribution in an ordination space using DECORANA, a detrended correspondence analysis (Hill 1979a).

Vascular plant nomenclature follows Gleason and Cronquist (1991) except for *Typha glauca* Godr. which they list as a hybrid (see discussion below) which we treat as a distinct species.

RESULTS

Flora

The most abundant species in the two wetlands was the glaucous cattail (*Typha glauca* Godr.). This species is very large. In our plots it attained maximum heights of 3.2 m, averaged between 2.5-2.8 m with cover values of approximately 100 to 110%. Taxonomists differ on the status of cattails in this area, some believe there are three distinct species, the broad-leaf cattail (*Typha latifolia*), narrow-leaf cattail (*T. angustifolia*) and glaucous cattail (*T. glauca*) Others disagree and believe *T. glauca* to be a hybrid between the narrow and broad-leaf species. From key characters and observing the plants in the Irondequoit systems (Table 1), we believe it best to name most of the cattails *T. glauca.* We did find some small areas with plants that were clearly *T. latifolia* but did not find narrow -leaf cattail.

We observed a total of 60 plant species in the two wetlands (Table 2). For comparison we have divided the two wetlands into five types; three classified as wet; the aquatic, the cattail and the mixed marsh, and two dryer sites; the fen and the levees bordering the streams (Figs. 2 and 3). Most species were found either in the wet or dry sites with few found across the whole gradient. Nineteen of the 60 species were found only in the three deep water sites (Table 2); 33 were found only in the two dry sites. Eight species were found in both wet and dry sites. The fen and levees had the highest diversity, the former with 21 species, the latter with 30.

Wetland Communities

Figures 2 and 3 map the distribution of the plant communities we recognized in both the upper (Fig. 2) and lower (Fig. 3) wetlands. The areas of open, deep water are found along the channels and wider, slower flowing portions of the streams (Figs. 2 A and 3 A). These have mostly aquatic plants depending on the current and depth of water. Submerged plants characteristic of deep water were *Potamogeton crispus, P. nodosus, P. foliosus* and *Myriophyllum sp.* Areas of deep water with little current were dominated by water lilies (*Nymphaea odorata*) and a number of small floating plants including the duckweeds (*Spirodela polyrhiza, Lemna minor, Wolffia sp.*) and aquatic liverworts (*Riccia fluitans* and *Ricciocarpus natans*). Very slow flowing areas of deep water were characterized by the shrub *Decodon verticillatus* and strikingly by large colonies of yellow iris (*Iris pseudoacorus).*

The most extensive community type, dominating most of the area of both wetlands was the cattail community (Figs. 2B and 3B). This community type occurred in a wide range of water depths, from the water table at the soil surface to about 40-45 cm above the surface.

This community had a relatively low species diversity but scattered touch-me-nots (*Impatiens capensis*) were common and duckweeds and aquatic liverworts floated on the water surface.

There was a mixed marsh community scattered in quiet water areas in both upper and lower wetlands (Figs. 2C and 3C). They were characterized by having 3-5 large macrophyte species present including the glaucous and broad-leaf cattails, sedge (*Scirpus acutus*), burr reed (*Sparganium eurycarpum*) and reed canary grass (*Phalaris arundinacea*). These community types occurred in areas with little current . They also supported all of the floating aquatic species.

Levees along the channels (Figs. 2 and 3) varied in height which caused variation in the species composition and contributed to the highest diversity we found in any area of the wetlands. Tree species present on the levees were black willow (*Salix nigra*), American elm (*Ulmus americana*) and white birch (*Betula sp*) while the herbs included thistle (*Cirsium sp.*), dock (*Rumex sp.*), deadly nightshade (*Solanum dulcamera*), touch-me-not, hedge bindweed (*Convolvulus sepium*) and grape (*Vitis riparia*).

A small area in a cove in the southeastern corner of the upper wetland (Fig. 2F) was classified as fen. This area was somewhat drier and, while still dominated by glaucous cattail, had a number of species not found or found sparingly in other areas. These species were black willow, white ash (*Fraxinus americana*), the shrubs alder (*Alnus rugosa*) and red-osier dogwood (*Cornus stolonifera*), two ferns, the sensitive (*Onoclea sensibilis*) and interrupted (*Osmunda claytoniana*) and two sedges (*Carex comosa* and *C. psdudo-cyperus*). This was a species-rich site, much of the reason for high species diversity was the topography since there were many high hummocks of sedges and downed logs which had fallen into the fen, both of which alternated with areas of soft, wet muck.

Secondary Wetland and Upland Communities

We surveyed three other communities in our reconnaisance that were not in the main area of the wetlands. The first was a relatively extensive area dominated by reeds (*Phragmites australis*) which grew on the western slope of the upper wetland just south of the Narrows (Figs 2D and 3D). This slope had moist, sandy soil and was just down slope from the closed Town of Brighton landfill. In addition to the reed, we recorded only three other species from this community; reed canary grass, reed meadow grass (*Glyceria grandis*) and touch-me-not.

A second community, the willow community, occurred in scattered areas between the wetland and upland and on the larger levees (Figs. 2H and 3H). Plants found were generally a mixture of both wetland and upland species with the former dominating. Touch-me-nots were an especially important herbaceous species in this community type.

The third area we surveyed was the dry upland community on slopes adjoining both the upper and lower wetlands. Species diversity in these areas was high, we found 34 different species of which the most important tree species were oaks, including white oak (*Quercus alba*), sugar maple (*Acer saccharum*) and red maple (*A. rubrum*). Hickory (*Carya ovata*) and sassafras (*Sassafras albidum*) were also important. The most common shrubs were witch hazel (*Hamamelis virginiana*) and two *Viburnum* species (*V. acerifolium* and *V. recognitum*). Herbs common to the upland community were bracken fern (*Pteridium aquilinum*), grape (*Vitis labrusca*) and Virginia Creeper (*Parthenocissis quinquifolia*).

Transect

Fig. 4 illustrates a TWINSPAN analysis of the transect plot data from both upper and lower wetlands. The first division separated five plots in the upper wetland from all others. These five plots were on either a dry site on the edge of the upper wetland at the beginning of the transect or on the dry levee that the transect crossed. Important species were reed canary grass, touch-me-not and thistle. Cattail cover in these plots was low and did not exceed 50 %. The water table was between 10 and 40 cm below the surface.

The wet division of the analysis separated five lower wetland and all upper wetland plots from the remaining lower wetland. The lower wetland sites were divided into two types, the cattail plus *Decodon type* where the water table was between the surface and 10 cm above the surface and the monospecific cattail stand with a good coverage of floating plants and the water table ranging from 2-45 cm above the surface.

The upper wetland plus five lower wetland plots were divided into two types, the wet type with cattail and floating aquatic type with the water table 0-45 cm above the surface and the moist type with cattails mixed with drier habitat species, mostly touch-me-not. The water table ranged between 1-8 cm below the surface.

The relationship of species to environmental gradients is shown in Fig. 5, a Detrended Correspondence Analysis (DECORANA). The DECORANA analysis was designed to ordinate species or samples so that those found together in the community more often than not would be arranged close to one another in the ordination space while those found separate more often would be further apart in the ordination space. The first axis of this ordination illustrates a moisture gradient. Species found on wetter sites are to the left in the ordination and include *Decodon*, *Lythrum*, the floating aquatics, *Myriophyllum*, Galium and *Typha*. The dry site plants characteristic of levees and dry wetland-upland borders are *Phalaris*, *Cirsium*, *Carex* and *Polygonum*, all found on the right of the ordination.

DISCUSSION

The soil surface in these wetland systems was discontinuous. Some areas were solid underfoot while others were extremely soft making travel treacherous. This was particularly true during the time we sampled because the water table was high following heavy spring and early summer rain storms. Of note, we saw no damage to plants from the high water indicating that short-term flooding as planned by the water diversion project would have no immediate impact on the existing communities.

Most of the area of the wetlands was dominated by the glaucous cattail. This species is very large, reaching heights of 3.2 m or more at maximum and providing 100 percent cover. As noted, we believe the important cattail to be *T. glauca* although there were some areas of broad-leaf cattail present in the lower wetland, especially where the water levels were somewhat lower and the soils somewhat higher in sand content. This is probably the preferred habitat for *T. latifolia* (Grace and Wetzel 1981). Except for the small floating duckweeds and liverworts, few other plants were found in most areas of the cattail-dominated community. The greatest areas of species diversity were the drier sites within the wetlands, the fen area, the levees, or moist edges of the upland, all characterized by a mixture of wetland species, some typical mesic upland herbs and scattered shrubs and trees.

Because of the large size of these wetlands and the resulting wide range of environmental conditions present, species diversity was quite high. Even so, our species list must be regarded as incomplete since we visited the sites in summer and could have missed some additonal species characteristic of early spring or autumn. In common with DeGasperi and Bannister (1983), we found no rare or endangered species.

Both upper and lower wetlands had the same types of communities present but they differed in their relative abundance. The upper wetland had cattail marsh except for small areas of deeper water supporting aquatic plants and/or a mixture of large wetland species. These aquatic communities were more common in the lower wetland probably because there was a greater area of broad channels with slow moving current than in the upper wetland.

Water depth appears to be the most important factor regulating both the density and growth of cattails, and the diversity of the communities present. Cattails grew best in water depths between a few cm to 25-40 cm above the soil surface. Dry conditions such as those found on levees or other raised surfaces supported fewer and smaller cattails and allowed a mixture of wetland species more tolerant to dryer conditions to enter the community. At the wet end of the gradient, density of cattails decreases although shoot size did not decrease to the same extent. Under deep-water conditions and low cattail density, other species such as *Decodon, Lythrum* and floating aquatic plants become part of the community resulting in a

mixture of species. These mixed communities were found in relatively deep water with slow-moving current.

It appears that most communities we have designated on Figs. 2 and 3 can be arranged on a gradient of water depth proceeding from the aquatic communities of channels to high levees and surrounding uplands. *Phragmites* is difficult to place here because it is on a slope above the wetland water table and has an unknown water regime.

SUMMARY AND CONCLUSIONS

Most of the area of the upper and lower wetlands was dominated by the cattail, often with floating aquatic plants and some touch-me-not in the community. This community and others described in this paper did not appear to be damaged by the early summer high water levels.

If the proposed flow-control structure is operated as intended, that is, for storm flows of a specific magnitude causing short-duration increases in water levels above those which would otherwise occur, we believe the wetland plant communities will not be damaged to any extent.

The communities we have described and the species found seem to be arranged along a water table gradient proceeding from the submerged aquatics of deep water channels to the high levees and surrounding uplands. The cattails were able to grow and be an important part of most of these communities again indicating its potential to survive periods of high water.

The cattails are the dominant plants in these wetlands. These should be used as indicator plants for flooding damage since damage to them will adversely impact the community. Most of the other species are limited in size, community distribution or area covered and would not impact these wetlands greatly if the flood regime harmed their growth and reproduction.

BIBLIOGRAPHY

Adamus, P.R., and L.T. Stockwell. 1983. A method for functional assessment: Vol.1, critical review and evaluation concepts: Federal Highway Administration Report No. FHWA-IP-82-23, 181 pp.

DeGasperi, C. and T. T. Bannister. 1983. Survey of the Irondequoit Creek Wetlands; Possible effects of short-term impoundment of storm water behind a proposed flow-regulating device at the Narrows. Irondequoit Bay Report No. 13. 21 pp.

Gleason, H. A. and A. Cronquist. 1991. Manual of the vascular plants of northeastern United States and adjacent Canada. 2nd. ed. New York Botanical Garden, New York. 910 pp.

Grace, J. B. and R. G. Wetzel. 1981. Phenotypic and genotypic components of growth and reproduction in *Typha latifolia*: Experimental studies in marshes of differing successional maturity. Ecology 61: 789-801.

Hill, M.O. 1979a. DECORANA-A FORTRAN program for detrended correspondence analysis and reciprocal averaging. Ecology and Systematics, Cornell University, Ithaca, NY.

Hill, M.O. 1979b. TWINSPAN-A FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. Ecology and Systematics, Cornell Univ., Ithaca, NY.

Kappel, W.M., R.M. Yager, and P.J. Zarriello. 1986. Quantity and Quality of urban storm runoff in the Irondequoit Creek basin near Rochester, New York-Part 2. Quality of storm runoff and atmospheric deposition, rainfall-runoff-quality modeling, and potential of wetlands for sediment and nutrient retention: U.S. Geological Survey Water-Resources Investigations Report 85-4113, 93 pp.

O'Brien and Gere. 1993. Nationwide urban runoff program, Irondequoit basin study final report: Rochester, N.Y., Irondequoit Bay Pure Waters District, 164 pp.

Strecker, E.W., J.M. Kersnar, E.D. Driscoll and R.R. Horner.1992. The use of wetlands for controlling stormwater pollution: Terrene Institute, Washington, D.C., 65 pp.

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Table 1. Comparison of botanical characteristics of the cattails *Typha latifolia, T. angustifolia* and *T. glauca.*

Parameter	*T. latifolia*	*T. angustifolia*	*T. glauca*
Height	1-2.7 m	0.75-1.5 m	2.0-3.5 m
Leaf Width	6-23 mm	3-8 mm	7-10 mm
Infloresence	Not Separated	Separated	Separated

Table 2. Flora of five types of plant communities of the upper and lower Irondequoit Creek wetlands.

Species Names		Community				
Scientific	Common	Aq.	Cat	Mixed	Fen	Lev.
Riccia fluitans	Liverwort	x	x	x		
Ricciocarpus natans	Liverwort	x	x	x		
Ceratophyllum demersum	Hornwort	x				
Decodon verticillatus	Loosestrife	x	x		x	
Eleocharis acicularis	Spike Rush	x				
Galium sp	Bedstraw		x			
Impatiens capensis	Touch-me-not	x		x	x	
Iris pseudoacorus	Yellow Iris	x				
I. versicolor	Blue Flag	x				x
Lemna minor	Duckweed	x	x	x		
Lythrum salicaria	P. Loosestr		x		x	x
Mentha cardiaca	Mint		x			x
Myriophyllum sp	Water Milfoil	x				
Nymphaea odorata	Water Lily	x				
Phalaris arundinacea	Canary Grass			x		x
Potamogeton crispus	Pondweed	x		x		
P. foliosus	Pondweed	x				
P. nodosus	Pondweed	x		x		
Sagittaria graminea	Duck Potato	x				
S. latifolia	Arrowhead	x				x
Scirpus acutus	Spike Rush			x		

Scientific	Common	Aq.	Cat	Mixed Fen		Lev.
Sparganium americanum	Burr Reed	x		x		
S. eurycarpum	Burr Reed	x				
Spirodela polyrhiza	Gr. Duckweed		x	x	x	
Typha glauca	Cattail	x	x	x	x	x
T. latifolia	Cattail	x	x			
Alnus rugosa	Alder				x	
Andropogon scoparius	Bluestem					x
Betula sp	Birch					x
Carex comosa	Sedge				x	
C. lacustris	Sedge				x	x
C. pseudo-cyperus	Sedge				x	
Circaea sp	Nightshade					x
Cirsium sp	Thistle					x
Convolvulus sepium	Bindweed					x
Cornus stolonifera	Dogwood				x	
Cyperus strigosus	Sedge					x
Eupatorium sp	Joe-Pye Weed					x
Fraxinus americana	White Ash				x	
F. nigra	Black Ash				x	
Glyceria grandis	Meadow Grass					x
Impomoea sp	Morning Glory					x
Myosotis scorpoides	Forget-me-not					x
Osmunda claytoniana	Int. Fern				x	
Onoclea sensibilis	Sens. Fern				x	
Parthenocissus quinquifolia	Virg. Creeper				x	x
Phleum pratensis	Timothy					x
Phragmites australis	Reed					x
Podophyllum peltatum	May Apple				x	
Polygonum coccinium	Smartweed				x	x
Populus grandidentata	Big Tooth Aspen				x	x
P. tremuloides	Quaking Aspen					x
Rumex crispus	Dock					x
Salix discolor	Pussy Willow					x

Scientific	Common	Aq.	Cat	Mixed Fen	Lev.
S. nigra	Black Willow			x	x
Solanum dulcamera	Nightshade			x	x
Symplocarpus foetidus	Skunk Cabbage			x	
Ulmus americana	American Elm			x	
Vaccinium corymbosum	Highbush Blueberry			x	
Vitis labrusca	Grape				x

Figure 1. Map of the area of the upper and lower wetlands in Irondequoit Creek. The solid black lines indicate the location of the permanent transect lines. Horizontal bar represents approximately 250 meters.

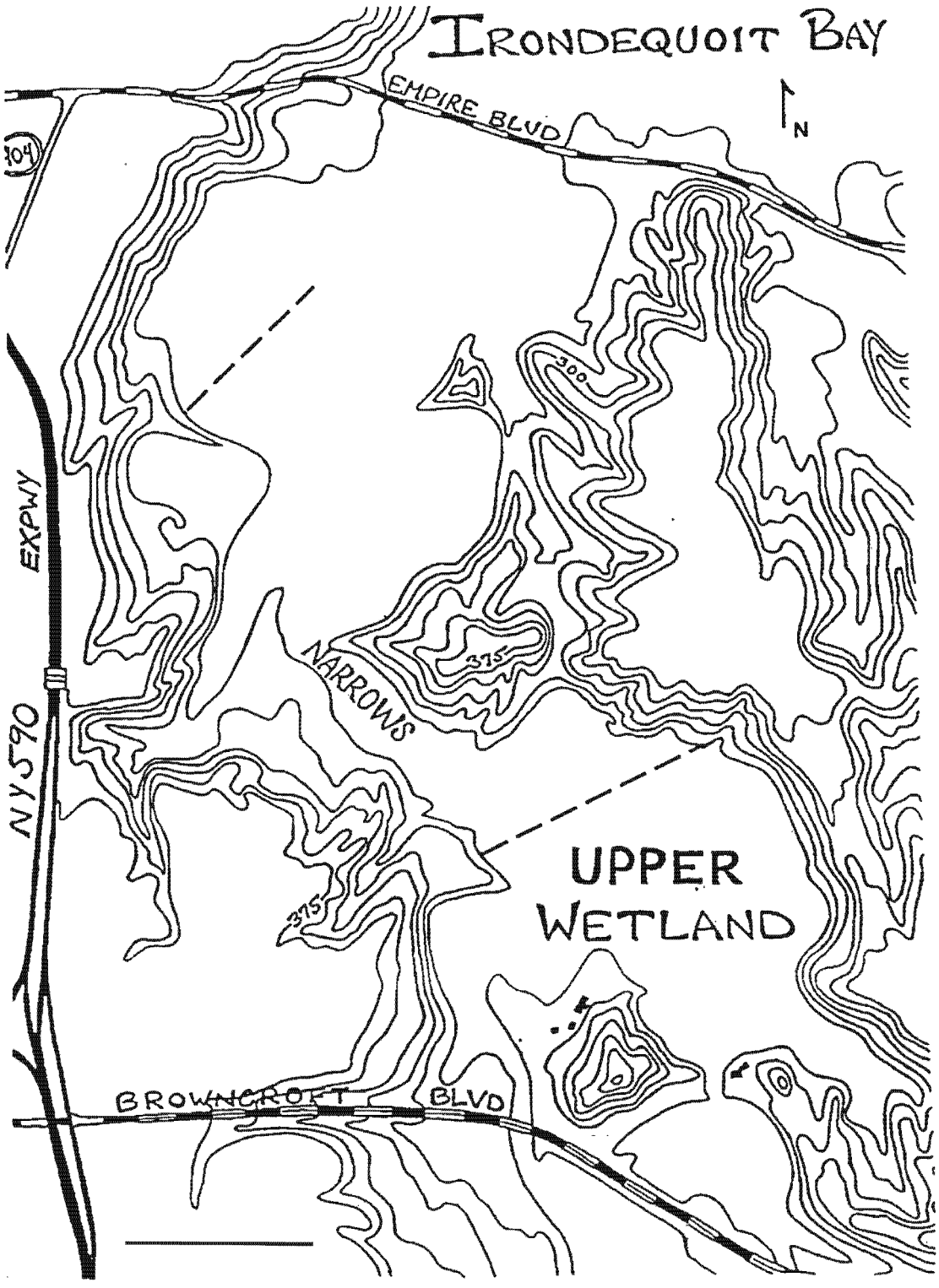


Figure 2. Plant communities in the upper wetland area of Irondequoit Creek. The key to symbols is: A, open water communities; B, cattail community; C, mixed emergent community; D, *Phragmites* community; F, fen; G, ponds; H, willow community. The communities of levees are indicated by the black areas along the streams. The line from 1-2 is a reference to illustrate the area at the narrows where the upper wetland ends and the lower wetland begins. Horizontal bar represents approximately 250 meters.

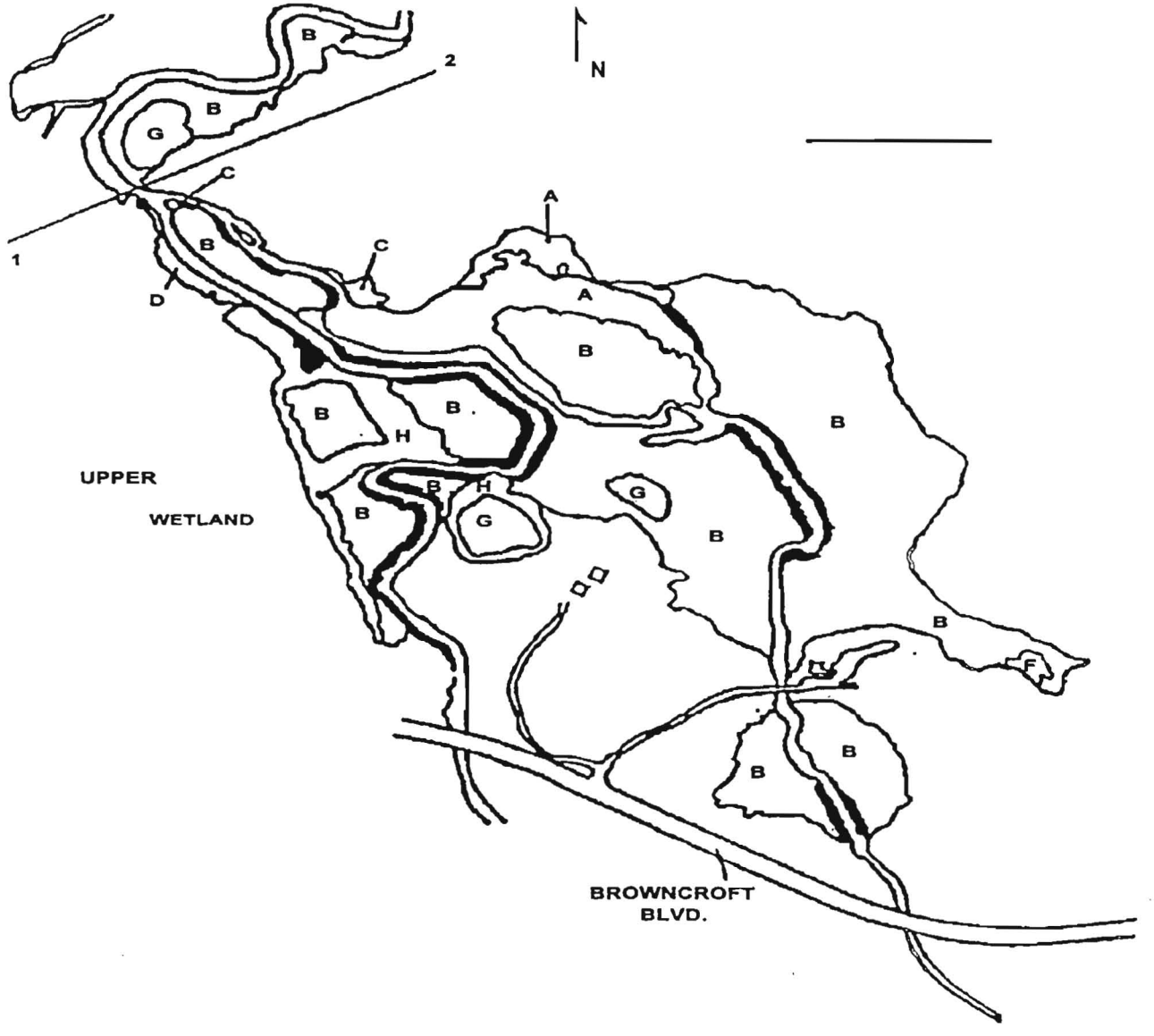


Figure 3. Plant communities in the lower wetland area of Irondequoit Creek. The letters used to denote communities are the same as in Figure 3. The line 1-2 illustrates the border between the upper and lower wetland. Horizontal bar represents approximately 250 meters.

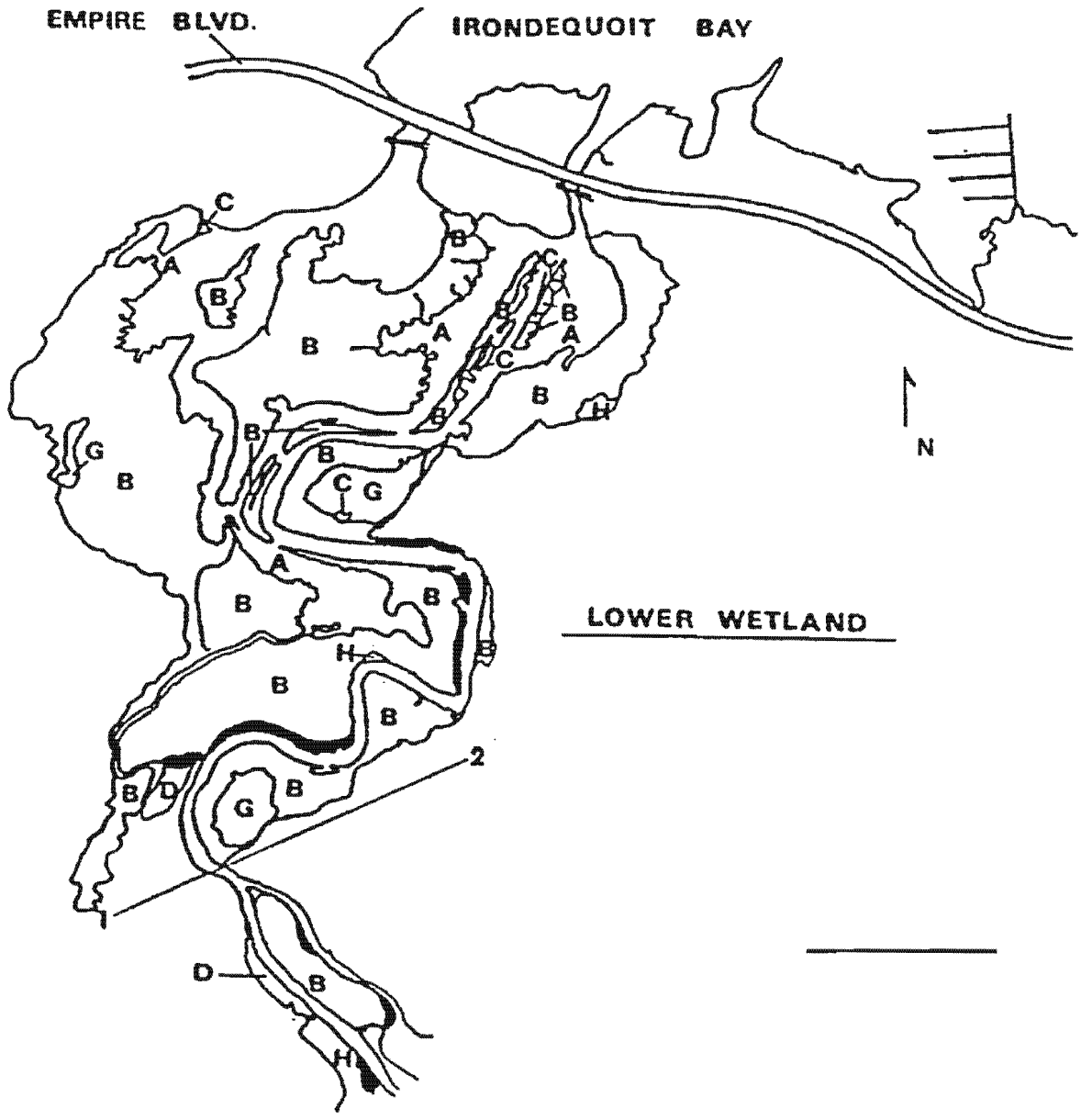


Figure 4. Dendogram based on the sample TWINSPAN classification of plots in the upper and lower wetlands of Irondequoit Creek. Symbols represent species as follows: IMCA, *Impatiens capensis*; PHAR, *Phalaris arundinacea*; CALA, *Carex lacustris*; CISP, *Cirsium sp.*; POCO, *Polygonum coccinium*; EUSP, *Eupatorium sp.*; TYGL, *Typha glauca*; DEVE, *Decodon verticillatus*; GALI, *Galium sp.*; LYSA, *Lythrum salicaria*; FLAQ, Floating Aquatics; SODU, *Solanum dulcamera*; MYRI, *Myriophyllum sp.*; MECA, *Mentha cardiaca*.

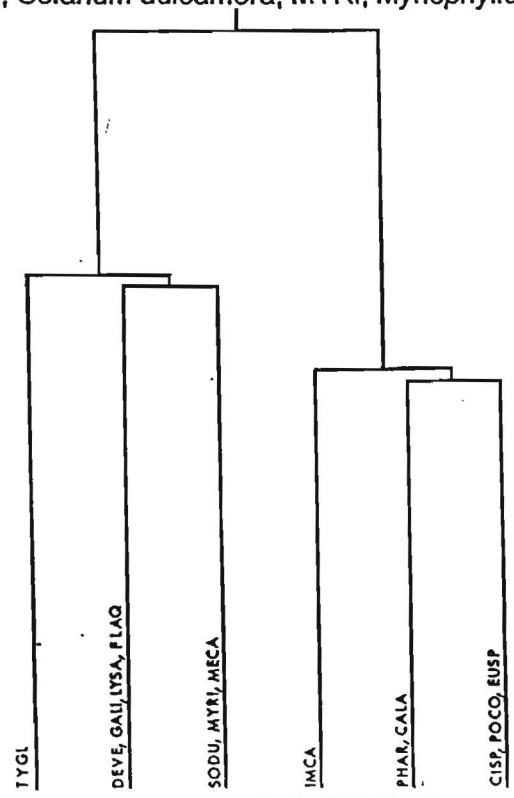
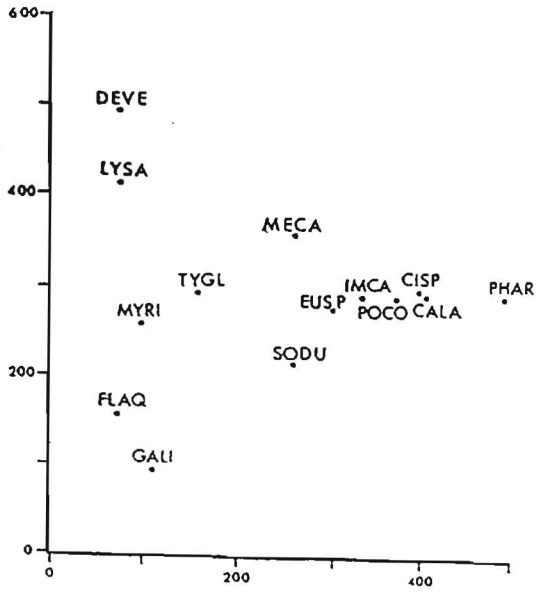


Figure 5. Detrended Correspondence Analysis (DCA) of species distributions in an ordination space. The key to species is the same as in Figure 4. Species characteristic of deep water are on the left, those of drier areas such as the levees are on the right.



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HERMAN LEROY FAIRCHILD: An Early Promoter and Defender of Meteorite Impact Cratering

by Jutta Siefert-Dudley

Introduction

Herman Leroy Fairchild's life, from 1850 to 1943, spans a time of great change in science. The geological sciences were maturing and their importance was becoming recognized. Fairchild played an active role in advancing studies of the earth - as a professor and popular lecturer, as a founding father of the Geological Society of America, an active participant of several scientific organizations, and through extensive fieldwork. Geologists today recognize him for his founding work in American glacial geology, but he made contributions in other areas as well. Fairchild's participation in the Meteor Crater controversies and his interest in earth origins are not generally well known, although *Coon Mountain Controversies* (Hoyt, 1987) has somewhat redressed that. The recognition and understanding of impact cratering in the Earth-Moon system took an important leap forward during his life time. His supportive efforts helped propel radical ideas ahead, into the mainstream of thought.

A meteorite strike near home?

One evening in 1894, at a farmhouse in Fishers, Ontario County, New York, the Woolston family heard a roar which shook their home. Had something struck the ground? A search of their property the next morning revealed a huge hole fifteen feet across and thirty feet deep. Dirt had been thrown up in all directions. Recognizing an unusual geologic phenomenon had occurred, Mr. Woolston contacted Herman Leroy Fairchild, professor of geology at the University of Rochester. The next day the professor was at the site exploring the cavity. Soil samples were taken by wagon to the university. Henry A. Ward of Ward's Natural Science Museum, and his assistant Frank Pugsley of Pittsford, dug away trying to find the meteorite presumed to have created the hole. The digging was not successful and no meteorite was ever found (Fisher, 1987).

Professors Fairchild and Ward were not unfamiliar with extraterrestrial rocks. Ward had by the early 1890s, already amassed and sold, two large collections of meteorites. In 1894 he commenced collecting for his last and greatest meteorite collection (Ward, 1904). His interest in meteorites was both commercial and scientific. Although he did not contribute papers at national scientific meetings, he later wrote a number of articles in the Rochester Academy of Science Proceedings about meteorites in his collections. Fairchild's acquaintance with meteorites at that point in time was less intimate than Ward's. However, he would have been familiar with the specimens in the university museum collection as well as the information Ward shared as a fellow member of the Rochester Academy of Science.

The impressions Fairchild and Ward had of their visit to the Fisher crater site and any subsequent studies of the collected soils remain unknown to us today. Diligent searches for references to this site in their personal papers, archived at the University of Rochester, have been unfruitful. The exact location of the former hole is no longer known since it was filled in over the years and has since became part of a housing development. One can question whether the pit was of meteoritic origin, since collapse and even cave-like features have occasionally been reported in this region of the Irondequoit valley (Fisher, 1987). With

active gypsum mines not far away, it is conceivable that solution of underlying gypsum deposits caused the Pleistocene sediments to collapse on the Woolston farm.

It is likely that Fairchild's interest in craters had already been piqued, since two years earlier he had invited Karl Grove Gilbert to speak on such a topic at a gathering of the Rochester Academy of Science (Fairchild, 1892a). The former University of Rochester student, originally a math and classics major, became a geologist after becoming inspired by this field while clerking for Henry Ward. Now a chief geologist for the United States Geological Survey (USGS), Gilbert spoke of his investigation of a huge crater in Arizona, only recently made known to science. The Arizona feature, known as Coon Butte or Coon Mountain to the locals, would, years later, become the focus of a scientific controversy. Fairchild would become more than a bit player in the exchanges that took place. This enigmatic hole in the ground and what it represented for planetary processes would engage his attention and study sporadically over several decades.

A crater surrounded by meteorites is brought to the attention of geologists.

Gilbert heard about the crater in northern Arizona in 1891 from A. E. Foote, a mineral dealer who first recognized the meteoritic origin of the irons strewn around it. Foote wrote about the meteorite finds and commented that no volcanic products were to be found near the crater (Foote, 1891a). The implication of these observations was noted by Gilbert during Foote's subsequent presentation to the American Association for the Advancement in Science in 1891. Following the lecture, Gilbert suggested that the crater had been created by a "small star" and was similar to the impact depressions on the moon (Foote, 1891b; Gilbert, 1896).

Although meteorite studies had for a century been acceptable topics of study, impact cratering studies were yet in their infancy and still on the fringes of acceptable scientific pursuit. First hand experiences with impacting meteorites was limited, and observations often reported the formation of relatively shallow depressions - not deep craters. The Earth's craters were recognized as being of volcanic origin (unless they were sink holes), so impact cratering was studied primarily in relation to lunar topography. Nevertheless, the prevailing theory among astronomers held that lunar features were also of volcanic origin.

The opportunity to compare the Arizona crater with lunar craters appealed to Gilbert. He sent his assistant, Willard Johnson to investigate. Johnson reported back that the Coon Butte crater was likely of volcanic steam explosion origin. This conclusion assumed the meteorites on the surrounding plain were coincidental. Perhaps not satisfied with this conclusion, late in 1891, Gilbert decided to see for himself. He was accompanied by Marcus Baker of the US Coast and Geodetic Survey, an expert on magnetic observations. While at the site, Gilbert gathered evidence for two opposing hypotheses-steam explosion and meteoritic impact (Gilbert, 1892, 1893a, 1896). They surveyed the site topographically, geologically, and magnetically for two weeks. Another two weeks were spent in the nearby volcanic San Francisco peaks area, for comparative studies. Collected samples were later studied by petrographers and chemists at the Survey. A promised report on Coon Butte never materialized but his conclusion was shortly made public.

Gilbert described the Coon Butte investigation at professional meetings in Washington, D.C. and again in August of 1892 while attending the American Association for the Advancement of Science meeting in Rochester, New York. His presentation was at the invitation of Fairchild, and under the auspices of the Rochester Academy of Science. Entitled "Coon Butte and the Theories of its Origin," the lecture was advertised as being accompanied by lantern slides (Fairchild, 1892b). He also brought with him a contour model of the crater which he left for the University of Rochester museum (Fairchild, 1892c). None of Gilbert's presentations were published, so the details are unknown. Fairchild remembered years later that Gilbert had favored the volcanic steam hypothesis during the Rochester lecture (Fairchild, 1928b). His speeches must have formed the nucleus of an important presentation and paper that would follow three years later.

Gilbert repeated his conclusion in an address to the Washington Academy of Science in 1895. His presentation and subsequently published paper "The Origin of Hypotheses, Illustrated by the Discussion of a Topographic Problem," revealed a marvelous adherence to the multiple working hypothesis principle promoted by Thomas C. Chamberlin and the scientific method. His main theme was that "tentative explanations are always founded on accepted explanations of similar phenomena" (Gilbert, 1896). His readers and listeners were treated to his use of analogy to form hypotheses using the Arizona crater investigation as a case study.

Understanding that the irons found near the crater were meteoritic, Gilbert envisioned a falling body from space impacting the earth. The idea was conceived from a model of solar system origin that described planet formation as the falling together of many small celestial bodies. Also, the craterform features left by raindrops in mud or projectiles fired into steel, were analogous to what an infalling asteroid might create on a larger scale. On the other hand, an explosion caused by steam, as concluded by Johnson, was also likely in the context of the volcanism exhibited in the region. It was these two hypotheses that Gilbert wanted to test.

The crucial test, Gilbert believed, would be the absence or presence of a buried extraterrestrial mass. He believed an impact would leave a buried mass below the crater. Lack of such a mass would bolster a volcanic steam explosion origin. Based on these assumptions, Gilbert planned to make several observations. The contents of the rim debris should theoretically be greater than the hollow left behind if a buried "star" is below. Making such a quantifiable observation should prove satisfactory in solving the problem. Since the meteorites in the region are of iron, he assumed the buried mass would be also. He reasoned that detection of the buried iron could be accomplished with a magnetic dip needle, as was done by prospectors in northern Michigan.

A magnetic survey found no variation in direction or intensity in or near the crater. Tests of the equipment later revealed that any buried meteorite must either be much smaller than the crater or buried very deeply. The topography of the area was mapped with an interval of ten feet. This allowed calculations of the volume of rim material and the hollow. The results showed they were equal. The test results seemed to rule out the meteoritic hypothesis. "I did not find the star because she is not there" he later told William M. Davis (Davis, 1926). Little was said about the observations which led to the conclusion that the steam hypothesis was valid. Gilbert mentioned that calculations of the energy released by the heating of water in the sandstone revealed that it could eject fragments to the surrounding plain. Analogies were made to volcanic explosions, in particular to the catastrophic steam events in Japan of 1888. Since the Arizona crater lies close to a volcanic region, this analogy seemed logical. Further analogies were made with the maars of Europe and India which were believed to be of cryptovolcanic origin.

Since the marriage of two ideas is often satisfactorily merged into one hypothesis, Gilbert credits Warren Upham for proposing in 1894 that underground conditions at the Arizona site were ripe for an explosion that was triggered by the impact of the bolide. However, Gilbert firmly dismissed this theory as depending too much on coincidence.

At the end of his 1896 article, Gilbert brought forth some points made by Edwin E. Howell who had studied a collection of meteorites from Coon Butte. The irons are individuals and not broken fragments Howell observed. He inferred they should all be connected somehow and suggested that they arrived in a large stony meteorite. Therefore, if like "plums in an astral pudding," the buried "star" might not attract a magnet even if very large. In addition, the shock of impact may have compressed the rock strata below, thereby occupying less space. Gilbert freely acknowledged this would invalidate his original argument. He pointed out that when a conclusion becomes unsettled, it illustrates the tentative nature of both hypotheses and the results of science.

Gilbert's declaration of a volcanic steam origin were heard louder than his admission of possible error. His reputation as a fine geologist with the U.S. Geological Survey solidified this conclusion in many scientist's minds. This mind-set would slow down the revolution

that would eventually break the volcanism paradigm that attempted to explain terrestrial and lunar craters.

The volcanism paradigm

By the early 1800s most scientists had accepted the idea of rocks falling to the Earth from space. That these rocks could be large enough to create craters on the moon or earth, however, was not yet generally accepted. Craters from known meteor falls were relatively shallow, so lack of experience with major falls tempered the scientists' imaginations. On the other hand, craters formed by volcanic activity were well known on the Earth. It seemed reasonable to assume that lunar craters could be created in similar fashion. In the 1830s and 1840s several renowned selenographers and geomorphologists produced works that authoritatively established the volcanic origin of the lunar craters (Marvin, 1986). An impact explanation given by Franz von Paula Gruithuisen in 1829 was not popular but, astronomer Richard A. Proctor revived the impact theory in 1873 in his book *The Moon*. Proctor reasoned that meteoritic downfalls could have created the lunar landscape because the solar system was thought to have been created by collisions between planetesimals (Marvin, 1986). This was an idea that would capture the attention of Gilbert as well as Fairchild and other earth scientists, as they attempted to explain the origin of the Earth-Moon system. Although careful scrutiny revealed differences between lunar and terrestrial craters, few were willing to give up a known process. The alternative seemed too incredulous.

Gilbert's study of Coon Butte led to research on volcanism and lunar craters (Gilbert, 1893). Careful analysis of lunar craters and impact cratering experiments confirmed his conviction that lunar craters were of impact origin. He came up with an ingenious explanation for lunar craters. He envisioned the newly forming earth as being surrounded by a ring of moonlets which further accreted to form the moon (Hoyt, 1987, Ch. 3). The last rocks to fall created the lunar topography we see today while on the earth, erosion had long ago destroyed evidence of such impact (Mark, 1987, p. 28).

Gilbert's astronomical studies were short-lived and not generally known or appreciated by astronomers (Baldwin, 1949, p 64). Since many influential astronomers believed volcanism explained the lunar topography, knowledge of Gilbert's work would not have changed their way of thinking, just as the work of others in this regard had been disapproved. His foray into lunar studies however was later emulated by his geological contemporaries, Fairchild and Daniel M. Barringer, who would eventually follow Gilbert's footsteps to the Arizona crater.

Gilbert's lunar impact idea, minus the moonlets, was mentioned as a footnote in the popular earth science text *Geology* by T. C. Chamberlin and R. Salisbury (1905, p. 598). These authors imagined the lunar craters as being of an unusual volcanic class similar to Coon Butte. Most geologists were hesitant to join Gilbert in his acceptance of lunar impact cratering. On the other hand, most were willing to agree with his widely known volcanic steam origin conclusion for Coon Butte. The volcanism paradigm had not yet run its course.

A meteoritic origin for the Arizona crater is defended

Daniel Moreau Barringer, a mining engineer and geologist, heard about Coon Butte in 1902 while in Tucson. Samuel J. Holsinger told him the locals believed it had been created by a meteorite. One of them, a local trader named Volz, had been collecting and selling the Canyon Diablo irons scattered across the plain. He had told Holsinger that there should be a meteorite in the crater. The idea of a possible commercially extractable nickeliferous iron mass below the ground intrigued Barringer. Back home, in Philadelphia, he and his physicist friend Benjamin Chew Tilghman, were convinced by the specimens they received from Holsinger, that claiming the site for mining would be worthwhile. In 1903, Standard Iron Company was formed, claims were filed, money was raised, and drilling began, with Holsinger as operations manager. Geologic observations at the macroscopic and microscopic

level indicated that no volcanic explosion was possible. A formal letter submitted to the Academy of Natural Science of Philadelphia in September 1905, established their claim that Coon Mt. was of impact origin. They followed up with articles of their findings in the Academy proceedings (Barringer, 1905; Tilghman, 1905). The two articles, in direct opposition to Gilbert's previous findings, started what is called the "Coon Mountain controversies" (Hoyt, 1987, p. 89). The debates (first over origin, then, regarding the disposition of the meteorite) would essentially end by 1930. Even so, acceptance in some quarters lingered until the dawn of the space age!

Barringer believed the geological evidence collected at the site refuted the steam explosion theory of Gilbert. After a thorough description of the topography and geology in the 1905 publication, Barringer discussed several theories of crater origin. Lengthy points of refutation were given against volcanic or steam explosion hypotheses while the impact origin was advanced. The geologic evidence for meteorite collision was overwhelming. Within the crater, the originally horizontal strata of the Colorado Plateau were uplifted and tilted. In some places sections were thrown out and overturned. Fragments of the strata from depths of 1000 feet were strewn concentrically around the rim and beyond. Huge blocks were found up to a mile away. Very fine silica powder, angular in shape, lay in huge quantities around the rim and in the crater. Meteoritic irons were found concentrically arranged about the crater. "Shale balls," or magnetic iron oxide nodules, were found admixed with other fragments around the rim. The hummocky topography around the crater showed evidence of having flowed as in a splash.

Tilghman refuted the calculations of Gilbert, finding the rim debris to be much less than the volume of the hole. His experiments with broken up magnetite revealed that the absence of a magnetic anomaly could easily be explained by the presence of many meteoritic fragments in the basin. He showed that the iron oxide fragments (shale balls) were chemically similar to the Canyon Diablo irons. They also exhibited typical features of iron melted in flight. Tilghman described the powdered silica, as well as the crushed and fractured strata, as being created by a powerful blow. Experiments with projectiles were described and the roundness of resulting craters, regardless of the angle of penetration, was demonstrated. Drilling deep into the crater showed that meteoritic material was present. Tilghman concluded his article with estimates of the age of the crater as well as the size of the meteorite. He indicated that the object must not have been retarded by the atmosphere, but struck at cosmic velocity.

These facts were significant in establishing the validity of their impact hypothesis and were incompatible with the currently favored steam explosion idea. Nevertheless, these facts were criticized or ignored by those who preferred the less outrageous steam theory, or just preferred to follow in the footsteps of influential USGS geologists.

Fairchild is initiated into the crater controversy

Fairchild visited the far west during the summer of 1906. He wanted to see the effects of the great earthquake in California and planned to attend a meeting in Mexico City later. His long time friend, John Casper Branner of Stanford University, had just been to the crater in Arizona and was quite intrigued by the meteoritic evidence that contradicted Gilbert's findings. Branner was a friend and mentor of Daniel M. Barringer whom he'd met in 1890 when Barringer served as his geological apprentice in the Arkansas Geological Survey (Hoyt, 1987, p. 75). More recently, Branner had also made the acquaintance of Gilbert as they served on a post-earthquake commission together. Branner urged Fairchild to visit the crater while he was in the region. This was surely an opportunity Fairchild did not want to pass up.

With its awesome expanse of more than 4,000 feet across, and a depth of 570 feet, the Arizona crater impresses even the most jaded tourist today. One can imagine Fairchild's exuberance and eagerness to learn what created this world wonder. By 1906 few people had seen the crater and even fewer had stayed to study it. Fairchild had only two days to examine

the geology, but what he saw and heard from site manager Samuel J. Holsinger, convinced him the great depression had been created by impact.

The 10th International Geologic Congress (IGC) was held in September in Mexico City, shortly after Fairchild's visit to the crater. As a delegate to the conference, Fairchild willingly brought the attention of the IGC attendees to the new findings. He took geologic samples along and passed out a dozen of Barringer's paper which had been mailed to him in Mexico City. Renewed interest in the crater was certainly generated among the geologists due to Fairchild's enthusiasm and stature as a professional colleague. By that time, at age 56, Fairchild had contributed at least forty articles to the geological literature and was serving as Secretary of the Geological Society of America (GSA).

Frequent correspondence with Holsinger, his host at the crater, ensued after his visit. Holsinger was given permission by Barringer to give Fairchild any photos or information he desired (Holsinger, 1906a). Until his death in 1911, Holsinger would send him specimens, update him on their drilling progress and exchange prints or lantern slides. They would engage in friendly discussions over the nature of the bolide and the impact, the samples and the contrary opinions of the "enemy forces" (D. M. Barringer's term for the USGS scientists and others who opposed the meteoritic origin).

Barringer and his partner, Tilghman, were anxious to share their ideas with Fairchild since they had heard of his plans to read a paper about Coon Butte at the upcoming GSA meeting in New York. They wished to continue fostering his support but wanted assurance that his views aligned with theirs. He was invited to Philadelphia to meet with them. Apparently at this meeting Fairchild brought up the idea of a steam explosion created by heat generated by the impact. This "percussion cap theory" as Barringer called it, was not to his or Tilghman's liking. Both men wrote long, detailed letters to Fairchild explaining why this idea was not compatible with mechanics or the geological facts. He was encouraged to consider carefully all that they had presented to him, before committing himself to a combination theory of meteoritic impact and steam explosion (Barringer, 1906c; Tilghman, 1906). Fairchild's reaction was probable bemusement since he replied: "The energy with which you two men attack the fascinating problem is exceeded only by that of the projectile which made the hole. But I am sure that much more heat was generated by the impact than will be aroused by our correspondence" (Fairchild, 1906b). He feared that his suggestion for explosion (based on Upham's original concept) was more "prominent and argumentative" than he felt. However, Fairchild defended his suggestion due to his concern that a buried meteorite might not be found (Fairchild, 1906a; Fairchild, 1906b). He recognized that to be prepared for such a possibility, an explanation for an explosion should be considered. It was a rational suggestion since a considerable number of holes had been drilled inside the crater and no definitive proof of a buried mass had been provided. Even Holsinger admitted to Fairchild, that based on their conversations and an article he'd read by Henry Ward on the Bath aerolite, he feared in his heart "that the meteor exploded and that all that remains of it is the wreck that is scattered over the plains." He realized this view was contrary to his commercial interests at the crater and were in conflict with his "great desire to possess the largest meteor in the world" (Holsinger, 1906d).

Origin of shale balls a clue to the nature of the bolide?

Among the intriguing features at the site were the plentiful magnetic iron "shale" fragments and "shale balls." Their appearance was different from the Canyon Diablo meteorite specimens that people had been collecting for years at the site. Shale balls occurred as fragments, curved flakes with a laminated structure, globular lumps, or were found encrusting irons. Their origin and relation to the CDs was a source of speculation. It was discovered that when those with iron centers were exposed to air, they disintegrated into iron oxide. The elemental composition of the iron shales was found to be similar to the Canyon Diablo specimens. Barringer believed the iron shales were produced by heat as the iron meteor passed through the atmosphere, and formed part of the luminous tail of the

meteor. He described them as being like "flaming drops" which may have encountered and been smothered by the silica and rock being ejected from the just created hole (Hoyt, 1987, p. 92, 95).

Branner admitted to Barringer that being without expertise in mineralogy, he had no clue about the origin of the enigmatic iron shales. He reported that Oliver C. Farrington, meteorite expert at the Field Museum of Natural History, believed they were of meteoritic origin but didn't think it mattered whether the lumps were "fused drops" or "fragments broken from the sides of a hot penetrating mass" (Branner, 1906). Farrington suggested the shale balls were simply irons oxidized by burial. George P. Merrill of the Smithsonian, on the other hand, said the sulphur-chlorine-rich individuals became oxidized upon exposure. To relate the two types of meteoritic irons found at the site he proposed a modification of Howell's "plums in a pudding" hypothesis. The iron "plums" in an oxidizable "pudding" might have arrived as a heterogeneous mass of nickel-iron with segregated masses of easily weathered stony material (Hoyt, 1987, p. 122).

Holsinger sent Fairchild samples that he believed showed signs of fusion-cementation as related to the "flaming drops" hypothesis previously described. This was in response to Henry Ward raising the question of oxidation-cementation as an alternative explanation (Holsinger, 1906b). Fairchild was not satisfied that the samples showed fusion and Holsinger obliged by sending more. Holsinger told Barringer that Fairchild "...must put his hands in the nail prints. I think these specimens will convince the most doubting Thomas. But I think Prof. Fairchild is really convinced already but he wants absolute proof" (Holsinger, 1906c). However, upon inspection of these additional samples, Fairchild declared they did not prove fusion since they were hydrated to limonite. He believed that while "fusion products exist there, they are probably so changed by subsequent oxidation that it may not be proven" (Fairchild, 1906a). In addition he noted that it was unlikely the unchanged irons (Canyon Diablo siderites) had been kept dry at the surface while the changed specimens (iron shales) rusted due to burial. The nodular, laminated forms were "probably given that form by swelling and cracking due to absorption of O and H" he stated.

In December of 1906, Fairchild was ready to present a paper on the origin of Coon Butte to the GSA, that would reject the volcanic steam explosion hypothesis. Correspondence with the Standard Iron Co. men, analysis of specimens, and the study of geologic maps and photographs of the site had prepared him well for the presentation. Fairchild's presentation may not have been completely to Barringer's liking since he left open the question of the meteorite's composition and its disposition. Fairchild wondered about the relation between the irons and the different types of iron shales. Did they represent two falls? Did they grade into each other, representing variations in composition or different hydration circumstances of one huge bolide? If the latter, Howell's astral "plums in a pudding" idea might be relevant, even though extraterrestrial stony material had not been found at the site. Whether part of the wrecked bolide would still be found under the crater was an open question that only further drilling might answer (Fairchild, 1907).

Coon Butte is renamed by Fairchild

"I am going to make an effort to change the name of your dent in the earth" Fairchild revealed to Holsinger. "Is the raccoon found at all in Arizona? How did the place ever get such a silly name? Do you think of a better name than METEOR CRATER?" he asked (Fairchild, 1906a). Barringer had already agreed the new name, Meteor Crater, was more meaningful than Coon Butte or Coon Mountain (Barringer, 1906b). It was at the GSA meeting that Fairchild formally suggested a name change. The new name was quite well received since it had a nice ring to it and described its generic origin. Better yet, it agreed with the name of the nearest post office, Meteor, which Barringer had established not long before, at the Sunshine flag stop on the railroad. Although the name Meteor Crater became increasingly popular in use afterwards, the term Crater Mound was the official name from 1932 to 1946. This was due to the zealous efforts of Nelson H. Darton, a firm believer in the

crater's terrestrial origin. Since 1950, meteoriticists have recognized the scientific work of Barringer by referring to it as the Barringer Meteorite Crater. Although meteorite crater is technically more correct, Fairchild's original name has stuck to this day.

Fairchild defends Barringer's contributions

Fairchild's early recognition of the impact theory along with other supportive scientists, helped focus the debate toward the nature of the bolide and its fate. Geological clues and calculations mounted over the years to support the idea of an explosive interaction between a bolide and the earth. Scientists with expertise in mechanics became involved in the debates. Fairchild made no direct contributions to these discussions for many years. The cessation of drilling between 1908 and the early 1920s, and in particular, the untimely death of Holsinger in 1911, coincide with Fairchild's formal silence. Fairchild had infrequent contacts with Barringer during this time but delighted the latter with his continued interest in the crater (Barringer, 1915).

Fairchild was abruptly brought back into the crater saga more than once by the continuing trials and tribulations of Barringer and the Standard Iron Company. In 1926, Barringer had to convince the State of Pennsylvania that soliciting Pennsylvania stockholders into the enterprise in Arizona would not be misleading. He relied on supportive letters from his allies, including Fairchild, and eventually won the right to sell stock. Fairchild's formal statement, to be used in court, verified that the crater was of impact origin and that "scientific men are no longer in doubt." He admits uncertainty as to "whether any of the meteor remains in the ground" but expressed hope that Barringer would have help in the search and overcome any opposition (Fairchild, 1926). The negative implication of his comments caused Barringer to realize he hadn't informed the professor of their latest discoveries and sent him many pages of drill logs along with a paper he'd written (Barringer, 1926). It is unlikely that Fairchild's opinions were changed by the reports of buried shale balls, drills stuck in meteoritic material, etc., having expressed doubts since 1906 about the existence of any significant quantity of meteorite remaining in the crater.

In 1928, Barringer sought Fairchild's support one last time. An article by William Boutwell had appeared in the *National Geographic Magazine* that implied, by omission of information (i.e. Barringer and colleagues' work at the crater), that G. K. Gilbert of the USGS had discovered the impact origin of the Arizona crater. Barringer was terribly upset by this insult. "I ask you to come to my rescue" he wrote to his long time supporter (Barringer, 1928). Fairchild responded by immediately writing to Gilbert Grosvenor, the editor, and then to John Edson, the chairman of the Board of Trustees, a few months later. His assertive letters clearly stated Barringer deserved credit for discovering the meteoritic origin of the crater (Fairchild, 1928a, 1928b).

Fairchild stated his belief that the late Gilbert knew he had made a mistake in concluding a steam origin and would, if he could speak now, say that Barringer deserved the credit for recognizing its meteoritic origin (Fairchild, 1928b). His assessment of Gilbert's beliefs were based on the fact that Gilbert never spoke against the impact theory after Barringer's and Fairchild's papers had been published. In addition, Gilbert had privately given Branner, back in late 1906, the impression that this new information changed the conclusions he had drawn regarding the crater. Branner had shared this with Barringer and he in turn with Fairchild (Barringer, 1906a).

The incident with the National Geographic was symbolic of a problem that had been building for over two decades. Careful scientific endeavors by a significant group of geologists had validated the claim that the crater was of impact origin. Yet, something important was missing - official recognition of this work from the top geologic institution - the USGS. Support from geologists associated with the survey was either negative, non-committal, or only privately positive. The official silence of the USGS, to what seemed like incontrovertible evidence for impact, frustrated those who believed in this origin.

A flurry of correspondence from Barringer's supporters brought few replies and no correction or retraction from the National Geographic Society's board of trustees. Barringer was then encouraged to write a letter to *Science* which would be followed by an article from Fairchild. Fairchild knew that as a former long time friend of Gilbert, it would be appropriate for him to speak his mind (Fairchild, 1929a). Although the editor did not accept Barringer's letter, he did publish Fairchild's article in May, 1929 (Hoyt, p. 255). Fairchild questioned the scientific and journalistic ethics of the National Geographic by not crediting Barringer for his contributions to the crater studies, and attributing them to Gilbert and the USGS instead. He also criticized the attitude of the survey which had from 1893 by its silence, held to the steam explosion hypothesis by ignoring the work of other scientists since Gilbert. He ventured to suppose the chief reason for ignoring the truth was the fact that "an eminent and beloved member of the survey" had made a mistake. He further supposed that "confession by the survey will of course be painful." and that "...evidence of humility and admission of fallibility by a great bureau of the government would be something new." (Fairchild, 1929b). A statement from the National Geographic or the USGS never appeared. Their silence would not be broken until several more decades passed and government associated geologists would once more reappear to study Meteor Crater.

Explosion of bolide accepted

Fairchild's condemnation of the two well known institutions marked a turning point in the Meteor Crater and impact cratering studies. Lack of support from the USGS was offset by the interest of certain astronomers and physicists who joined in the Meteor Crater studies. A quiet but intense debate concerning the size and velocity of the meteorite, and its dynamics in the atmosphere and lithosphere began (Hoyt, 1987, p. 264). Heated correspondence was exchanged between eminent physicists, geologists and astronomers. The calculations of astrophysicist Ray F. Moulton, addressed in several reports, gained repute and Barringer was shaken by them. Moulton confidently showed that a meteorite or a swarm of meteorites with a mass less than most presumed, struck at cosmic speed. The shock of impact pulverized and vaporized both strata and meteorites, which were violently thrown out. An incredible explosion had occurred after all. One of the debaters on the losing side facetiously agreed: "It's a hell of a big hole and it was made by a hell of a big thing!" (Hoyt, p. 317).

It was in the midst of the debate that Barringer died, late in 1929. After writing a paper recognizing the work of Barringer, Fairchild prepared another article about Meteor Crater for publication (Fairchild, 1930). The fate of the bolide that created Meteor Crater was an interesting problem that he wanted to address. He submitted his manuscript to the Barringer sons and astrophysicist Moulton for comment. Because he emphasized the explosive fate of the bolide, the Barringers did not agree with Fairchild's conclusions, while Moulton only questioned that the meteorite had been stony (Barringer, B., 1930; Barringer, D. M. Jr., 1930; Moulton, 1930)

Fairchild questioned whether the bolide could penetrate itself deeply under the southern wall as claimed by the Barringers (Fairchild, 1930). The Barringers on the other hand, couldn't see evidence for a violent explosion (Barringer, B.,1930; Barringer, D. Jr., 1930). They also held that the bolide had been a swarm of irons, best described as a comet. The elder Barringer had first described it as such before the expected arrival of Halley's comet. In this model the rounded iron nodules were explained as having been abraded in the cometary swarm, while the pits in the irregular Canyon Diablo irons were explained by oxidation. Fairchild claimed the latter irons were undecomposed segregations from vanished material - either stony or oxidizable iron. The nodules, he implied, were oxidized irons intimately associated with the irons, i.e. the irons were nuclei of shale balls. But the Barringers noted that known siderolites (stony-irons) contain only irregular inclusions, not rounded ones. The perishable nature of some meteorites was pointed out by Fairchild using an example of a typical Canyon Diablo that had disintegrated to powder in his university collection. Because of the perishable nature of meteorites and the significant outnumbering

of stony falls to iron falls, Fairchild (1930) felt confident in proclaiming that time had erased most of its mass.

Moulton shared with Fairchild some results from his meteorite impact computations regarding kinetic energy, resistance at penetration, and the explosive results. "Your conclusion reached by a different train of reasoning are in a general way in harmony with my own" he agreed (Moulton, 1930). Fairchild kept Moulton's figures in mind when he wrote about the affects of the meteor's kinetic energy which resulted in shattering of the strata, the meteorite and the formation of intense heat. The fusion of the pulverized Coconino sandstone into a glassy material, and the nickel-iron stains from vaporization were proof of the latter. The saturated water in the porous sandstone must have expanded rapidly after initial compression. Therefore, Fairchild brought in steam explosion as a major factor in the expulsion of the rock. His earlier thoughts, once disparaged by Barringer and Tilghman, had once again resurfaced. The argument had ironically come full circle; the explosion as recognized by Gilbert so many years previously, but from the wrong cause, was once again being advocated.

The Planetesimal Theory captures the imagination of the Meteor Crater proponents

Modern concepts of solar system origin are based on several basic hypotheses advanced in the last two hundred years. Pierre Laplace's nebular hypothesis has enjoyed popularity since 1796. In the 1880s, J. Norman Lockyer's description of the origin and evolution of celestial bodies included collisions between swarms of meteoroids. At the turn of the century, another concept was explored by geologist T. C. Chamberlin, and astronomer, Forest R. Moulton. Their planetesimal hypothesis described the falling together (accretion) of the solar system bodies from matter that had been torn from the sun as it nearly collided with another star. The older nebular hypothesis proposed that the planets formed from superheated gases that first coalesced into liquids, then solids. It followed from this theory that as the earth cooled, it shrank, producing basins and mountains (Dawson, 1873, p. 7-14). The new planetesimal hypothesis on the other hand, described the planets as growing by cold accretion. Gilbert, as described earlier, had originally envisioned the Arizona crater being formed by a late arriving planetesimal and had later created the moonlet hypothesis based on a planetesimal concept.

Fairchild's acceptance of the planetesimal hypothesis manifested itself first in finding explanations for earth processes, and much later, to explaining the lunar surface. Fairchild believed the cold accretion process, if true, demanded rethinking about certain earth processes. So he presented a paper at the GSA meeting in St. Louis in 1903 in which he discussed the possible changes in geological thought that would come about by accepting this hypothesis over the nebular concept. Fairchild's anticipated publication of "Geology under the new hypothesis of earth-origin" met with disapproval from at least two of Chamberlin's friends. Apparently Chamberlin had not published a detailed account of his view, so they felt this should come first. Claims were made that Chamberlin did not approve of Fairchild's paper (Leverett, 1904; Russell, 1903). Fairchild had indeed received approval from Chamberlin, who stated the paper was a "...clear and effective statement and my only suggestions relate to minor points." He realized Fairchild had brought out some features and applications that differed from his own conceptions, but variations in view "are as inevitable as they are desirable," he said. He even appreciated Fairchild's enthusiasm (Chamberlin, 1903).

Fairchild was embarrassed by all the uproar and reminded those in GSA withholding publication, that his paper was not a discussion of the hypothesis itself, but the hypothesis' application to solving geologic problems. Only he was responsible for its contents, not Chamberlin (Fairchild, 1904). The paper was published that year in several journals and included a discussion by four other scientists.

Fairchild would once more publish in reference to the planetesimal hypothesis, but not until 1938. Suffering from vision loss, he nevertheless produced, at age 88, "Selenology and

Cosmogeology; Cosmic and Geologic Import of the Lunar Features" (Fairchild, 1938). In this paper he made connections between the origin of the solar system, the lunar topography and Meteor Crater. He excused himself for "trespassing in the astronomic field" since geologists have "some reasonable ideas in selenology." He was referring to the contributions of geologist T. C. Chamberlin, who with Moulton, had supposedly overthrown the nebular hypothesis. Perhaps he also thought of, without mentioning, the earlier selenology contributions by his fellow geologist G. K. Gilbert, or even those of D. M. Barringer.

Gilbert's lunar studies in 1893 as discussed previously, resulted in some unique insights but had no impact on the prevalent way of thinking. By 1912, Barringer too was convinced of lunar cratering by impact and in the ensuing years would draw analogies between lunar craters and Meteor Crater (Hoyt, 1987, p. 157). In the 1920s he wrote a few articles about lunar cratering, one of which he requested Fairchild to critique. His goal, he explained to Fairchild, was to stimulate an interest in lunar topography among geologists. He believed that too many geologists, not caring much about the moon, followed the lead of astronomers who had "made up their minds long ago that the craters, etc., on the moon are the result of volcanic activity." The planetesimal theory, he thought, was upheld by the validity of impact cratering. He was convinced that geologists who studied the moon well, would reach the same conclusion as he had (Barringer, 1925).

Fairchild's 1938 article, was his last and 264th published paper (Tinkler, 1962). In it he continued to uphold the planetesimal theory of Chamberlin and Moulton, and used Meteor Crater as a terrestrial feature that could be compared with lunar craters. The article stated lunar craters were created by impact and were "ocular confirmation" that "planets were built by cold accretion" which "implies acceptance of the planetesimal hypothesis". He made the point that earth and moon studies had been retarded because of the adherence to a mistaken concept - Laplace's nebular hypothesis. He espoused the idea that geology favors the cold accretion concept of the newer cosmology. In a letter to Moulton, before the paper's publication, Fairchild with some humor wrote: "We must believe our earth was not in a hot, molten state, but in a cold, Moulton state!" (Fairchild, 1938a).

Moulton and Fairchild discussed what difference, if any, impacts on solid rock versus lose material might have. At that time it was assumed the moon was composed of unconsolidated materials. Fairchild had assumed an impact on solid rock, as happened in Arizona, would result in an explosion, while impact on the moon would result in the burial of a bolide. Further evidence for bolide burial was drawn from projectile experiments that showed resurgence of the missile created central peaks, as on the moon (Fairchild, 1938a, 1938b). But Moulton did not think the surface material would influence the impact nor the resulting explosion (Moulton, 1938). In his article, Fairchild did not concede on this point to Moulton, an expert in ballistics and explosion physics. He indicated that the planetesimals penetrated the "lunite" with a splash, and were heated and melted while being engulfed. Resurgence from the shock created central peaks and flat floors from semimolten material. Vaporization didn't occur he declared, but fusion did, which explained the dark color resembling lava. The maria, he explained, resulted from subsidence on the moon which somehow erased previous cratered topography. By assuming the lunar lithosphere is so different from the Earth's crust, Fairchild conveniently explained an unknown by claiming that "the peculiar mechanics are difficult of interpretation" (Fairchild, 1938).

Fairchild was surprised to discover that T. C. Chamberlin, co-author of the planetesimal hypothesis preferred the volcanic explanation for lunar topography. This was affirmed by correspondence with the late Chamberlin's son Rollin (Fairchild, 1938c; Chamberlin, 1938). Contrary to Fairchild's view, Chamberlin envisioned the maria as possibly being covered by lava. If true, this implied prodigious volcanic activity. The unequal distribution of lunar craters was further evidence of volcanic, rather than impact origin. Apparently, Chamberlin envisioned planetesimals accreting early in the history of the earth-moon system, not later, to produce the current topography. He believed meteorites today could be left over planetesimals or visitors from outside the solar system. Fairchild seems to have borrowed

these words in his article to describe the errant meteoroid that created the Arizona impact crater, but ignored T. C. Chamberlin's contrary ideas.

A penchant for accepting new ideas when they explained the facts better than the old ideas, enabled Fairchild to promote radical concepts, such as the planetesimal theory. The foundation of geological thought was shaken by this theory, but Fairchild accepted this as a new way to explain certain geological processes. His efforts would aid the difficult transition to a new paradigm. Many years later, at Fairchild's memorial service, J. E. Hoffmeister (1946) would credit him, more than any other geologist, with "the successful readjustment of ideas to meet the requirements of the Planetesimal hypothesis."

Fairchild's cosmogeology article made no new contributions to impact cratering studies but it served as an affirmation for an Earth-Moon model that he had promoted for many years. Chadwick (1945) described this last article by Fairchild as "the concentrated essence of his philosophic thinking in the great field of cosmic geology." Similar views to Fairchild's and those in opposition would be debated for several decades more, until the dawn of the space age. Cosmic geology would then become an acceptable interdisciplinary subject of study - astrogeology. Appropriately, at the dawn of the manned space age, the first terrestrial training field site was at Meteor Crater. Once again the crater was recognized as a link between the Earth and the rest of the solar system.

References

Baldwin, Ralph (1949). *The face of the moon*. Chicago: University of Chicago Press.

Barringer, Brandon (1930). Letter to H. L. Fairchild, September 22, 1930. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, Daniel Moreau (1905), Coon mountain and its crater, *Proceedings of the Academy of Natural Sciences of Philadelphia, 57,* pp. 861-886.

Barringer, D. M. (1906a). Letter to H. L. Fairchild, October 17, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, D. M. (1906b). Letter to H. L. Fairchild, October 29, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, D. M. (1906c).Letter to H. L. Fairchild, November 20, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, D. M. (1915). Letter to H. L. Fairchild, April 21, 1915. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, D. M. (1925). Letter to H. L. Fairchild, October 29, 1925. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, D. M. (1926). Letter to H. L. Fairchild, April 13, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer D. M. (1928). Letter to H. L. Fairchild, July 6, 1928. Fairchild Papers, Rush Rhees Library, University of Rochester.

Barringer, D. Moreau, Jr. (1930). Letter to H. L. Fairchild, December 8, 1930. Fairchild Papers, Rush Rhees Library, University of Rochester.

Branner, John C. (1906). Letter to D. M. Barringer, October 30, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Chadwick, George H. (1945). Memorial to Herman Leroy Fairchild. In *Proceedings Volume of the Geological Society of America for 1944,* pp. 185-222.

Chamberlin, Thomas C. (1903). Letter to H. L. Fairchild, December 24, 1903. Fairchild Papers, Rush Rhees Library, University of Rochester.

Chamberlin, Rollin (1938). Letter to H. L. Fairchild, September 29, 1938. Fairchild Papers, Rush Rhees Library, University of Rochester.

Dawson, J. W. (1873). *The story of the earth and man*. New York: Harper Brothers.

Davis, William M. (1926). Biographical memoir Grove Karl Gilbert. *Memoirs National Academy of Sciences, 21* (5). [Presented to the Academy at the annual meeting, 1922.]

Fisher, J. Sheldon (1987). The great ball of fire. In *The groaning tree* (pp. 62-64). Interlaken, NY: Heart of the Lakes Publishing.

Fairchild, Herman Leroy (1883-1893). Letters to J. C. Branner. Letter press copy book volumes I and II, Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1892a). Letter to G. K. Gilbert, July 22, 1892. Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1892b). Letter to G. K. Gilbert, August 6, 1892. Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1892c). Letter to G. K. Gilbert, October 14, 1892. Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1904). Letter to I. C. White, June 7, 1904. Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1906a). Letter to S. J. Holsinger, November, 21, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1906b). Letter to D. M. Barringer, November, 23, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Fairchild, H. L. (1907). Origin of Meteor Crater (Coon Butte), Arizona. *Bulletin of the Geological Society of America, 18,* 493-504. [Read before the GSA, Dec. 29, 1906.]

Fairchild, H. L. (1926). Letter to D. M. Barringer, April 10, 1923. Fairchild Papers, Rush Rhees Library, University of Rochester. [Year 1923 typed on manuscript is probably in error.]
Fairchild, H. L. (1928a). Letter to G. Grosvenor, July 23, 1928. Fairchild Archives, Rush Rhees Library, University of Rochester.
Fairchild, H. L. (1928b), Letter to J. J. Edson, October 9, 1928. Fairchild Papers, Rush Rhees Library, University of Rochester.
Fairchild, H. L. (1929a). Letter to J. M. Cattell, March, 1929. Fairchild Papers, Rush Rhees Library, University of Rochester. [Date incomplete.]
Fairchild, H. L. (1929b). Meteor crater exploration. *Science, 69*, 485-487.
Fairchild, H. L. (1930). Nature and fate of the Meteor Crater bolide, *Science 72* (1871), 463-466.
Fairchild, H. L. (1938a). Letter to F. R. Moulton, April 2, 1938. Fairchild Papers, Rush Rhees Library, University of Rochester.
Fairchild, H. L. (1938b). Letter to F. R. Moulton, April 28, 1938. Fairchild Papers, Rush Rhees Library, University of Rochester.
Fairchild, H. L. (1938c). Letter to R. Chamberlin, September 24, 1938. Fairchild Papers, Rush Rhees Library, University of Rochester.
Fairchild, H. L. (1938d). Selenology and cosmogeology; cosmic and geologic import of the lunar features. *Science, 88* (2294), 555-562.
Foote, A. E. (1891a). A new locality for meteoritic iron with a preliminary notice of the discovery of diamonds in the iron. *American Journal of Science, 3rd series, 42* (251), 413-417. [First read before the AAAS, August 20, 1891.]
Foote, A. E. (1891b). Geological features of the meteoritic iron locality in Arizona, *Proceedings of the Academy of Natural Sciences of Philadelphia , 43* (p. 407). [Highlights of lecture and discussion which took place at the AAAS meeting in Washington, D.C.]
Gilbert, G. K. (1892). *13th Annual Report, United States Geological Survey, Part 1*, p. 98
Gilbert, G. K. (1893). *14th Annual Report, United States Geological Survey, Part 1*, p. 187.
Gilbert, Grove Karl (1896). The origin of hypotheses, illustrated by the discussion of a topographic problem, *Science, n.s. 3* (53), 1-13. [Annual address of the president of the Geological Society of Washington; read Dec. 11, 1895 before Scientific Societies of Washington.]
Hoffmeister, J. E. (1946). Herman Leroy Fairchild, geologist. *Proceedings of the Rochester Academy of Science, 9* (1), 1-4. [Read at memorial service December 5, 1943.][pub. 1953]
Holsinger, Samuel J. (1906a). Letter to H. L. Fairchild, September 20, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.
Holsinger, S. J. (1906b). Letter to H. L. Fairchild, September 26, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.
Holsinger, S. J. (1906c). Letter to D. M. Barringer, November 10, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.
Holsinger, S. J. (1906d). Letter to H. L. Fairchild, November 29, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.
Hoyt, William Graves (1987). *Coon Mountain controversies*. Tucson, AZ: The University of Arizona Press.
Leverett, Frank (1904). Letter to C. M. Hayes, February 12, 1904. Fairchild Papers, Rush Rhees Library, University of Rochester.
Mark, Kathleen (1987). *Meteorite craters*. Tucson, AZ: The University of Arizona Press.
Marvin, Ursula B. (1986). Meteorites, the moon and the history of geology. *Journal of Geological Education, 34* (3), 140-165.
Moulton, F. R. (1930). Letter to Fairchild, October 14, 1930. Fairchild Papers, Rush Rhees Library, University of Rochester.

Moulton, Forest R. (1938). Letter to H. L. Fairchild, April 5, 1938. Fairchild Papers, Rush Rhees Library, University of Rochester.

Norton, O. Richard (1994). *Rocks from space*. Missoula, MO: Mountain Press Publishing Company.

Russell, Israel C. (1903). *Notes on Professor Fairchild's paper on "Geology under the new hypothesis of earth-origin."* Fairchild Papers, Rush Rhees Library, University of Rochester.

Tilghman, Benjamin Chew (1905), Coon Butte, Arizona, *Proceedings of the Academy of Natural Sciences of Philadelphia, 57*, p. 887-914.

Tilghman, B. C. (1906). Letters to H. L. Fairchild, November 7 and 27, 1906. Fairchild Papers, Rush Rhees Library, University of Rochester.

Tinkler, Joan C. (1962). *Register of the Herman Leroy Fairchild papers, 1869 - 1943.* Fairchild Papers, Rush Rhees Library, University of Rochester.

Ward, Henry A. (1904). *The Ward-Coonley collection of meteorites*. Chicago: Marsh, Aiken & Curtis Co.

EIGHTEENTH ANNUAL FALL SCIENTIFIC PAPER SESSION

LARRY J. KING MEMORIAL LECTURE
Pesticides in the Environment
by
Ward Stone
New York Department of Environmental Conservation

HOBART AND WILLIAM SMITH COLLEGES
GENEVA, NEW YORK
November 2, 1991

ABSTRACTS OF PAPERS

THE POPULATION STATUS AND ECOLOGY OF THE BLACK TERN (*Chlidonias niger*) AT THE IROQUOIS/TONAWANDA/OAK ORCHARD COMPLEX 1990. David J. Adams, 26 Walnut Street, Hudson Falls, New York 12839

The Black Tern (*Chlidonias niger*) is a semi-colonial water bird which can be found nesting among inland fresh water marshes. Since 1983 this bird has been listed as a species of special concern in New York State. In conjunction with a major state wide survey this study was conducted in order to re-evaluate the status of the Black Tern in New York State.

During the 1990 field season data was collected concerning the ecology and population status of the tern at the Iroquois/Tonawanda/Oak Orchard wetland complex in western New York. The date of arrival and nest occupation were approximately May 10 and June 1 respectively. Clutch initiation began mid June and hatching in mid July with an average clutch size of 2.45. A total of thirty one active nests were located on six marshes, the average area per marsh being 156.1 hectares. Nest data obtained included measurements of the width of the mat upon which the nest was constructed, the water depth at the nest, the height of the eggs above water, the nest cup width and the nest width. A large number of the nests were located among burreed, the regaining among cattail.

Current management for the Black Tern includes annual marsh drawdowns. Adjoining marshes are drawn down in alternate seasons, disked and reflooded to stimulate the growth of emergent vegetation with interspersed pools. High muskrat populations and annual harvest of sixty to seventy percent provide the inactive muskrat lodges and feeding platforms that the tern prefers to nest on.

Future research will be continued on site for a minimum of two additional seasons due to funding obtained through Return a Gift to Wildlife. Work will include annual nest surveys, \ the banding of chicks and a possible telemetry study.

THE SIMULATION OF ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF ORGANIC FREE RADICALS ADSORBED ON POROUS SOLIDS. W. Barker, D. Dwyer and M. Schillaci, Department of Chemistry, SUNY College at Brockport, Brockport, N. Y. 14420

The Electron Paramagnetic Resonance (EPR) spectrum of the benzyl radical adsorbed on porous silica shows different line shapes as a function of surface coverage and silica pore diameter. A simulation of this spectrum using techniques for calculating the EPR spectra of pi-type organic free radicals in polycrystalline hosts, which were developed previously in our laboratory, has been undertaken. Preliminary results indicate that the variation of the line shapes in the EPR spectrum, which occur as the surface coverage and pore diameter are varied, can be explained by changes in the molecular motion of the benzyl radical .

AUTOMATED MEASUREMENT OF MAGNETO-OPTIC EFFECTS. C. R. Boehly. T. Bekele*, K, O. Cottrell, M. G. Woodard+ and D. B. Hall, Department of Physics, SUNY College at Brockport, Brockport, NY 14420

Many systems have been developed to accurately measure Faraday rotation. The system on which we report has already yielded test results which Low promise that it will be placed among the aforementioned systems. The general operation of the system is as follows: plane polarized light passes through a transparent material and the orientation of the light's plane of vibration is determined with a polarizer. As the polarizer is stepped through a complete 360° range, the intensity of the light changes. The object of this procedure is to find the angle at which the intensity is lowest. This angle is known as the extinction angle. By performing two trials of this experiment, one with the sample subject to an external magnetic field and the other with the sample not subject to the field, the Verdet constant can be found. We can also measure the magnetic susceptibility of the sample with a similar process. The entire system is controlled by a computer through the use of a GPIB board. allowing automated reading of data and remote control of the polarizer's orientation. Throughout the process, the computer is also monitoring the temperature of the sample. thus making the system virtually automated, tremendously increasing the amount of data which we are capable of taking.

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GROWTH AND DEVELOPMENT OF STOLONS OF *Phragmites communis trin.* Christopher A. Capozzi, Department of Biology, Ithaca College

Phragmites communis trin. is a large aggressive wetland macrophyte, often growing in monotypic stands. It reproduces vigorously, usually by the production of below-ground rhizomes. Not so well known is that this species may also produce long aboveground stolons which also serve for reproduction of new shoot systems.

Stolons were collected over summer 1991 from a number of sites including Irondequoit Bay wetlands, sites along the NYS Thruway near Syracuse, and from constructed wetland beds near Binghamton and Ithaca. All stolons found were growing from smaller, presumably young clumps of plants or at the edge of established stands. All were growing over open, essentially bare areas not heavily vegetated.

Stolons ranged from approximately 450-500 cm to a high of 940 cm in length; most were over 600 cm in late September. Growth of these stolons is rapid, averaging 8.6 cm to 11.3 cm per day in late June-early July. Nodes are produced about every 20 cm along the stolon and almost all produce either a new shoot, branch stolon, or rhizomes and roots but what is produced is variable. Observations suggest that when water is limiting at the surface, stolons grow very long but produce only upright shoots at the nodes but when water is present shoots and often roots and rhizomes are produced. Five stolons harvested in late August weighed between 75-112 g dry weight with the main stolon making up 25-60 % and new shoots 20-44 t of the total. Roots were mostly not important, averaging between 1.2-8.1 %.

It appears bated on these observations that *Phragmites* produces stolons which have the ability to grow over large areas, producing new viable growth units at favorable sites. These may then grow and dominate the new site in the future.

THE EFFECTS OF DIFFERENT METALS AND GEOMETRIES ON THE ELECTROCHEMICAL ANALYSIS OF AQUEOUS AND NONAQUEOUS SOLVENTS AND SUB-MICROLITER VOLUMES. Mary Elizabeth Clark and Walter J. Bowyer. Department of Chemistry, William Smith College, Geneva, NY 14456

A method for performing three-electrode voltammetry in drops as small as 0.02 microliters has been developed. A strip of metal foil, metal wire or foil, and metal foil are sealed into a multidecker sandwich with Tefzel heat sealing film. Cutting the sandwich exposes a cross section of three closely spaced electrodes. A platinum foil band acts as a counter electrode while a silver

foil band serves as a quasireference electrode. The working electrode varies and can be gold, silver, or platinum foil or wire of various thickness. The effects of the different metals, geometries, and spacing between bands on Wee analysis of aqueous and nonaqueous solvents and sub-microliter volumes were studied.

NUCLEAR MAGNETIC RESONANCE STUDIES OF HYDROGEN BONDING AND TAUTOMERISM IN ACETYLACETONE/METHANOL MIXTURES. D. Dwyer and J. Fox, Department of Chemistry, SUNS College at Brockport, Brockport, New York 14420

Nuclear Magnetic Resonance (NMR) studies of methanol/acetylacetone solutions indicate a proton exchange occurring between the hydroxyl protons of methanol and the enol tautomer of acetylacetone. This exchange implies the existence of a hydrogen-bonded complex in the liquid state. The exchange has been found to be both concentration and temperature dependent with changes in concentration having the more pronounced effect on position of the exchange resonance line. The chemical shift of the exchange resonance can be described by considering it to be a concentration-weighted average of all hydroxyl-containing species present, while the temperature dependence measurements show an increase in shielding (decrease in chemical shift) as expected. An interesting anomaly in the exchange resonance line behavior has been observed where the resonance line was observed to increase in shielding with a decrease in temperature. Previous work has also quantitatively described hydrogen bonding in liquid methanol via temperature and high pressure NMR measurements of the chemical shift of the hydroxyl protons. This technique will be applied to the methanol/acetylacetone system in combination with the concentration and temperature data to determine the effects of the solvation and of the exchange on the hydrogen-bond network in liquid methanol.

MICROWAVE INDUCED DELAYED PHOSPHORESCENCE (MIDP) SPECTROSCOPY OF CARBOXYLATE SALTS ADSORBED IN POLYVINYL ALCOHOL FILMS. D. Dwyer, M. Langdon, C. Pryor and J. Ross, Department of Chemistry, SUNY College at Brockport, Brockport, NY 14420

Microwave Induced Delayed Phosphorescence (MIDP) has been observed at room temperature from the sodium salt of 2-naphthoic acid absorbed in various polyvinyl alcohol (PVA) films. To the best of our knowledge, this is the first tide MIDP has been observed at room temperature. The MIDP technique can be used to determine the zero field splitting parameters and spin polarization of the excited triplet state of 2-naphthoate. The zero field splitting parameters can then be used to determine specific information about molecular motion and orientation in the polymer host. Preliminary data obtained for 2-naphthoate absorbed in several different PVA films indicates triplet sublevel energy separations which are similar to those found in the literature for naphthalene at 77 K.

TIME-RESOLVED EMISSION SPECTROSCOPY OF CARBOXYLATE SALTS ABSORBED IN POLYVINYL ALCOHOL FILMS. D. W. Dwyer, M. Langdon, C. Pryor and J. Ross. Department of Chemistry, SUNY College at Brockport, Brockport, New York, 14420

The time-resolved emission spectra of the sodium salts of 1-Naphthoic, 2-Naphthoic, and 4-Biphenyl carboxylic acids absorbed in three different Polyvinyl Alcohol (PVA) films at room temperature have been measured. Excited triplet-state lifetimes have been estimated from the emission spectra for the salts absorbed in: 1) a non-cross-linked PVA film, 2) a PVA film which has been cross-linked with sodium borate decahydrate, and 3) a non-cross-linked PVA film which has been doped with potassium iodide. The non-cross-linked PVA films show triplet lifetimes greater than 1.0 second at room temperature. The PVA films doped with KI display shorter lifetimes and greater triplet emission intensities as expected from the external heavy atom effect.

ABSORPTION AND EMISSION SPECTROSCOPY OF CARBOXYLATE SALTS ABSORBED IN POLYVINYL ALCOHOL FILMS. D. Dwyer, C. Murray-Regan and C. Prior, Department of Chemistry, SUNY College at Brockport, Brockport, New York, 14420

The steady-state absorption, fluorescence and phosphorescence spectra of the sodium salts of 1-Naphthoic, 2-Naphthoic, and 4-Biphenyl carboxylic acids absorbed in a Polyvinyl Alcohol (PVA) film have been recorded at room temperature. The long-lived triplet excited states of these salts at room temperature allow for the salts to be employed as probes of molecular orientation and motion in certain polymer hosts. Preliminary studies on PVA films have provided data on the absorbence and emission wavelength maxima and the average separation of the salts in the films, which has been useful in elucidating the nature of their excited electronic states.

BEHAVIOR OF TWO-SPOTTED SPIDER MITES ON FOUR FORMULATIONS OF DICOFOL. Mary H. Edwards. Department of Biology, Hobart and William Smith Colleges, Geneva, NY 14456

Four formulations of dicofol showed varying degrees of repellency to dicofol-susceptible spider mites performing three behavior patterns on freshly sprayed discontinuous residues. The most dramatic result was found on the Multi-Flowable residues where the mites exhibited a significant difference in bout frequencies between on-residue and off-residue. This difference was so extreme that only approximately 10% of both the feeding and standing behavior patterns were performed on-residue, while the percentage of walking behavior patterns performed on-residue was 35%. Emulsifiable Concentrate also proved to be significantly repellent, but did not show dramatic differences in bout frequency between on-residue and off-residue behavior patterns. Both 35 Wettable Powder and 50 Wettable Powder exhibited some significant differences between on-residue and off-residue behavior patterns. Although these results were significant, they were not as extreme as that shown by the Multi-Flowable or the Emulsifiable Concentrate. Thus as a group, both Wettable Powders can be considered less repellent than the other formulations.

STRUCTURE AND FUNCTION ANALYSIS OF A MITOCHONDRIALLY ENCODED PROTEIN IN YEAST. Kerry Fluhr and Vicki Cameron. Biology Department, Ithaca College, Ithaca N.Y. 14850

A yeast strain which is defective in respiration due to a mutation in a specific mitochondrial gene, subunit II of cytochrome c oxidase, was previously characterized. This mutant strain produces no subunit II protein and therefore cannot respire. The defect is due to an alteration in a single nucleotide, which results in a change from a leucine codon to a stop codon at amino acid 47.

Revertants of this mutant strain have also been previously characterized. These revertants may have recovered the ability to carry out cellular respiration by the restoration of the original, functional, sequence; by a second mutation in the nucleotide sequence at amino acid 47 which results in the creation of a new functional codon which is neither leucine nor a stop colon; or by a mutation elsewhere which compensates for the first. In order to determine which amino acid substitutions at this position result in a functional protein, it is necessary to determine the nucleotide sequence of this region of subunit II in the revertants.

In order to sequence the revertant DNA, it is necessary to isolate the DNA from the cell and convert to a form suitable for sequencing. The Polymerase Chain Reaction was used to amplify the DNA in the region of interest. The resulting PCR fragments were subsequently cloned into a vector which is specifically designed for joining to PCR-generated fragments. Restriction enzyme digests were performed on the recombinant plasmids to confirm that the fragment had been inserted and to determine the orientation of the fragment in the vector. The region of interest was then cut out of the vector and inserted into the single-stranded genome of M13MP18. Single stranded template can be generated and sequenced using the dideoxy chain termination method. Approximately 150 base pairs of readable sequence was obtained from one of the revertant strains. We are now in the process of repeating the sequencing reactions-of this mutant DNA and sequencing other revertants.

ANATOMY OF A CORN KERNEL: THE FORMATION OF PROTEIN BODIES IN DEVELOPING MAIZE ENDOSPERM. Amy L. Frechette and Craig R. Lending, Department of Biological Sciences, SUNY Brockport, Brockport, NY 14420

Fifty percent of the total seed protein in corn seeds is contained within protein bodies. These protein bodies contain the seed storage proteins of corn seeds (collectively termed zeins). The

various zeins are synthesized during endosperm development, and are transported into the lumen of the rough endoplasmic reticulum, where they assemble into protein bodies. These seed storage proteins have considerable significance, both with respect to kernel characteristics and nutritional value. To better understand the distribution of the various zeins within protein bodies, and the interactions that occur between the various proteins, we used immunolocalization techniques to demonstrate that the various zeins interact sequentially to assemble the storage proteins into a protein body. Several mutant corn lines, with altered levels of zeins, show profound changes in protein body structure and kernel characteristics. An understanding of the cellular mechanism of protein body assembly will provide valuable guidance in future attempts to modify zeins through recombinant DNA procedures, site-specific mutagenesis and genetic engineering.

MONITORING PARAMAGNETISM OF NON-METAL RARE EARTH SOLID MIXTURES WITH INTERACTIVE INDUCTORS. .L. Gano, D. B. Hall, Department of Physics, SUNY College at Brockport, Brockport, NY 14420

In this endeavor we shall investigate the paramagnetism rare earth halide glass samples. In particular, we are measuring the a.c. magnetic susceptibility of these samples using a mutual induction technique. The samples will be subjected to low temperatures, less than 10 K (Kelvin), and weak magnetic fields on the order of 0.02 G (Gauss). As the temperature of the samples is changed, so is the amount of magnetic flux through them. This change in flux is proportional to the magnetic susceptibility of each sample. The susceptibility is determined by a circuit that is connected inductively to the changing magnetic flux generated in and about the sample. The samples we are studying contain dilute amounts of magnetic atoms which are randomly juxtaposed with nonmagnetic atoms. At temperatures below 4.2 K, the magnetic atoms interact with each other and enter a magnetic phase known as "spin glassy . The onset of the spin glass phase is characterized by a frequency dependent cusp in Wee a.c. magnetic susceptibility of the sample. Our interest is in determining the process by which these systems enter the spin glass phase. The apparatus is automated and computerized to effect the best possible retrieval of data. This research is supported by NSF's Research Experience for Undergraduates, Grant DMR-9100820.

THE MAPPING OF PHOSPHOFRUCTOKINASE PEPTIDE FRAGMENTS TO ITS PRIMARY STRUCTURE USING AMINO ACID COMPOSITION ANALYSIS. Indraneel Ghosh and David W. Craig (Advisor). Department of Chemistry, Hobart and William Smith Colleges Geneva, NY 14456

This study focuses on the development of a method of mapping specific sites on rabbit muscle phospho-fructokinase with respect to its primary amino acid sequence. Phosphofructokinase (PFK) is the key regulatory enzyme in the metabolism of glucose It has several binding sites for both substrates and regulator molecules. Many of these sites have been covalently modified. This study is focusing on the development of protein fragmentation and ammo acid analysis methods to map the specific sites on the protein by coming amino acid analyses to the known sequence. Preliminary amino acid analysis results will be presented.

CONDITIONS INFLUENCING COMMUNITY DEVELOPMENT IN A NORTHERN NEW YORK ALVAR LANDSCAPE. Bruce A. Gilman, Natural Resources Conservation, Community College of the Finger Lakes, Canandaigua, New York 14424

Alvar landscapes occur where horizontally bedded limestone is covered by little or no soil. They support a vegetational mosaic with low community cover adapted to extreme seasonal fluctuation in moisture and temperature. Plant communities and environmental conditions were studied in calcareous pavement barrens west of Watertown, New York. Site quality was heterogeneous, and included a harsh temperature regime reaching surface levels of 43°C. Soil volume was limited, with quadrats containing 0 to 201,560 cc/m2 surface area. Soil reaction varied from a pH of 6.15 to 8.50. Microtopographic slope ranged from level to 73 percent. Evidence of fire was observed in 34 percent of the quadrats, cryptogamic crust heaving from needle ice action in 41 percent of the quadrats. Woody colonization, through exploitation of bedrock crevices, appears to ameliorate site quality and modify community development.

THE EFFECTS OF VEGETATION ON SOIL DEVELOPMENT ALONG A SLOPED GRADIENT. M. Halsted, Horticulture Department, Penn State University, University Park, Pennsylvania and M. Wentland, Biology Department, St. John Fisher College, Rochester, New York

An investigation was conducted to determine the effects of recently planted trees on the soil development along a sloped gradient on property recently acquired by the College. Scotch pine (Sinus sylvestris), planted thirty years ago, are growing at the top of the slope that gradually becomes an open field at the bottom. Analyses of various physical and chemical factors was done to determine the effects of decomposition, leaching and runoff along the gradient, on the development of the soil.

Soil pH increased along the gradient while organic matter, nitrate nitrogen, phosphorus and potassium declined. Interpretation of this data and suggestions for additional work will be presented. This work was partially supported by a student grant from the Rochester Academy of Science.

OPTIMIZING MICROELECTRODE ARRAYS. Jennifer L. Ingram and Walter J. Bowyer; Department of Chemistry; Hobart and William Smith Colleges; Geneva, New York 14456

Microelectrode arrays can be fabricated by heat sealing metal foil been multiple layers of Tefzel film. These arrays are found to have a high capacitance, apparently due to poor seals between the metal and the Tefzel. Many attempts have been made to minimize the capacitance of the arrays, including plating the arrays with mercury, phenol, dimethylphenol, and lithium oxide, as well as varying the temperatures of the potassium nitrate solutions in which the capacitance measurements are made. To date, none of these approaches have been successful; this lack of success leads to the question of whether or not the cracks do in fact exist, in spite of widespread acceptance of this theory.. One piece of evidence that suggests there are no cracks is their absence in scanning electron microscopy. Future experiments include coating the arrays with poly(methyl methacrylate) and octadecyltrichlorosilane.

CLIMATIC IMPLICATIONS OF SYSTEMATIC VARIATIONS IN ABYSSAL SEDIMENTATION THROUGH THE LAST GLACIAL MAXIMUM, NORTHERN BERMUDA RISE. A. E. Isley. Department of Geosciences, Hobart and William Smith Colleges Geneva, New York, 14456-3397

Core LPC-01 was collected from the Northern Bermuda Rise, which receives biogenic and eolian sediment derived from upper thermocline waters and fine-grained aluminosilicates deposited from south-flowing abyssal currents. Sediment deposited through the last glacial maximum at 18 ka was analyzed to determine climatically-linked variations in the abyssal fluxes of major sediment components. Sedimentation rates were estimated using previously dated basinwide stratigraphic events. Mass accumulation rates were evaluated using these and measurements of dry bulk density. The flux of CaCO3 to the seafloor remains of the same order through the last 18 ka; this component is diluted during the glacial epoch by an order of magnitude increase in the flux of terrigenous materials (particularly, fine-grained aluminosilicates introduced via the regional nepheloid layer and, secondarily, eolian particles). There is evidence for the; increased importance of the upper thermocline production of biogenic silica during the period 11.5 - 14.0 ka.

THE STUDY OF PROTEOGLYCANS FROM CARTILAGE AND INTERVERTEBRAL DISC: MONOCLONAL ANTIBODIES REVEAL STRUCTURAL SIMILARITIES, DETERMINE CARTILAGE DAMAGE IN ARTHRITIS. M. Jahnke. Division of Natural Sciences, Keuka College, Keuka Park, NY 14478

Intervertebral disc and cartilage consist mainly of an extensive extracellular matrix:. The main components of this matrix are Type II collagen (responsible for the compressive stiffness of We tissue) and proteoglycans (large glycoproteins wit long, negatively charged carbohydrate side chains responsible for the reissues' resistance to compression). These proteoglycans are enormous (average size, 1-5 million Daltons), are heavily substituted with carbohydrate (average 90%

carbohydrate, 10% protein) and interact with another carbohydrate, hyaluronic acid, to form extracellular, macromolecular complexes of several billion Daltons or more. Diseases, such as rheumatoid arthritis, release proteoglycan fragments as the cartilage is degraded. The study of these large macromolecules has been facilitated by the production of r monoclonal antibodies (which recognize a sequence Of approximately six amino acid residues or a hexasaccharide), eider to intact proteoglycans or to enzymatically or chemically deglycosylated proteoglycan fragments, to learn about the protein or carbohydrate portions of these molecules . ;

Antibodies directed against specific amino acid sequences of eider cartilage or disc proteoglycans recognized both cartilage and disc proteoglycans. Antibodies directed against file carbohydrate portions of these molecules suggested that disc proteoglycans had different carbohydrate clam. Taken together, this suggests tat Wee same core proteins, produced in either cartilage or intervertebral disc cells, are glycosylated differently in the different cell types. These antibodies have also demonstrated tat the same cartilage-type core protein is produced m very different tissues, such as brain; He core protein is the same, but very little carbohydrate is added in these cells. Furthermore, these antibodies have proved to be particularly useful in monitoring the effectiveness of various drug treatments at halting the destruction of cartilage by rheumatoid arthritis. Proteoglycan fragments liberated into He bloodstream by destruction of We cartilage can be monitored by sampling a patient's blood at various stages during treatment Cleanly, monoclonal antibodies have revealed import structural information about cartilage and disc proteoglycans, and will play an increasingly important role in Me study, and Me clinical management, of rheumatoid arthritis.

DAILY RHYTHM IN CLOACAL GLAND AREA IN JAPANESE QUAIL (*Coturnix coturnix japonica*) KEPT ON A 15L:9D PHOTOPERIOD. W. Karam, J. Kerlan, Department of Biology, Hobart and William Smith Colleges, Geneva, N.Y. 14456

Diurnal rhythm in copulatory behavior, crowing and locomotor activity have been reported in male Japanese quail. These different behaviors, as well as the size of the cloacal gland, a secondary sex structure, are dependent on testosterone. Our unreported observation that cloacal gland area (CGA) was Significantly larger in the day than in the night ($p<0.05$) suggested this study.

Ten adult quail kept on a 15L:9D photoperiod

(ON: 0700) were studied. Measurements of the cloacal gland wile taken every six hours for three days. Each day the timing of the initial measurement was advanced 2 hours, so that 12 times of the day were sampled. The maximum CGA (Mean = 236 mm^2) occurred at 1200 hours and the minimum CGA (Mean = 160mm^2) occurred at 0400 hours. Moreover,-the onset of cloacal gland recrudescence preceded dawn and the onset of cloacal gland regression anticipated dusk. Analysis of CGA revealed that data collected on three separate days fit a second degree polynomial expressed by the equation:

$y = 106.883 + 0.144x - 4.757E\text{-}5x^2$. This pattern was statistically significant ($p= 0.0001$) and accounts for much of the daily variation in cloacal gland size (Adjusted R-squared = 0.848).

In summary, CGA exhibits a 24 hour rhythm which fits a second degree polynomial curve. Studies are in preparation to determine the relationship between variations in CGA and daily changes in blood testosterone level.

BROMINATIONS OF PORPHYRINS AT THE β-PYRROLE POSITION. Matthew Lang[1], G. Miskelly[2]. Department of Chemistry, University of Rochester[1], Rochester, New York 146274216, Department of Chemistry, University of Southern California[2,3], Los Angeles, California 90089-0744

Porphyrins brominated at the β-pyrrole position were prepared for evaluation as catalysts for redox reactions. The bromination alters the electronic nature of the porphyrin, changing the redox potentials. Copper tetraphenyl porphyrin, Cu(TPP), was prepared and brominated according to literature procedures using molecular bromine. The procedure was extended, in this work, to the bromination of the Co(TPP) porphyrin. The reaction and products were monitored by UV-VIS,

TLC and characterized by NMR. The reaction with Cu(TPP) proceeded as reported to give $Br_8Cu(TPP)$. Under comparable conditions the reaction with Co(TPP) was much slower and gave mixtures of products. Column chromatography on Al_2O_3 gave a low yield of $Br_8Co(TPP)$, This direct bromination product had the same UV-VIS spectrum as the cobalt complex reported from the metal exchange of $Br_8Cu(TPP)$ with Co(II). A new procedure was developed to demetallate $Br_8Cu(TPP)$ by refluxing in trifluoroacetic acid. Br_8TPP was obtained by filtering on a short column of basic alumina.

Water soluble tetraryl porphyrin complexes of copper, cobalt and cadmium were prepared (aryl = 4-N-methylpyridinum tosolate). Bromination of these complexes in methanol was monitored by UV-VIS and TLC. Partially brominated products were evident from the TLC and UV-VIS characterizations. The bromination of the Cu(TMePyP) was the fastest. $Br_8Cu(TMePyP)$ and $Br_8Co(TMePyP)$ were isolated in low yields from mixtures of bromination products by column chromatography and fractional crystallization. We explored the effect of the variation of the counterion on the crystallization procedure. We attempted to demetallate the brominated copper and cobalt complexes with HCl and trifluoroacetic acid, without success.

[3]Work performed at USC.

CRYOPRESERVATION OF THE RAT HEART EXPLANT. J. R. Layne, Jr. and T. Wang (Dept. of Biology, Nazareth College, 4245 East Avenue, Rochester, Nets York 14618; Dept. of Surgery, University of Rochester School of Medicine, 601 Elmwood Avenue, Rochester, New York 14642).

Human organs generally cannot be banked for extended periods of time. For example, a harvested heart must be transplanted into a recipient within hours. Such time constraints foster problems With respect to matching histocompatibility, screening for infectious agents, and having the patient continuously available for the surgical team. If organs could be stored prior to their use, then some constraints on organ transplantation units would be lessened. Low temperature seems a logical means to preserve organs however, mammalian organs quickly succumb to freezes at very lout subzero temperatures.

Naturally freeze-tolerant animals may help elucidate. the steps that are necessary to freeze and revive organs. For example, several frog and turtle species recover from freezes lasting weeks. However, freeze-tolerant Vertebrates do not survive freezing at temperatures below -8 C for extended periods.

We report here that rat heart explants can be frozen and refined. Our protocol was based on selected aspects of vertebrate freeze tolerance: tissue freezing at high subzero temperatures via surface inoculation, moderate concentrations of cryoprotectant, and partial tissue dehydration prior to freezing. For example, the addition of glycerol to the storage solution improved heart recovery if its concentration was no more than 75 mM. Moreover, reducing tissue water content by adding 5% polyethylene glycol (PEG, 8000), a potent osmotic agent, protected heart explants even better. The latter treatment may correspond to organ dehydration seen in freeze-tolerant frogs.

Optimization of the storage process is slow and laborious since seemingly minor solution components impact heart recovery following freezing. Currently, we are able to store rat hearts for up to 10 h with a maximum tolerable ice content around 35-40% of total tissue water.

EFFECTS OF A LEACHATE FROM A MUNICIPAL LANDFILL ON A SEASONAL STREAM Leahy, J., Wings M., and Chiaranzelli, J; Department of Geoscience, Hobart and William Smith Colleges, Geneva, N.Y. 14456

The purpose of this project is to study the effects an inactive municipal landfill located in the rural community of Dix, N.Y., has had on nearby surface waters. The landfill is located on a hillside adjacent to a small tributary of Catherine Creek, which drains into Seneca Lake. The town of Dix landfill operated for approximately ten years and closed in 1981. The landfill accepted municipal refuse from surrounding communities. The presence of methyl ethyl ketone and acetone in the leachate may support claims of dumping of hazardous wastes in the site (NYSDOH files). The area of the landfill is twenty acres, covered with Mardin and Aurora channery silt loam as well

as a thin coating of shale chips. Dead vegetation surrounds the site.-The landfill is underlain by Devonian aged Genesee group shales and siltstones.

Problems associated with the site are 1) runoff of leachate into the nearby unnamed tributary of Catherine Creek, 2) erosion of the cover reflected by drainage channels in the cover from the leachate, 3) possible contamination of the aquifers and movement of the leachate into Catherine Creek, and 4) possible contamination of Catherine Creek.

The unnamed tributary of Catherine Creek is a seasonal stream with low fall discharge. The leachate has formed several small drainage channels on the surface of the landfill, most of which drain into one primary leachate channel. This leachate tributary is flowing even during this time of drought. There is runoff and seepage of the leachate along the stream banks and within the underlying rock units. A conductivity map has been drafted of the unnamed stream. Results from this map show abnormally high conductivity readings all along the length of the stream, even several hundred feet downstream from the landfill site. Normal conductivity readings can be seen in the portion of the stream directly beneath the landfill, followed by abnormally high readings downstream from the junction of the stream with the leachate channel. Based on this, I hypothesize that the leachate is moving not only by the stream but through fractures in the underlying rock units as well as the underlying aquifer.

The parameters being tested in this study are conductivity, alkalinity chloride ion, pH, mercury, lead, other heavy metals, and organics. The bulk of the sampling will occur along the length of the unnamed stream, Catherine Creek, and the leachate channels within the landfill proper. Sampling will occur seasonally.

Preliminary results from this project will be discussed at the conference.

THE DETECTION OF SELENIUM BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY WITH GOLD BAND MICROELECTRODES. Jeffrey S. Lundgren and Walter J. Bowyer, Chemistry Department, Hobart and William Smith College, Geneva, New York 14456.

Selenium is a heavy metal that can be toxic to the environment in natural and drinking waters. Many standard techniques used to measure selenium concentrations are not sensitive enough to detect hazardous levels of the metal. One technique that can be used to measure metal concentrations in water quantitatively is anodic stripping voltammetry by differential pulse with microelectrodes.

The success of the Weld microelectrodes and their capability to detect low concentrations of selenium depends on the geometries of the gold band and the matrices used to seal the band. A calibration curve of the current (I) peak versus the concentration (M) of selenium is plotted to determine the detection limits of the electrode. The electrodes provide a linear detection limit range of 1@7 to 1C5 M for approximately the first seven trials. Also of interest is the initial potential at which the Se(IV) will Plated on to the electrode surface.

RADIANT "COLOR-TEMPERATURE". Frank Mooney, 6135 Dugway Rd. Canandaigua, NY 14424.

From antiquity until modern times, colors from red to cherry to yellow guided blacksmiths and masters in foundries. Wien's Law is honored as if it identifies the color-temperature of perfect emitters, like that of an oven with a tiny window. Wien's wavelength is the mode (or peak) of the emission spectrum: when plotted as a function of wavelength. His wavelength decreases with increasing temperature in inverse proportion, and it agrees with experience that hotter ovens include more of the visible spectrum. This paper suggests three other wavelengths - from the mode of the radiant frequency spectrum, from the average emitted frequency, and the average of the wavelength spectrum - with the same thermal dependence as Wien's Law, with big differences, and with enough rationale to have been chosen.

Wien's wavelength is much the shortest of the four. It then is hardly a suitable choice, in first approximation, as the spectral core of emitted radiation. Is there a best choice?

FACTORS AFFECTING THE DISTRIBUTION OF THE RARE COPPER-MOSS, *MIELICHHOFERIA MIELICHHOFERIANA*. N. Niguidula. Department of Biology, Ithaca College, Ithaca, New York, 14850.

Mielichhoferia mielichhoferiana is one of about ten species of bryophytes that are known as "copper mosses" because they seem to have an affinity for soils rich in copper. Like other copper mosses, *M. mielichhoferiana* is very widespread geographically occurring in North America, Europe, and Asia, but is extremely rare throughout its range. It has been assumed that the species is rare because of a requirement and/or tolerance of high substrate copper concentrations. However, elemental analyses of soil samples from North American populations reveal that copper is rarely present in higher-than-normal concentrations. I tested the hypotheses that *M. mielichhoferiana* requires/tolerates high copper by growing plants on nutrient media with varying copper concentrations. Tolerance of *M. mielichhoferiana* to copper was compared to a known copper-tolerant race and a known nontolerant race of the widespread moss, *Funaria hygrometrica.* Two experiments, one including spore germination and early sporeling growth, and the other involving protonemal regeneration, both showed that *M. mielichhoferiana* is neither exceptionally tolerant of copper, nor does it appear to require high copper. Thus, the label, "copper moss", appears to be a misnomer for the population of *M. mielichhoferiana* I studied. Other hypotheses to explain the rarity of *M. mielichhoferiana* are being pursued.

A SIMPLE INTERACTIVE MONTE CARLO SIMULATION OF BROWNIAN MOTION FOR A FIRST YEAR CHEMISTRY COURSE. Lavanya Premvardhan and David W. Craig (Advisor). Department of Chemistry, Hobart and William Smith Colleges, Geneva, NY 14456

An interactive computer program has been designed that is being used to teach the kinetic theory of gases to introductory chemistry students. Using the Monte Carlo technique the path of a Brownian particle is followed on the computer screen as it is struck by gas molecules from random directions with velocities distributed according to the Boltzman function. After a selected number of collisions a velocity histogram of the colliding gas molecules is displayed. Students can examine the influence of temperature and molecular weight on the simulation experiment. They can also examine the influence of the number of events on the statistical fluctuations of molecular velocities. This simulation is currently being integrated into a module of gas law experiments for introductory chemistry The program was developed using PC:Solve by Pacific Crest Software, Inc.

A NATIVE SUBSTANCE INHIBITING INDOLEACETIC ACID-CONTROLLED PROMOTER ACTIVITY IN TOBACCO. Jeffrey D. Randall. Imre A. Tamas, Biology Department, Ithaca College, Ithaca, NY 14850.

The genetic mechanism regulating plant development can be studied now in transgenic tobacco plants using bacterial luciferase luxA and luxB as reporter genes. The promoter controlling lux activity (measured as the amount of emitted light) is stimulated by the plant hormone indoleacetic acid (IAA), and inhibited by an unknown substance, tobacco shoot inhibitor (TSI). When shoots are extracted in 70% methanol and the solvent is evaporated, the remaining residue inhibits luciferase expression if applied as a buffered solution to stem sections of lux plants.

Results irk this report show that TSI and IAA, present together fin tissue extracts, can be separated by solid phase e * action. On quaternary amino (SAX) columns, IAA is retained but TSI is allowed to pass through. TSI is not readily inactivated by heat (boiling for five minutes) OF oxygen (bubbling oxygen gas through the extract for 10 minutes), and is not retained by ultrafiltration at a cutoff molecular weight of 10,000 (Amicon). These preliminary results suggest that TSI is not a protein, and further that it is of reasonably good stability.

EXACTLY SOLUBLE HAMILTONIANS WITH TIME-DEPENDENT POTENTIALS. J. Rogers and D. Spector, Dept. of Physics, Eaton Hall, Hobart and William Smith Colleges, Geneva, NY 14456

We consider non-relativistic quantum mechanical systems in which the Hamiltonian has an explicit time-dependence in its parameters, Provided that these time-dependent parameters satisfy a

condition that we derive, the associated time-dependent Schrödinger equation can be solved by separation of variables. In the special cases of the harmonic oscillator and the hydrogen atom, when the time-dependent coupling constant satisfies the above-mentioned condition, we are able to solve the system exactly, by both operator and power-series methods. Our results shed light on several physical questions, including: the behavior of experimental systems in a time-varying environment; the excitation spectrum of solitons; Dirac's suggestion that the apparent "constants of nature" may change with time; and the applicability of separation of variables as an analytical technique.

LIGHT AND ELECTRON MICROSCOPY OF THE *Pisonia* MYCORRHIZAE. Ross A. Rupert, *D. Jean Lodge, and T. M. Hammill. Department of Biology, SUNY College at Oswego, Oswego, NY 13126, and * Center for Energy and Environment Research, San Juan, Puerto Rico 00936

During the summer of 1991, fine roots of *Pisonia subcordata* were collected from the El Verde rain forest in Puerto Rico and prepared for examination by light and electron microscopy. Upon initial inspection, the roots appeared to be ectomycorrhizal in nature. The root tip was enveloped by a sheath of fungal tissue from which extramatrical hyphae radiated.

Typical ectomycorrhizae are characterized by the presence of such a sheath surrounding the root tips and by the intracellular penetration of fungal tissue into the root cortex. The fungal organ which penetrates between the cells of the cortex is known as the Hartig net. The Hartig net serves as the site of nutrient exchange between the plant and fungus.

Examination of sectioned material revealed a well developed sheath, but the Hartig net was absent. The outer walls of the epidermal cells abutting the fungal sheath had formed wall ingrowths or pegs. These pads increased the surface area between the fungus and the host, and may be responsible for increased apoplast-symplast exchange. It is possible that these ingrowths serve as an alternative strategy for nutrient exchange, and may be developed instead of a Hartig net. Although this symbiotic system contains a fungal sheath which is a characteristic of all ectomycorrhizae, the absence of the Hartig net, accompanied by the presence of wall ingrowths make the *Pisonia* mycorrhizae unique to all associations studied to date.

ELECTROCHEMICAL CHARACTERIZATION OF THE ION-EXCHANGE BEHAVIOR OF POLY(ESTER SULFONIC ACID) ANIONOMERS. William Rusin, Thomas Gennett, Chemistry Department, Rochester Institute of Technology, Rochester, NY 14623

The goal of the proposed research is to develop a viable nonelectrolyte, electrochemical detector for use in high pressure liquid chromatography and flow injection analysis experiments. Electrochemical detection requires the mobile phase to be ionically conductive, therefore a supporting electrolyte must be added to the mobile phase. This requirement limits the type of mobile phases available for liquid chromatography with electrochemical detection (LCEC). The proposed nonelectrolyte detector system utilizes ionomeric polymers as the charge carrier support, eliminating the need for an added electrolyte. The result is an increased range of important and previously unavailable. pharmaceutical-chromatographic applications for LCEC.

This research involves the use of a series of Eastman Kodak AQ poly(ester sulfonic acid) anionomers that have proven to be stable in nonaqueous electrochemical solutions. These polymers are cast on the electrode surface resulting in a membrane thickness of about 4 μm. These electrode-membrane systems produce reproducible physical and electrochemical behavior, as well as an increase in selectivity. The primary purpose of this research is to characterize the ion exchange properties and electrochemical response of these polymers with respect to various parameters that include membrane thickness, electrolyte size, and ionic strength. The presentation will include a discussion of the current results of this research and the future directions of this project.

REACTIONS OF METAL CLUSTERS WITH ALKYNES: The Reactions of $H_2Ru_2Re_2(CO)_{16}$ with 1,2-$(C_2(C_6H_5))C_6H_4$. Schuyler O. Sanderson and Romana A.

Lashewycz-Rubycz (Advisor), Chemistry Department, Hobart and William Smith Colleges, Geneva, New York 14456

There have been numerous studies of the reactions of dodecacarbonyltriruthenium, $Ru_3(CO)_{16}$, with monomeric alkynes. These reactions not only yield interesting organometallic products, but also provide information about reactions on metal surfaces.

This research involves The study of the reactions of a ruthenium-rhenium cluster with a dimeric acetylene. The ruthenium-rhenium hetero-tetranuclear carbonyl cluster, H2Ru2Re2(CO)l6, was prepared. The Knight and Mays (1972) procedure was modified to increase both yield and purity. The sodium rhenate, $NaRe(CO)_5$, was produced by the reaction of sodium amalgam and decacarbonyl-dirhenium, $Re_2(CO)_{10}$. The metal cluster was synthesized from pure $Ru_3(CO)_{12}$ and $NaRe(CO)_5$ in an inert environment (under N2), isolated and purified. *Ortho*-bis(phenylethynyl)benzene, 1,2-$(C_2(C_6H_5))C_6H_4$, was prepared from the reaction of phenylacetylene, $HC_2(C_6H_5)$, with *para*-diiodobenzene, 1,2-$(I_2)C_6H4$. The cluster was reacted with the *ortho*-bis(phenylethynyl)benzene to show the salient interactions of metal clusters with complex attunes. Of the two metals in the cluster, The reactive side (Ru) and the unreactive side (Re) should exhibit their qualities during the overall reaction.

GLAZE STORM DAMAGE TO WESTERN NEW YORK FOREST COMMUNITIES. F. K. Seischab, J. M. Bernard, and M. D. Eberle. Departments of Biology, Rochester Institute of Technology and Ithaca College. We investigated glaze damage to trees as a result of the March 3-4, 1991 storm. Forest communities of Monroe and Ontario Counties were examined to determine the extent of damage to the tree species encountered. Estimates of damage to standing trees and data on downed branches were gathered in 20 X 25 m plots in six communities.

Estimates of percent crown damage wore greatest in *Sassafras albidum* (61%), *Salix nigra* -l48%), *Prunus serotina* (47%), *Quercus velutina* (33%),.and *Q. rubra* (31%). Average crown damage for all species encountered was 20%. In some species weak branch crotches and rotten stems were a contributing factor to branch breakage. The proportion of unsound stems in some of the species were as follows: *Quercus alba* (59%), *Q. rubra* (51%), *Sassafras albidum* (43%), *Q. velutina* (41%), *Fraxinus pensylvanica* (38%), and *Populus grandidentata* (32%). The average diameter of downed branches at the butt end was 6.2 cm.

Forest edge communities experienced the greatest amount of crown damage, particularly those which were north and east facing. Percent crown damage to communities are listed in descending order as follows: north facing forest edge (51%), oak-maple forest (35%), maple-oak-hemlock (24%), hedgerow (21%), hemlock-hardwood (15%), maple-ash-elm (15%), beech-maple (14%), and red maple-ash (13%).

FIRST RECORD FOR THE SOLDIER FLY, *Nemotelus kansensis* ADAMS (DIPTERA: STRATIOMYIDAE) IN NEW YORK STATE. Carey E. Vasey, Biology, Department, SUNY at Geneseo, NY 14454.

Nine specimens of the soldier fly, *Nemotelus kansensis* Adams were collected at three different sites in the towns of Geneseo and Avon (Livingston County), New York in June 1989. Three more specimens were found at a different site in Geneseo in June 1991. These collections represent new records for this species whose previous easternmost distribution was Michigan and Indiana.

THE DESIGN OF AN INTERACTIVE PROTEIN MODELING COMPUTER PROGRAM FOR THE DISPLAY OF BROOKHAVEN PROTEIN DATA BANK FILES. John Venesky and David W. Craig (Advisor). Department of Chemistry, Hobart and William Smith Colleges, Geneva, NY 14456.

An interactive computer program has been designed that is being used to teach protein structure and to support research in protein chemistry at the undergraduate level. The structure information comes from the Brookhaven National Laboratory Protein Data Bank repository of X-ray structure analysis. The user selects data files and display attributes from a menu using a mouse pointing device. User-selectable features, include the display of abbreviated a-carbon backbones or

complete backbones, individually selectable amino acid R groups, rotation, zoom, prosthetic groups be displayed as bond-stick structures with or without Van der Waals dot surfaces, and colors can be coded by chain, atom type, or hydrophilicity. The role this program plays in undergraduate instruction will be demonstrated. Several examples will illustrate how protein function can better be understood when the investigator has control over the display of specific features of protein structure. The programming language is Digital VAX Basic with GKS graphics. Program output can be directed to several different display terminal types (DEC VT340's or PC's with emulation, VAXstations, and other X-Window or DECWindows-compliant terminals) and a varied of hardcopy devices including a color inkjet printer (DEC LJ250).

ORIGIN OF THE ALLEN'S FALLS CONGLOMERATE. Whalen, J., and Cisarenzelli, J., Geoscience Dept, Hobart & William Smith Colleges, Geneva, NY. 14456

In northern New York, quartz arenites of the Potsdam Sandstone overlie unconformably the Precambrian gneisses deformed during the Grenville Orogeny (-1050 Ga). A twenty meter thick exposure of the Allen's Falls Conglomerate is the largest of several small isolated deposits which provides our only record of this 500 million year stratigraphic gap. This study is designed to determine the depositional environment and provenance of the Allen's Falls Conglomerate in hopes of obtaining critical information about the Late Precambrian /Early Cambrian history of eastern North America.

The Allen's Falls Conglomerate is exposed along the west bank of the St. Regis River in Parishville, NY. It is a poorly sorted, coarse grained, polymictic conglomerate, with hematitic staining. The clasts within the conglomerate range in size from clay to boulder and have a variety of shapes from rounded to subangular. Larger clasts are predominantly of locally derived basement rocks, including granitic gneiss, metaquartzite, marble, and undeformed pegmatite. In contrast to the highly indurated Potsdam Sandstone, the conglomerate is weakly cemented by calcite and clay minerals. A faint stratification and imbrication are believed to east; however, no vertical size distribution has been noted.

In this study several different techniques will be utilized. These include study of thin sections and rock slabs, x-ray analysis of the matrix material and age dating of a local, undeformed pegmatite dike, clasts of which are found within the conglomerate. This work will be used to constrain age and origin of this unit.

Previous work, on the Allen's Falls Conglomerate has led to a variety of interpretations. These include origins as tillite (lithified glacial till), as part of an alluvial fan complex formed in response to block faulting, and as an immature, basal unit of the Potsdam Sandstone. The origin of coarse clastic deposits will be discussed with specific reference to new data for the Allen's Falls Conglomerate and its implications for regional geologic history.

THE FREQUENCY AND DIVERSITY OF ANTIBIOTIC PRODUCTION BY *Erwinia herbicola*. R. Wodzinski, Department of Biology, Ithaca College, Ithaca, NY 14850

Erwinia herbicola, a harmless epiphytic bacterium, is a potential biological control agent against *E. amylovora,* which causes the fire blight disease of apple and pear trees. One way *E. herbicola* can inhibit *E. amylovora* is by antibiotic production. Often the antibiotics of *E. herbicola* are not toxic in the presence of certain amino acids, presumably because the antibiotics inhibit the biosynthesis of different amino acids. The frequency and diversity Of antibiotic production by *E. herbicola* was determined. Forty-two percent of 346 isolates of *E. herbicola* produced antibiotics inhibitory to *E. amylovora.* Of 121 antibiotics studied in detail, 83% were the type that is not toxic in the presence of one or more amino acid. Antibiotics that were not toxic in the presence of histidine, leucine, arginine, isoleucine, valine, Iysine, alanine, aspartic acid and proline were found. By far the most common antibiotic was the type that was not toxic in the presence of histidine; 60% of the antibiotic producing isolates were of this type.

GROWTH OF AMERICAN CHESTNUT (*Castanea dentata*) IN TISSUE CULTURE. James M. Wolfe, Biology Dept., Houghton College, Houghton, NY 14744

Cultures of American chestnut (*Castaneadentata*) were developed from fruits collected from a tree 12 in. dbh. Seeds were refrigerated for six weeks, surface sterilized with 1 % Clorox solution, and the embryo tissue placed on MS medium with 0.5μM BAP and 0.5μM NAA. Callus cultures have been maintained for two years in MS media. Attempts to generate roots or shoots have been unsuccessful, despite varying the ratio of BAP/NAA. Old callus cultures show the production of browning compounds, probably tannins. Changes in nitrogen content of media may be critical in initiating root or shoot formation.

THE ORIGIN OF A LATE DEVONIAN DIAMICTON. Wolcott, J. and Woodrow, D.L. Department of Geoscience, Hobart and William Smith Colleges, Geneva, N.Y. 14456

The origin of a unique set of rocks, a diamicton, marking the top of the Devonian sequence in areas of Pennsylvania, Maryland, and West Virginia has been the subject of much speculation: glacial, mud- or debris flows resulting either from tectonics or sedimentary processes activity, subaqueous slump or, most outrageously, the result of a tsunami from a bolide impact.

We have examined 11 of the nearly 50 outcrops of this unit which appear along a northeast-southwest trending belt through central Pennsylvania and western Maryland to test the tsunami hypothesis. A typical sequence of these rocks includes at the base several meters of diamictite, followed by pebbly mudstone, laminated sandstone, and fine to medium gained sandstone at the top. The diamictite is distinguished by its lack of sorting and stratification, large Lasts, and distinct weathering pattern. The coasts range in size from one inch pebbles through boulders up to eight feet in diameter to sheet-like bodies of sandstone as much as 10 meters across. Body fossils are conspicuously absent from the diamicton however, palynomorphs from the diamicton have been assigned by Dr. John B. Richardson to a single palynozone at the top of the Strunian, the uppermost Devonian Stage.

Based on our analysis of the rock sequences lithology, thickness variation and age, we reject all of the hypotheses except that involving an impact.

ANALYSIS OF MITOCHONDRIAL TRANSCRIPTION IN YEAST. Amy Woodard and Vicki Cameron, Biology Department, Ithaca College, Ithaca, NY 14850

The purpose of our research is to understand the transcriptional process for genes encoded on mitochondrial DNA in yeast. The specific system under investigation is transcription of subunit II of cytochrome c oxidase, which is encoded on mitochondrial DNA and whose wild type DNA sequence is known. A respiration deficient yeast strain, VC36, has been isolated and it has been shown that no subunit II specific RNAs or polypeptide are produced. Analysis of the DNA sequence immediately preceding the protein encoding region showed that the mutant phenotype is due to a single nucleotide change, an A to a T at the -58 positions relative to the wild type sequence. Mitochondrial RNA polymerase binds to this sequence, the promoter, and initiates RNA synthesis. Therefore, this single nucleotide change in the mutant strain makes the promoter unrecognizable by mitochondrial RNA polymerase, transcription is not initiated, no subunit II mRNA is produced, and therefore, no protein is made.

Mitochondrial revertants, strains which recover the ability to respire, have been isolated in order to further investigate transcription of the subunit II gene. The purpose of this research project is to determine the mitochondrial DNA sequence of the subunit II promoter region in four of these revertants, and to determine how the sequences differ from the original mutant sequence of VC36 and from the wild type. DNA from the promoter region of each revertant has been amplified using the Polymerase Chain Reaction (PCR). The PCR amplified fragment was cloned into a vector specifically designed to accept such fragments and we confirmed that the correct piece of DNA had been inserted by restriction enzyme analysis. We then cut out the region of interest and cloned the DNA into M13, which can be used to produce single stranded DNA suitable for sequencing. We again confirmed that the correct fragment had been inserted. Single stranded DNA was prepared from each of the revertants and we are now in the process of determining the DNA sequence. The results of these experiments will allow us to determine precisely which nucleotide sequences are able to function as promoters for subunit II in yeast.

AN OPTICAL PROBE FOR MAGNETIC PHENOMENA. M. G. Woodard+, C, R. Boehly, T. Bekele*, K. O. Cottrell, and D. B. Hall, Department of Physics, SUNY College at Brockport, Brockport, NY 14420

Through the application of a magnetic field and the observed change in the rotation of plane polarized light as it passes through a sample, we can extract information concerning the sample's magnetic properties. This rotation of polarized light is called Faraday Rotation. When an optically transparent material, subject to an external magnetic field, is illuminated by linearly polarized light traveling parallel to the applied magnetic field, the polarized light's plane of vibration is rotated as it passes through the sample. Tide total rotation (@) is given by 0 = V L B. where B is the strength of the applied magnetic ' Ad and L, the distance that the light has traveled through the sample. The constant of proportionality, V. is called the Verdet constant. Upon entering a transparent medium. plane polarized light is decomposed into two circularity polarized modes of vibration rotating in opposite directions with the same angular frequency. In viewing the light from a forward direction the mode rotating in a clockwise direction is called right circularly polarized (RCP) and the one rotating counter clockwise is called left circularly polarized (LCP). Because of the presence of a longitudinal magnetic field, the index of refraction for the RCP light is different from that of the LCP light. As a result the two modes will reach the end of the sample at different times, causing the plane of vibration for the exiting light to be rotated from that of the incident light. Measurement of the Verdet constant allows us to draw conclusions concerning the magnetic susceptibility and clustering processes occurring in the sample. Time dependent measurements of the degree of rotation provide information on the dynamics of the sample's magnetism. We have developed a system that is capable of making these types of measurements over a temperature range from 1.5 K to 273 K.

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NINETEENTH ANNUAL FALL SCIENTIFIC PAPER SESSION

LARRY J. KING MEMORIAL LECTURE
Science and Universalism
by
Varadaraja Raman

ROCHESTER INSTITUTE OF TECHNOLOGY
ROCHESTER, NEW YORK
November 7, 1992

ABSTRACTS OF PAPERS

THE POPULATION STATUS AND ECOLOGY OF THE GREEN HERON (*Butorldes striatus*) AT THE TONAWANDA WILDLIFE MANAGEMENT AREA, 1991. David J. Adams, Department of Biology, St. John Fisher College, 369G East Ave., Rochester, NY 14618.

The Green Heron (*Butorides striatus*) is generally known as a solitary individual but occasionally breeds in colonies and can be found nesting along lake margins, streams, ponds, and marshes. The Tonawanda Wildlife Management Area, administered by the New York State

Department of Environmental Conservation and located in western New York, was found to sustain a thriving colony of 30+ Green Heron nests.

During the 1991 field season, data was collected concerning the ecology and population status of the Green Heron on the Tonawanda WMA wetland complex. The rookery was first noticed on May 22, located in Wood Marsh. Clutch initiation began prior to May 22 and hatching began in late May with an average clutch size of four. All nests were abandoned by the last day in June. The nests' construction was a loose aggregate of sticks located in stands of Green Ash (*Fraxinus pennsylvanica*) at five to fifteen feet above ground in standing water of three feet in depth.

Current management of this wetland includes water level control and active exotic weed control. Green Ash should be encouraged in standing water in future management.

Future research should be continued on site. An in-depth study of the breeding biology of this species would be valuable as the current scientific literature available is limited. Work should include annual nest surveys, the banding of chicks to determine population return, and a possible telemetry study. Partially funding was obtained from the Rochester Academy of Science, Helmer Nature Center, and Burroughs Audubon Nature Club.

5-ADIC & 7-ADIC CATALAN DIVISORS. Frank R. Bernhart, Rochester, NY

The sequence 1 1 2 5 14 42 132 429 ... of CATALAN numbers is easy to generate, and has many well-known elegant properties. We find a beautifully simple answer to two questions: (a) What is the highest power P of 5 (or 7) which divides C(n), the nth Catalan number, and what is the value, modulo 5 (or 7) of C(n)/P. Simple rephrase: if C(n) is written as a numeral in base 5 (or 7) instead of ten, how many zeroes are at the end (right-most), and what is the last non-zero digit? If n = 1037, then C(n) is huge, but our method requires only the inspection of n written in base 5 (or 7). Other primes may be used; the method is the same, but the details may vary.

SYSTEMATICS AND EVOLUTION OF TREE MOSSES (*Climacium dendroides* AND *Climacium americanum*) I: MORPHOLOGICAL STUDIES. Bryan Bernstein, 953 Danby Road, Ithaca College, Ithaca, New York 14850.

Two species of the moss genus *Climacium* occur in North America. The taxonomic status of the two has been questioned, however, because of reported morphological intergradation between them. In order to clarify their systematic and evolutionary relationships, ninety one individuals of *Climacium americanum* and *Climacium dendroides* were collected from Sapsucker Woods in Ithaca, New York. Measurements of leaf cell length/ width ratios and leaf auricle sizes were obtained using a morphometric computer program, AGVISION. In spite of some differentiation, extensive overlap in both traits made it arbitrary to distinguish two species by morphology alone.

AQUATIC PLANT COMMUNITY STRUCTURE PRIOR TO GRASS CARP (*Ctenopharyngodon idella*) BIOLOGICAL MANAGEMENT. Jean Bruns and Bruce Gilman, Conservation Department, Finger Lakes Community College, Canandaigua, New York 14424

Fishing success on recreational ponds can be hindered by excessive growth of aquatic plants. Recent problems in a New York State Department of Environmental Conservation (DEC) pond located in East Avon were caused by Eurasian water milfoil (*Myriophyllum spicatum*). A preliminary study of the pond revealed the presence of five species of submersed plants, with milfoil dominating at all water depths. Standing crop biomass estimates ranged from 285 to 887 gm/m2. Stocking of sterile grass carp is planned for next year, with the expected outcome being a significant reduction in milfoil biomass and a restoration of fishing opportunities. Future studies will be necessary to confirm the effectiveness of this biological management technique.

ARCHIMEDES' PRINCIPLE AND THE "EUREKA" STORY. James J. Carr, Corning Incorporated, The Center for Fiber-Optic Testing SP-BN-01-1 Corning, New York 14831

Physics instructors often delight in introducing their students to the principle of buoyancy by retelling the time honored story of Archimedes' discovery. Those familiar with the story will recall

that Archimedes, having stepped into a filled bath, observed his own body displacing a quantity of water in the overflow. Struck by this observation Archimedes had a brilliant flash of insight, sending him running naked through the streets of Syracuse shouting, "Eureka" (I've got it).

What Archimedes had actually discovered was not buoyancy, but the principle of fluid displacement which is used to determine volumes of irregular objects. The story, if true, undoubtedly led to the principle of buoyancy. In fact Archimedes proved, strictly by deductive logic, that a body immersed in a fluid is buoyed up by a force equal to the weight of fluid displaced.

VISUALIZATION IN THE CALCULUS SEQUENCE VIA MATHEMATICA. Patricia A. Clark, Rebecca E. Hill, Department of Mathematics, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, New York 14623-0887

Visualization is important at all levels of mathematics, but it especially enhances the Calculus sequence and brings to life concepts that sometimes seem nebulous to students. Mathematica is currently being used in some sections of Calculus and Differential Equations at RIT through classroom demonstrations and laboratory exercises. We have developed exercises where a student can not only see graphical representations, but use the symbolic manipulation and graphical capabilities of Mathematica in a "research" and discovery mode of study never before practical. There is a new excitement in the teaching and study of Calculus for us and our students.

One of the uses of Mathematica in each of these five courses will be presented. These examples include the secant line animation, approximation of areas by rectangles, approximations of functions by Taylor polynomials, three-dimensional surfaces as understood from their 3D graphs and contour plots, and direction fields and the study of uniqueness of a solution of a differential equation at a point.

Participants in the Rochester Academy of Science are invited to visit the Symbolic Computation Laboratory in 08-3100 during the afternoon to experiment first-hand with some of the laboratory exercises that students are experiencing in the Calculus sequence.

IRON ASSIMILATION AND VIRULENCE IN *Pseudomonas aeruginosa*. K. Corbett, K. Dudek, and J. Lodge, Department of Biology Rochester Institute of Technology Rochester, New York 14623

Pseudomonas aeruginosa is the causative agent of pneumonia in cystic fibrosis patients, some nosocomial urinary tract infections, and septicemia in immunocompromised patients. The virulence of many pathogens is partially related to their ability to grow and multiply within the host. Such growth requires iron, which in the human host is not easily accessible since most of the iron is bound to ferritin, lactoferrin, and transferrin. Thus the human host is an iron-limited environment. *Pseudomonas aeruginosa* produces the fluorescent siderophores, pyoverdine and pyochelin under iron-limited conditions. Siderophore production is greatest at pH values of 7-7.4, but large amounts of siderophore are made over the pH range of 3-8. Siderophore production is greatest when the cells are grown at 37°C, however significant siderophore synthesis is seen at 42°C. *P. aeruginosa* produces siderophore when cultured in the presence of lactoferrin, transferrin or conalbumin. None of these iron chelators have an effect on growth at 37°C, however transferrin causes a 55% decrease in siderophore synthesis and a 20-25% decrease in cell yield, at 42°C, lactoferrin has no effect. The production of elastase and capsule were also assayed for when cells were grown under iron-limited conditions. In *P. aeruginosa* PAO1 elastase activity increased 4-fold when cells were grown under iron-limited conditions while capsule synthesis was unaffected.

BIOCHEMICAL GENETIC ANALYSIS OF THE ORIGIN OF RAINBOW SMELT POPULATIONS OF LAKES ERIE AND ONTARIO. Amy L. Donner and Stuart W. Calhoun, Department of Biology, State University of New York College at Buffalo, 1300 Elmwood Avenue, Buffalo, NY 14222

Populations of rainbow smelt (*Osmerus mordax*) in the Great Lakes are believed to be descended primarily from the introduction of 16,400,000 eggs into Crystal Lake, Michigan, in 1912. The species spread rapidly through the Great Lakes system; it is believed to have entered

Lake Erie via the Detroit River in 1935 (e.g., Leach and Nepsky, 1976, J. Fish. Res. Board Canada 33:622638). The origin of the rainbow smelt population of Lake Ontario, however, remains an enigma (see the review by Smith, 1972, J. Fish. Res. Board Canada 29:717-730). Various authors have proposed that: (1) the Lake Ontario population is indigenous and of glaciomarine origin; (2) the population originated via migration of individuals from the Atlantic Ocean, through the St. Lawrence Seaway or interconnected waterways of the Finger Lakes region; or (3) the population was derived from the Lake Erie population and hence comprises descendants of the Crystal Lake introduction. We hypothesize that if the origin of the Lake Ontario population of rainbow smelt is independent of the Lake Erie population (as in 1 and 2), genetic differences should be apparent among samples from the two lakes.

We examined electrophoretic variation in proteins encoded by 24 gene loci among samples collected from spawning populations of rainbow smelt from Lake Erie (vicinity of Port Dover, Ontario; N = 20) and Lake Ontario (the Niagara River, at Lewiston, NY; N = 20). Twenty-two of the loci were fixed for the same allele in both populations, and similar allele frequencies were observed at the remaining two loci. The high coefficient of genetic similarity (S = 0.997) and the small fixation index (F_{ST} = 0.004) calculated for these samples suggest that rainbow smelt in Lakes Erie and Ontario are not genetically distinct; thus both populations are likely derived from the Crystal Lake introduction. In addition, the paucity of genetic variability among samples (average individual heterozygosity of 0.023 and 0.035 for samples from Lakes Erie and Ontario.

IMMUNOTOXICOLOGICAL EFFECTS OF IRON AND CADMIUM. Richard Doolittle, John Waud., Department of Biology and Department of Allied Health Sciences, Rochester Institute of Technology, One Lomb Memorial Drive, PO Box 9887, Rochester, New York 14623-0887

The potential exposure of human subjects to environmental and occupational toxins has been a major area of scientific investigation. However, it has become apparent recently that many of the toxicological effects of these compounds are mediated by alterations in the immune response of the exposed individual. In animal models, the first family of compounds in which immunosuppression was demonstrated to mediate the known toxicological effects was the polybrominated biphenyl, polychlorinated biphenyl, and dioxin group.

Chronic exposure to an equally important group of xenobiotics, the heavy metals, is thought also to induce toxicological effects due in part to alteration of one or more components of the immune system. A substantial body of literature exists concerning the immunotoxicological effects of a wide variety of heavy metals e.g., lead, mercury, cadmium, chromium, etc., much of which continues to prove controversial. In an attempt to develop a comprehensive three-pronged approach, a battery of *in vivo* and *in vitro* procedures is being explored to examine further the capacity of iron, cadmium, and possibly other metals to induce immunotoxicological changes. It is expected that, in the long term, the data generated may lead to the ability to predict immunological alterations in human subjects inadvertently exposed, environmentally or industrially, to xenobiotics.

CHEMICAL AND TRANSPOSITION-INDUCED MUTAGENESIS OF *Bacillus megaterium*. Jean A. Douthwright, Travis Stams, and David Manley, Rochester Institute of Technology, Rochester, New York 11623

Bacillus megaterium QM B 1551 was mutagenized using nitrosoguanidine and transposition. Mutants will be used to examine the metabolic pathways of amino acid and vitamin synthesis. This microbe is used extensively to study bacterial sporulation and germination, industrially to produce amino acids and vitamins, and to modify antibiotic molecules and hormones. An exponentially growing culture of *Bacillus megaterium* QM B1551 was treated with the chemical mutagen nitrosoguanidine to yield one percent survival. The culture was divided into two hundred independent cultures so that independent mutants could be outgrown isolated. The cultures were outgrown and frozen in 10% dimethyl sulfoxide (DMSO) at -70 degrees Celsius. Single colonies from the cultures were isolated and replica-plated onto minimal glucose salts medium with and

without Auxotrophs and were isolated, cloned, and refrozen. These will be out by growing an which contains Tn917 examined further. Transposition was carried overnight culture of *Bacillus megaterium* PV360 on plasmid pTV1. A mid-log culture grown at 30 degrees Celsius in chloramphenicol is diluted 1:100 into LB medium with erythromycin and lincomycin, and grown at 48 degrees Celsius to induce transposition. After incubation for twelve hours a 1:50 dilution is made into LB medium with no antibiotics to allow for outgrowth of the mutants. Late log-phase cells are harvested by centrifugation, resuspended in LB medium with DMSO and frozen. A control experiment is done to determine whether transposition is caused by a jackpot. These cultures will be examined for the production of insertional mutations.

CHEMISTRY IN A ZEOLITIC CAGE. Dave Dwyer, Jack Fox, Clifford Frederick, Department of Chemistry, SUNY Brockport, Brockport, New York 14420

This talk will introduce the relatively new concept of chemistry in a restricting medium. Quite often, the restricting medium is a catalytic surface or a model of such a surface. In this case, the medium is a synthetic zeolite, faujasite, which is widely used in many different industrial and research applications. The X and Y-type faujasites used in this study contain large cages in their crystalline structures, into which organic molecules can be loaded. The talk will be divided into four sections: 1) an introduction to the zeolite host and guest organic molecule, 2) the experimental procedure for the preparation of the host and guest, 3) the loading study of guest molecule, the Perinaphthenyl Radical and 4) the results of Electron Paramagnetic Resonance (EPR) spectroscopic measurements of the chemistry and physics of the guest molecule in the zeolitic host. As part of the loading study, the technique used to prevent double loading of the organic guest into a zeolite cage will be discussed. Finally, the EPR results will be interpreted in order to describe the chemistry and physics of the organic host molecule as a function of temperature and variation of the cage size in the host.

GENETIC ANALYSIS OF A PROTEIN ENCODED ON YEAST MITOCHONDRIAL DNA. Matt Eagen and Vicki Cameron, Biology Dept., Ithaca College, Ithaca, N.Y. 14850

One approach to understanding protein structure and function is to isolate derivatives of a protein in which specific amino acids have been altered and to determine the effect of the specific this project, a yeast strain that is respiration deficient due to a single nucleotide change which creates a stop codon in the gene encoding subunit I cytochrome c oxidase has been characterized. This subunit II protein is non-functional and the yeast cell carrying the mutation is respiration deficient.

Spontaneous revertants of this mutated strain were isolated and then analyzed to identify the compensatory change that allows recovery of function. We predicted that the stop codon could be reverted to nearly any other amino acid since the mutation occurred in a nonconserved region of the protein. In different organisms a whole variety of amino acids is found at this position in the protein. As expected, in one revertant a serine codon was substituted for the original lysine codon. This substitution is a dramatic one since a codon specifying a polar amino acid is being replaced by a codon which specifies a positively charged amino acid. In a second revertant, the stop codon is still present in the gene and the rest of the coding region is unchanged. Therefore, the change responsible for recovery of function in the second revertant is located in another region of the genome; either in the nucleus or elsewhere on the mitochondrial DNA. Both of these possibilities are being explored as well as confirmation that the mutant stop codon is still present in the revertant.

GROWTH MODELS FOR CONFINED CAIMAN *Crocodilus yacare*. Alejandro B. Engel, Department of Mathematics, Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, NY 14623 and Rodney C. Bassanezi, Department of Mathematics, Universidade Estadual de Campinas, Caixa Postal 6065, Campinas, SP 13081 Brazil

The time evolution of length and weight of the subspecies Caiman Crocodilus Yacare of the Caiman Crocodilus family is studied. Based upon field data of confined animals, a logistic model

for time evolution of average length was found to best fit the data. With this model, an allometry is used to find a model for the time evolution of average length of these confined reptilians. It was also found that the area of the hide of these animals is proportional to their live length squared; this fact was derived from a study of allometric field data.

The average cost of a confined crocodile was found to be proportional to the integral of its weight over time, plus an overhead cost. On the other hand, the selling price of its hide was found to be proportional to its area; thus, to the live length of the animals squared. In order to eliminate the proportionality constants, both the cost and the selling price of the hide must be transformed into dimensionless units; this is achieved by dividing these quantities by the their numerical value at the break even point in time (that is, the time when cost equals the selling price of the hide). With these two dimensionless models for cost and selling price, an optimal management strategy can be devised based upon profit or return.

CHARACTERIZATION OF A GROWTH INHIBITORY MOLECULE DERIVED FROM BOVINE VITREOUS. Irene M. Evans, Muhd Rashdan Abdulrashid, Louis J. Cantolupo, Hay Man Ho, Stephanie Leuenroth, Muthu Meyyappan, Jeanne H. Oh, Hazizun A. Rahman, and Jeffrey W. Walters, Department of Biology, Rochester Institute of Technology, Rochester, New York 14623

The normal adult vitreous of the eye is an avascular tissue and may contain molecules which inhibit blood vessel growth and proliferation. In pathological states such as proliferative diabetic retinopathy the normal avascularity of the vitreous is breached and new blood vessel growth occurs from the retina into the vitreous. This neovascularization is a leading cause of new cases of blindness in adults with long term diabetes. The primary thrust of our research has been to biochemically characterize components of normal vitreous to try to identify molecules which inhibit blood vessel growth. To search for anti-angiogenic factors, our laboratory has fractionated bovine vitreous humor using ultrafiltration and reverse phase high pressure liquid chromatography (RP-HPLC). Fractions having potential blood vessel inhibitory activity are screened using an endothelial cell proliferation assay. A low molecular weight fraction smaller than 10,000 daltons (<10K) has potent antiproliferation activity when tested against bovine large vessel endothelial cells or retinal capillary-derived endothelial cells. Two fractions containing peptides are resolved using RP-HPLC. One of these fractions is inhibitory to endothelial cell proliferation while the other surprisingly stimulated cell proliferation. Biochemical characterization of the first inhibitory peptide fraction shows it to be heat and acid stable. An apparent molecular weight of 6,600 daltons is estimated by HPLC size exclusion chromatography. Amino acid analysis of this molecule shows high concentrations of serine and glycine to be present. Biochemical characterization of the stimulatory molecule yielded an apparent molecular weight of 2,200 daltons and high concentrations of the amino acids serine and glycine. These factors may play some role in the avascularity of normal vitreous and may be useful to treat conditions such as proliferative diabetic retinopathy.

AN INTERESTING FEATURE OF THE PRODUCT-MOMENT CORRELATION COEFFICIENT. David L. Farnsworth, Department of Mathematics, Rochester Institute of Technology, Rochester, New York 14623

The product-moment correlation coefficient (r) has a variety of interpretations when used with the usual least-squares line for n data pairs. This line and r are reviewed briefly. Then, we explore positions in the plane where an additional point can be placed while the numerical value of r for the n+1 data is the same as for the original n data. There are such positions both distant from the original n data and close to them. This seems to limit the usefulness of this coefficient. Other related limitations are displayed. The references listed below will be cited.

Anscombe, F. J. (1973) Graphs in statistical analysis, *The American Statistician,* 27,17-21.

Farnsworth, D. L. (1990) The effect of a single point on correlation and slope, *The International Journal of Mathematics and Mathematical Sciences,* 13, 799-805.

Farnsworth, D. L. (1992) r-invariant curves for linear regression, *Journal of Applied Statistics, 19* , 295-299.

Hampel, F. R. (1971) A general qualitative definition of robustness, *Annals of Mathematical Statistics,* 42,1887-1896.
Neter, J., Wasserman, W., and Kutner, M. H. (1990) *Applied Linear Statistical Models,* 3rd ed. (Homewood, IL, Irwin).

SYNTHESIS AND CHARACTERIZATION OF THERMOTROPIC LIQUID CRYSTALLINE POLY(ESTER-IMIDE)S CONTAINING CHIRAL CENTERS. Edwin T. Freeman and Jerry M. Adduci, Department of Chemistry, Rochester Institute of Technology, Rochester, New York 14623

Liquid crystal polymers have become increasingly an active field of study. They offer various phase transitions for study. Fibers, films, coatings and molding materials with remarkable mechanical properties are made from the oriented anisotropic phase of these polymers.

A series of novel poly(ester-imide)s was prepared by the reaction of imide dicarboxylic acids with various diols containing two, three, six and twelve methylene groups by a melt polymerization technique. The imide dicarboxylic acid monomers which contained the chiral centers were prepared by reacting D,L-, D-, and L- alanine with pyromellitic anhydride,**1**, and trimellitic acid anhydride, **2**, using the method of Wrasidlo and Augl [1]. The poly(ester-imide)s were characterized by dilute solution viscosity, infrared spectroscopy, differential scanning calorimetry and polarizing light microscopy. The preparation and characterization of the monomers and the poly(ester-imide)s will be discussed.

1. W. Wrasidlo and J. M. Augl, J. Polym. Sci. A-1, 7, 321 (1969).

AVAILABILITY OF INSECTS AND INSECT CONSUMPTION BY *Cebus capucinus* IN THE LIVING FENCE POST AND PLANTATION HABITATS. E. Frye, R. Morley, Box 927, Nazareth College Box 10998 Rochester, NY 14618

Insect consumption and availability were documented for *Cebus capucinus* at Curu National Wildlife Refuge, Costa Rica. Consumption of insects by white-face capuchins was compared in two man-made habitats: living fence posts and plantations. Data were collected using a behavioral focal sampling method and insect consumption was determined to be higher in the plantations than the living fence post habitat. Availability of insects in four habitats, banana, mango, border, and living fence post, was measured by the insect sweep method. The greatest abundance of insects was recorded in the living fence post, followed by mango plantations, border habitat, and then banana plantations.

The results of the two studies were evaluated in order to determine the relationship between consumption and availability. It was found that. as insect availability increased, insect consumption decreased. The purpose of the study was to determine the effects of capuchins' insectivorous diets on the plantations, and subsequently their implications on crop yield. By substantiating evidence that *Cebus capucinus* are possibly useful by acting as a natural insecticide, it is intended that the study will help in the conservation of the species.

HABITAT INVENTORY AND CLASSIFICATION: THE FIRST STEP IN RESOURCE MANAGEMENT OF THE RG&E RUSSELL STATION PROPERTY. Margret Gebhart and Bruce Gilman, Conservation Department, Finger Lakes Community College, Canandaigua, New York 14424

Successful resource management requires that landuse decisions be guided by limitations imposed by the physical environment, sensitivity to fragile resources, suitability of natural systems to rehabilitation, and the policies of the landowner. The initial step must be an inventory and evaluation of current resources.

Detailed vegetative information was collected from quadrats and transects, wildlife data from traplines and timed counts, and fisheries information from boat electroshocking and angler surveys. Habitats were classified according to the New York State Natural Heritage system. A total of ten habitats were noted, home to over 300 species of plants and animals.

This comprehensive ecological database will assist in the selection of habitat restoration techniques pursuant to the landuse goals of Rochester Gas and Electric.

HISTORIC PHYTOGEOGRAPHY OF AQUATIC MACROPHYTES IN CENTRAL AND WESTERN NEW YORK. Lauren Elaine Giebel and Bruce Gilman, Conservation Department, Finger Lakes Community College, Canandaigua, New York 14424

Management of freshwater fish and wildlife requires a thorough understanding of the habitats created by the aquatic macrophyte community. Information on modern plant composition, as well as data on beneficial plants that might potentially grow in a lake, could provide direction to resource managers. Details on the historic distribution of macrophytes, when compared to modern records, may help document recent trends in lake ecology.

The 1990 publication, Atlas of New York State Flora, provides preliminary distributional information on aquatic macrophytes, but is not site specific. Visits to four regional herbaria were used to catalog historic occurrences of 78 taxa in specific water bodies within an 18 county region of upstate New York. These historic data were compiled for each water body, then compared to available, recent inventories of macrophyte community composition. A need for more inventories of modern aquatic macrophyte communities is apparent.

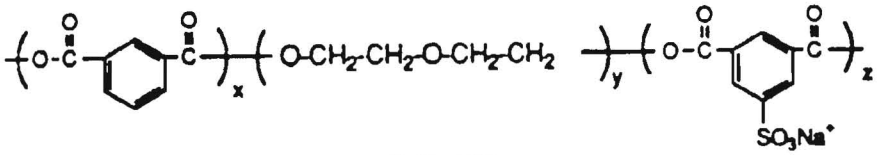
ELECTROCHEMICAL DETERMINATION OF PARTITIONING COEFFICIENTS FOR A SERIES OF POLYESTER SULFONIC ACID IONOMERS. Lynn M. Gier.

The use of ionomer-modified electrodes in non-aqueous electrochemistry has been limited because of several inherent problems with the ionomeric membranes in non-aqueous solvents: swelling, solubility, lack of structural integrity, etc. However, we have found a series of polyester sulfonic acid ionomers to be stable in several nonaqueous electrochemical solutions. The ion-exchange, electrochemical behavior of platinum disk electrodes coated with five to ten micron films of three different ionomers (see figure 1) were studied.

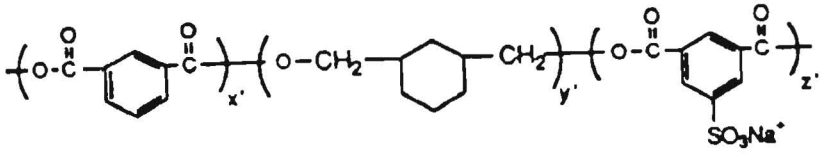
All electrochemical experiments were performed in a three electrode cell consisting of a platinum working electrode, a saturated Ag/AgCI reference electrode, and a platinum counter electrode. Two electrolytes were used, ($(C_4H_9)_4NPF_6$) and ($NaClO_4$) in acetonitrile, to determine the effect of counter ion on ion-exchange partitioning. In this study, we concentrated on the electrochemical determination of K, the partitioning coefficient, of $Ru(bpy)_3Cl_2$ with differential pulse voltametry.

From the concentration isotherm graph, the partitioning coefficients were found to be $9.66 \times 10^3 \pm 10\%$ for AQ29, $1.38 \times 10^4 \pm 10\%$ for AQ38, and $1.56 \times 10^4 \pm 10\%$ for AQ55.

FIGURE 1:



AQ 55



AQ 29

AQ 38

THE MECHANISM OF RESISTANCE TO THE HERBICIDE BENSULIDE. Chris Gunn, Martin Vaughan, Department of Biology, Rochester Institute of Technology, Rochester, NY 14623

Bensulide is a partially selective herbicide that is registered for use in a variety of dicot crops and in turf grass. Bensulide inhibits root growth of sensitive seedlings but the mechanism of the phytotoxic action is not known. Although many plants have been shown to be resistant to Bensulide, there has been no study dedicated to resistance to Bensulide. Our preliminary studies of the monocots, onion (*Allium cepa*) and corn (*Zea mays*) and the dicots, tobacco (*Nicotiana tobacum*) and carrot (*Daucus carota*) treated for 24 h with 10l, 10-5, and 10 M Bensulide have indicated that onion and tobacco are resistant and corn and carrot are sensitive. There is no clear pattern of resistance in the monocots or dicots from this study or from previous reports. Thus, models of resistance mechanisms are difficult to create. In cases of resistance where the mechanism is known, one of the following occurs: inability of the herbicide to reach the site of action due to lack of penetration or sequestration, metabolism of the herbicide, change at the site of action. Penetration barriers present in the intact root may not be present in suspension cell cultures. Therefore, suspension cultures of tobacco and carrot were treated with the same herbicide concentrations as above. Cell growth, as measured by settled cell volume, following 4 days of treatment showed that carrot cultures were still inhibited while the growth of the tobacco cultures were unaffected by Bensulide treatment. These data indicate that penetration of the herbicide is probably not the mechanism of herbicide resistance.

SYSTEMATICS AND EVOLUTION OF TREE MOSSES (*Climacium dendroides* and *Climacium americanum*) II: ISOZYME EVIDENCE. M. Gutkin, Department of Biology, Ithaca College, Ithaca New York 14850

An isozyme study was performed in order to test for genetic differences between two morphologically similar species of the moss genus *Climacium*. Ninety-one plants were collected from Sapsucker Woods, Ithaca N.Y., an area thought to contain both species. The plants were extracted and assayed for AAT, ACO, ACP, ALD, HEX, IDH, MDH, ME, PGI, PGM, PRX, SKD, SOD, and TPI.

The two species exhibited fixed allelic differences for three enzymes: ACO, HEX, and ME. Three other enzymes (IDH, PGI, and SKD) were polymorphic within both species but allele frequencies did not differ between species. Isozyme data revealed no evidence of hybridization between these two morphologically similar species.

STRUCTURAL STUDIES OF DEHYDROGENASE INHIBITORS. Wendy Hallows, Ph.D., Department of Chemistry, Rochester Institute of Technology; B. M. Goldstein, M.D., Ph.D., Department of Biophysics, University of Rochester

We have employed the techniques of small molecule x-ray crystallography and protein crystallography to study key features of molecular structure and drug-enzyme interactions of a series of nucleoside and nucleotide analogs which inhibit dehydrogenase enzymes. One of our nucleotide analogs is β-methylene SAD, shown below. Many of theses inhibitors exhibit antitumor activity, and some are currently in clinical trials. Highlights of our methods and results will be discussed.

SIGNAL PROCESSING AND DATA COMPRESSION. Dr. Edwin T. Hoefer, Department of Mathematics, Rochester Institute of Technology, P.O. Box 9887, Rochester, NY 14623-0887

The subject of this paper is the encoding of signals, such as a musical wave form, that is to be stored on some medium in an appropriate form. My interest is in the amount of information that is stored, how densely the information is packed onto the medium and how much of the original signal can be recovered.

Examples presented will show the signals stored on early Edison cylinders, the 78 rpm, 45 rpm and LP type of records, taped information, videotaped information, and up to compact disc and videodisc methods.

This lecture will be an introduction to questions concerning storage of digitized pictures. Since digitized data is easy to store, the real question is how much information needs to be stored in order to recover the essential features of the original picture.

THE DIVERSITY AND THE STABILITY OF THE PUTATIVE AMINO ACID BIOSYNTHESIS INHIBITING ANTIBIOTICS PRODUCED BY *Erwinia herbicola*. Carissa Jock and Richard S. Wodzinski, Biology Department, Ithaca College, Ithaca, NY 14850

Approximately one half of the *Erwinia herbicola* occurring naturally were found to produce antibiotics that inhibit *Erwinia amylovora*, the fire blight pathogen of pear and apple trees. The antibiotics produced by these bacteria seem to inhibit the biosynthesis of amino acids in *E. amylovora*. A majority of the antibiotics produced are of the type that seem to inhibit the biosynthesis of histidine (the histidine-type). A study was done to determine if all the histidine-type producing *E. herbicola* were producing the same antibiotic. The ability of the strains to inhibit each other was studied. If two strains produced the same antibiotic they would not inhibit each other. Three different types of antibiotics were found in the histidine-type antibiotic producing strains. The stability of the antibiotics produced by the strains was studied. It was found that most of the histidine-type antibiotics were not stable at room temperature after 24 to 48 hours.

URBAN CLIMATIC CHANGE ASSOCIATED WITH LAND USE CONVERSION. Ray Lougeay, Department of Geography, State University of New York at Geneseo, Geneseo, NY

Satellite image data from the Landsat thematic mapper, coupled with data from a ground level network of automated meteorological monitoring stations, and manned microclimatic energy budget observations, are used to assess ambient surface and near surface temperatures associated with various land use categories in the Phoenix, Arizona metropolitan area. An analysis of surface temperature, as portrayed by Landsat thermal remotely-sensed data, was compared to current land use patterns in regions of rapidly expanding urban landscape near, and including, Phoenix, Arizona. Techniques of remote sensing and geographic information systems have been employed to extract surface climatic information related to various biophysical land use categories of the present and future. In the context of global change, land use projections for the future are used in constructing regional scale climate projections employing the proposed study's findings. Use of these projections will be made in developing strategies for studying possible future land surface induced climate change in this, and other, desert regions. This project has been supported by the National Science Foundation initiative to study Human Dimensions of Global Change. Logistical support was provided by the Salt River Project, the National Severe Storms Laboratory, and the Office of Climatology and Department of Geography at Arizona State University.

A SIMPLE MATHEMATICAL MODEL OF A CANCER CELL CULTURE GROWTH BY DIFFUSION OF TUMOR GROWTH FACTORS. Sophia A. Maggelakis, Department of Mathematics, Rochester Institute of Technology, Rochester, NY 14623

Cancer growth is a function not only of the cancer cells and their environment, but also of their interactions with each other and normal cells. These interactions are due to the presence of growth factors which are defined as polypeptides. Such factors can affect the growth of most all major tissue types, and they can act as positive or negative modulators of cell proliferation (depending on their concentration). The proposed model examines the effects of the so called tumor growth factors (TGF) on the growth of a cancer cell culture. The tumor growth factor production is taken to be uniform in the region of living cells that constitute the cell culture, and the time-independent diffusion equations are solved in spherical geometry.

TWO SUSPECTED MAGNETIC EFFECTS IN THUNDERCLOUDS. Frank Mooney, 6135 Dugway Road, Canandaigua, NY 14424

1. Arago noted (~1825) that a turning magnet turned a parallel copper plate. Earth s magnetic field turns about local zeniths in proportion to the sine of the latitude and, by analogy, biases turning of ionized clouds. Torques have no line of action, so every turning ion-drop should turn its cloud a bit. If a 10 km cloud keeps pace with daily spin, convergence with conserved angular momentum tum toward a core of electrically overheated air will speed a 20 m funnel to 280 mph at 45°, 200 mph at 30°.

Tornadoes drop from clouds - nearly all are cyclonic; waterspouts and dust devils rise - many are anticyclonic, and they abound in the tropics where tornadoes are rare.

The Coriolis Effect of Earth s spin turns winds in expansive storms but barely bothers compact whirls. It shares little with Arago-turning for small clouds with nearly calm air. Coriolis-force is an illusion of Galilean kinematic relativity; Arago-torque is a reality of electromagnetic relativity.

2. An electrical charge moving with speed v builds magnetic forces that are weaker than pure static electrical forces in the ratio of v2/ c2 where c is the speed of light. Thus magnetic forces are small, but abrupt collapse of the magnetic sheath around a concluded stroke adds inductive impetus to inertial momentum of residual ions.

Upward driven ions add to usual domes overshooting into the stratosphere above flat-topped anvils of big thunderstorms. Downward driven ions could trigger microbursts and funnels.

HIGH RESOLUTION CONODONT STRATIGRAPHY AND THE FRASNIAN-FAMENNIAN BOUNDARY (UPPER DEVONIAN) WITHIN THE HANOVER-DUNKIRK TRANSITION, WESTERN NEW YORK STATE. D. Jeffrey Over, Department of Geological Sciences, SUNY College at Geneseo, Geneseo, New York 14454

The Frasnian-Famennian boundary in western New York State has traditionally been placed at the base of the Dunkirk Member, Canadaway Formation, where persistent black shale units overly green-gray calcareous shales of the Hanover Member of the Java Formation, or equivalent units. This assignment was based on general faunas of the respective units and not detailed paleontologic and stratigraphic study across the transition. The contact of the Hanover and Dunkirk is marked by interbedded green-gray and black shale units where individual beds my have gradational to abrupt contacts.

The lowest occurrence of *Palmatolepis triangularis* and *Pa subperlobata* overlying strata bearing *Pa bogartensis?, Pa. winchelli, Ancyrodella cf: Ad nodosa,* and *Ancyrognathus (asymmetricus/calvini)?* allows recognition of the Frasnian-Famennian (F/F) faunal change within a 20 cm interval in the transition beds of the upper Hanover Shale and the base of the Dunkirk Shale in western New York State. At Pt. Gratiot the F/F boundary is placed at the base of thick Dunkirk strata, coincident with a conodont bearing pyritic lag deposit. To the east, along Walnut Creek and Franklin Gulf, the F/F boundary is placed 50-60 cm below thick Dunkirk strata, at the base of a thin black shale 16 cm above a 16 cm thick black shale containing Frasnian conodonts. At Irish Gulf, the F/F boundary is 3.0 m below the base of the Dunkirk.

The F/F boundary represents a time line in Upper Devonian strata of the northern Appalachian Basin. The diachronous nature of the upper Hanover Shale is clearly demonstrated, indicating non-deposition or greater erosion in the basin relative to more near shore localities. Locally the Frasnian-Famennian boundary interval in the upper Hanover Shale is potentially conformable due to relatively high sedimentation rates on the eastern margin of the northern Appalachian Basin. Recognition of the Frasnian-Famennian boundary to a discrete horizon will allow analysis of this interval to determine possible causes of F/F extinctions.

SYNTHESIS AND CHARACTERIZATION OF MONOMERS FOR THE PREPARATION OF THERMOTROPIC LIQUID CRYSTALLINE POLY(ESTER-IMIDE)S. D. Polk, R. Ponticello, T. Smit, J. Adduci and K. Turner, Department of Chemistry, Rochester Institute of Technology, Rochester, New York 14623

From various journal articles, it would appear that the trimellitimide, **1**, and pyromellitimide, **2**, groupings when incorporated into a polymer backbone with the appropriate components should impart liquid crystalline properties to the polymeric structure. With this objective in mind, a number of monomers containing preformed trimellitimide and pyromellitimide groupings were prepared by reacting amino carboxylic acids or amino alcohols with trimellitic acid anhydride or pyromellitic anhydride using the method of Wrasidlo and Augl[1]. A total of nine novel monomers were prepared and characterized by infrared spectroscopy, H^1 NMR, and elemental analysis. They would be reacted with dicarboxylic acids or dialcohols containing four, five, six, seven, eight, nine, ten, and twelve methylene groups utilizing a melt polymerization technique. Preliminary polymerizations resulted in the formation of low molecular weight materials. The preparation and characterization of the monomers will be discussed.

CRYSTALLIZATION KINETICS OF POLY(PROPYLENE) AND POLY(VINYLIDENE FLUORIDE). J. Risley, A. Langner, Department of Chemistry, Rochester Institute of Technology, Rochester, NY 14623

The morphology, spatial arrangement of phases, of a semi-crystalline polymer is almost entirely determined by the thermo-mechanical history of the crystallization process. In this paper we present a model for the crystallization kinetics of spherulite growth in melt crystallized polymers and apply this model to polarizing light microscopic (PLM) and differential scanning calorimetric (DSC) data on the iso-poly(propylene) and poly(vinylidene fluoride) polymer systems. The PLM and DSC experiments were performed by one of us (JR) as part of the NSF-Research Experiences for Undergraduates program offered by the Dept. of Chemistry at RIT during the summer of 1992.

The linear growth rates for spherulite formation were measured as a function of melt-annealing temperature and degree of supercooling. The melting temperature for both polymer

systems was determined to be 171 °C. However, crystallization temperatures, for measurable growth rates, were 125-140°C and 140-155°C for poly(propylene) and poly(vinylidene fluoride), respectively. In addition, it was observed that the nucleation site for crystallization was "remembered" after extensive annealing of the poly(vinylidene fluoride) melt, whereas poly(propylene) displayed classic sporadic nucleation upon cooling from the melt.

The linear growth rate data obtained from the PLM experiments were employed to parameterize a model for crystallization kinetics which in turn was used to model the DSC thermograms. The model combines a second order rate equation with a diffusion equation for chains in the heterogeneous morphology of the crystallizing polymer matrix. A brief overview of how the model can be employed to extract kinetic parameters from DSC thermograms will close out the talk.

ISOLATION OF UV-SENSITIVE MUTANTS OF *Agrobacterium tumefaciens*. R. H. Rothman, K. Rozanski, and W. Pulkinnen, Biology Department, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY

Agrobacterium tumefaciens causes Crown-Gall disease, the only known plant tumor. The disease occurs when a plant wound becomes infected with the bacteria. During the healing process, the bacteria transfer a large plasmid to the cells, thereby causing neoplastic transformation. While the plasmid is absolutely essential for Crown-Gall induction, certain evidence indicates a strong involvement of the bacterial chromosome in the disease process. Moreover, there appears to be a linkage between the disease process and the mechanisms by which bacteria repair radiation- or chemically-induced DNA damage. Accordingly, we have mutagenized *Agrobacterium* with nitrosoguanidine and have isolated eight UV-sensitive mutants. Analysis of survival curves shows that these mutations fall into three and possibly four groups based on sensitivity.

DNA repair studies are facilitated by studying the interaction between bacteria and UV-irradiated bacteriophage. Accordingly, we have isolated a bacteriophage from sewage, have partially characterized it, and have tested the abilities of the UV-sensitive mutants to repair the irradiated bacteriophage. By comparing survival curves of irradiated cells and irradiated bacteriophage, we conclude that the four classes of UV-sensitive mutations inactivate both inducible and non-inducible DNA repair pathways.

THE RIVER CONTINUUM: OBSERVATIONS FROM A THERMALLY IMPACTED STREAM. Scott Schicker and Frank Smith, Conservation Department, Finger Lakes Community College, Canandaigua, New York 14424

The river continuum concept relates changes in lotic communities to the downstream gradient of abiotic factors as one moves from the stream headwaters to the stream mouth. Broad generalizations have been made about the feeding adaptations of fish across this gradient, but supportive evidence is incomplete. In this study, fish communities within Slater Creek were sampled through electroshocking. The small creek arises in the town of Greece, drains northward across the RG&E Russell Station power plant property where it receives a thermal discharge, and shortly thereafter enters Lake Ontario. Twenty four species of fish were captured and released. Omnivores dominated the headwater section of the stream, with piscivores common near the stream mouth. The influence of the thermal discharge and discharge volume on fish community structure will be considered.

PITCH PINE COMMUNITIES IN UPSTATE NEW YORK. F. K. Seischab and J. M. Bernard, Dept. of Biology, Rochester Institute of Technology, Rochester, NY 14623 and Dept. of Biology, Ithaca College, Ithaca, NY 14850

In upstate New York, pitch pine *(Pinus rigida* Mill.) communities are found in one of four environmental settings. They are on glacial deltaic sands, on rock outcrops of sandstone, conglomerate or granitic gneiss, on gravelly-channery old field sites or in *Sphagnum* filled depressions of rock outcrops where they form wooded wetlands.

These communities are distributed as islands in a landscape of deciduous forest, agriculture, urban and suburban regions. Being islands, surrounded by more mesic communities, it is not

surprising that each site has its own distinct floral composition which is slightly different from all other sites.

These communities occur in three physiognomic forms. The closed forest form, on more mesic sites, tends to have taller trees and a greater proportion of mesic overstory and herbaceous species. The more open canopy communities tend to have shorter trees and a higher proportion of ericaceous shrubs in the understory. Wooded wetlands have open canopies with a substantial ericaceous understory and contain taller trees than the surrounding pitch pine communities on rock outcrop. Rock outcrop communities have very short trees (sometimes dwarfed), ericaceous shrubs if a peaty soil has accumulated to sufficient depth, *Leucobryum glaucum* and *Polytrichum* mosses, and a variety of lichens.

"I WISH I'D REALIZED SOONER!": FACULTY INSIGHTS AFTER USING *CLASSROOM ASSESSMENT* TECHNIQUES. Glenda Senior, Rochester Institute of Technology, NTID Science/Engineering, Support Department, One Lomb Memorial Drive, PO Box 9887, Rochester, NY 14623-0887

How often have you wished you'd known sooner that students were experiencing difficulties with your course? Traditional classrooms often use summative evaluations to grade student performance. Unfortunately, for those students experiencing difficulties, this type of evaluation often comes too late to make midcourse corrections. In contrast, formative midcourse evaluations help the instructor and learner to clarify goals and assess progress toward them.

Recent research on evaluation of teaching and learning suggests students are reliable sources of information about teaching and how it affects them. Cross and Angelo, two educational researchers, use the term *Classroom Assessment* to describe the process of involving the disciplinary specialist in the formal study of teaching and learning. It is a way for the course instructor to gather limited, focused information about what, how and how well students are learning in her class. Using this information, the instructor can adjust her teaching to improve student learning.

This presentation will describe the *Classroom Assessment* philosophy and explain one of the data gathering techniques the author used in a freshman laboratory course. After showing samples of information collected from students in this way, the author will explain how she capitalized on it to adapt her teaching and to promote student self awareness of the learning process. The implications of this assessment approach for student success and retention will be briefly discussed.

PRACTICAL STRATEGIES TO HELP THE UNDERPREPARED STUDENT IMPROVE HIS/HER REPORT WRITING PERFORMANCE. Glenda Senior, Rochester Institute of Technology, NTID Science/Engineering Support Department, One Lomb Memorial Drive, PO Box 9887, Rochester, NY 14623-0887

Underprepared students often have difficulty expressing themselves in formal written laboratory reports. This difficulty may be the result of inexperience on the part of the student or assumptions on the part of the course instructor. Although the instructor may identify grammar and sentence structure difficulties as the major cause of the problem, the presenter's experience has shown that poor reports can more often be attributed to weaknesses in technical vocabulary as well as thinking, organizing and analyzing skills.

As part of a special project, the presenter worked collaboratively to identify and improve the quality of engineering students' writing. Using classroom intervention, direct instruction, and individual meetings with students, the presenter developed a number of strategies which have resulted in improved report writing performance.

After describing three strategies, which proved effective in helping students improve the quality of their reports, the presenter will suggest ways technical instructors can infuse these strategies into their classroom teaching.

SYNTHESIS OF NOVEL RING ACTIVATED SUBSTITUTED MALEIMIDES. Victor Vandell, Department of Chemistry, Rochester Institute of Technology, Rochester, NY 14623

A comprehensive study of the factors which govern the formation of substituted N-phenyl maleimides from their substituted N-phenyl maleamic acid precursors is currently underway. The transition of the maleamic acid to the maleimide occurs via a nucleophilic ring closure reaction [1] . Our investigation takes a look at whether steric and/or electronic effects, of the substituted phenyl ring, enhance or deter the nucleophilicity of the amide nitrogen. Computer aided modeling through programs like AMPAC and Chem 3-D offer the theoretical foundation to our investigation. This theoretical approach is currently being tested through experimental synthesis of N-phenyl maleimides with electron-donating, electron-withdrawing, and bulky steric groups. Measuring of the Pkb of the maleamic acid as well as monitoring of the reaction's progress are some of the ways that will be employed to determine experimentally the effects that the various substituents may have upon the ring closure reaction. Thus far several substituted maleimides have been synthesized. Of these the most electron-withdrawing and electron-donating analogs have been made. Characterization of these substituted maleimides was done using Fourier Transform Infrared (FTIR) and Nuclear Magnetic Resonance (NMR).

STUDIES OF LENTIL ISOLECTINS. Elisabeth Veith, Oliver Lau, Irmgard Howard, Chemistry Department, Houghton College, Houghton, NY 14744

Lectins are plant proteins which agglutinate specific cells. Commercial lentil lectin contains two isolectins, LcH-A and LcH-B. Are these isolectins the individual expressions of different plant strains represented in the commercial source, or are both isolectins present in a single cultivar? The present research addressed the question of origin of these isolectins by comparing the isolectins of a single cultivar to those of the commercial mixture.

Lectin was isolated from the 'Red chief' lentil cultivar by affinity chromatography, concentrated by ultrafiltration, and separated into individual isolectins by electrophoresis on cellulose acetate. The electrophoretic mobilities and relative amounts of 'Red chief' isolectins were then compared with the isolectins present in a standard commercial source. The chromophore of the 'Red chief' cultivar was also investigated.

Upon affinity chromatography, the 'Red chief' lentil lectin eluted separately from the chromophore. In contrast to the commercial lectin which contains predominantly LcH-A, the 'Red chief' lentil lectin was found to contain LcH-A and LcH-B in approximately equal amounts.

ENHANCEMENT OF REGENERATION IN A REGENERATION-DEFICIENT MUTANT STRAIN OF HYDRA BY THE ELIMINATION OF THE INTERSTITIAL CELL LINEAGE. N. Wanek, Department of Biology, Rochester Institute of Technology, Rochester, NY 14623 and T. Sugiyama, National Institute of Genetics, Mishima 411, Japan

The entire interstitial cell lineage consisting of interstitial stem cells, nerve cells, and nematocytes, was eliminated from a regeneration-deficient mutant strain *(reg-16)* of *Hydra magnipapillata* . The resultant interstitial cell lineage-free or "epithelial" *reg-16* animals showed a marked enhancement in the ability to regenerate head structures. The epithelial *reg-16* polyps regenerated nearly the same number of tentacles as were originally present within 8 days after head removal, while interstitial cell lineage-containing (or "complete") *reg-16* polyps restored less than one-third of their original tentacle number under the same conditions.

Two morphogenetic potentials, head activation and inhibition, have been thought to be involved in maintaining normal morphology in intact animals and in head regeneration. When the head is removed from a wild-type hydra, the head activation and inhibition potentials undergo a series of changes that appear to play crucial roles in determining and bringing about head regeneration (Gierer and Meinhardt, 1972; Wolpert *et al,* 1974). The head activation and inhibition potentials of intact epithelial *105* (a wild type strain) and intact epithelial *reg-16* polyps were nearly identical to the potentials in their complete counterparts. Activation-inhibition changes occurring after head removal in the epithelial *reg-16* animals, however, were different from those in complete

reg-16 polyps. The changes in the head activation-inhibition potentials in the epithelial *reg-16* animals were similar to those observed in wild-type hydra while those of complete *reg-16* polyps were highly abnormal.

THE IMPORTANCE OF A CONSERVED GLYCINE IN AN ESSENTIAL PROTEIN. Todd M. Wilson and Vicki Cameron, Biology Department, Ithaca College, Ithaca, New York 14850

A yeast strain defective in function of a mitochondrially encoded protein, subunit II of cytochrome c oxidase, was characterized. The strain produces a normal sized subunit II protein, yet is unable to carry out cellular respiration. The defect is due to a single nucleotide alteration which results in a change from a glycine codon to an arginine codon at amino acid #226. This mutation is in a region of the protein which is highly conserved and thought to bind a copper atom involved in electron transport and cellular respiration. Four revertants of this mutant strain, which have recovered the ability to respire, have also been characterized. Three of the four revertants returned to a wild type sequence. That is, the mutated arginine is restored to the wild type glycine codon. In the fourth revertant, the mutant arginine codon is still present on the mitochondrial DNA. Genetically, it has been found that the reversion is due to a compensatory mutation located on the nuclear DNA. Presumably, the nuclear gene altered in this revertant interacts directly with the mutated subunit II protein in a way that restores function.

BIOLOGICAL AND CHEMICAL PROCESSES WITHIN SENECA LAKE IN RELATION TO ZEBRA MUSSELS (*Dreissena Polymorpha*). Dr. M. Wing. N. Acquisto, Hobart and William Smith Colleges, Geneva, NY 14456-3387

Seneca Lake is a large (56 km. long x 5 km. wide) and extremely deep (198 m.) member of New York State's Finger Lakes. During the summer of 1992, intensive research was done on the chemistry and biology of this fresh water body. In order to observe the impact of zebra mussel (*Dreissena polymorpha*) infestation within Seneca Lake, one must have insight to the biological and chemical processes which shaped this fresh water environment before the presence of these mussels. By observing these processes before widespread infestation, the future effects of these aquatic organisms on the environment within Seneca Lake can be estimated.

Seasonal correlations exist in Secchi disk measurements, types and amounts of plankton (both phyto- and zooplankton), temperature, nutrient concentrations (phosphate, nitrate, and silicate), salinity. dissolved oxygen, chlorophyll a and the pH within Seneca Lake. All of the previously mentioned measurements are dependent upon one another because each affects the biological and chemical processes within the lake.

The expected growth in zebra mussel populations should result in a great flux in the ecological processes within the lake. For example, the consumption of plankton by these mussels would result in an increase in Secchi disk measurements since the lake would be less densely populated with plankton: hence, increasing water clarity. Changes in plankton populations would then affect nutrient concentrations and the quantity of chlorophyll a within the lake. The future effects of zebra mussels on Seneca Lake will be evident when compared with these initial measurements.

MACROALGAL COMMUNITIES IN TIDEPOOLS ON MOUNT DESERT ISLAND, MAINE. James M. Wolfe, and Andrew F. Lowell, Biology Department, Houghton College, Houghton, NY 14744

Macroalgal communities were studied in 36 tidepools on Mount Desert Island, Maine, during June and July 1992. A total of 51 taxa were found, with the most (21) as red algae and the smallest number (14) as green algae. Pools ranged in total number of species from 4 to 26, with the highest pools tending to have the smallest number of species. For the 36 pools, the percentage of total species as Chlorophyta was significantly ($p < 0.01$) positively correlated with tidepool height, which ranged from 92 to 803 cm above mlw. The percentage of total species each as Rhodophyta or Phaeophyta was significantly ($p < 0.05$) inversely correlated with tidepool height. The percentage of total species as Chlorophyta was significantly ($p<0.05$) inversely correlated with

littorine density, which ranged from 0 to 680 m^{-2}. The percentage of total species each as Phaeophyta or Rhodophyta was significantly ($p<0.05$) positively correlated with littorine density.

A dendrogram of the 36 pools based on community similarity (Horn's index of similarity) showed the presence of four groups of pools. The first group was characterized as high pools with low littorine densities and were dominated by the green algae *Enteromorpha* spp. and *Cladophora* spp. A second group of pools were low to mid pools with low littorine densities. Most of these pools had a high cover of *Spongomorpha* spp. A third group of pools were either pools high in the intertidal zone or had high littorine densities. A fourth group of loosely associated pools were low :n the intertidal zone or had low littorine densities and high species diversity. The results from this study show the importance of tidal height and littorine density in the determination of the structure of macroalgal communities in tidepools.

MULTIPLE GLACIATIONS IN THE GENESEE VALLEY PREDATiNG THE MOST RECENT (LATE WISCONSIN) READVANCE: A UNIQUE RECORD OF GLACIAL EVENTS AND FAUNA IN THE FINGER LAKES-WESTERN NY REGION. Richard A. Young, Geological Sciences, SUNY, Geneseo, NY 14454

Seven new radiocarbon dates from two complex glacial sequences in the Genesee Valley provide clear evidence of multiple ice advances and recessions into the Genesee Valley prior to 20,000 years ago. The strata are buried beneath the well studied Late Wisconsin deposits left by the final ice advance, which covered most of NY State. The two older events best documented by these studies are probably correlative with the Port Talbot and Plum Point Interstadials. At Port Talbot, ice-free conditions have been inferred to have occurred in the Ontario Basin about 40,000 to 50,000 B.P. from evidence near Toronto, whereas the Plum Point Interstadial approximates the interval from 25,000 to 35,000 years B.P. (before present).

The Genesee Valley sections are located both in shallow surface excavations and in deep borings along a 20-mile north-south transect between Lake Ontario and Geneseo, NY. Only fragmentary, evidence of either of these events has been previously noted anywhere in NY, in contrast to the better record of Middle Wisconsin events preserved in Ontario, Canada.

The stratigraphy in the Genesee Valley records a sequence of glacial advances separated by ice-free lacustrine intervals (organic-rich rhythmites) and the formation of thin peat deposits. The existing data demonstrate that the ice margin withdrew well back into the Lake Ontario basin during the Port Talbot Interstadial. This allowed organic-rich sediments to form on the lake floor that were subsequently reworked by the following Late Wisconsin ice readvance.

Aside from providing a unique record of the major middle Wisconsin glacial events for west-central NY, the organic remains will provide data on Middle Wisconsin flora and fauna. A mastodon/mammoth rib bone indicates the valley was occupied by large mammals over 30,000 years ago, and the peat deposits contain an abundance of insect parts, plant fragments and pollen. The complexity of the record discovered to date at elevations above the Genesee River floodplain raises theoretical questions about how such relatively shallow, unconsolidated sediments survived the prolonged ice scour conditions and deep bedrock erosion that so obviously shaped the surficial and buried bedrock landforms. The location and diversity of the deposits call for a reexamination of some of the simpler assumptions concerning the interpretation of seismic sections and multiple till exposures in the broader region where the strata often lack regional stratigraphic controls or absolute chronology.

Acknowledgements are made to SUNY Geneseo, Monroe County Environmental Health Laboratory, Eardman, Anthony and Associates Inc., Regional Sand and Gravel, Town of Webster, and the University of Arizona for funding or support of this work.

TWENTIETH ANNUAL FALL SCIENTIFIC PAPER SESSION

LARRY J. KING MEMORIAL LECTURE
Jurassic Park: Fact or Fiction?
by
Robert H. Rothman
Department of Biology
Rochester Institute of Technology

FINGER LAKES COMMUNITY COLLEGE
CANANDAIGUA, NEW YORK
November 6, 1993

ABSTRACTS OF PAPERS

THE POPULATION STATUS AND TREND OF THE BLACK TERN (*Chlidonias niger*) AT THE IROQUOIS / TONAWANDA / OAK ORCHARD WETLAND COMPLEX 1990-1993. David J. Adams, *D. A. Seyler, +J. M. Hickey, and *D. Carroll. New York State Department of Environmental Conservation, New Paltz, NY 12561; NYS DEC, Iroquois Sub-Station, Casey Road, P.O, Box 422, Alabama, NY 14003; +S.U.N.Y. College of Environmental Science and Forestry, Syracuse, NY 13210

The Black Tern (*Chlidonias niger*), a semi-colonial water bird, has been the subject of study at the Iroquois / Tonawanda / Oak Orchard wetland complex for the pact four years. This species is currently listed 28 a species of special concern by the New York State Department of Environmental Conservation. This endeavor has been carried out in conjunction with a state wide survey to re-evaluate the status of the Black Tern in Hew York State.

Nesting data was obtained each field season for the years 1991 through 1993 inclusive. In evaluating the data, it appears that the Black Tern (*Chlidonias niger*) is maintaining a stable, productive nesting population. The average number of nests per nesting season located on the complex during the period of interest is 32.8, with a low of 29 in 1992 and a high of 37 in 1991. The average clutch size over the time of this study is 2.4, with a low of 2.2 in 1993 and a high of 2.6 in 1992. The nests were located among bur-reed (*Sparganium*) and cattail (*Typha*) in standing water, The nests were constructed on muskrat feeding platforms, muskrat houses, floating logs, and artificial substrate.

Current land management for the Black Tern (*Chlidonias niger*) involves wetland water level manipulation via drawdown. Adjoining marshes are drawn down in an alternate pattern, disked, and flooded to stimulate the growth of emergent vegetation interspersed with Open water. High muskrat populations, combined with a high annual harvest provide the inactive muskrat lodges and feeding platforms the Black Tern prefers to nest on.

PRENATAL ALCOHOL EXPOSURE EFFECTS ON SOCIAL BEHAVIOR IN WEANED RATS. Karen M. Cianci[1] , Jessica Jackson[2], Jessica Lease[2] and Timothy Sanders[2]. [1]Biology Department, Houghton College, Houghton, NY 14744. [2]Psychology Department, Franklin & Marshall College, Lancaster, PA 17603-3003

The devastating effects of maternal alcohol consumption on the health of the newborn have been observed throughout history and were defined as Fetal Alcohol Syndrome (FAS) in 1967 by French practitioner, Lamache. FAS characteristics fall into three categories: growth deficiencies, facial abnormalities and central nervous system dysfunction, Research on central nervous system dysfunction has reported both cellular and behavioral abnormalities. FAS rats show hyperactivity,

decreased emotional activity, deficiencies of balance and motor coordination, attention, and learning, delayed development of the righting reflex, increased speed of negative geotaxis, fewer sucking movements, and more reactivity to bright light(Rockwood and Riley, 1986; Driscoll et al., 1990; Cianci and Aquilino, 1992). Reported behavioral differences in human FAS include hyperactivity, irritability, and attentional deficits (Streissguth et al., 1980; Bower, 1991; and Warren and Bast, 1988). Social withdrawal and psychopathology have been suggested effects of FAS, but primary effects become entangled in complex social and cognitive interactions, particularly in humans. Our study focused on social behavior manifested by weaned pups who were exposed *in utero* to alcohol by maternal consumption of 10% ethanol for the first week and 20% ethanol for the last 2 weeks of gestation, with total alcohol consumption providing up to 35% of the total daily caloric intake. An "empty calorie,' group received 35% of its total caloric intake from sucrose, to control for malnourishment effects of the alcohol consumption. The control group's total calories and remaining calories for the EtOH and sucrose groups were derived from Purina pellets. Two darns were assigned per group and all litters were reduced to 8 pups; 4 males, 4 females. Alcohol consumption ceased on the birth day. Pups were weaned on day 21 by housing them in social groups of 4; 2 males, 2 females.

Focal animal sampling with observer blind to group was begun on postnatal day 25 by placing housed groups of 4 into a Plexiglas/wood play chamber (30x60x30 cm) for 15 minutes. On day 25 significant differences were found in the number of play partners involved in a play bout (EtOH 2.20, control 2.43, $P<.05$), the mean length of a play bout (EtOH 4.83 sec., control 7.33 sec., $P<.05$), and the social index (play bout duration x number of partners, EtOH 10.65, control 18.33, $P<.01$). Hyperactivity in the FAS group was not confirmed in open field activity or behavioral repertoire. Our study supports social withdrawal in that when play behavior was begun in a group, fewer FAS pups joined than controls. It also supports reduced attention, in that play bouts were shorter.

A New Mineral Horizon within the Lockport Group (Silurian) at Walworth Quarry, Walworth, New York. Samuel J. Ciurca, Jr., 48 Saranac Street, Rochester, New York 14621

The Lockport Group, consisting mostly of dolomitic and quartzose dolomitic rocks, is particularly well known for the occurrence of a variety of colorful minerals, especially in the region from Rochester eastward to Walworth, New York.

Most of the minerals occur in vugs within biostromal beds at the base of the Oak Orchard Member (as described by Zenger, 1965) and in the vuggy zones of the Can of Worms Biostrome (Ciurca, 1988, RAS Abstracts; 1990, Lapidary J. p36-40) within the upper part of the Penfield Member (as described by Zenger, 1965).

I have found a new horizon in the Walworth Quarry containing another suite of minerals similar to those occurring stratigraphically lower, as described above. The new horizon occurs at the south end of the quarry where a favositid biostrome occurs in the stratigraphically highest portions of file quarry. The new horizon does not occur at Penfield Quarry, and hence was not previously recognized. The new horizon is higher than any strata now exposed at the Penfield Quarry.

At the Walworth Quarry, the southerly dip of the strata brings the new horizon into view only in the southern (and southern portions of the east and west walls) portion of the quarry. The horizon occurs stratigraphically above the Chert Beds.

To date the following minerals have been obtained:

Fluorite	well-developed purple cubes.
Sphalerite	lustrous crystals of a noticeably redder color than occurrences below.
Calcite	dogtoothlike, but stubby crystals often in clusters. (The occurrence of calcite "roses" is currently being investigated.)
Dolomite	crystals ubiquitous.

In contrast to the well-known occurrences I believe that the new horizon conspicuously contains vugs that are more likely to bear two or three different minerals within any one vug. If this

observation is confirmed, it means that some unusually fine matrix specimens could be obtained adding materially to the quality of the mineral specimens collectors exploit within our region.

Attempts are currently being made to delineate more accurately the position of the new horizon within the Lockport strata and to collect and preserve as many specimens as possible before the layers are completely destroyed by quarrying operations.

AN ELECTRON PARAMAGNETIC RESONANCE (ERR) STUDY OF THE INTERMEDIATES FORMED DURING THE PHOTOLYSIS OF DIBENZYL KETONE ADSORBED ON POROUS SILICA. Michelle DelleFave and Dave Dwyer, Department of Chemistry, SUNY College at Brockport, Brockport, N Y 14420

The Electron Paramagnetic Resonance (EPR) spectrum of the organic free radicals formed during continuous UV irradiation of dibenzyl ketone (DBK) adsorbed on porous silica shows different resonance lines and line shapes as a function of surface coverage and silica pore diameter. A simulation of this spectrum using techniques for calculating the EPR spectra of pi-type organic free radicals in polycrystalline hosts, which were developed previously in our laboratory, has suggested that for certain silica pore sizes the benzoyl methyl radical is formed at observable steady-state concentrations. As a result, photochemical studies on deuterated DBK adsorbed on porous silica have been undertaken in order to provide direct experimental evidence for the formation of the benzoyl methyl radical. Preliminary results on the deuteration of DBK, photochemistry of the deuterated DBK, and analysis of EPR data will be presented.

VEGETATION-ENVIRONMENT RELATIONSHIPS IN A NORTHERN NEW YORK ALVAR COMMUNITY. Bruce Gilman[1] and Robert Burgess[2]. [1]Department of Environmental Conservation Finger Lakes Community College, 4355 Lake Shore Drive, Canandaigua, NY 14424-8395. [2]Department of Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY, 13210-2778

Alvar communities occur where horizontally bedded limestone outcrops. Adjacent deep soils support a mixed forest (*Acer, Carya, Picea, Pinus*) where composition is related to stand history. Open canopy cedar glades occur on small limestone rises, and structurally vary according to grazing intensity and frequency of past cutting. Patterns in alvar meadows and pavement barrens change along topographic and soil moisture gradients. Community organization is strongly influenced by site-specific soil properties microtopography and the presence of bedrock crevices that function as safe sites. Effects of regional droughts are accentuated in alvar landscapes. Severe microclimatic conditions also contribute to community patterns. It is hypothesized that community development is governed by drought conditions and microsite disturbances including frost perturbations solution channel erosion and animal influences.

COMPETITIVE FEEDING INTERACTIONS BETWEEN ZEBRA MUSSELS AND ZOOPLANKTON: A MODELING ANALYSIS. Nasseer Idrisi, and Donald Stewart, SUNY, College of Environ. Sci, & Forestry, Syracuse, New York, U.S.A., 13210

We test the hypothesis that differential filtration rates as well as competition for certain size ranges of particles for zebra mussels and zooplankton would impact the zooplankton community. Literature and field data are applied to models simulating competitive feeding rates between zebra mussels and zooplankton in Oneida Lake, New York. We modeled particle size preferences and threshold food concentrations using stochastic parameters for both zebra mussels and zooplankton. These parameters represent various levels of uncertainty and are used to determine the probabilities that various densities of zebra mussels would have a negative impact on the zooplankton community.

ANTICYCLONES. Frank Mooney. 6135 Dugway Road, Canandaigua, New York 14424

Air at the center of highs is dead-calm, as it should be. Air spiraling from these highs is shown on weather maps to accelerate angularly without applied torque. This roundly violates

Newton's revered Second Law of Motion and subtly violates the presumed directional uniformity or directional symmetry of Space.

Earth's daily rotation provides the three kinds of turning of winds around highs. Most air north of the equator turns anti-clockwise (cyclonic) instead of clockwise (anticyclonic) when viewed from a non-rotating frame of reference.

Is motion of air around big highs an illusion? Are tight anticyclonic highs in half of the dust-devils and in some waterspouts also illusions? Which kind of anticyc!one, relative to surrounding wind, lies in the eye of a hurricane; is this low actually a high - an illusion of an illusion?

Unwhirling these confusions is attempted.

HOT-WET AND COLD-DRY JET-STREAMS. Frank Mooney. 6135 Dugway Road, Canandaigua, New York 14424

Jet-streams entered Weather Science about thirty years before texts explained Polar Jets in a rational credible way. A polar jet is also called the cold jet and is shown as a blue storm-track on some TV weather-displays. But texts on weather have yet to accommodate Bernoulli lowering of pressure by moving liquids and extended by Euler to wind, so the physics of wind has yet to be properly included by Weather Science.

And as of 1990 or later, texts do not explain Subtropical Jet-Streams - warm jets, red humidity-flows on TV-displays.

What causes jet-streams, and what do they cause?

How do hot-wet and cold-dry jets relate? What drives subtropical jets? Why do subtropical jets slow in summer?

Slowed wet flow - a vestigial subtropical jet-stream surely brought the Great Monsoonal Flood of 1993, just as the far far greater part of water that whitens the Sierras, that crests Niagara, and that greens America's heartland always comes by AIR from tropical seas.

Tentative but reasonable ideas are explained.

STRUCTURING MENTAL MAPS IN AN ASIAN METROPOLIS: MTR AWARENESS IN HONG KONG. Darrell A. Norris, Department of Geography, State University of New York College at Geneseo, Geneses, New York 14454

Each day, Hong Kong's Mass Transit Railway (MTR) carries a passenger load equivalent to half the Territory's population. Under such circumstances, individuals' spatial constructs of their environment their mental maps, are inextricably entwined with the organizing schema afforded by a transit network. This paper shows the remarkable grasp of the network among Hong Kong University students, and analyzes awareness differentials accountable to factors of traffic volume, system centrality, end-node importance and visibility, and developmental sequence. Individual mental maps are shown to either derive from broad familiarity with Hong Kong's geographical configuration, or simply accommodate it in the distorted space of the MTR system map displayed in trains and stations.

ECOLOGICAL ADAPTATION IN A NATIVE CANADIAN COMMUNITY: THE ALGONQUINS OF BARRIERE LAKE. Sue Roark-Calnek, Dayle Bowen, Sarah Guido, Mark Wamsley, and Amy Zimmerman. Department of Anthropology, SUNY Geneseo, Geneseo, New York 14454

Methods and preliminary results from an ongoing. multi-site research project on Barriere Lake Algonquin adaptations will be presented in a joint faculty-student poster session. Three components of the project are currently in progress at SUNY Geneseo: studies of the demographic evolution of the Barriere Lake population over the last 150 years; genetic relatedness in the present population and its relationship to task group and site occupancy group composition; and traditional Algonquin toponymy as an expression of environmental knowledge and as an indicator of territorial range. The poster session will include visual displays and demonstrations of research procedures.

FORESTS OF THE ALLEGANY STATE PARK REGION: 200 YEARS OF FOREST CHANGE. Franz K. Seischab, Department of Biology, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, New York 14623

In the 1790s the majority of Allegany State Park was covered with a beech-hemlock-sugar maple forest. Drier sites were covered with a diversity of oaks, beech, hemlock, chestnut and white pine. On the droughtiest of sites were oak-heath communities. Along streams, drainages and on very steep, mesic slopes were hemlock and beech-hemlock communities.

By the 1920s and 1930s regrowth forests had undergone considerable change. The map of Gordon *et al.* (1934) no longer showed a beech-hemlock or hemlock forest at streamsides because most of these areas had been converted to agricultural production. Such communities were mentioned in the 1930s literature even though the authors did not recognize them as distinct communities. Chestnut frequency had dropped by half in the oak forests an obvious result of chestnut blight. There was also an apparent increase in white oak, red maple and hickory in these oak forests with little or no mention of beech. Taylor (1927) referred to these as oak-hickory forests even though he cited a frequency of hickory at only 5%. By the thirties the sugar maple-beech forest had less hemlock and a corresponding increase in sugar maple, beech and yellow birch a reflection of the predominance of second growth forests.

Today, change in forest composition is underway as a result of widespread death of beech. The frequency of beech dropped from 36% to 16.5E in sugar maple-beech forests from 1927 to 1993. There has been a corresponding decline of beech in the streamside beech-hemlock and hemlock communities. Communities mapped as aspen forest by Gordon *et al.* (1934) are presently beech-sugar maple-red maple with black cherry, white ash, and hop-hornbeam as well as red oak and black birch. Best described as mixed hardwoods, these communities represent the likely composition of beech bark diseased communities in the future.

THREE-DIMENSIONAL RECONSTRUCTION OF PROTEIN BODIES IN MAIZE ENDOSPERM USING IMMUNOCYTOCHEMICAL METHODS. Sherry Spinelli and Craig R. Lending, Department of Biological Sciences, SUNY College at Brockport, Brockport, NY 14420

Zeins comprise 50-60% of the total seed protein of maize (*Zea mays* L.)* and therefore are major contributors to the nutritional value of the kernel. They belong to a class of proteins known as prolamines which are devoid of lysine and low in tryptophan. Both these amino acids are essential nutritional requirements for humans and some livestock. Increasing the lysine content of maize would be beneficial because of the grain's economic importance worldwide. The research project to be discussed today is part of a larger ongoing study aimed at determining the quantitative variation of the different zein (protein) types within the endosperm, how these variations affect protein body formation and the study of the effect of location within the endosperm on protein body composition. Ms. Spinelli's research involves fixation and examination of serial tissue sections at the electron microscopic level using both normal inbred lines and several mutant lines which are composed of 'high-lysine' genotypes. Immunolocalization techniques demonstrate zein distribution within the protein bodies. Micrographs of the area of interest are taken for each serial section and the images transferred to computer disc. A three-dimensional image analysis system is utilized for the analysis of the data.

A ROOM TEMPERATURE MICROWAVE INDUCED DELAYED PHOSPHORESCENCE (MIDP) PROBE OF POLYVINYL ALCOHOL FILMS. Dave Dwyer and R. J. Sucharski, Department of Chemistry, SUNY College at Brockport, Brockport, NY 1442O

Microwave Induced Delayed Phosphorescence (MIDP) has been observed at room temperature from the sodium and cesium salts of land 2-naphthoic acid absorbed in various polyvinyl alcohol (PVA) films. To the best of our knowledge, this is the first time MIDP has been observed at room temperature. The MIDP technique can be used to determine the zero field splitting parameters and spin polarization of the excited triplet states of 1- and 2-naphthoate. The zero field splitting parameters can then- be used to determine specific information about molecular

motion and orientation in the polymer host. This presentation will discuss recent improvements in the computer controlled data acquisition set-up employed in our MIDP measurements and phosphorescence decay data collected at room temperature for several PVA films.

BIRD INVENTORY AND SEASONAL HABITAT UTILIZATION AT THE RG&E RUSSELL STATION PROPERTY. Chris Van Schaick and Frank Smith, Department of Environmental Conservation, Finger Lakes Community College, 4355 Lake Shore Drive, Canandaigua New York 14424

The south shore of Lake Ontario is used by a large number of birds during migration and throughout the year. From June 1992 through May 1993 bird species utilizing the Russell Station Property were inventoried by students and staff from Finger Lakes Community College. Each month permanent transect lines were walked and all bird species observed were recorded. In addition timed area counts were made monthly at six locations which offered viewing of the various habitats within the property. The relative abundance of bird species were calculated using timed area count data. The data was then grouped into seasonal categories for comparison.

During the study, 76 species of birds were observed. Twenty six species were found on the site for only one month while 15 species were resident for eight or more months. It was concluded that 15 species were year-round residents, 24 species were summer residents, and 29 species used the area during migration. Twenty two species were observed using the RG&E property for breeding.

The Russell Station property has a diverse bird population varying with seasons. The warm water discharge in the lower section of Slater Creek attract a wide variety of waterfowl during the fall and winter months. Abundant terrestrial habitats provide food and cover for numerous songbirds. Most bird species were widely distributed on the RG&E property, typically being found in several habitat types.

PHOSPHORUS DYNAMICS IN SPRING LAKE, ALLEGANY COUNTY, NEW YORK. James Wolfe and Andrew Lowell. Department of Biology, Houghton College, Houghton, New York 14744

The limnology of Spring Lake, a small (0.1 km^2) kettle lake in northern Allegany County, has been studied since November 1991. Spring Lake has a maximum depth of 9 m, a volume of 30,000 m^3 and a watershed / surface area ratio of 8.3. Mean conductivity (237 11 $\mu S/cm^2$), mean alkalinity (91 mg/L) and mean total hardness (105 mg/L) showed that Spring Lake is a hardwater lake fed mainly by groundwater flow and has a low level of chloride (5.7 mg/L). Temperature and oxygen measurements at depth indicated a dimictic pattern with stratification during summer (thermocline at 4 m) and inverse stratification during winter under ice cover. Oxygen during stratification showed a clinograde curve, with anoxic conditions below 4 m. pH was generally alkaline, but decreased with depth, especially during periods of anoxia in the hypolimnion. Ammonia (mean = 4.41 mg/L) also showed highest levels in the anoxic hypolimnion during stratification.

Levels of total phosphorus indicated a eutrophic lake, confirmed by mean chlorophyll (20.8 µg/L) and mean Secchi depth (1.3 m). Levels of total phosphorus during summer stratification were highest in the anoxic hypolimnion while epilimnetic total phosphorus was much lower. During late autumn and winter, high levels of total phosphorus were periodically recorded for the epilimnion. Coupled with a decrease in Secchi depth during autumn to spring, this suggests that Canada geese, found from autumn until late spring in flocks up to 150 individuals, could be significant contributors to phosphorus input.

TWENTY-FIRST ANNUAL FALL SCIENTIFIC PAPER SESSION

LARRY J. KING MEMORIAL LECTURE
Virtual Reality: The Present and the Promise
The Future of Image-Ination
by
John Briggs
NorthLight Technologies
Rochester, New York

NAZARETH COLLEGE
ROCHESTER, NEW YORK
November 5, 1994

ABSTRACTS OF PAPERS

THE IMPACT OF THE ZEBRA MUSSEL, *Dreissena polymorpha,* WITHIN SENECA LAKE. Nadine Acquisto, Box W2, Hobart & William Smith Colleges, Geneva, New York 14456

A study of the biochemical processes of Seneca Lake prior to the expected arrival and infestation of the exotic zebra mussel, *Dreissena polymorpha,* was initiated in the summer of 1992. During this study, those characteristics of lake water, such as planktonic populations, water clarity and nutrient concentrations believed to be affected by the future onset of zebra mussel infestation were analyzed and monitored. The same year following that study, the first confirmed sighting of zebra mussels was made. Since then, they have colonized the entire shallow aquatic habitats of the Lake. Currently, a study is in progress to determine the magnitude of zebra mussel infestation based upon the morphological and biochemical characteristics of the Lake. Any variation in current data with the data obtained in 1992 will be an indication that zebra mussels have a significant impact on the biochemical processes within the Lake.

NOTES ON THE ECOLOGY OF A SPOTTED SALAMANDER POPULATION. David J. Adams, Mohonk Preserve Research Associate. Mohonk Preserve, 1000 Mountain Rest Road, Mohonk Lake, New Paltz, NY 12561

During the spring of 1992 a survey was conducted of Aqueduct Pool, a vernal pool located adjacent to the Mohonk Preserve, New Paltz, New York. The objective was to monitor spotted salamander (*Ambystoma maculatum*) activity. These observations were then correlated to physical environmental parameters noted on site.

Nocturnal survey results are as follows; 25+ spotted salamanders were noted in the edges of the pool and on the surrounding terrain. These salamanders were observed in several groups of 5+ individuals and in pairs as well as individually. Follow up surveys were conducted later in the season to count egg masses. Sixty (60) egg masses were noted, of these 38 were thought to be spotted salamander egg masses. The remaining 22 egg masses were wood frog (*Rana sylvatatica*) egg masses.

Physical environmental parameters noted on site were ground temperature, precipitation, air temperature, pH and water temperature. Many of these parameters were collected by other Mohonk Preserve staff and as separate experiments by other Mohonk Preserve Research Associates. Ground temperatures (F) at 4:40 PM the evening of the nocturnal survey were as follows: at the surface 26.5°, at l cm 25° and at 12 cm 25.5°. The next morning at 9:30 am ground temperature at the surface was 29.5°, at l cm 30° and at 12 cm 26°. Air temperature min. and max. for the 24 hour period were 38° and 46°F. Precipitation in the 24 hour period was 1.05 inches.

Water pH was 4.41 and temperature 33.5°F (these two parameters were taken at 10 days prior to the nocturnal survey).

In conclusion, it appears that spotted salamander (*Ambystoma maculatum*) activity is triggered, at this site, when the ground temperature at the surface approaches 30°F and moderate precipitation occurs.

THE RED DESERT BASIN PROJECT: VERTEBRATE PALEONTOLOGY AND GEOLOGY OF AN INTERMONTANE BASIN IN SOUTHWESTERN WYOMING. Robert L. Anemone[1], Dayle Bowen[1], Laure-Jeanne Davignon[2], Diana Koepfer[1], and D. Jeffrey Over[2]. Departments of Anthropology[1] and Geological Sciences[2], SUNY at Geneseo, Geneseo, NY 14454

During the summer of 1994, a field crew from SUNY at Geneseo and the College of Charleston (SC) began geological and vertebrate paleontological investigations of late Paleocene and early Eocene sediments in the Red Desert Basin of southwestern Wyoming.

Long term goals of this project include the development of a basin wide understanding of the stratigraphy and mammalian biostratigraphy, the collection and analysis of mammalian fossils from all exposed stratigraphic levels, and reconstruction of environments of deposition and paleoclimate based on sedimentological and geochemical analyses of sediments.

The Red Desert Basin forms the northeastern part of the greater Green River Basin. The basin formed during the Laramide Orogeny (Cretaceous-Eocene) as the present Rocky Mountains were uplifted. A large lake (Lake Gosiute) existed in the basin for much of the Eocene. Fluctuations in lake size over time resulted in intertonguing of the Green River Formation (lake deposits) and fluvial mudstones and sandstones of the Wasatch Formation. The Green River Shales are famous for the numerous fish-bearing intervals. Underlying the mostly Eocene Green River and Wasatch Formations are strata of the Paleocene Fort Union Formation. The presence of abundant coal beds in the Fort Union suggests deposition in river, marsh, and swamp environments.

Searching exposures of the Fort Union and Wasatch formations in the Red Desert Basin, we collected vertebrate and invertebrate fossils from approximately 20 different localities. Preliminary faunal lists include gastropods, abundant reptilian remains (mostly turtle and crocodile), and mammals representing several placental orders: Primates, Artiodactyla, Perissodactyla, Condylarthra, Carnivora, and Pantodonta. The mammals consist of, for the most part, fragmentary craniodental and isolated postcranial remains. Our most complete specimen, a nearly complete thoracic skeleton (found in association with a single molar) of a medium sized phenacodontid condylarth, holds out the hope that we may find additional relatively complete mammalian specimens in coming field seasons.

SPIN PROBING AMORPHOUS SOLIDS. Michelle Birdsall, and Dave Dwyer, Department of Chemistry, SUNY College at Brockport, Brockport, NY 14420

The molecular motion of the phenalenyl (PNL) spin probe adsorbed on zeolites, asbestos, and powders of metal salts has been characterized by continuous wave electron paramagnetic resonance (CW-EPR) spectroscopy. All of the solid hosts produce a CW-EPR spectrum which displays evidence of a low temperature thermal activation from a stationary (non-rotating) molecular state to a state of in-plane rotation. The zeolite hosts also show a higher temperature activation from the in-plane rotating state to an effectively isotropic state. In some of the solid hosts the in-plane rotation appears to be about an axis along which the half-filled, non-bonding pi-orbital on the PNL probe interacts with a monovalent metal cation.

A HISTORY OF WILDLIFE DAMAGE CONTROL, IN THE USA AND THE RELEVANCE TO WILDLIFE CONSERVATION. Lynn Braband, Critter Control. P.O. Box 19389. Rochester, NY 14619

A synopsis of the philosophies and approaches to human/wildlife conflicts will be presented. The evolution from "predator extermination" to "wildlife damage management" will be

described along with a discussion of the conflicts within the natural resource conservation and environmental communities over wildlife damage control. The importance of wildlife damage management to wildlife conservation includes: 1) the need to consider humans as part of ecosystems, 2) the impact of abundant generalist animals on biodiversity, and 3) the maintenance of public support for conservation. A January Conference in Rochester on the theme of human/wildlife conflicts will be announced.

LOW GENETIC VARIABILITY IN NORTHERN FRESHWATER FISH. Betty Lou Brett, Department of Biology, Nazareth College of Rochester, 4245 East Ave. Rochester, NY 14618-3790

Evidence suggests that fish which inhabit previously glaciated areas have extremely low levels of genetic variability. Populations of *Etheostoma, Rhinichthys, Micropterus* and *Stizostedion* from the Great Lakes are compared with fish from non-glaciated areas. The neutral theory predicts that random mutations with no selective effect can be incorporated into the genome, however, northern populations of vertebrates have undergone 3-6 thousand generations without incorporating significant genetic changes into the genome. These low levels can in part be explained by low numbers of founders after the glacial retreat and possibly by stabilizing selection. However, the low levels of heterozygosity, that are found in the Great Lakes drainages cannot be explained within the context of the neutral theory. Other studies show that heavy metals present in streams also reduce the genetic diversity of the fish populations. The implications of low heterozygosity to fisheries management is profound as populations with little or no genetic variation may be more susceptible to disease or extinction from pond culture, environmental changes, or pollution.

VIRTUAL REALITY: THE PRESENT AND THE PROMISE THE FUTURE OF IMAGE-INATION. John C. Briggs of NorthLight Technologies, 2203 Westfall Rd. Rochester, NY 14618 (716) 271-7328

Workshop Purpose: To provide a non-technical overview of Virtual Reality (VR) and its applications in the present and the future.

Definition: VIRTUAL REALITY (VR) produces a computer-generated parallel world in which the user is immersed in a dynamic, interactive artificial environment. VR provides a different reality which mimics our everyday reality.

VR Equipment: Software - tool kits to off-the-shelf programs Hardware -- Reality Engines to PCs Displays - Booms, Cabs, Caves, HMDs, Shudder Glasses, and WoWs: Windows Worlds Effectors - gloves, spaceballs, wands, mice, position trackers, and other items

VR Applications Today and Tomorrow: Architecture -- Walk through your building or house before construction. UNC: "That wall is in the wrong place." In Japan: 'Try out your kitchen before it is built."

Art - Virtual art galleries: 'You are part of the picture" or the art work. Travel to the virtual art gallery. New forms of Wart at the Guggenheim.

Business - Stock market flow: "Mountains of data and information at a glance". Flow sheets. Virtual shopping. The virtual company: "The whole company is in your hands".

Disabilities - Wheel throughs: virtual wheelchairs. The VIRA Project. Therapy.

Education and Training - Learn through the virtual lab or virtual galaxy. Try a new experience or technique, safely. Learn through doing tasks virtually.

Engineering - simulations, prototypes, and repairs: "Sim it before you build it!" Virtual work bench. "All here at the bench?: Palo Alto, Singapore, Rochester, Tokyo?"

Entertainment - "BattleTech" is coming to a mall near you. Lucas Habitat and the space station game. "Voomies" and virtual theater. "Is it real or is it Vividex?" Disney.

Medicine - Biochemical, molecular research. Aiming X-rays. Virtual cadavers. Virtual operations. "The body electronic."

Military - Flight Simulators. Air, Land, and Sea. "SimNet" tank battles. "Defense Simulation Internet." "The war began in VR - Planes flew their missions. Tanks moved forward. We won and then fought the real war."

The Presenter: John C. Briggs is a co-founder of NorthLight Technologies, a VR start-up company in Rochester, New York. He is Communication Director of the Western New York Futurists, a chapter of the World Future Society.

MISSISSIPPIAN AGE FISHES FOUND AT TIOGA COUNTY, PENNSYLVANIA. Paul Buhlig, 6 Manlon Terrace, Cheektowaga, NY 14225 and John Honan, 50 Bly Street, Rochester, NY 14620

The red beds of Tioga County were studied as far back as the Early 1900's as brief entries in professional publications. More serious studies have been done in 1991 by educators and students from the Rochester area.

In May of 1994, Paul Buhlig of Buffalo, NY and John Honan of Rochester began collecting fossil specimens from various outcrops (red beds) of the Catskill Formation, Tioga County. A systematic record was kept of all localities collected.

The following is a list of Vertebrate Fauna collected at Tioga County:

Antiarchi: *Bothriolepis* Sp.
Euarthrodira: Undetermined Sp.
Crossopterygii: *Holoptychius* Sp.
Primitive Amphibian: Undetermined Sp.
Plant Material - Branches And Tree Stems: *Archaeopteris* Sp.

The objective of this paper is to report on the Stratigraphy which includes the vertebrate-bearing sandstones and shales of Tioga County. Previous reports have not detailed any information concerning the distribution of the vertebrates according to horizons located in these areas. Vertebrates are present not only in the channels that contain gray or grayish-green sandstones and shales, but also in the red beds that belong to the Catskill Formation.

In the red beds as well as other horizons of Tioga County are scales of the Holoptychiid Genera. Namely *Holoptychius* species. The scales of *Holoptychius* have evolved from those of the early Holoptychiidae by a progressive reduction of the superficial enamel and dentine.

The authors Paul W. Buhlig and John Honan will publish a forthcoming work using the scales of the *Holoptychius* species as a comparative reference to earlier forms found in the upper Devonian at Escuminac Bay, P.Q. Canada.

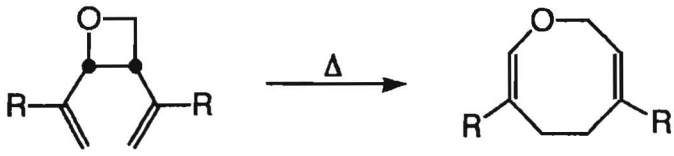
In summary, extensive field work will be needed to evaluate the study of progressive evolutionary reduction of the *Holoptychius* scales. As a result, this research may provide further information about Crossopterygians entering the Mississippian Age.

Orvig, Tor. 1957. Remarks on the Vertebrate Fauna of the Lower Upper Devonian of Escuminac Bay, P.Q. Canada.

Bryant, W. L. 1919. Structure of Eusthenopteron. Bulletin of the Buffalo Society of Natural Sciences, Buffalo, NY Vol. XIII No. 1.

A SYNTHETIC APPROACH TO OXOCANES VIA RING EXPANSION OF DIVINYLOXETANES. Li Chen, Celeste O'Connell, Jane Owens, and Janet Kaydos, Department of Chemistry, Hobart and William Smith Colleges, Geneva, NY 14456 and Mitchell Weaver, Department of Chemistry, Ohio Wesleyan University, Delaware, OH 43015

The oxocane ring system is featured in an expanding number of natural products, particularly of marine origin. However, existing methodology for the construction of these ethers is limited. We are exploring the potential that vinyloxetanes hold as precursors to oxocanes. Specifically, our studies are focused on the synthesis of the eight membered ring ethers via Cope rearrangement of 2,3-divinyloxetanes. Progress toward the preparation of the key divinyloxetane intermediates will be presented.



EPR CHARACTERIZATION OF THE INTERACTION BETWEEN MONOVALENT METAL CATIONS AND A NEUTRAL ORGANIC FREE RADICAL IN HOMOGENEOUS SOLUTIONS. Michael Ciraolo, and Dave Dwyer, Department of Chemistry, SUNY College at Brockport, Brockport, N. Y. 14420

Previous work with cation-exchanged X- and Y- zeolites (faujasites) has indicated a correlation between the continuous wave electron paramagnetic resonance (CW-EPR) spectrum of the phenalenyl (PNL) radical and the nuclear hyperfine frequencies of the exchanged alkali metal cations Li^+, Na^+ , K^+, and Cs^+. This correlation is believed to result from the formation of a PNL-cation Lewis acid/base complex. In this study we have undertaken a systematic measurement of the CW-EPR spectra of the complexes formed between Li^+, Na^+, K^+, and Cs^+ and PNL in homogeneous methanol and hexane solutions as a function of metal ion concentration. The CW-EPR data for the larger metal ion complexes (PNL-K^+ and PNL-Cs^+) indicates that a simple isotropic hyperfine interaction exists between the metal ion and the unpaired electron on PNL. Preliminary CW-EPR data for the smaller metal ion complexes (PNLLi^+ and PNL-Na^+) indicates a more complicated hyperfine interaction where the cation is believed to be jumping between three different sites in the PNL radical.

EURYPTERIDS FROM THE EARLY SILURIAN WHIRLPOOL FORMATION (RIDGE LEA BED), WESTERN NEW YORK STATE. Samuel J. Ciurca, Jr., 48 Saranac Street, Rochester, New York 14621

Early Silurian rocks of Western New York consist primarily of siliciclastic sediments that originated from a generally southeast source during the Taconic Orogeny. The Whirlpool Formation forms the base of the Silurian and consists of fine-grained white quartz sandstone with interbeds of flat-pebble (Shale) conglomerates. Thin units of greenish-gray shale, varying from seams to thin beds up to 15 cm. thick, occur within the upper half of the Whirlpool. Formation. The entire formation reaches a maximum thickness of 8 meters. *Lingula* is the most important macrofossil found in the Whirlpool Formation, though the abundance of trace fossils indicates the presence of many marine forms.

In one interbedded shale bed, herein termed the Ridgelea Bed for a nearby locality, remains of a small eurypterid were encountered. These consist of isolated but very well preserved carapaces, tergites and sternites tentatively identified as belonging to a hughmilleriid. The new occurrence is actually not unusual since a diverse fauna has been known for many years in shales intercalated with the Shawangunk Formation sandstones and conglomerates in southeastern New York (see Clark & Ruedemann, 1912). The new occurrence is very important, however, because we may finally be able to begin to correlate some of the Early Silurian eurypterid occurrences when details of the new fauna are fully known.

While eurypterids have rarely been reported from rocks low in the Silurian section, eurypterid remains have long been recognized in a dolomitic unit at the Ordovician-Silurian boundary in Ontario, Canada. Recently eurypterid remains have also been reported from the Maplewood Shale, Clinton Group at Rochester New York (Ciurca, 1989 RAS Abstracts). Undoubtedly, new horizons will be found in Early Silurian rocks.

***Cooksonia* FLORA FROM THE LATE SILURIAN WILLIAMSVILLE FORMATION (BERTIE GROUP) OF WESTERN NEW YORK STATE AND ONTARIO, CANADA.** Samuel J. Ciurca, Jr., 48 Saranac Street, Rochester, New York, 14621

Increasingly, but still. ever-so-slowly, fossil plant remains continue to be rarely found in the waterlimes of the late Silurian Bertie Group of New York State and Ontario, Canada. A personal search that began over 30 years ago (S. Ciurca, 1962, "Eurypterids at Passage Gulf" in Earth Science Magazine) has finally been rewarded with the discovery of *Cooksonia*, a presumed early land plant, in the Williamsville Waterlime of southwestern Ontario, Canada.

The specimens recovered consist of well-preserved fragments exhibiting dichotomous branching with terminal sporangia that are characteristic of this simple early land plant. A photograph of the new specimen was recently published in the New York State Geological Association Field Trip Guidebook, University of Rochester in October of 1994. Another plant recovered was *Medusaegraptus*, a form that has been variously interpreted to be either an alga or a graptolite. LoDuca (J. Paleon. 1990, p. 469-474) has shown *Medusaegraptus* to belong to the noncalcified, dasyclad algae.

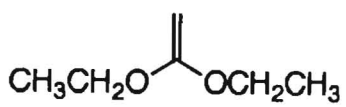
Both plants were found intimately associated in the same bed (Williamsville A Member) with *Inocaulis*, all forms being part of the *Eurypterus remipes lacustris* assemblage that occurs, geographically, from at least the area of Haggersville, Ontario, Canada eastward to the vicinity of Manchester, New York where the assemblage is replaced by the *Paracarcirlosoma scorpionis* assemblage. These are overlapping assemblages that are dated by the widespread occurrence of the brachiopod, *Eccentricosta jerseyensis*, within the overlying Williamsville B Member. The brachiopod is an important zonal fossil occurring in the Appalachian Basin, particularly in New Jersey and Pennsylvania.

Previous occurrences of *Cooksonia* have been known only from the slightly older Phelps Waterlime Member of the Fiddlers Green Formation of eastern New York at Passage Gulf, the zone of widespread occurrence of the *Eurypterus remipes remipes* assemblage. In this region, fossil scorpions are an important element of the biota. See S. Ciurca, 1978, 1982, NYSGA Field Trip Guidebooks.

Although many eurypterid horizons occur cyclically from the base of the Salina Group up to the top of the Bertie Group, and although these have been searched diligently for many years, *Cooksonia* has only been found in the two units within the Bertie Group that are discussed above. The search continues.

PREPARATION OF KETENE DIETHYLACETAL. Nancy Ciszkowski, Jane Owens, Kerri Many, and Janet Kaydos, Department of Chemistry, Hobart and William Smith Colleges, Geneva, NY 14456

Our investigations into alternative methods for the preparation of ketene diethylacetal (1), which offer advantages over previously reported syntheses of this compound, will be presented.



(1)

ADAPTIVE NEUROENDOCRINE RESPONSES TO INTERMITTENT FEEDING IN MICE. Barbara J. Davis, Robert W. Hamill, James N. Livingston and Donald K. Ingram, Monroe Community College, Nazareth College and University of Rochester School of Medicine and Dentistry, Rochester NY and Gerontology Research Center, Baltimore, MD

Lifelong dietary restriction by intermittent feeding prolongs life span in rodents, but the underlying mechanisms remain unknown. The present study determined whether a lifelong regimen of intermittent feeding alters hormonal or neural regulation of blood glucose.
Male mice (C57BL) were started on lifelong regimens of every other day feeding beginning at six weeks of age (DR) Control male C57BL mice were fed the same diet but on an ad-libitum basis (AL). All mice were killed at twenty months of age. Plasma was analyzed for glucose (glucose oxidase method) insulin and glucagon were measured (radioimmunoassay), adrenals were assayed for tyrosine hydroxylase activity as an index of sympathetic activity (radioenzymatic assay), sections of liver were stained for histochemical localization of glycogen and hepatic insulin receptor tyrosine kinase activity was estimated using SDS-PAGE analysis of receptor phosphorylation in the presence of varying concentrations of insulin.

The dietary restriction regimen resulted in a 20% increase in mean life span in a parallel group of DR cohorts. Compared with AL, DR mice showed a slight increase in body weight, markedly elevated plasma insulin, decreased plasma glucagon levels, elevated adrenal tyrosine hydroxylase activity, increased glycogen deposition in liver, but no change in hepatic insulin receptor tyrosine kinase activity. These results suggest that lifelong dietary restriction by intermittent feeding lead to adaptive neuroendocrine changes associated with both increased storage and utilization of glucose.

Supported by NIH grant AM07194 to BJD

SUPPLEMENTATION RATE OF BREAST FED BABIES AT A LOCAL HOSPITAL AND POSSIBLE EFFECTS ON THE DURATION OF BREAST FEEDING IN INFANT NUTRITION.

Anne M. Delles, Department of Biology, Nazareth College of Rochester, 4245 East Ave., Rochester, NY 14618, and Cynthia R. Howard, M.D., Department of Pediatrics, Rochester General Hospital, 1426 Portland Ave., Rochester, NY 14621

Breast feeding can be extremely beneficial to infant health. On the average, breast fed babies have fewer medical problems than formula fed babies. However, national statistics show that only a small percentage of mothers continue breast feeding their infants past the first four months of life. The first few days in the hospital are crucial for the establishment of breast feeding as the main source of nutrition for the baby.

When supplementation must be implemented, cup feeding is the one method that does not discourage breast feeding. The baby does not begin to learn to position it's tongue and lips in a way that conflicts with feeding from the breast. Infants that learn to feed on a bottle may have difficulties switching back to the breast. Cup feeding is a way of avoiding certain problems, and can hopefully encourage a longer course of breast feeding.

A chart review was conducted to determine how often supplementational feedings occurred during newborn stays at Rochester General Hospital. Patient charts (mothers and infants) were reviewed to determine why supplementation was implemented, what types of infants were supplemented, and if the infants were cup or bottle fed during the additional feedings. Data was analyzed using Epi Info. Approximately 70% of breast fed infants were supplemented at some time during their stay at the hospital. Of the infants sampled, the major means of supplementation was through bottle feeding rather than cup feeding. This study may help change nursing practices in the nursery at Rochester General Hospital so that the total number of supplementational feedings decreases, and that cup feeding becomes the primary procedure for additional feedings. Hopefully an awareness of this data may lead to a prolonged and improved duration of breast feeding.

ANALYSIS OF LEAD IN LICHENS. Marlene A. Faust, Nazareth College, 4245 East Avenue, Rochester, NY 14618

A graphite furnace atomic absorption instrument was used to determine the amount of lead in lichens (genus *Parmelia*). Lichens were sampled from three different areas: Rochester, Racquette Lake and Ava, New York in order to compare and contrast results based on location. The highest lead concentration was found in the lichens collected in Ava, while the lichens from Rochester and

Racquette Lake had similar lead concentrations. None of the samples analyzed contained lead levels that were above the standards set for lead concentration in soil samples.

ROLE OF CRYPTOGAMIC LIFE-FORM DURING PRIMARY SUCCESSION. Bruce A. Gilman. Finger Lakes Community College, 4355 Lake Shore Drive, Canandaigua, New York 14424-8395

In many community studies, taxonomic bias towards cryptogams has resulted in the artificial grouping of species with vastly different environmental tolerances under the collective categories of "moss", "liverwort" or "lichen". During primary succession, these plants play a major role in community development and are deserving of singular attention. Data is presented from a study of Limerick Cedars Nature Preserve, a northern New York alvar community. Cryptogam importance within 516 samples, arranged in order of changing substrate quality, were examined through direct gradient analysis. Vegetation on limestone outcrops is related to morphological adaptations of cryptogams, particularly the species life-form. Life-form classification systems for cryptogams are pictorially reviewed and the relationship between life-form and substrate quality is highlighted.

ANALYSIS 0F ZENITHERM DEGRADATION. Christine Groben, Dr. Laura Ellen Tubbs, Rochester Institute of Technology, Department of Chemistry, 1 Lomb Memorial Drive, Rochester, NY 14623

Formation of an unknown powder found on Zenitherm walls of the Fountain Court at The Memorial Art Gallery in Rochester, NY is being explored. Basic composition of the powder has been ascertained and possible causes are being postulated. The cause of the powder appears to be due to physical and environmental factors and is thought to be directly related to the degradation of the aging Zenitherm, a popular building material in the 1920's. The aim of the work is to clean, preserve and prevent reoccurrence of the powder formation phenomena.

RARE EARTH ELEMENT (FREE) GEOCHEMISTRY AND POSSIBLE NEGATIVE CERIUM ANOMALY IN ORDOVICIAN BLACK SHALES: EVIDENCE FOR HETEROGENEITY IN POST-ARCHEAN SHALE COMPOSITION. R. E. Hannigan, A. R. Basu, and F. Teichmann, Department of Earth and Environmental Sciences, University of Rochester. Rochester, NY 14627

The graptoliferous Ordovician (Mohawkian) black shales of the Taconic Foreland Basin are organic-rich and non-metalliferous. These shales range in thermal maturity from initially mature (Quebec) to mature (Ontario) to post-mature (New York). Deposition of these shales occurred under dysoxic to episodically anoxic conditions. Samples from the Utica Shale (and its correlatives) from its base in the *C. americanus* zone to its top in the *G. pygmaeus* zone. in the northernmost portion of the Taconic Foreland Basin, were collected and analyzed at 6 meter intervals for lanthanide concentration using ICP-MS.

The chondrite-normalized REE patterns of these shales, in general, mimic that of Post-Archean Australian Shale (PAAS), but, in detail, show distinct differences; in particular low ΣREE values (average: 89 ppm) with a characteristic light REE depletion (ΣLREE average: 74 ppm) with respect to PAAS. The LREE depletion is characterized by the lanthanum to neodymium ratio ($La/Nd^{PAAS}N$) equal to 0.8 to 0.9 normalized to PAAS. This depletion observed in the post-mature samples cannot be attributed to the presence of carbonates in the shales nor to the loss of lanthanide-bearing complexes during thermal maturation and hydrocarbon migration. We suggest that the characteristic LREE depletion may be typical of Lower Paleozoic black shales. However, it is interesting to note that the initially mature Quebec sample does not show this LREE depletion. suggesting non-uniform behavior in the Ordovician black shales.

Several post-mature samples from different biozone show a negative cerium anomaly (Ce/Ce^*= 0.82 to 0.94) which is absent in the initially mature and mature samples, while the magnitude and confirmation of the cerium anomalies are currently being investigated using

isotope-dilution techniques, its presence is in concert with both paleontological evidence and carbon-sulfur-iron systematics for episodic dysoxic deposition.

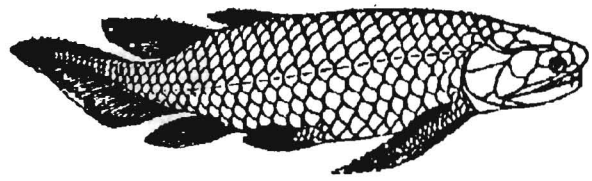
PALEOINDIAN EXCAVATIONS AT THE ARC SITE. Marc D. Hess, Department of Anthropology, SUNY Brockport, Brockport, NY 14420

The Arc Site, a paleoindian habitation site located in Genesee County, New York, underwent its first season of excavation this past summer. The excavations revealed evidence of repeated Paleoindian occupations at the site. The magnitude of artifactual evidence and the context within which it was found suggests that the Arc Site will prove to be a major source of Paleoindian research in the northeastern United States. Due to its location around and within a swamp, the site has the potential of containing seasonality data, paleo-ecological data, paleo-climatic data, and possible kill sites.

UPPER DEVONIAN FISHES OF PENNSYLVANIA. John R. Honan, 50 Bly Street, Rochester, NY 14620

In 1907, Dr. Charles R. Eastman published a book entitled, "Devonic Fishes of the New York formations." In describing New York's fossil fish, Dr. Eastman also figured specimens found in Pennsylvania. Examples recovered are of Ostracoderms (shell-skinned, jawless fish), both shark and lungfish teeth, and scales of Crossopterygian or lobe-finned fish. Fossil collectors also find fin-spines of Acanthodian (small fishes which superficially resemble sharks) and bony plates of the Placoderm fishes. Both Acanthodians and Placoderms are extinct. Eastman's book illustrates (plate 7, fig.1) bony plates of the shoulder region of a Bothriolepis, which is a Placoderm fish. The Placoderms (Gr. plax=plate + derma=skin) had their heads and bodies encased in a series of bony plates). *Bothriolepis* is found throughout the world in both marine and fresh water sediments; it occurs in great abundance in a large cliff at Maguasha, in Quebec. Finds of Bothriolepis in Pennsylvania, therefore, is of great importance in Biostratigraphy. On May 30, 1994, Mr. Paul Buhlig and I collected specimens of *Bothriolepis*, near Tioga, Pennsylvania; numerous individual plates, and a few complete specimens were recovered. Scales (both small and large) were found of the Crossopterygian fish *Holoptychius*. This fish abundantly occurs in Scotland and in Greenland. Arthrodire plates (these were the predatory Placoderm fishes) were also found.

BOTHRIOLEPIS



HOLOPTYCHIUS

ADIRONDACK TEMPERATURE ANOMALIES: A CARTOGRAPHIC PRESENTATION. Jennifer E. Josiah and Ray Lougeay, Geography Department, State University of New York College at Geneseo, 1 College Circle, Geneseo, New York 14454

It is hypothesized that if elevation is the sole cause of Adirondack anomalous temperatures, then these temperatures, when adjusted for the environmental lapse rate, would all be equivalent. Typically, such abnormal temperature patterns can be explained by the tropospheric lapse rate as it is associated with elevation. This project investigates the degree to which elevation affects observed temperatures in northern New York. Compilation of data for monthly and annual maximum, average, and minimum temperatures was accomplished using National Weather Service Cooperative Observational Stations. A regression analysis comparing elevation and observed

temperatures was calculated to determine the appropriate regional lapse rate to use in each seasonal case. These derived lapse rate values were applied to the original data and illustrate the extent to which elevation controls the Adirondack temperature patterns. Computer generated isotherm maps display these data. The final isotherm maps accentuate particularly anomalous areas and illuminate sites experiencing extremes of temperature which are unexplained by elevation.

MAYA WOMEN AND FOWL PLAY. Ellen R. Kintz (Department of Anthropology, SUNY Geneseo, NY and Diana L. Koepfer, Department of Anthropology, SUNY Geneseo, NY

The study of Yucatec Maya women and their families demonstrates utilization of poultry as an essential economic resource. Analysis of the requirements for care and conservation of the flocks has illuminated this proven successful economic strategy which is passed on matrilineally. The following attributes characterize domestic fowl management: (1) The flocks are controlled and maintained almost entirely by women and represent an integral contribution to the family economy, (2) The domesticated chicken and turkey represent a critical banked resource that provides the family with economic security, (3) The birds can be converted to cash or used as barter for commodity acquisition for goods necessary for the welfare of the family. (4) Either as producers of eggs or meat, the birds supply a source of protein for the family and are a critical village dietary resource. (5) Due to the fact that the birds are a valued resource, to avoid foul play, they are marked by the women owners with various colored string on their head or wings. These marks indicate, not only possession of birds, but the power of the women curators, and the age structure of the flock reflecting their economic value.

This interpretation of Yucatec Maya women's economic contribution to their household economy represents a more holistic and gender-based approach to understanding peasant economic organization.

A SOCIOBIOLOGICAL LOOK AT INFANTICIDE IN CONTEMPORARY NEW YORK. Diana L. Koepfer. Department of Anthropology, SUNY Geneseo, NY

A review of theory concerning infanticidal patterns reveals two distinct schools of thought. These two theories differ on the units of selection they advocate. The first explains infanticide at the level of group selection. Infanticide is seen as a mechanism aiding in population regulation. By regulating the population size, over exploitation of available resources is prevented. Therefore infanticide serves to benefit the group at a cost to the individual. The second or sociobiological explanation views infanticide as a factor in individual selection. Infanticide is then seen as a mechanism that serves to enhance inclusive fitness and therefore deliverers individual benefit. After a discussion of these two theories it will be shown how the sociobiological theory can be applied not only to animal and traditional non-western societies, but can also be used to explain human infanticidal patterns in contemporary New York. The methods for research and results, as well as possible future research implications will be discussed.

GENIC VARIATION AND BIOGEOGRAPHY OF THE DEER MOUSE, *Peromyscus maniculatus*, IN EASTERN NORTH AMERICA. J. Alden Lackey, Department of Biology, SUNY, Oswego, NY 13126; Laura L. Janecek, Savannah River Ecology Laboratory, University of Georgia, Drawer E, Aiken, SC 29802; Phyllis K. Kennedy, Department of Biology, University of Memphis, Memphis, TN 38152; Duane A. Schlitter, Section of Mammals, Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, PA 15213-4080

Genic variation was measured by means of starch-gel electrophoresis of 26 enzymes from samples of the deer mouse *Peromyscus maniculatus* collected at 35 localities from western Ontario and Minnesota eastward to the Atlantic coast in Canada and the USA, and southward to Tennessee. Samples were available from 5 currently recognized subspecies. The data were analyzed by a variety of techniques included in BIOSYS-1, such as Nei's (1972) unbiased genetic distance, Rogers (1972) genetic similarity, and others. This report is based on a preliminary examination of the data; further analyses are underway.

Assessment of genetic distance among the 6 samples of the cloudland deer mouse, *P. m. nubiterrae* from TN, WV, and PA supports the existence and distribution of this subspecies as determined previously by traditional studies of morphometric characters. Similarly, 4 samples of the subspecies *P. m. abietorum* from New England, New Brunswick, and the Gaspé Peninsula of Québec, support the currently mapped distribution that is based on morphometric characters. The subspecies *P. m. plumbeus,* found in a small area on the north shore of the Gulf of St. Lawrence, is only weakly differentiated genetically from other nearby deer mouse populations. The widespread subspecies *P. m. qracilis* demonstrated strongly marked genetic differences between various populations of this subspecies; these differences were greater than those found between some currently recognized subspecies. The subspecies *P. m. maniculatus,* presently mapped as occurring north of *P. m. qracilis* does not appear to represent a genetically distinct subspecies, but instead seems to represent northern populations of *P. m. qracilis;* the sampled populations of *P. m. "maniculatus"* are genetically closer to populations of *P. m. qracilis* to the south than they are to each other, thus suggesting the subspecies *P. m. "maniculatus"* does not exhibit the cohesive gene pool expected of a subspecies.

An analysis based on Nei's genetic distance allowed the development of a model of the recolonization of glaciated regions by this species. Assuming this species occurred in then-suitable habitats in the coastal regions of the south Atlantic states (e.g., NC, SC, GA) during the Wisconsin glacial age, dispersal during Holocene time initially involved a colonization of the southern Appalachian Mountains, and dispersal northward along the Atlantic coastal plain to ME, New Brunswick, and the Gaspé Peninsula; enroute, there were some westward dispersals into eastern PA and southern NY. One of the coastal populations may have dispersed northward through eastern NY and possibly western VT, along the Hudson River-Champlain valley lowlands, eventually giving rise to populations in eastern Quebec and possibly Labrador. Another population, originating in the Hudson River region, apparently dispersed westward along the Mohawk River Valley, then northward and around Lake Ontario, with some dispersing northward in Quebec and Ontario, and others westward, eventually reaching MN and western Ontario the western extent of the present study]. One population just north of Lake Ontario apparently dispersed southwesterly in Ontario, crossing the Niagara River, and entering extreme southwestern NY; this dispersal route is suggested by a population in Allegheny State Park that is genetically distinct from other NY populations and from populations of P. m. nubiterrae immediately to the south in PA, but is genetically close to a population in the Bruce Peninsula of Ontario.

The deer mouse was not found during 3 weeks of field work across the width of Labrador and in several human settlements on the Atlantic coast of Labrador; there are old reports of its occurrence in human settlements along that coast. The reported occurrences perhaps resulted from accidental introductions by humans over the past several hundred years. The species may have become extinct in the two settlements (Happy Valley-Goose Bay, North West River) checked in this study.

COMPARISON OF ENDOMYCORRHIZAL FUNGI OF ORGANICALLY AND TRADITIONALLY GROWN CROPS. Kelley McMurray and Dr. Christine Gruhn. Department of Biology, Nazareth College of Rochester, 4245 East Avenue, Rochester, NY 14618

Endomycorrhizal fungi form an important symbiotic relationship with many agricultural crops. These mycorrhizae invade root cortical cells and make nutrients, especially phosphorus, accessible for absorption by the plant. The plant in turn provides the mycorrhizae with photosynthetically produced glucose. This relationship may be especially crucial in organic farming when chemical fertilizers are not used.

We have collected roots and soil from both organic and inorganic farms. The roots have been stained and counted for their percentage of endomycorrhizal colonization; soil has been evaluated for the number and types of endomycorrhizal spores.

Comparison of samples at midsummer showed that organically raised corn had 49 percent more mycorrhizal colonization than the traditionally grown corn. By late summer the organically raised corn showed 37 percent more mycorrhizal colonization than the traditionally grown corn.

Other crops sampled included beans, potatoes, asparagus and carrots. In addition, soil phosphorus levels and spore numbers were correlated with crop species and endomycorrhizal colonization.

This research may provide important information for crop rotations in organically grown crops. In addition, it further demonstrates the importance of low levels of fertilization in realizing the benefits provided by endomycorrhizal fungal colonization.

MOLECULAR ENTRAINMENT. Frank Mooney 6135 Dugway Road, Canandaigua NY 14424

The motion of an airborne molecule changes billions of times a second, yet it moves freely most of the time. Feature-less, size-less molecules of an IDEAL-GAS would never attract or collide. Relatively rare bumps limit REAL-AIR'S mean free path, and a moving stream of molecules scours those nearby, be they gas, liquid, or solid, and entrains some of them.

Entrainment is so commonplace that it assaults us constantly. We inhale to relish the fragrance of flowers. We sniff to test the freshness of fish. We hold our breath to fend the foulness of feces.

Entrainment is the molecular process that lifts airplanes, explains vacuum cleaners, sprays paint, and lowers pressure of all inviscid streams. Entrainment is the source of Lake Effect Snow and nearly countless other varieties of weather. And entrainment by oil in diffusion pumps enables much of experimental physics, but I have yet to find mention of it in physics primers. Nor apparently have advanced texts explained Bernoulli's Principle by statistical analysis of moving molecules.

VITAMIN A EFFECTS ON APOPTOSIS IN CHINESE HAMSTER OVARY CELLS. Carleen M. Pope and Robert S. Greene, Department of Biology, Niagara University, Niagara University, NY 14109

Apoptosis is the process of programmed cell death. It is an active process which requires metabolic energy as well as RNA and protein synthesis. Apoptosis can be induced or suppressed through the use of certain growth regulatory factors such as retinoids. We used immortalized CHO and chemically transformed mouse 10Tl/2 cell lines to study apoptosis and the effect of retinoids on this process. We have analyzed the DNA of cells treated with retinoic acid and 9-*cis* retinoic acid by agarose gel electrophoresis and the proteins by SDS PAGE Phast Gels. Our results indicate that apoptosis is more pronounced in those cells that have detached from the cell matrix of the flask. The direct comparison of CHO and 10Tl/2 results indicates that 10Tl/2 cells do not undergo apoptosis as the CHOs do. Retinoic acid has been found to inhibit apoptosis in detached serum-starved CHO. However, the isomer 9-*cis* retinoic acid did not suppress the process in the serum-starved CHO cells. The analysis of the cellular proteins shows that there is a significant absence of high molecular weight protein in the cells in which apoptosis was suppressed by retinoic acid. Our results indicate that retinoic acid modulates programmed cell death in the CHO cell line.

ARCHAEOLOGICAL CHEMISTRY: THE ANALYSIS OF MORTAR. Jose S. Santos. and Laura Ellen Tubbs. Department of Chemistry, Rochester Institute of Technology, N.Y. 14623

The purpose of this ongoing research is twofold. The first objective is to design an analytical instrument free procedure that isolates the smallest number of mortar components needed to be determined to characterize the mortar. The second objective is to analyze a series of mortar samples from an abbey in France using the designed procedure. In this procedure, the sample is prepared by treatment with hot hydrochloric acid. The amount of calcium is determined by titration of calcium oxalate with potassium permanganate. Magnesium is determined gravimetrically as magnesium ammonium phosphate hexahydrate. The carbonate is measured gravimetrically as carbon dioxide using an alkalimeter. In order to test the procedure, the amounts of calcium, magnesium, carbonate, and insoluble material were determined in a series of control samples made up of calcium carbonate (25%-75% by weight), magnesium carbonate (5% by weight), iron oxide (0.5% by weight), calcium oxide (0.5% by weight), aluminum oxide (0.5% by weight), and

quartz (18.5%-68.5% by weight). The results from the analysis of the control samples have been very satisfactory and analysis of the samples from the abbey in France will be carried out.

AN ESTIMATE OF THE ANNUAL PRODUCTIVITY OF HONEOYE LAKE MACROPHYTE COMMUNITIES. Craig A. Smith and Bruce A. Gilman. Finger Lakes Community College, 4355 Lake Shore Drive, Canandaigua, New York 14424-8395

Submerged aquatic plants exhibit unique seasonal phenologies in growth rate and abundance. Repeated seasonal sampling along water depth transects allows the estimation of annual weedbed productivity as the sum of peak standing crop biomass for individual species. Transects beginning at the shoreline and extending 400 feet into the lake were positioned at three locations in Honeoye Lake. Each transect contained five sampling sites and was visited in early June, late July and early October. Samples were collected through use of a weighted quadrat frame and SCUBA gear. Results verify the eutrophic condition of Honeoye Lake, with some samples exceeding 500 gm/m^2. The relationship between macrophyte biomass and current lake management activities will be discussed.

A CLOSER LOOK AT THE MACHAERIDIA: ARTICULATED SCLERITE ASSEMBLAGES OF *Lepidocoleus* FROM THE SILURIAN (WENLOCKIAN) OF WESTERN NEW YORK. Wendy L. Taylor, Dept. of Earth and Environmental Sciences, University of Rochester, Rochester, NY 14627

The problematic class Machaeridia has presented paleontologists with a taxonomic and paleoecologic challenge for over a century. This group of benthic marine, worm-like invertebrates, is present in Lower Ordovician to Pennsylvanian age strata. Despite a worldwide distribution, machaeridians have received only sporadic attention from the paleontological community. More recently, new information is being introduced regarding sclerite growth (ontogeny), dorsal hinge geometry, and taxonomy. While the majority of systematic work focuses on isolated calcitic sclerites, rare articulated "sclerite assemblages" are of critical importance to reconstruct machaeridian bauplane and ultimately, to infer their paleoecology.

Nearly intact assemblages of *Lepidocoleus sarlei* were collected from two obrution (rapid burial) intervals within the Lewiston Member of the Rochester Shale (Wenlockian) of western New York State. These intervals range from 0.5-1.5 m in thickness and consist of fossiliferous mudstones and packstones rich in well-preserved crinoids, cystoids, stelleroids, trilobites, bryozoa and brachiopods. Storm activity deposited siliciclastic and carbonate sediments into the relatively shallow, subtropical Appalachian Basin during the Silurian. Fossils are preserved at the bases and within thin siliciclastic mud and carbonate silt beds representing distal tempestites or gradient current deposits. Mudstones and calcisiltites within the obrution intervals, in some cases, are traceable along depositional strike for over 80 km. The extraordinary preservation of delicate, multi-element skeletons, indicates extremely rapid and deep burial of benthic communities.

Well-preserved specimens of *Lepidocoleus* consist of a biseriate assemblage of 10-14 overlapping sclerites from 1.3-1.5 cm in overall length. Opposite sides of the scleritome articulate dorsally by means of a tongue-and groove hinge (Adrain, 1992), with the ventral margins of nearly all sclerites in close contact. The most striking feature is a distinct dorsal groove 2.0-3.0 mm wide and 1.0 mm deep, formed by the overlap of adjacent sclerites. This feature runs down the entire length of the assemblage. One specimen exhibits a cluster of three subtriangular sclerites that appear to overlap and cover an opening between the ventral margins of the anterior sclerites. This structure is unusual and awaits further study. Curvature of the assemblages and overlap of the sclerites, suggests a moderate amount of skeletal flexibility. The analysis of well-preserved sclerite assemblages is crucial to further unravel the paleobiology and taxonomy of this enigmatic group.

FIRST RECORDS OF *Chrysopilus testaceipes* BIGOT (DIPTERA: RHAGIONIDAE) IN NEW YORK STATE. Carey E. Vasey, SUNY Geneseo, NY

The discovery of *Chrysopilus testaceipes* Bigot in Livingston County, New York is a new distribution record for this Pacific Coast species. According to James (1965) this rhagionid ranges

from Washington, British Columbia and Alberta to Southern California and New Mexico. A single female specimen was taken by aerial net from a back lot in Geneseo, New York on July 26, 1986. On July 17, 1993 five females were collected from a shady north slope of a back yard in the village of Geneseo. All five specimens were taken as they were sitting on leaves of *Parthenocissus quinquefolia* (L.), the Virginia creeper. A Cone male specimen was caught on July 21, 1993 as it rested in a screen door on the same property. The specimens were determined to species using Hardy's (1949) keys to the North American *Chrysopilus*.

I am indebted to Dr. Donald W. Webb of the Illinois Natural History Survey, Champaign Illinois who verified my determinations.

SEARCH FOR TOBACCO SHOOT INHIBITOR (TSI). Tung Vuong, Imre A. Tamas, Donald Crampton, Alexandra Mandoki. Biology Department, Ithaca College, Ithaca, NY 14850-7478

The expression of the auxin-sensitive mas promoter was investigated in transgenic tobacco plants using luciferase *luxA & luxB* as reporter genes. The results suggest that a native inhibitor, TSI, can counteract the effect of auxin on *luxA & luxB* expression. Here we report on an attempt to isolate and characterize TSI. The active substance was separated from methanolic extracts of tobacco stems and immature inflorescence using a Sephadex LH-20 column. TSI activity was assayed by applying column fractions to stem sections of *luxA & luxB* plants, and measuring the decrease in luciferase activity. Our results show that TSI is eluted from the column as a single peak. Fractions of this peak are being further purified by HPLC on a C-18 column. A single peak with TSI activity has been tentatively identified. Results on the further characterization of the substance will be presented.

THE INACTIVATION OF THE ANTIBIOTIC OF *Erwinia herbicola* BY PROTEOLYTIC ENZYMES. Deborah Wilsker and Richard Wodzinski. Department of Biology, Ithaca College, Ithaca, NY 14850.

Erwinia herbicola produces an antibiotic that inhibits *Erwinia amylovora* which causes fire blight, a bacterial disease of apple and pear trees. However, in the presence of the proteolytic enzyme pronase E, the antibiotic of *Erwinia herbicola* is not toxic to *Erwinia amylovora*. The method by which the proteolytic enzyme detoxifies the antibiotic of *Erwinia herbicola was* investigated. When the proteolytic enzyme was boiled, denatured and mixed with antibiotic, the *Erwinia herbicola* antibiotic again was not toxic to *Erwinia amylovora*. Thus the proteolytic activity of the enzyme was not responsible for inactivating the antibiotic. The antibiotic's effectiveness was then tested in the presence of various other proteins. It was found that the antibiotic was also rendered ineffective by bovine serum albumin and acid phosphatase. When passed through an ultrafilter, the filtrates of these proteins did not inhibit the antibiotic. It is suggested that the antibiotic may bind to some proteins or high molecular weight molecules allowing *Erwinia amylovora* to grow in the presence of the antibiotic.

THE ROLE OF PHOTOSYNTHETIC ORGANISMS IN SPRING LAKE, ALLEGANY COUNTY, NEW YORK. James M. Wolfe and H. Stephen Lausch. Department of Biology, Houghton College, Houghton, New York 14744

The role of photosynthetic organisms were investigated for Spring Lake, a small (0.1 km^2) eutrophic, hardwater (110 mg/L $CaCO_3$) kettle lake in northern Allegany County. Chlorophyll a values varied widely with depth and by season, with a mean of 8.4 μg/L and reaching a peak of 31 μg/L in the hypolimnion in July 1993. Photosynthetic bacteria, as detected by plating on PMS media from water samples in February and March 1994, were found to be facultatively-aerobic, heterotrophic, gram-negative bacilli and cocci which occurred in low numbers (maximum of 360 colonies/mL}. Phosphorus and ammonia concentrations were highest in the hypolimnion during summer with peaks in late August 1993 of 417 pbb and 5 mg/L respectively. We suggest that spring blooms of phytoplankton, as indicated by peaks in chlorophyll *a* concentrations are correlated with mixing of hypolimnetic nutrients after ice breakup in spring.

CAPTIVE PRIMATE ENRICHMENT. Anthea Yannopoulos, 38 Valley View Drive, Penfield, NY 14526

This paper provides a look at current trends in the enrichment of captive primates both in the lab and on exhibit. It examines the growing awareness and concern among scholars, researchers, and zoo technicians for the previously ignored emotional component of primate health. My research at Rochester's Seneca Park Zoo during the summer of 1994 involved the behavioral observations of a series of primate species including orangutans, spider monkeys, gibbons, and Demurs. These observations were focused on apparent neurotic behavior and probable causes. Subsequent efforts were made at engaging the primates in alternative activities such as providing task-oriented feeding devices and experimenting with various methods of food distribution. This was intended to maximize the amount of time captive primates spent foraging for daily food rations. Previous research has indicated that successful enrichment results in a decrease in the levels of neurotic and self-abusive behaviors.

TWENTY-SECOND ANNUAL FALL SCIENTIFIC PAPER SESSION

LARRY J. KING MEMORIAL LECTURE
Music: More Than Just Sound!
by
Ellen Koskoff
Eastman School of Music
University of Rochester, Rochester, New York

MONROE COMMUNITY COLLEGE
ROCHESTER, NEW YORK
November 4, 1995

ABSTRACTS OF PAPERS

THE HISTORY OF PURPLE LOOSESTRIFE (*Lythrum salicaria*) IN SOUTHERN NEW YORK. David J. Adams, NYS DEC, 21 South Putt Corners Road, New Paltz, NY 12561

Purple loosestrife, (*Lythrum salicaria*), has aggressively outcompeted the native wetland vegetative species in much of New York State. In past years various means of eradication have been implemented nation wide to attempt to lessen the impact of this exotic species on native wildlife. Methods utilized historically include cutting, mowing, burning, flooding, spraying of herbicide, as well as competition by other more advantageous species.

Four wetland complexes in southern NY have received one or more of the control methods mentioned above. At the Stewart Buffer Zone a dam was constructed to raise the water levels and, therefore, flood the purple loosestrife. The Bog Brook Unique Area utilized several methods including raising the water level, and periodic burns. Tivoli Bay has not been able to implement a control program due to its lack of water level control structures. The fourth area, the Bashakill, was altered by the construction of a dam to raise water levels.

As expected, much of the control of purple loosestrife to date has been implemented at a high cost. The benefits are not nearly as obvious as hoped. Also, the raising of water levels has led to a change in the character of the wetlands in which this method has been utilized.

The use of a biological control program may be the only alternative to the continual problem of biological degradation to the wetlands of New York State by purple loosestrife. The establishment of the biological control of purple loosestrife program should be aggressively

pursued throughout the State. During the field season 1995 Region 3 of the NYS DEC implemented the first stage of this program. We released 2,000 eggs of the root-mining weevil, (*Hylobius transversovittatus*), at two sites within Region 3, one east and one west of the Hudson River, The two leaf-eating beetles, (*Galerucella* sp.) will be released in 1996.

IDENTIFYING CLAY SOURCES FOR PREHISTORIC POTTERY BY ATOMIC SPECTROSCOPY AND MULTIVARIATE STATISTICS. Walter J. Bowyer, Elizabeth A. Kneisel, Frank S. Walker, Thomas G. Huntsberger, Richard D. Faust, Dept. of Chemistry, Hobart and William Smith Colleges, Geneva, NY 14456

Due to the high cost of neutron activation analysis, atomic spectroscopy is increasingly used for analysis of prehistoric pottery sherds and clays. We are using both atomic absorbence and inductively coupled plasma emission spectroscopy to analyze sherds and potential clay sources from southern Arizona, Lithium metaborate fusion and hydrogen fluoride digestion are compared. Standard reference materials are analyzed to estimate accuracy of the analyses. Precision by atomic spectroscopy is shown to be better than that reported for neutron activation analysis. Multivariate statistics are used to match pottery sherds to the likely source of clay used for their production.

IN SEARCH OF THE *Rhizodus*. Author: Paul W. Buhlig, 6 Manlon Terrace, Cheektowaga, N.Y. 14225

In late July of 1995, the author visited the provinces of New Brunswick, Nova Scotia, and Gaspé, province of Quebec, Canada. The objectives of this trip were to report on the fossil fish *Rhizodus* and field collecting at one of these sites.

Rhizodus is a Crossopterygian fish which grew to enormous lengths of 1-3 meters. Some of it's scales are almost 70 mm's in diameter and their teeth have been collected up to 50 mm's in length. One lower jaw was reported to have been nearly a foot long.

This ancient species of fish, *Rhizodus*, evolved in the Upper Devonian Period and continued into the Carboniferous Age throughout the world.

The author had previously laid the groundwork in field collecting at Tioga Co. in Pennsylvania in 1994. At this location, collections were made of huge scales and numerous teeth of the Rhizodon species from the Upper Devonian Period. These specimens found at Tioga were used as a comparison study of younger dentine structures of scales found at Joggins, Nova Scotia. The underlying black shales at Joggins, produced many smaller scales and teeth of *Rhizodus*. These scales and teeth from Joggins, N.S. are from the Lower Carboniferous Age which provide clues to the progressive reduction of superficial enamel and dentine structures of this species .

Important fossil finds continue at Tioga, Pennsylvania with the discovery of a large *Rhizodus* skull in August of 1995. The specimen was found in the grayish-green sandstone channels of the Catskill Formation at a higher level than previously excavated. The skull, nearly 200 mm's in length, was found in Matrix-Profile, with the lower mandible and all of it's huge teeth intact.

In summary, extensive field collecting will be needed to evaluate a more constructive anatomy of the Rhizodon species.

The author's continuing research and studies await new and exciting field discoveries of these ancient fish and their evolutionary transition into the Mississippian Age.

PHYSICS AND FORENSICS IN THE 0. J. SIMPSON TRIAL. James J. Carr, 14 Tall Meadow, Painted Post, NY 14870

Throughout televised sessions of the 0. J. Simpson trial, both prosecution and defense routinely referred to presentations of scientific evidence or testimony. Almost everything of a technical nature was characterized as "scientific"; presumably to lend greater import and credibility in the minds of jurors. Interestingly however, two (legitimate) scientific issues vigorously debated early in the proceedings were left unresolved. Both issues as it happens, are easily analyzed in the context of elementary physics.

The defense alleged that round, regular blood drops accompanying shoe prints in blood leading away from the crime scene were planted, because drops from a moving source should be

(to an extent) elliptical and somewhat irregular. A wound dripping blood from the hand of a fleeing subject, as suspected with Simpson, nevertheless can be explained by vector analysis as resulting in regular drop patterns.

A second contention advanced by the defense team involved a cup of ice cream found at the crime scene. It seems the first policeman on the scene observed what he testified to as a cup of partially melted ice cream (on a banister at the foot of a staircase) while surveying inside the premises. Defense therefore argued in favor of a much later time for the slayings, since the ice cream undoubtedly would have fully melted in the interval (about 2 hours) between the prosecution's earlier estimated time and when the first officer arrived. Rumors followed to the effect that the policeman was mistaken and the ice cream had completely melted. Rumors notwithstanding, it is an easily decided question with the use of Newton's law of cooling.

ICP ELEMENTAL ANALYSIS OF SENECA AND CAYUGA LAKE SEDIMENTS IN THE STUDY OF PALEOCLIMATIC INDICATORS. Nancy A. Ciskowski, Walter J. Bowyer, John D. Halfman*, Departments of Chemistry and Geoscience*, Hobart and William Smith Colleges Geneva, New York 14456

Surface sediment from Seneca Lake and downcore sediment from Cayuga Lake (Central New York) were analyzed via inductively coupled plasma spectrometry (ICP) for ten major and minor elements, including Mg, Ca, Al, Na, K, Fe, Zn, Mn, Ba, and Sr. The relationships and trends of these elemental abundances were studied in order to elucidate environmental conditions both in the present and past geologic time. The results suggest ICP elemental analysis of lacustrine sediments is a useful tool in probing paleoclimatic indicators of climate change.

INTRODUCTORY CHEMISTRY TELEVISION COURSE. John Cullen, Monroe Community College, 1000 East Henrietta Road, Rochester, NY 14623

In the spring semester of 1995 Monroe Community College (Rochester, NY) offered a non-science majors chemistry course as a telecourse for the first time. The course was based on The World of Chemistry series of 26 half-hour programs hosted by Roald Hoffmann. Students were given weekly reading and problem assignments from The World of Chemistry textbook to complement the television programs. Students were encouraged to become "science literate" and were given several writing assignments toward this goal. There were five three-hour on-campus seminars scheduled. These seminars were used for explanation and discussion of material presented on the television programs and the textbook and problem assignments, for testing and for four or five short laboratory experiments. A questionnaire was done to determine the academic background and plans of the students and a student survey was given to the students at the end of the course to assess student attitudes on the course and the telecourse format. These results and the instructor's assessments of the strengths and weaknesses of the telecourse compared to the traditional format will be discussed.

SEXUAL SELECTION BY FEMALE CHOICE IN A LEK SPECIES. David Droney, Benjamin Hock, Hobart and William Smith Colleges, Biology Department, Geneva, NY 14456

The evolutionary role of sexual selection through female choice is often disputed. Selection by female choice has the potential to be a major evolutionary force. This is especially likely to be the case in a lek species, where females risk predation to mate at sites where males communally display. This study examined male courtship behavior in the lek species *Drosophila grimshawi*. We attempted to determine whether sexual selection was acting through female choice. We also attempted to identify male traits that served as cues for female mate choice. Data regarding male mating success and other male behavioral and physical traits was collected. Repeatability was calculated for both male courtship rate and pheromone deposition rate to determine whether these potential cues were "honest signals" of male quality. Data indicated that male mating success was significantly non-random, suggesting that female choice was occurring. A significant correlation was shown to exist between male mating success and pheromone deposition rate, indicating that pheromone deposition rate was a cue for female mate choice. Furthermore, pheromone deposition behavior was highly repeatable in a population of male *Drosophila grimshawi* ($r=0.97$), and thus

could be an "honest signal" of male quality. This complex system of male cues and female preferences is intimately related to the evolution of lek mating systems, Results of this study suggest that sexual selection by female choice is a significant evolutionary force.

IMMUNOFLUORESCENT AND RHODAMINE BEAD LABELING OF SEROTONERGIC PROCESSES BETWEEN THE CEREBRAL AND PEDAL GANGLIA IN *Aplysia*. Jennifer Fisk and Nancy Meehan. Biology Department. State University of New York at Geneseo. Geneseo, NY 14454

Previous studies done on the marine invertebrate, *Aplysia brasiliana,* have suggested that serotonin (5-HT) plays an important role in several hormonal and behavioral responses. In the abdominal ganglia, 5-HT has been found to inhibit the release of egg laying hormone (ELH) from the bag cells. In addition, several studies have shown, once the animal is stimulated, 5-HT is released in the abdominal ganglion to facilitate the gill withdrawal reflex and amplify an excitatory response. 5-HT has also been found to be important for locomotion. Experimental evidence for this has shown that locomotion is induced by injecting 5-HT into the pedal ganglia.

Serotonergic cells have been identified in the cerebral, abdominal, and pedal ganglia, where the pedal ganglion has the highest concentration followed by the abdominal. In the cerebral ganglion, a small population of cells that have been shown to contain 5-HT also project to the abdominal ganglion. This is the site where both the gill withdrawal reflex and ELH release occur. Other ganglia, the pedal, also contain 5-HT, and this is the site of locomotor generation.

Taking the above studies into account, we believe that these ganglia may be coordinated and possibly part of a synchronized escape mechanism. For example, one stimulus could initiate the release of 5-HT from the cerebral ganglion where it could be transported throughout the nervous system to initiate a multitude of responses. If these ganglia are somehow connected and also contain 5-HT, this could serve as a model for a simple escape behavior. For example, if the animal is being irritated, the release of 5-HT in the cerebral ganglia could facilitate a simultaneous release of 5-HT in the abdominal and pedal ganglia which would in turn, inhibit ELH arresting egg laying, trigger the gill withdrawal reflex, and initiate locomotion.

In this experiment we injected rhodamine beads into the left pedal ganglion where they were picked up and retrogradely transported throughout the rest of the nervous system. This labeled the cells that project to the injection site. The ganglia were cut on a microtome and placed on slides. These slides were then treated with a rabbit antibody against 5-HT and these were subsequently labeled with a fluorescent tagged anti-rabbit antibody. The results of this experiment showed that there were cells in both the contralateral pedal and cerebral ganglia that positively stained for both rhodamine and 5-HT. This implies that these cells contain 5-HT and also project to the left pedal ganglion. This may mean that these cells may be part of a larger mechanism involved in a simple escape mechanism. The cells in the cerebral ganglion could be further checked to see if they are the same cells that project to the abdominal ganglion and if they also project to the serotonergic pedal ganglion cells.

ENDOMYCORRHIZAE OF ORGANICALLY GROWN VEGETABLE CROPS. Christine M. Gruhn, Nazareth College of Rochester, Department of Biology, Rochester, NY 14618

The percentage of the root system colonized by endomycorrhizal fungi and the endomycorrhizal inoculum potential of the soil (MIP) was determined for a variety of vegetable crops collected on an organic farm in Wayne County, New York. The farm has used only organic methods of fertilization and pest control for the past fifteen years. The MIP was obtained using a corn/mung bean greenhouse bioassay. The MIP was determined by the previous year's crop, but did not correlate with root colonization levels of the present crop, demonstrating that soil MIP is not a good predictor of crop mycorrhizal status. The abundance of natural areas and hedgerows on this small farm likely provide a constant source of endomycorrhizal inoculum so that the field is not completely dependent on the existing crop to maintain the diversity of endomycorrhizal species. Some crops (e.g. garlic) achieved a uniform percentage of colonized roots regardless of field and previous cropping, while the mycorrhizal status of others (e.g. lettuce) appear to be more sensitive

to the mycorrhizal status of the previous crop. This second group may benefit from greenhouse inoculation with endomycorrhizal fungi prior to transplanting in the field. These results demonstrate that although mycorrhizae are present in relatively high levels in organically grown vegetable crops, recommendations for cultural practices to enhance mycorrhization will likely need to be highly specific.

A MACROINVERTEBRATE SURVEY OF NEIGHBORHOOD STREAMS WITH ANALYSIS OF NUTRIENTS, SUBSTRATE AND BACTERIA. William Hallahan Nazareth College, Biology Department, 4245 East Avenue, Rochester, NY 14618

The primary focus of this study was to assess water quality in two watershed parcels in Pittsford and Henrietta that drain into Allen's Creek, part of the Irondequoit Creek watershed. For purposes of comparison, portions of Honeoye Creek, Allen's Creek and Irondequoit Creek were also examined. Macroinvertebrate samples were obtained with a Surber sampler. Phosphates and nitrates were measured using the ascorbic acid and cadmium tests, respectively. Abiotic measurements were taken in order to calculate discharge and nutrient load. Water samples were cultured for coliform bacteria.

Although coliform bacteria were found in one stream with large populations of Diptera larvae and oligochaetes, the presence of these two groups is not diagnostic. Populations of Diptera, Oligochaeta, Amphipoda and Isopoda did not correlate with phosphates or nitrates. Of interest, however, is the positive relationship between phosphates and mayflies, caddisflies and stoneflies up to a point where this nutrient inhibits their populations. Honeoye Creek, for example, which received discharge from two sewage treatment plants, has higher overall phosphate levels and a greater diversity and number of invertebrates than the streams from Pittsford and Henrietta. There is also evidence for a negative impact on the Diptera populations by drainage from two golf courses.

THE MADCP CONSORTIUM OF COLLEGES: DISCOVERY LABS. Gary Hickernell, Dept. Of Natural Science, Keuka College, Keuka Park, NY 14478; Kathleen Dougherty, 816 West Lake Road, Hammondsport, NY 14840; Jason Lake, P.O. Box 1191, Keuka Park, NY 14478

A consortium of colleges began activities in 1993 to develop chemistry laboratory exercises based upon the student's discovery of principles, rather than confirmation of principles. It is the goal of this consortium to prepare a wide variety of laboratory exercises over the period of this three-year FIPSE grant. During the first year, approximately twenty exercises have been developed and are now in the testing phase. The World Wide Web is only one of many ways in which the information is to be disseminated.

This poster will present the MADCP (Middle Atlantic Discovery Chemistry Project), its goals and a number of prepared experiments.

AN INEXPENSIVE ADAPTATION OF RAPID-CYCLING BRASSICAS (*Brassica rapa*) FOR LARGE INTRODUCTORY BIOLOGY CLASSES. Steven Jakobi, John Buckwalter. Department of Physical and Life Sciences, Alfred State College, Alfred, NY 14802

Rapid-cycling brassicas (RCBs) are useful plant models in laboratory instruction due to their rapid growth and development and their limited space requirement. Plants complete their life cycle in about 35-40 days and the harvested seeds can be used immediately to start additional experiments. Developed at the University of Wisconsin [hence often called "Wisconsin Fast Plants" (TM)], RCBs are marketed exclusively through the Carolina Biological Supply Company. Carolina sells a variety of cytoplasmic and nuclear mutant RCBs, irradiated seeds as well as kits containing Styrofoam planters, potting medium and other ancillary materials necessary for growth. Since continuous light is a must for the successful development of these plants, specially designed lighting systems are also available from the company.

Due to the costs involved in purchasing these materials for 100-120 students enrolled in our general biology labs, we have developed our own system of growing and caring for the plants. We use a regular potting soil/vermiculite mixture for the growth medium and small plastic pots can

support 3-4 plants per pot. Inexpensive shop lights with standard 4-ft-long 40 W fluorescent bulbs provide adequate lighting for growth. We grow our own seeds, with an occasional infusion of purchased seed to avoid excessive inbreeding.

These and other modifications have reduced our per student costs to a fraction of the price of the commercial products and have enabled us to provide both biology and non-science majors insight to the scientific process. Our students have been enthusiastic about the hands-on experience in biological experimentation.

CLOACAL GLAND FOAM AND DISCRIMINATORY BEHAVIOR IN ADULT JAPANESE QUAIL. Anne Konkle, Dr. Joel Kerlan Hobart and William Smith Colleges, Geneva, NY 14456

Several theories have been proposed regarding the biological role of cloacal gland foam produced by adult male Japanese quail including: sperm transport medium (Cheng, Hickman and Nicholas, 1989), sperm trap (Cheng, McIntyre and Hickman, 1989), and territorial marker (Schmidt and Shaller, 1972). This study was undertaken to investigate the effects of cloacal gland foam on the behavior of adult male and female Japanese quail. If foam serves as a behavioral stimulus, then females will consume foam and feces samples from long day males and will not consume feces only samples from short day males. In addition, females will consume foam, but males will not. Tests were completed in which test birds were given a choice between long day male samples and short day male samples. Based on videotaped tests, the following measurements were taken: time test birds investigated samples, time test birds consumed samples and mass of samples consumed. Females spent significantly longer consuming long day male samples than short day male samples (Wilcoxon;p=0.0209). Moreover, females consumed significantly more of the long day male samples than short day male samples (Wilcoxon;p=0.025 1). Females seemed to prefer samples of particular long day males over others within a trial and also between trials. Test males did not respond. There was no investigation or consumption time (Binomial Probability;p=0.016). Questions about the biological significance of foam consumption by females remain unanswered.

THE KINETICS AND MECHANISM OF THE ELECTROPHILIC SUBSTITUTION REACTIONS INVOLVING Ni, Co, AND Fe IN *MESO* -TETRAPHENYLPORPHYRIN. Romana A. Lashewycz-Rubycz, Jonathan P. Wilkerson, Department of Chemistry, Hobart and William Smith Colleges, Geneva, New York 14456

Metalloporphyrins are present in all biological systems, Many of these are involved in respiration of both plants and animals.

Small steric changes in porphyrin conformation can affect mechanistic pathways in reactions that involve them, other researchers have shown that modulation of redox and light-absorbing properties may occur.

The kinetics and the mechanism of the electrophilic substitution of Ni, Co and Fe ions in 5, 10,15, 20-tetraphenyl-21*H*-23*H*-porphine is under investigation. This is an extension of the research done by Blakely (1994) in this lab concerning the substitution of Cu(II) for Zn(II) in 5,10,15,20-tetraphenyl-21*H*-23*H*-porphine. Because each metalloporphyrin absorbs visible light at unique wavelengths, the rate of the substitution reactions being studied can be monitored using visible spectroscopy. The changes in the concentration of both the reactant and product with respect to time can then be used to determine the rate constants for each of the reactions. The order of reactivity for the substitution of metal ions can then be established by using the rate constants to determine the relative case of substitution for the various metals in porphyrins.

The mechanism for the replacement reaction proposed by Blakely, involves the puckering of the porphyrin prior to substitution. The distortion maybe aided by solvent coordinating onto the metal in the porphyrin. This hypothesis is tested using an alcohol sequence: methanol, ethanol, *n*-propanol and *tert*-butyl alcohol.

A MOLECULAR VIEW OF BERNOULLI'S PRINCIPLE. Frank Mooney 6135 Dugway Road, Canandaigua NY 14424

Air blowing directly toward an obstacle stagnates, and a boundary-layer of calmer air around the obstacle swerves wind that is not on-line. D'Alembert's Paradox - that frictionless wind pushes no harder than dead air - challenges experience but is true. Bernoulli's Principle - that speeding flow lowers pressure - is the only relevant physics. Molecular entrainment by passing gusts, alee of a cradle, rocks the baby (also cools and thins air). A molecular explanation may clarify. Incidentally, only adiabatic changes (p-T-ρ) keep the equilibrium needed for continuous validity of an equation-of-state gas law.

Increased chaotic molecular motion of slowing wind as it enters a redwood forest increases pressure - for the essence Of pressure is random molecular motion.

This nearly tautological logic explains this converse of Bernoulli's Principle, and it is an uncomplicated molecular explanation of the principle. A thin calm layer of air shields each tree from wind, so molecules of the wind are scattered elastically by similar molecules. Aspersions that Bernoulli's Principle ill-suits air, which also has viscosity, are invalid. Water's viscosity is mainly friction; air's is mainly diffusion. Air-tables, air-tracks, and air-bearings show the lubricity and the elasticity of the molecules in dry clean air.

Ordering random molecular motion should require reduced pressure for the direct form of Bernoulli's Principle.

New question: How can wind-momentum transfer without kinetic energy? Grossly mismatched masses transfer negligible energy for lack of a machine to match impedances lever, wedge, pulley, or transmission. Infinitesimal transfer of speed from wind to trees-roots-Earth wanes quadratically to a second-Order infinitesimal for kinetic energy.

In brief, scatter and eddies stop wind by agitating the air, which also raises pressure inside a weather office.

ENTHALPY AND BERNOULLI'S PRINCIPLE. Frank Mooney, 6135 Dugway Road, Canandaigua, NY 14424

Enthalpy or total energy is conserved even in shock waves. It is barely mentioned to physics students - only for the Joule-Thomson free expansion of gases. Its heat-content term is widely used by chemists. It quantifies Bernoulli's Principle - the only dynamic effect of airflow in the absence of friction. The value of enthalpy as an analytic tool is outlined here.

For an average diatomic molecule of air, $m \approx 48.09 \cdot 10^{-27}$ kg:

1. Ideal-Gas Law for Compressive Energy pv: $pv = kT = pm/\rho$.
   $k = 13.80658 \cdot 10^{-24}$ J/K, $m = 48.09 \cdot 10^{-27}$.
   v = pro-rated volume/molecule, ρ = density kg/m^3, T in K.
2. Enthalpy: $h = c_vT + pv = c_pT = 3.5\ kT$ = Heat Content + pv.
   =(Intramolecular c_vT) + (Intermolecular $pv=pm/\rho$) Energies.
3. Isolated System = Conserved Energy, "First Law" or dq = 0.
   $dh = 3.5\ k\ dT = [c_vdT + p\ dv] + v\ dp = [dq = 0] + v\ dp$.
   = [Heating + Work = 0] + Internal Energy Reassignment (vdp).
4. Adiabatic Convection: $dq = 0 = dh - v\ dp = 3.5\ k\ dT - v\ dp$.
   Use hydrostatic law $dp = -\rho g\ dz$. Then $dT/dz \approx -9.76$ K/km.
5. Adiabatic Cooling: $3.5\ kT_o = 3.5\ kT + mu^2/2\ kT_o$,
   (Very slight $T/T_o = 1 - mu^2/7\ kT_o$.
6. Pressure: $p/p_o = (T/T_o)^{3.5}$. (An adiabatic formula).
   (Bernoulli) $p/p_o \approx (1 - mu^2/2\ kT_o)$.
7. Expansion: $(\rho/\rho_o) = (T/T_o)^{2.5}$. (An adiabatic formula).
   ($\rho = m/v$) $(\rho/\rho_o) \approx (1 - mu^2/2.8\ kT_o)$.

Note that $[1/2.8 + 1/7 \equiv 1/2]$. Also that $p/p_o = (\rho/\rho_o)(T/T_o)$, so the Ideal-Gas Law includes adiabatic behavior.

The adiabatic p, T. and ρ formulas developed here have served wind-tunnel analyses since L. Prandtl's 1920s work.

A previous report showed how wind slowed by trees regained lost pressure - likewise when slowed within a weather station. The Science of Meteorology could properly disdain Bernoulli's Principle if weather were an indoor event.

OLD GROWTH FOREST AT "THE LANDINGS", WEBSTER, NEW YORK? Brenda Neville and Bruce Gilman, Finger Lakes Community College, Department of Environmental Conservation/Outdoor Recreation, 4355 Lake Shore Drive, Canandaigua, NY 14424-8395

The occurrence of old growth forests in New York is rare and, as a result, they have been considered a significant habitat in the New York Natural Heritage Community Classification system. Evaluating whether or not an area is considered old growth involves the use of several structural attributes of the forest. These include the presence of old large trees, the frequency of dead standing snags, the occurrence of a pit and mound microtopography, canopy gaps associated with large fallen trees, all-aged stand structure and the general absence of human disturbance.

General reconnaissance and random quadrant sampling of "The Landings" forest reveal that some old growth attributes are present but others are missing. Possible explanations for the missing attributes are considered before a final determination of old growth status is made.

TRAVELS WITH LUCENA: THE KIBBS FAMILY TRANSCONTINENTAL AUTO ODYSSEY IN 1936; DISTANCE, TIME, AND EXPENDITURE ON DEPRESSION-ERA FEDERAL HIGHWAYS. Darrell A, Norris, Department of Geography, S.U.N.Y., Geneseo, NY 14454

On July 22, 1936, the Kibbs family set off from Yorkville NY on a pleasure journey to California and back. The daily log maintained by Ms. Lucena Kibbs until they returned on September 1 provides a fascinating perspective on the circumstances of 1930s road travel. At least ten hours each day were spent "on the road" and the family only once exceeded a thirty miles per hour average speed. Accommodation in roadside cabin courts was typically a two dollar overnight expense. Other expense items, notably for gasoline and groceries, were noted, as were roadside hazards and attractions. Analysis of the Kibbs, itinerary dovetails their travel strategy with the dispersed and now mostly defunct pattern of services that catered to pre-World War II motorists.

THE MECHANISMS USED BY ANTIBIOTICS OF *Erwinia herbicola* TO INHIBIT *Erwinia amylovora*, THE BACTERIUM THAT CAUSES FIRE BLIGHT. Marci Rice and Richard Wodzinski, Ithaca College, Biology Department, Ithaca, NY 14850

The mechanisms by which the antibiotics of *Erwinia herbicola* (Eh) inhibits *Erwinia amylovora* (Ea), the bacterium that causes fire blight disease in apple and pear trees were investigated. The most common antibiotics produced by Eh are not toxic to Ea in the presence of histidine. An attempt was made to determine if the antibiotic entered through the histidine transport protein and could be blocked from entry by histidine in the medium or if the antibiotic interfered with a step in the biosynthesis of the amino acid histidine. A histidine auxotroph of Ea321 was studied to determine the concentration of histidine it required to grow. The concentration of histidine needed to overcome the toxicity of the EhC3 antibiotic to Ea321 and Ea273 was the same as the concentration the auxotroph needed to grow. The results indicate that the antibiotic enters the cell and interferes with a step in the biosynthesis of the amino acid histidine but the histidine in the medium allows Ea to grow normally.

The experiment was repeated using EhR196, which produces a different type of antibiotic. A much higher concentration of histidine was required to overcome the toxicity of the antibiotic to Ea then Ea required for growth. These results support the histidine transport hypothesis. The antibiotic would not be toxic in the presence of high concentrations of histidine because the histidine would block the transport protein, preventing the antibiotic from entering.

METAPLASM THERAPY AND A SUGGESTED APPROACH TO NONLINEAR BIOLOGICAL SYSTEMS DISEASES. Wayne Schlemitz, 276 Hartsdale Rd, Rochester, NY 14622

An effective strategy is needed to confront a mighty killer that has taken millions of lives over the year and is currently the number one killer in America, cancer. This paper addresses a strategy Called metaplasm therapy and will answer why researchers have had such a difficult time in finding a cause of the disease. A theory is offered that can answer many inconsistencies with current thoughts of the cause of the disease. The study of chaos or nonlinear dynamic systems will be presented in the context of cancer and nonlinear diseases.

A CROSS CULTURAL COMPARISON OF PALEOINDIAN SUBSISTENCE STRATEGIES. Dr. Kenneth B. Tankersley, Stephen N. Bland

The assemblages of six Paleoindian sites, dated from approximately 10,000 yrs BP, were analyzed according to type, raw lithic material and artifact diversity. Three of the sites are located in western New York State and three are in the region of the upper Mississippi River. Intersite and intraregional similarities and differences among the artifact assemblages were noted and quantified using nonparametric tests. These data indicate social and economic similarities between the two regions.

MACROPHYTE COMMUNITIES OF HONEOYE LAKE: TEN YEARS LATER. Scott Updyke, Bruce Gilman and Frank Smith Finger Lakes Community College, Department of Environmental Conservation/Outdoor Recreation, 4355 Lake Shore Drive, Canandaigua, NY 14424-8395

Like terrestrial vegetation, aquatic plant growth and distribution are influenced by complex interactions among environmental factors, individual plant tolerances and human impacts. Responding to a residential concern about "excessive" weedbeds in 1984, an intensive plant inventory was completed. At that time, expansion of the macrophyte communities was speculatively linked to the recent completion of perimeter sewering. Diversion of cottage wastes had reduced lake nutrient levels, resulting in lower algal densities. This improved water clarity and the macrophytes responded with earlier and more luxuriant growth. Mechanical harvesting was selected as a management strategy to control weedbed biomass.

In 1994, the macrophyte communities were resampled using the same techniques, timing and locations. The distribution of most macrophytes had increased over the ten year interval, especially Eurasian milfoil, flat-stem pondweed, elodea and coontail. Species richness had generally increased and was positively correlated with fall standing crop biomass ($r=0.454$). Comparisons between fall standing crop biomass for 1984 and 1994 indicate that five transects declined an average of 194 g/m while 15 transects increased an average of 79 g/m. No long-term trends were noted for estimated annual productivity.

Changes in macrophyte communities of Honeoye Lake do not appear related to the mechanical harvesting program. While short-term reduction in standing crop biomass is accomplished through harvesting, the potential for regrowth remains high. Increases noted for certain aquatic plant species suggest that Honeoye Lake macrophyte communities are experiencing long-term structural changes as these plants pioneer deeper waters.

THE ROLE OF PHOTOSYNTHETIC ORGANISMS IN SPRING LAKE, ALLEGANY COUNTY, NEW YORK. James M. Wolfe, Paul Byron, Noelle Gurley, H. Stephen Lausch, and Aaron Routhe. Department of Biology, Houghton College, Houghton, New York 14744

The role of photosynthetic organisms was investigated for Spring Lake, a small (0.1 km^2, z max = 9 m) eutrophic, hardwater (110 mg/L $CaCO_3$) kettle lake in northern Allegany County and which strongly stratifies during summer. Chlorophyll a values varied widely with depth and by season, with a mean of 8.4 µg/L and reaching a peak of 46 µg/L in the hypolimnion in July 1994. Photosynthetic bacteria, as detected by plating on PMS media from water samples in February and

March 1994, were found to be facultatively-aerobic, heterotrophic, gram-negative bacilli and cocci which occurred in low numbers (maximum of 360 colonies/mL). Since study in 1992, blooms of diatoms appeared in late winter and blue-green bacteria in late spring. Phosphorus and ammonia concentrations were highest in the hypolimnion during summer with peaks in late August 1993 of 417 pbb and 5 mg/L respectively. We suggest that blooms of phytoplankton as indicated by peaks in chlorophyll a concentrations may influence stratification patterns in Spring Lake and its trophic status. We propose that shading by blooms and subsequent death of diatoms and blue-green bacteria gives rise to a deep anoxic zone (below 4 m), which in turn allows for the release of phosphorus at depth. Turnover during fall and winter allows for recharge of nutrients to the upper water column and fuels further blooms.

THE INFLUENCE OF CIRCUMNUTATION ON GRAVITROPISM - THE ROLE OF THE SHOOT TIP AND YOUNG LEAF. Rick L. Yang, and Herbert B. Tepper SUNY-College of Environmental Science and Forestry, Dept. of Environmental and Forest Biology, 409 Illick Hall, Syracuse, NY 13210-2778

In a study of the very early phases of gravitropic response of light-grown pea seedlings we observed that while all gravistimulated seedlings eventually curve upward, most curve downward initially for a variable period of time. Most workers studying gravitropic responses address this problem by increasing the sample size and the variability is smoothed by averaging. We also observed that in vertically placed pea seedlings, the stem tips move continuously in an elliptical pattern. This elliptical movement, circumnutation, was first reported by Darwin and is a widespread occurrence in plants. We studied the effect of circumnutation on the initial phases of gravitropism using time-lapse photography. The irregular gravitropic responses observed previously disappeared when plants were gravistimulated while at the same phase of the circumnutational cycle. Our finding suggests that circumnutation should be taken into consideration when studying the early phases of gravitropism in plants.

The physiology of circumnutation is still a subject of debate. We investigated the involvement of the growth substance indole-3-acetic acid (IAA) by ringing the stem with lanolin containing an IAAtransport inhibitor (20 mmole L^{-1} triiodobenzoic acid, TIBA). Application of TIBA eliminates circumnutational movement suggesting that IAA is involved in the process of circumnutation. We attempted to remove the purported source of IAA synthesis by surgical removal of the shoot tip and/or the young leaf. Circumnutation was reduced after removal of the shoot tip and/or the young leaf. However, attempts to replace these sources of IAA synthesis with an external application of 10-4 mole L^{-1} IAA in lanolin to the cut surfaces mitigate but do not completely restore circumnutation, However, replacing the excised shoot tip and young leaf with an artificial leaf of equal weight and general shape restored circumnutation. Our results suggested that although IAA plays an important role in circumnutation, the action of gravitational force on the mass of the plant is also a driving force of circumnutation.

TWENTY-THIRD ANNUAL FALL SCIENTIFIC PAPER SESSIN

LARRY J. KING MEMORIAL LECTURE
Molecular Targets for Anticancer Drugs
by
Mark Wentland
Department of Chemistry
Rennselaer Polytechnic Institute
Troy, New York

SUNY COLLEGE AT BROCKPORT
(Department of Chemistry and Physics)
BROCKPORT, NEW YORK
November 23, 1996

ABSTRACTS OF PAPERS

THE STATUS & MANAGEMENT OF THE PEREGRINE FALCON IN THE HUDSON VALLEY. David J. Adams and T. Kerpez, NYS DEC, Bureau of Wildlife, 21 S. Putt Corners Rd., New Paltz, NY 12561. B. Loucks and W. Stone, NYS DEC, Wildlife Resource Center, 108 Game Farm Rd., Delmar, NY 12054

Peregrine falcons, like many other birds of prey, have suffered from the use of pesticides. Exposure to DDT and other contaminants have caused population declines since the 1940's. These pesticides cause eggshell thinning which drastically lowers breeding success.

At one time, there were approximately 350 breeding pairs in the eastern U.S., including 40-50 historic eyries in New York. Eighteen of these were located in the Hudson River Valley. By 1962, all were gone and populations in other parts of the country showed similar declines. The last Hudson Valley eyrie was vacated in 1957 .

Release programs initiated by the Peregrine Fund in the mid 1970's have resulted in peregrine falcons breeding in New York once again. About 160 peregrine falcons were released within the State at 8 hacking sites, one being located in the Hudson Valley. In 1994 the first reoccupation of a historic Hudson Valley eyrie occurred. In 1995, 25 pairs bred successfully in New York, fledging a total of 46 young. Gradual increases in the breeding population have been recorded throughout the east.

Laws banning the use of DDT were passed by New York State in 1971 and by the federal government in 1972. Although DDT contamination has been reduced in this country, it continues to affect the peregrine and its prey outside our borders. Peregrine carcasses and unhatched eggs continue to be analyzed for DDT and other contaminants. The DDE levels in an unhatched egg retrieved from a 1995 Hudson Valley eyrie remain well below the oft-cited 20 ppm threshold for reproductively significant eggshell thinning.

Management of the peregrine falcon has now shifted to locating, monitoring and protecting breeding pairs. This often involves cooperation between various government agencies, nonprofit organizations and private landowners. The recovery goal established in the 1987 NYS Recovery Plan For The Peregrine Falcon is 30 occupied nesting territories with at least 15 under definitive protective management.

THE EBOLA VIRUS: THE ECOLOGY OF EXPOSURE, OUTBREAK, AND TRANSMISSION. Maryann Aiello, Department of Geography, SUNY Geneseo, Geneseo, NY 14454

A virus that resides in a non-human host and ecological niche, but is about to collide with a human host environment, demonstrates a common early warning sign of scattered, apparently disconnected outbreaks. Ebola exemplifies this pattern. In 1976, 55 villages along the Ebola tributary of the Zaire (Congo) River broke out with a previously unidentified virus. Mortality among victims was 90 percent. Ten months later, an Ebola strain appeared in the Sudan. Outbreaks have since occurred in Gabon, Zaire and in laboratory settings in Reston, VA and Texas. This paper reviews field and laboratory evidence and conjecture for Ebola's host species and niches, its transmission to and between humans, ability to contain and control spread in African societies, and the risks of Ebola's breakout to the industrialized world. The paper is based extensively on contemporary web-site information as well as published sources.

CHERT OF THE ONONDAGA FORMATION OF GENESEE COUNTY, NEW YORK AND THE POSSIBLE ARCHAEOLOGICAL SIGNIFICANCE. David A.

Boehm and Judy A. Massare, Department of the Earth Sciences, SUNY College at Brockport, Brockport, NY 14420

Lithic artifacts recovered from archaeological sites in western New York are dominated by a mottled, blue-gray chert, identified as coming from the Onondaga Formation. The Onondaga Formation, however, is made up of four distinct members, all of which are chert-bearing. Colors range from white, tan, and light gray to dark gray, brown, and black. Does this mean that paleoindians preferred a certain color chert for their tools, as has been suggested?

Our field observations in Genesee County indicate that the workable chert in the Onondaga is largely restricted stratigraphically to the Edgecliff and Moorehouse members. Edgecliff chert is quite variable in color, but includes a mottled blue-gray chert similar to that found in artifacts. The Moorehouse chert is dark gray to black. Within the Edgecliff, workable chert seems to be restricted to western Genesee County and regions to the west. In eastern Genesee County, Edgecliff chert is too fractured for knapping, but the Moorehouse chert is workable. The Edgecliff member, however, has a higher percentage of chert than does the Moorehouse member, and so probably forms natural outcrops more readily. It initially appears that the widespread use of blue-gray Onondaga chart may reflect the availability of natural outcrops of workable chert.

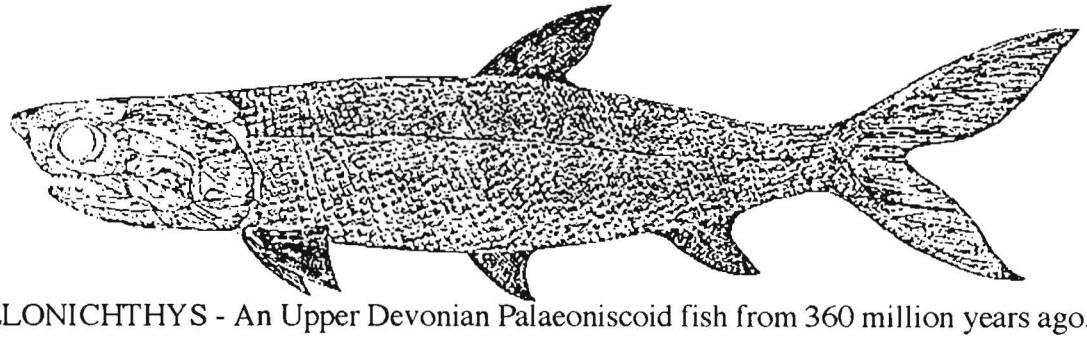
STATUS OF RABIES IN MONROE COUNTY. Lynn Braband, Critter Control, P.O. Box 19389, Rochester, NY 14619

The last several years, increased attention has been given to rabies as a zoonotic disease. This paper will survey the status of the disease in Monroe County,-New York over the past year. The focus will be upon the major vector species: raccoon (*Procyon lotor*) and bats. People's emotional responses to reports of the disease's status will also be discussed.

AN UNDESCRIBED PALAEONISCOID FISH FROM THE UPPER DEVONIAN SHALES IN CLINTON COUNTY, PENNSYLVANIA, U.S.A. Paul Buhlig, 6 Manlon Terrace, Cheektowaga, NY 14225 and Russell Falletta, of Buffalo, NY 14215

A primitive Palaeoniscoid fish from the Upper Devonian shales of the Catskill Formation were collected by the author during the past several years in Clinton County, Pennsylvania, USA. Average size of these fossil fish ranged from 5 cm to 6 cm in length.

This formerly undescribed Palaeoniscoid fish, is *Elonichthys*. The author in this report, attempts to examine and define a new species of this fish, while emphasizing the importance of their biogeographic and biostratigraphic locations in which these fossils were found.
Although the *Elonichthys* species may have attained a global and equatorial distribution throughout the world, their excellent preservation and availability in Clinton County, Pennsylvania will provide quality fossil research material for many years to come.



ELONICHTHYS - An Upper Devonian Palaeoniscoid fish from 360 million years ago.

SOMATIC EMBRYOGENESIS AND PLANT REGENERATION OF GRAPE. Jane J. Choi and Ming-Mei Chang, 1 College Circle, SUNY- Geneseo, NY. 14454

Genetic engineering of grape via *Agrobacterium* transformation is limited by the low frequency of embryo regeneration (embryogenesis). To optimize tissue culture techniques for grape embryogenesis, leaf disks of Cabernet Sauvignon (*Vitis vinifera* c.v. Cabernet Sauvignon)

grown *in vitro* were cultured on Nitsch and Nitsch (NN) agar medium supplemented with 10 μM 4-PU and different concentrations of 2,4,5-T for 2 months. Callus proliferation was observed within a month. These callus containing leaf disks were transferred to the same NN medium containing 10.7 μM NAA and 0.9 μM BAP for another 2 months. Finally, they were transferred to a hormone free medium. White, opaque embryos were visible within a week. All of the embryos were placed on a woody plant (WP) medium supplemented with 1 μM BAP to enhance shoot development. After a week, root formation was observed. Since zygotic embryos of grape seeds require chilling as a natural cue for germination, half of the embryos were also grown at 4 C to determine the chilling effect on germination.
Abbreviations: 4-PU: N-(2-chloro-4-pyridyl)-N'-phenylurea; 2,4,5-T: (2,4,5 trichlorophenoxy) acetic acid; BAP: 6-benzylaminopurine; NAA: alpha-naphthalene acetic acid.

CADMIUM ACCUMULATION IN FRESHWATER SHRIMP (*Gammarus spp.*) AND THE TESTING OF IT IN VARIOUS ROCHESTER STREAMS. Matthew Cross, Biology Department, Nazareth College, Rochester, NY 14618

Cadmium accumulation was measured with the atomic absorption spectrometer in freshwater shrimp (*Gammarus*) in the laboratory and then in five stream sites in Rochester, The laboratory results indicate that as exposure concentrations increase, *Gammarus* ingest more cadmium into their bodies, These results do not specify whether the cadmium is actually accumulating in the animal tissue or if it is simply ingested into the gut and can then be excreted, Survivorship data show that cadmium is in fact fatal to *Gammarus*. In particular, there seems to be a threshold between 0.05 ppm and 0.50 ppm that causes a significant increase in mortality, With the sensitivity of the lamp and the AAS 3000 (to 0,03 mg Cadmium/L), no significant amounts of cadmium were found in either the shrimp or water samples taken from Rochester stream sites, However, with the EPA maximum allowable concentration in freshwater streams of 0.0063 mg/L, the stream sites may still contain excessive amounts of cadmium.

MÖSSBAUER SPECTROSCOPY OF IRON OXALATE PHOTOCHEMISTRY IN SYNTHETIC ZEOLITES. Meagan Doody, Dave Dwyer, Dave Hall, and Kate Patton-Hall , Department of Chemistry and Physics, SUNY Brockport Brockport, NY 14420 and Department of Physics, SUNY Alfred, Alfred, NY

The photochemistry of ferric trisoxalate has been employed is many areas of academic and industrial science. its use as a model of important biological iron-containing photoreactive species and as a chemical actinometer have been recognized for many years. The photochemistry of ferric oxalate in homogeneous solution and single crystal hosts have been studied thoroughly with UV/Visible absorption and Electron Paramagnetic Resonance (EPR) spectroscopy. We have undertaken a novel study of ferric oxalate photochemistry absorbed into the amorphous solid NaX zeolite. This zeolite host is known to have allowed for unusual and/or unique photochemistry for many important organic systems. The opaque nature of the zeolite host and electronic configuration of the possible iron photoproducts make it very difficult, if not impossible to use UV/Visible and EPR spectroscopic techniques to characterize the relevant chemical events. As a result we are employing Mössbauer spectroscopy to directly probe the chemical environment of the iron atoms of the reactant and product species involved in the ferric oxalate photochemistry occurring in the zeolite hosts. Our use of ferric oxalate as a chemical actinometer and preliminary Mössbauer data on ferric oxalate photochemistry in the solid state will be presented.

FARADAY ROTATION OF A PHOTOGENERATED ORGANIC TRIPLET MOLECULE IN POLYVINYL ALCOHOL FILMS. Dave Dwyer, Dave Hall, and Paul Trotto, Department of Chemistry and Physics, SUNY Brockport, Brockport, NY 14420

Room Temperature Phosphorescence (RTP) has been observed from the sodium salt of 2-naphthoic acid absorbed in various polyvinyl alcohol (PVA) films. These phosphorescence decay data can be used to describe Some of the properties of the PVA polymer. for example, the rigid

nature of the polymer and degree to which moisture is absorbed On the surface both effect the lifetimes of the triplet State and change the decay data in a predictable way. Faraday rotation data from this paramagnetic triplet molecule has the potential to yield complimentary and more detailed information about the polymer host than the RTP decay data. The magnitude and temperature dependence of the Faraday rotation of paramagnetic species is usually significantly larger than that of diamagnetic species. As a result we expect to be able to see changes in the rotation data for our excited naphthoic acid salt probe at very low concentrations relative to its diamagnetic polymer host. Faraday rotation data has also been shown to be sensitive to ordering in some polymer systems. Our phosphorescence decay data and preliminary Faraday rotation data for naphthoic acid salts in PVA films will be discussed.

PERSPECTIVES ON THE BHOPAL TRAGEDY: THE WESTERN CORPORATION'S ROLE IN DISASTER PREPAREDNESS AND RESPONSE. Eric Goldman, Department of Geography, SUNY Geneses, Geneseo, NY 14454

On the night of December 2, 1984, the Union Carbide pesticide plant in Bhopal, India experienced a gas leak that killed 2500 people and injured tens of thousands more in the vicinity of the plant. My research reviews the available evidence concerning the roots of the disaster, its immediate and long-term impacts, the preparedness of the Company and authorities to mitigate its effects, and the ensuing investigation and drawn-out process of legal settlement. Overall, it appears that the Bhopal tragedy became a model for the ability of Western Corporations to circumvent safety measures in the Developing World, and then evade the adverse consequences of inadequate disaster prevention and preparedness measures. A recent and extraordinarily biased videotape released by Union Carbide exemplifies the lesson of irresponsibility learned by international business in Developing World settings.

TRACES OF LEWIS HENRY MORGAN. Robert J. Gorall, 2990 Tyler Rd., Newark, NY 14513

A slide-illustrated program briefly covering the life of Lewis Henry Morgan the "Father of Anthropology". L. H. Morgan was the namesake of the Morgan Elementary School located in Rochester and the Lewis Henry Morgan Chapter of the New York State Archaeological Association. A successful lawyer and author of numerous learned works including League of the Iroquois he lived almost his entire life in western New York State. Although best remembered for his scholarly brilliance he was also a man with everyday hopes, dreams and disappointments, This lecture will touch upon some of the important events in the life of this extraordinary man and offer a fresh perspective on "Rochester's most distinguished scientist".

THE EFFECTS OF TOPICALLY APPLIED PROGESTERONE ON INDUCED PREMATURE LABOR IN RATS (*Rattus norvegicus*), Julius Pepper Goslin, III*, J. Kenneth Boon, Ph.D., Biology Department, Houghton College, One Willard Avenue, P.O. Box 128, Houghton, NY 14744-0128 (* Now at 47 Snyder Hollow Road, New Providence, PA 17560-9792)

The number of premature births is one of the most serious medical problems in the United States. In this country, preterm birth accounts for 10% of all births and is associated with 83% of perinatal deaths not caused by congenital anomalies. In most cases, the cause of prematurity remains a mystery, and mechanistic models for premature labor are complex, because of the great variety of influences associated with prematurity. Specifically, the role of progesterone in mechanisms of labor has been confused by contradictory studies. There are a variety of approaches to *managing* preterm labor. Although tocolytic therapy is presently the most common *treatment* for preterm labor, it does not appreciably lengthen gestation, and is commonly accompanied by detrimental side effect for both the mother and fetus. In this experiment, fourteen pregnant rats were treated with 17β-estradiol to induce premature labor. Of those, five were treated with a topical application of a 3% progesterone creams and premature labor was inhibited in all five ($a < 0.05$). This suggests that topically applied progesterone may be effective in preventing premature labor.

NOVEL APPROACH TO CLASSIFY SEXUAL MATURATION IN CAPTIVE POPULATIONS OF *Oreochromis Niloticus*. J. Hagen, S. W. C. Chan, R. E. Brummet, Department of Biological Sciences, State University of New York at Brockport, Brockport, NY, 14420

Tilapias are among the world's most important food fish. The major constraint to expanding their potential in aquaculture is their tendency to spawn before reaching marketable size. Once tilapias reach sexual maturity, their body metabolism is mostly shunted from somatic growth to reproduction. An additional contributing factor towards their sexual precociousness is overcrowding, prevalent in most aquaculture conditions. Resources such as food and living space are essentially wasted on these captive post-maturation fish. Therefore the ideal fish for aquaculture purposes, is to select a phenotype of delayed sexual maturation which also grows rapidly. Until now, efforts to isolate such a phenotypic breeding stock from such a large gene pool as the outbred population of Tilapia has not been possible due to the lack of nondestructive methods used to determine gonadosomatic index in Tilapias. In this study we have successfully applied a nondestructive method to determine the degree of sexual maturation state of *Oreochromis niloticus* by blood sampling and radioimmunoassay (RIA).

Donor fish obtained from the Colby Farms (Rochester, NY), were anaesthetized with MS-222 (tricaine methanesulfonate) and blood samples of up to 400 μL were obtained from tapping the posterior cardinal sinus. Sera, extracted with ether, was then dried and analyzed by RIA using specific antibodies to testosterone and estradiol, respectively. The major sex steroid in both male and female fish is, in general, testosterone which is generally at low or undetectable levels up until ovulation or spermiation when it increases markedly. This increase is the benchmark with which we assume the onset of sexual maturity. This valuable tool, whereby sexual maturity can be monitored without killing the fish, opens up the possibility for selective breeding. Through this process we can establish a population of tilapias genetically predisposed for delayed sexual maturity. These data will allow for further studies on the interactions between *Oreochromis niloticus* and it's environment.

AN ALMOST COMPLETE ACANTHODIAN FISH FROM THE GENERAL CRUSHED STONE QUARRY IN HONEOYE FALLS, NEW YORK. John Raymond Honan, 50 BLY STREET, ROCHESTER, N Y. 14620

On November 5, 1994, I wrote an abstract (page 13) on Pennsylvania's Devonian Fossil Fish. This summary mentions the "fin-spines' of the Acanthodian fishes.

These extinct jawed fishes, mimicked the sharks, because of their upturned (heterocercal) caudal fins. All Acanthodians (Gr.akanth=spine or thorn; odiosus=hateful) had distinctive spines in front of their fins.

Acanthodian fin-spines are found at localities in Buffalo, Syracuse, and at the General Crushed Stone Quarry. Two types of fin-spines are preserved at the quarry. (1) Small and very slender undescribed species. (2) Larger spines of the Genus *Machaeracanthus*. Fin-spines of *Machaeracanthus* grew to a length of one foot and are shaped like sabers. *Machaeracanthus* is even found in Australia. All of these Acanthodian fishes occur in the black Marcellus Shales of Middle Devonian Age.

On October 3, 1996, I discovered a partially articulated Acanthodian fish at the crushed-stone quarry. This specimen is three and one-half inches (95 mm) long and shows the middle of the body. The scales are beautifully preserved, Two spines are present, The pectoral (28 mm) long and the anal (8 mm) long, The scales and spines will be compared with specimen in my Collection and scientific literature.

Interestingly, the scaled remains of a smaller Acanthodian may occur anteriorly to the larger fish specimen.

Newberry. J. S. 1889, The Paleozoic Fishes of North America. Plate 29.

Zidek, Jiri 1975, Some Fishes of the Wild Cow Formation (Pennsylvanian Manzanita Mountains, New Mexico).

Machaeracanthus - Natural size

A RELATIONSHIP BETWEEN GROWTH FORM AND LIFE HISTORY FOR ANGIOSPERM TREES OF NORTH AMERICA. John C. Hunter and Tonya L. Krueger, Department of Biological Sciences, State University of New York College at Brockport, Brockport, NY 14420

Most angiosperm trees have but a single shoot system of one or several trunks (with all of the trunks interconnected at their base). However, some trees produce numerous shoot systems from their roots (root sprouts). These prolific root-sprouters form clones that may spread laterally over large areas with trunks up to thirty meters apart. By comparing ninety North American species of angiosperm trees, we identified two other traits associated with root sprouting: more rapid sexual maturity and shorter life span. Together with root sprouting, these traits describe a pattern of occupying space by opportunistically producing a series of shorter-lived trunks over a relatively large area. This pattern of growth differs both morphologically and ecologically from that of a non-sprouting tree with its single shoot system, and therefore root sprouting trees should be considered a distinct growth form of woody plants.

HIGH TEMPERATURE MAGNETIZATION OF THE RE-ENTRANT FERROMAGNET $SmMn_2Ge_2$. Sunil Labroo, Brian Murphy, Ronald Soule and Dale Zych, Department of Physics, State University of New York, Oswego, NY 13126

Magnetic behavior of the ternary compound $SmMn_2Ge_2$ is studied at temperatures ranging from 77 K to 800 K Experimental data exhibits the classical re-entrant behavior below the room temperature. The high temperature magnetic properties are determined primarily by the Ma moments and they are sensitive to the Mn-Mn interlayer spacing. A broad minimum in magnetic susceptibility is observed, for the first time, at 740 K This feature indicates a possible onset of magnetic ordering in the Mn sublattice.

THE KINETICS AND MECHANISM OF THE ELECTROPHILIC SUBSTITUTION REACTIONS INVOLVING COPPER(II) AND ZINC(II) IONS IN MESO-TETRAPHENYLPORPHYRIN. Romana Lashewycz-Rubycz and Jennifer Christensen, Department of Chemistry Hobart and William Smith Colleges, Geneva, New York 14456

Metalloporphyrins are present in all biological systems. Some of these are involved in respiration of both plants and animals.

Small steric changes in porphyrin conformation can affect mechanistic pathways in reactions that involve them. Other researchers have shown that modulation of reduction/oxidation and light absorbing properties may occur.

The kinetics and mechanism of the electrophilic substitution of copper (Cu(II)) and zinc (Zn(II)) in 5,10,15,20-tetraphenyl-21*H*-23*H*-porphine is under investigation. This is an extension of the research done by Blakely(1994) and Wilkerson (1995) in this lab. Because each metalloporphyrin absorbs visible light at unique wavelengths, the substitution reactions being studied can be monitored using visible spectroscopy. The changes in concentration of both the reactant and product with respect to time can then be used to determine the rate constants for each of the reactions. The order of reactivity for the substitution of metal ions can then be established

The mechanism for the replacement reaction proposed by Blakely involves the puckering of the porphyrin prior to substitution. This distortion was shown by Wilkerson to be aided by the presence of alcohols. Contrary to expectations, the bulkier the alcohol, the faster-the substitution.

These results are being further investigated. The effect of a series of alcohols: methanol, ethanol, *n*-propanol and *tert*-butanol are being quantified. Various solvents and reaction temperatures will be employed to further elucidate the mechanism of metal substitution.

VONNEGUT'S LIGHTNING-THEORY OF TORNADOES. Frank Mooney, 6135 Dugway Road, Canandaigua, NY 14424

Bernard Vonnegut[1] in 1960 reasoned that only lightning can expand air for the 70°C contrasts needed to propel updrafts through the tropopause. He has been ignored. Electrical heating goes with current-squared, and the far-strongest bolts flash from ground-to-cloudtop after mid-cloud charge has neutralized. The voltage difference must be huge with a spacing of kilometers; the current is known to be large; and the power suddenly expanding the column of air would be enormous. He predicted[2] in 1977 that the height in km of a spire in the stratosphere would be H = u/20 where u is upward speed in m/s. For each 20 m/s, the tower rises 1 km in isothermal air. Turrets up to 6 km tell of speeds over 100 m/s or 225 mph even in non-isothermal air.

Warmer air around a frigid top-heavy column lets dense hail and air avalanche from its top and gain speed all the way down because falling air can warm no more than 9.7°C/km. Remote converging air whirls and often yields a tornado, but straight downbursts of cold air are not conspicuous. They slash radial scars and destroy airplanes trying to land with plane-flipping crosswinds glide-stretching headwinds, and lift-dumping tailwinds.

Whether all tornadoes fit this scenario is doubtful because a few seem to turn clockwise, and other patterns of development have been reported. Some whirling storms do not even descend from clouds, but lightning probably empowers the most powerful ones.

[1]Bernard Vonnegut, *J. Geophys. Res.*, 65, 203-212, Jan 1960.

[2]C. Moore & B. Vonnegut, Ch 3, Vol 1, Lightning (R. H. Golde, 1977, Academic).

KINETIC PHYSICS OF BERNOULLI'S PRINCIPLE - FINAL REPORT. Frank Mooney, 6135 Dugway Road, Canandaigua, NY 14424

Fluids flow if their pressure exceeds adjacent pressure. Deformation of water molecules pulled by gravity and of extremely compressed air provides the extra force for liquids with nearly constant density. Advecting wind is isothermal and flows from regions where molecules are more closely packed to regions of lower density. Air that is vacuumed into a Dustbuster® or into a wind-tunnel without transfer of heat (adiabatic flow) additionally transforms some random molecular motion, the essence of pressure, into ordered motion, the essence of flow.

Flowing frictionless air acquires a speed that measures the ratio of before-and-after pressures in each of these cases. Adiabatically sped air cools and also thins. Isothermally sped air thins but does not cool. Water and isopycnically sped air neither thins nor cools.

For subsonic speeds u in m/s, lowered pressure P_u/P_o, density r_u/r_o, and temperature T_u/T_o are formulated here. For sea-level air, $Q = r_o u^2/2\ p_o \approx 6 \cdot 10^{-6}\ u^2$.

U≥0	Iso-r	Iso-T	Adiabatic Air ≈	Approximations	Water
P_u/P_o	1-Q	e^{-Q}	$[1-(1/3.5)Q]^{3.5} \approx$	$e^{-Q} \approx 1-Q$	$1-u^2/200$
r_u/r_o	1	e^{-Q}	$[1-(1/3.5)Q]^{2.5} \approx$	$e^{(-Q/1.4)} \approx 1-0.707\ Q$	1
T_u/T_o	1	1	$[1-(1/3.5)Q] \approx$	$e^{(-Q/3.5)} \approx 1-0.286\ Q$	1

Note: $[\mathrm{Lim}/(x \to \infty)](1-y/x)^x \neq \exp(-y) \neq e^{-y} \approx 1-y-y^2/2$.

These formulas report that reduced pressure both in streaming isothermal (iso-T) air at subsonic speed as well as in adiabatic streaming air at subsonic speed are nearly the same as in isopycnic (iso-r) air (on Jupiter?). Derivations of all formulas are available on request.

GEOLOGY AND VERTEBRATE PALEONTOLOGY OF THE GREAT DIVIDE BASIN, SW WYOMING. Brett A. Nachman, Department of Anthropology, SUNY at Geneseo, Geneseo, NY 14454

Three summer field seasons of geological and paleontological work in terrestrial sediments of the Great Divide Basin of southwestern Wyoming have yielded a mammalian fauna of approximately 1500 specimens from nearly 30 different localities. Spanning the Paleocene-Eocene boundary, these fossils document evolutionary change in a series of lineages close to the origins of many modern mammalian Orders like Primates, Perissodactyls, Artiodactyls, Rodents and Carnivores. Ongoing work in the Department of Anthropology at SUNY at Geneseo involving the preparation, identification and curation of these specimens has led to a greater understanding of the evolutionary history of these fossils, as well as their geographic and temporal ranges. This paper will summarize the results of these field and lab studies with respect to one major question: the dating of these fossil assemblages.

The Great Divide Basin is a portion of the Greater Green River Basin, an intermontane basin that developed in what is now Colorado, Utah, and Wyoming in the early Paleogene. The basin is bound by the Wind River Range, Uinta Mountains, Wyoming Overthrust Belt, and the Granite Mountains/Sierra Madre which were sediment sources throughout the history of the basin. The Rock Springs Uplift and Wamsutter Arch demarcate the Great Divide Basin from the Greater Green River Basin in southwestern Wyoming. The Greater Green River Basin was subtropical in the late Paleocene and early Eocene, climactic fluctuations are indicated by growth and retreat of large lakes within the basin. Strata consist of interfingering fluvial, paludal, and lacustrine deposits assigned to the Fort Union Formation (Paleocene), Battle Spring, Wasatch, and Green River Formations (early Eocene), and the Bridger Formation (middle Eocene). Mammal remains have been found in paleosols and overbank deposits in the Fort Union (Twelvemile Well) and Main Body of the Wasatch formations (Tipton Buttes). Concentrated bone material was recovered from conglomerates and sands that indicate meandering streams and flood channels that eroded through overbank sediments (Tipton Buttes, Red Desert).

The fossil assemblage from the Twelvemile Well locality is dominated by archaic primates (e.g., *Plesiadapis cookei, P. dubius, Carpolestes simpsoni, Chiromyoides major*) and is most similar to other localities in Wyoming and Montana that date to the Clarkforkian land mammal age of the late Paleocene. Faunas from the Red Desert and Tipton Buttes localities are clearly early Eocene in age, as is demonstrated by the presence of typical Wasatchian forms such as euprimates (*Cantius* and *Copelemur*), horses (*Hyracothenum*), and artiodactyls (*Diacodexis*). After a discussion of the principles of biostratigraphic dating, complete faunal lists of each of these three localities will be presented and compared with standards from other localities in order to establish the relative chronologies of these sites and of their fossil faunas.

HAZARD, IMPACT, NEED AND RESPONSE: GEOGRAPHICAL PERSPECTIVES ON DISASTER RISK AND MORTALITY IN THE DEVELOPING WORLD. Darrell A. Norris, Department of Geography, SUNY, Geneseo, Geneseo, NY 14454

Public perception of natural and human-induced disaster tends to associate severity of impact with the inherent severity of the hazard itself. In fact, however, the human impact of disaster rests much more on the circumstances of populations at risk than on the severity of the hazards they are exposed to. As a result, disaster mortality and other adverse consequences of hazard are felt far more acutely in Developing World settings where human-environmental circumstances before, during and after a tragedy contribute to its toll. In this paper I present an instructional model which highlights the contrast between the Developing and Industrialized World's exposure to the effects of disaster, The model is corroborated by Geneseo students', macro- and micro-level analyses of well-documented disaster events since the 1960s.

A TAXONOMIC SURVEY OF THE MACROFUNGI AT RUSH OAK OPENINGS. Andrew H. Prior. Biology Department, Nazareth College, Rochester, NY 14618

Oak Openings and Limestone Woodlands both represent endangered and highly understudied habitats. This ongoing study focuses on both of these rare habitats and their respective macrofungi flora. The primary organisms of the study are the Homobasidiomycetes, although other macrofungi were also collected. This progress report will consist of a description of the unique properties of these habitats and the activities of the NYS DEC and the WNY-NC to restore these ecological communities. This report will include a discussion of some of the species found so far, Eventually, this study will hope to identify a correlation between the species collected and their respective habitats, Consideration of land use history and time of specimen collection will also be incorporated into the final report, Specimens have been collected, preserved and photographed on their substrate, Identification of the specimens is still in progress, This research is supported by an honorarium from the New York State Museum and the fungi will be contributed to the museum collection, The project has received the cooperation and endorsement of the Western New York Chapter of the Nature Conservancy and the New York State Department of Environmental Conservation.

DEVELOPMENT AND OPTIMIZATION OF A STRAIN-SPECIFIC 16S rRNA PROBE FOR THE TETRACHLOROETHENE AND TRICHLOROETHENE-DEGRADING BACTERIAL STRAIN MS-1. Carl Raimond and Sara Silverstone Department of Biological Sciences, SUNY Brockport, Brockport, NY 14420

Tetrachloroethene (PCE) and Trichloroethene (TCE) are common groundwater contaminants that nearly top the Department of Environmental Conservation's list of problematic pollutants. A strain of gram-negative bacteria, MS-1, found capable of the anaerobic degradation of PCE via TCE to *cis*- 1,2-dichloroethene (DCE), was isolated from a PCE-contaminated site in Victoria, Texas. *cis*- 1,2-DCE levels are tolerable at much higher concentrations in drinking water than PCE or TCE and is degraded easily by a variety of other organisms, The facultative anaerobic nature, high degree of metabolic diversity, lack of hazardous byproducts (such as vinyl chloride), and tolerance for near saturation levels of PCE make MS- 1 an excellent candidate for use in bioremediation.

In order to monitor the growth and activity of this strain under natural conditions, a rapid and efficient method for enumeration is being devised. By sequencing the 16S rRNA of MS- 1, a unique strain-specific nucleic acid probe will then be developed. Optimization of physical conditions such as temperature and pH will then be determined for whole-cell *in situ* hybridization.

KISL: A PIDGIN, STANDARD, OR OFFICIAL ENGLISH REGISTER? John Rhoades, Department of Anthropology, St. John Fisher College, Rochester, NY 14618

KISL in the acronym for Kodak International Service Language, a written variety employed for the production of Kodak service manuals. KISL presents several interesting questions in sociolinguistic typology. First, is it a pidgin? Second, is it a standard language? And third, is it an official language? The attributes of simplicity, codifications, and exclusive usage will be discussed as these apply to KISL and the manner in which it may be classified. It will be suggested that KISL's position cannot be assigned to any one of these traditional register types and a modified category will be offered. Finally, the role of such simplified registers as KISL will be assessed in light of the contemporary spread of English as a global lingua franca.

CLIMATIC INFLUENCE ON SANDSTONE COMPOSITION. M. L, Rhoades, St. John Fisher College, Chemistry Department, 3690 East Avenue, Rochester, New York 14618

One governing factor in determining sandstone composition is tectonic setting. However, climate during sandstone deposition may also play a governing role on sandstone mineralogy. Many workers (Mack, 1974; Suttner and others, 1981; Basu, 1986; Johnsson, 1988; Kairo and others, 1993; Rhoades and DeCelles, 1994) have studied the effects of hot, humid climate on sandstone maturity. Tropical conditions favor quartz retention at the expense of feldspar and unstable lithic fragments.

A preliminary study of 140 sandstone thin sections from four separate petrographic analyses was undertaken to determine the role between sandstone composition and climate,

irrespective of tectonic setting. The four petrographic analyses examined reveal that quartz-rich sandstones were deposited during hot, humid conditions, despite several different tectonic settings.

The four analyses are: 1) 42 samples from Mesozoic-Cenozoic sandstones deposited on the Labrador-Greenland margin, %QFL = 72, 23, 5 Higgs, 1978); 7) 47 samples from Eocene sandstones (southern California), %QFL = 53, 40, 7 (Graham, 1976; Rhoades, 1992); 3) 24 samples of Eocene-Oligocene sandstones from the Santa Ynez Range of the California Transverse Ranges, %QFL = 50, 47, 3 (VandeKamp and others, 1976); and 4) 27 samples deposited m the mid-Miocene (southern California), %QFL = 55, 40, 5 (Graham, 1976).

LABORATORY MANAGEMENT SKILLS IN A SCIENCE EDUCATION CLASS. Anne Marie Sokol and Maria Pacheco, Dept. of Chemistry, Buffalo State College, 1300 Elmwood Avenue, Buffalo, NY 14222

Laboratory management skills were introduced in the Laboratory Techniques In Secondary Science Education course currently offered at Buffalo State College. Students enrolled in the class are secondary science education majors, and the course concentrated on the development of laboratory and planning techniques necessary for the preparation and adaptation of educational laboratory activities. The Chemistry component of the class presented an array of materials and situations that could be encountered by a secondary science teacher, as well as a wide variety of techniques needed to address some of the technical problems encountered when dealing with chemicals and the management of an academic Chemistry laboratory. Lessons were developed such as to provide future science educators with the skills necessary to obtain valuable, quick chemical information and know-how that will allow them to choose educational activities based not only on their educational merit, but also taking in consideration budget reduction, inventory control, waste management, and versatility.

RECYCLING AQUACULTURE WATER FOR LAND RECLAMATION. J. A. Stedron, E. P. Glenn, and J. Brown, Biology Department, Houghton College, Houghton, NY 14744; University of Arizona, 2601 E. Airport Dr. Tucson, AZ 85706

The recent demand for aquaculture products has introduced a boom in shrimp farming businesses for coastal countries in Asia and Africa. Current mariculture systems are too expensive for these farmers, whose undeveloped farms contaminate ground water supplies and the mariculture systems themselves, and salinize soils rendering them useless for growing customary crops. The goal of this study was to evaluate the viability of using marine aquaculture waste water to grow halophytes on salinized soil from abandoned mariculture farms and other land that has been degraded by desertification. An avenue for inexpensively neutralizing waste water was addressed at the University of Arizona's Environmental Research Lab where we used 18 $1m^3$ lysimeters to grow the halophyte *Sueada esteroa* with aquaculture effluent treated with NaCl to 30 ppt for oceanic salinity. We wanted to find the optimum irrigation rate that would augment the growth of halophytes while at the same time minimize the amount of contaminants that reach the groundwater systems.

Using five irrigation treatments, the lysimeters were irrigated 3x per week using 50, 100, 150, 200, and 250% of the amount of potential evaporation. The amount of potential evaporation was measured using a Class A evaporation pan which varied from 4 cm to 2 cm per week over the course of the study. In the 12th week of the study all treatments had graduating degrees of healthy foliage, with the 50% treatments sporting the smallest plants and the 250% treatments displaying full canopies. We collected the leachate approximately 24 hours after irrigating and tested it for contaminants. The irrigation water initially contained 50 ppm phosphate, 5 ppm nitrate and 5 ppm ammonia. Initial results show that the leachate from the 50% treatment had the lowest level of phosphate (1-2 ppm), and due to excess water washing more phosphates out of the soil the leachate in the 250% treatment had the highest (6-10 ppm). Salinity levels also rose in the leachate from 0 at the beginning to 50 -60 ppt, doubling the applied salinity. Nitrate was highest in the lower treatments (100 ppm) and lowest in the 250% treatment. We believe this is a result that the larger healthier plants in the higher treatments take up more of the nutrients, and because the larger

leach volumes in the higher treatments dilute the nitrate concentrations. There was no ammonia found in the leachate; we presume it was oxidized to nitrate in the soil.

Overall the study shows that halophytes can be productive on sea water enriched with aquaculture effluent. The soil does a good overall job of removing solids and disease organisms that would otherwise go directly back into the ocean. However careful water management will be needed to avoid over-irrigating and polluting the groundwater.

***IN SITU* MOLECULAR DETECTION OF AN ANAEROBIC TOLUENE-DEGRADING BACTERIUM.** Jason Stricker and Sara Silverstone, Department of Biological Sciences, SUNY Brockport, Brockport, NY 14420

PRTOL1 is a bacterium that has the unique capability of degrading toluene in freshwater, anaerobic conditions, such as around water aquifers. This bacterial species is the only naturally occurring organism known that can remove toluene from the environment under such circumstances, PRTOL1 has just recently been isolated and identified, so very little is known about the environmental parameters that influence its growth rate and its ability to degrade toluene. In order to determine the feasibility of using PRTOL1 as a bioremediation agent more knowledge about influential ecological factors must be obtained. Several environmental factors, including soil pH, temperature, soil components. and the presence or absence of nutritional factors, can influence the ability of PRTOL1 to survive and to degrade toluene, Using a rapid and efficient *in situ* detection method that is specific for PRTOL1 that is currently being developed, the effect of these various environmental factors on the survival and growth of PRTOL1 can be determined.

TUBULAR ARRAYS FOUND IN THE ENDOSPERM OF MAIZE <u>OPAQUE-2</u> MUTANTS. Rebecca Taylor, Dr. Craig Lending, Department of Biology, SUNY College at Brockport, Brockport, NY 14420

The development of maize involves the complex formation and interaction of seed storage proteins. These proteins consist of zeins that differ in composition and structure and are classified based on their solubilities. Protein composition has a great effect on the nutritional qualities of the endosperm as well as its physical characteristics. These proteins contain large amounts of cysteine and methionine but lack significant amounts of lysine and tryptophan. Understanding the cellular mechanisms behind the ordered formation, deposition, and interactions of zeins provides great insight to perhaps improve the nutritional value of corn.

Protein bodies are spherical structures that contain four distinct proteins, α-, β-, γ-, and δ-zeins, that aggregate within the rough endoplasmic reticulum. The deposition of the zeins within the RER has been proven to be time specific (days after pollination-DAP). In young endosperm tissue (14 DAP), these protein bodies contain two of the sulfur-rich zeins, β- and γ-zeins, and can be found in the layers just beneath the aleurone layer. In protein bodies found at 18 DAP, the α-zein and sulfur-rich δ-zein form a central core within the β- and γ-zein periphery. These protein bodies are larger and are found further away from the aleurone, deeper into the endosperm.

In various mutant genotypes, the ratio of amino acids is modified to contain greater amounts of those desired amino acids that are of nutritional value. These genotypes still maintain the ordered deposition of zeins with respect to time and location. <u>Opaque-2</u> mutants contain a reduced level of the α-zein and also an increased lysine content. Despite the benefit of increased lysine, overall cellular protein is decreased, and the protein bodies that do form lack significant α-zein. Tubular arrays localized in the RER have been found that are closely associated with these protein bodies. The protein bodies appear to be forming from these tubular arrays, and since they have not been observed in normal genotypes, they are of interest to us. This tubular material may be a crystalline precursor of the protein bodies, since they have only been found at 14 DAP and not 18 DAP. This would suggest that the zeins somehow reform within the RER later in development. The tubular arrays may also be unique to only <u>opaque-2</u> mutants suggesting the formation of a new protein. There are variants of <u>opaque-2</u> that contain normal amounts of α-zein and increased γ-zein

yet have not been examined for the tubular arrays. We are currently searching all "modified" opaque-2 varieties for the tubular material, and a time line for their development is being examined. Once we establish when and where the tubular arrays are found, we will analyze the arrays by isolating and characterizing them.

CRYSTALLIZATION SELECTIVITY OF ALUMS FROM AQUEOUS SOLUTIONS. D. M. Underwood and J. M. Bopp. Nazareth College, Box 742, P.O. Box 18900, Rochester, NY, 14618-0900

The selectivity of crystal growth of alums was investigated. Combinations of ammonium iron alum, ammonium aluminum alum, potassium chromium alum, potassium aluminum alum, and ammonium chromium alum were studied. Four pairs of alums were co-crystallized from an aqueous mixture, each pair formed a series of solid solutions. The members of each pair shared a common univalent cation, but differed with respect to the identity of the trivalent cation. The crystals were analyzed for either iron or chromium by flame atomic absorption spectroscopy. The compositions of the solid solutions were compared to the compositions of the liquid solutions from which the crystals were grown. In each case, the solid phase selected for the less soluble alum of the pair. Three of the four systems. exhibited nearly ideal behavior. The fourth system suggested partial miscibility.

INFLUENCE OF PRENATAL NICOTINE ON EARLY POSTNATAL RAT PUP VENTILATORY RESPONSES TO HYPOXIA. William A. Walters III, Thomas Terndrup, Matthew Gregory, Steven Ognibene: State University of New York Health Science Center at Syracuse, 750 East Adams Street, Syracuse, NY 13208 Phone (315)464-4363

Recent information demonstrates an increased risk of Sudden Infant Death Syndrome. (SIDS) in infants of maternal smokers[1,2]. We examined the effects of prenatal nicotine exposure on ventilatory responses to hypoxia during early postnatal life in rats.

Post-conception day 5 (E5) Sprague-Dawley rats underwent insertion of a subcutaneous osmotic infusion pump for the delivery of nicotine bitartrate (group N), 6 mg/kg/day, throughout the remainder of gestation. Controls (group C) received an identical infusion of the bitartrate sodium salt. Litter size was standardized at 10, and rats were reared in standard housing, with food *ad lib.*

Ventilation was measured in resting, unanesthetized, postnatal day 2 (P2) rats using body plethysmography. Ventilatory responses were recorded under baseline, normoxic (21% oxygen) conditions, followed by hypoxic (7% oxygen for 14 minutes) exposure, as respiratory frequency (f) and minute ventilation (V_e; mL/kg/minute) were recorded at 4 minute intervals (T4, T8, and T12); mean inspiratory flow (MIF; tidal volume V_t / inspiratory time T_i) was also calculated. Comparisons of the % baseline values were performed using analysis of variance.

Mean litter and pup weight gain (C= 0.73 gm/rat vs. N= 0.72 gm/rat), with 5 rat pups in C group and 4 in the N group, were not significantly different. Baseline variables f, V_e, and MIF were not significantly different. Mean f decreased (16%) in N group, while an increase (11%) occurred at 12 min. of hypoxia in C ($P<0.05$). During hypoxia, mean V_e and MIF were significantly reduced compared to baseline in N. while C demonstrated a significant increase during early (6 min.) hypoxia.

Prenatal nicotine exposure, 6 mg/kg/day, results in a significantly reduced compensatory ventilatory response to hypoxia in newborn rats. These data may help us understand how prenatal nicotine exposure may contribute to respiratory instability.

[1]Milerad J. and Sundell H., Nicotine exposure and the risk of SIDS. *Acta Paediatrica,* 389(S);70-2, 1993.

[2]Slotkin, T. A., Lappi, S. E., McCook, E. C., Lorber, B. A., Seidler, F. J., Loss of neonatal hypoxia tolerance after prenatal nicotine exposure: implications for sudden infant death syndrome. *Brain Res. Bull.,* 38(1):69-75, 1995.

AN EXACT TEST FOR HOMOGENEITY IN 2x2 TABLES. Paul Robert Wilson, Department of Mathematics and Statistics, RIT, Rochester, NY 14623
KEYWORDS: Contingency table, 2x2 table, exact test, homogeneity, Pearson's chi-square, Fisher's exact test.

The determinant of a 2x2 table is the test statistic for an exact one- or two-sided test of the hypothesis of equal population proportions in two populations. The test allows for assessment of p-values conditioned on possible values of the nuisance parameter p.

TWENTY-FOURTH ANNUAL FALL SCIENTIFIC PAPER SESSIN

LARRY J. KING MEMORIAL LECTURE
Science and Government: Archeopolitics in the Empire State
by
Robert Kuhn
Historic Preservation Program Coordinator
New York State Office of Parks, Recreation and Preservation

ST. JOHN FISHER COLLEGE
ROCHESTER, NEW YORK
November 8, 1997

ABSTRACTS OF PAPERS

PERITONEAL POCKETS IN WOMEN WITH ENDOMETRIOSIS AND THEIR RELATION TO HEALTH AND FERTILITY STATUS. Jacqueline J. Christman, PO 18343 Rochester, New York 14618

Background: Endometriosis is a chronic disease of women associated with pain, bleeding and decreased fertility. Prevalence ranges from 10% to 50%. Cost of treatment in the USA is estimated in the millions each year.

Study Objective: To characterize women with endometriosis by peritoneal pockets, in terms of their health status (select endometriosis related symptoms—pelvic pain, heavy menstrual bleeding, painful intercourse, irregular menses, and pain with bowel movements) and fertility status (live and other pregnancy outcomes and secondary sex ratios) following surgical treatment for endometriosis.

Design: Prospective cohort study. Sixty-six women with peritoneal pockets and 161 women without peritoneal pockets were identified from a cohort of women with endometriosis. Standardized protocols for visualization and classification of endometriosis were routinely used.

Setting: A community-based, specialized center for endometriosis and other gynecologic disorders.

Participants: Participants comprised women who returned mailed, self-administered questionnaires approximately three years following surgical treatment for endometriosis and peritoneal pockets utilizing either laparoscopy (n=158) or laparotomy (n=74).

Main Exposure and Outcome Measures: Peritoneal pockets, the main exposure variable was analyzed in relation to the outcome variables: 1. Self-perceived change in five endometriosis related symptoms, and 2. fertility status defined as ever pregnant status and live birth status following endometriosis surgery. Secondary sex ratios were calculated for live births following surgery.

Results: No differences between respondents and non-respondents were noted for any sociodemographic variable except age including race, marital status, employment, gravidity, or

parity. Neither were there any differences in surgical technique or procedure used, staging of the disease, distribution of the peritoneal pockets or "other,, operative findings. Self-reported improvement in five symptoms did not vary by presence/absence of peritoneal pocket, although women with pockets were consistently less likely to report improvement in any of the five symptoms. Gravidity 21 was the only significant predictor of pregnancy following surgery age the only significant predictor of live births following surgery. The presence of peritoneal pockets did not display a consistent impact on the secondary sex ratio.

Conclusions: The presence of peritoneal pockets in women with endometriosis is not a significant predictor of perceived symptom improvement, live birth/adverse birth status or secondary sex ratio following surgical treatment for endometriosis in this study.

SEX STEROID PRODUCTION IN VITRO BY TILAPIA (*Orechromis niloticus*). M. Parady, S.W.C. Chan, R.E. Brummett*, Department of Biological Sciences, State University of New York at Brockport, Brockport, NY, 14420, *ICLARM/GTZ Africa Aquaculture Program, PO Box 229, Zomba, Malawi

Tilapia are commonly used in aquaculture . For Nile Tilapia (*Orechromis niloticus*), the major constraint to their suitability for culture is their tendency to spawn before reaching marketable size. In their early development, growth is mostly somatic, but once they reach sexual maturity, the body metabolism shifts toward reproduction purposes, especially for females. Therefore, the ideal fish for aquaculture purpose is to select a phenotype with delayed sexual maturation and rapid growth. So far efforts to isolate such a phenotypic breeding stock from the outbred population of Tilapia has not been possible due to the lack of non-destructive methods used to determine the gonadosomatic index (GSI). We have previously shown that the GSI for *O. niloticus* can be established by sampling blood without sacrificing them and performing sex hormone determination using radioimmunoassay (RIA). The following study was undertaken to confirm the applicability of such an approach by comparing *in vitro* production of sex hormones using sexually mature fish to what we previously obtained from *in vivo* studies.

Donor fish were obtained from Colby Farms (Spencerport, NY). Sexually matured males and females were sacrificed to retrieve testicular and ovarian tissues. Aliquots of both tissues were incubated in Krebs-Hensleit bicarbonate buffer under an atmosphere of 95% O_2 and 5% CO_2 with or without exogenous 1,2,6,7-^{3}H-progesterone. The incubates were then extracted with ether; steroid production from the "cold" incubates were analyzed by RIA, using specific antibodies to testosterone and estradiol, respectively. Steroid production from the "hot" incubates were separated using TLC. Progesterone, testosterone, androstenedione, and 11-keto-testosterone were isolated and quantified. Results indicate that the primary sex steroids in both male and female fish are testosterone and I 1-keto-testosterone, in approximately equal molar concentrations. Furthermore, the levels of both steroids for both male and female fish are virtually the same, judged on an equivalent tissue weight basis. These findings support our earlier *in vivo* work that for Tilapia of both sexes, testosterone and 1 l-keto-testosterone are the predominant sex steroids synthesized and secreted, and their measurement can be relied on for the establishment of GSI.

EFFECTS OF TESTOSTERONE IMPLANTS ON THE DAILY RHYTHM OF THE CLOACAL GLAND AREA IN THE MALE JAPANESE QUAIL (*Coturnix coturnix japonica*) John Fargo, Melissa Fasolo, and Joel Kerlan, Department of Biology Hobart and William Smith Colleges, Geneva, NY, 14456

Diurnal rhythm in copulatory behavior, crowing and locomotor activity have been reported in male Japanese quail. These different behaviors are dependent on testosterone. Since they are dependent on testosterone, we hypothesized that both blood testosterone levels and the cloacal gland area, a secondary sex characteristic that determines the sex and the stage of sexual maturity in the male quail, also have diurnal rhythms. Then we sought to find out if the cloacal gland area rhythm is testosterone dependent like the other behaviors above.

Thirty-adult quail kept at 16L:8D photoperiod (on:0700) were studied. The CGA of 15 birds, before testosterone implants, were measured every six hours (start:0600). While the CGA of

the other 15 birds were measured every six hours with a two hour difference in starting time (start:0800). The maximum CGA occurred at 1200 hrs for the first 15 birds (mean = 156.5 mm^2), and at 1400 hrs for the second 15 birds (mean = 168. 1 mm^2). The data obtained by these measurements fit a sine curve, which can be interpreted as a reoccurring fluctuation, or rhythm. The two sets
of measurements fit the equations,

A sin(Bx + C) + D

A=amplitude
B=period
C=horizontal shift
D=grand mean

21.2 sin(0.15x + -139) + 156.5

and

28.1 sin(0. 15x + -109) + 168.1

Then the same 30 male Japanese quail were implanted with testosterone implants (4x(0.062ID)x(0.0950D)). This was done to try and force the blood testosterone levels to be constant and in hopes for the CGA to be constant and at a maximum size. Which is only possible if CGA is dependent of testosterone. The same procedure for CGA measurements in the before implantation of testosterone quail, was followed for the after implantation of testosterone quail. Measurements started 3 days after implantation.

>From the results the CGA fit the same sine curve with the equations;

18.4 sin(0.15x + -139) + 172.3

and

19.0 sin(0.15x + -109) + 185.1

>From these results the CGA seemed to be flattening out (amplitudes decreased) and reaching a maximum area (grand means increased).

In summary, we obtained a 24 hr daily rhythm for CGA, which fit a sine curve. We also, using testosterone implants, attempted to control CGA, and produce a maximum CGA without any daily fluctuations. Studies are presently in progress to determine whether there is a time dependency needed for the testosterone implants to take physiological control, and to determine if the implants worked in the first place, and that the blood testosterone was at a steady level.

EFFECT OF TESTOSTERONE IMPLANTS ON DAILY RHYTHM OF CLOACAL GLAND AREA IN JAPANESE QUAIL (*Coturnix coturnix japonica*). Melissa Fasolo, John Fargo, Dr. Joel Kerlan. Department of Biology, Hobart and William Smith Colleges, Geneva, NY 14456

The cloacal gland is a testosterone-dependent secondary sex trait used to determine the sex and sexual maturity of quail. This study examined the relationship between the daily pattern of variation in blood testosterone levels and the daily rhythm of cloacal gland size. Thirty adult males kept on a 16L:8D (on:0700) photoperiod were studied. Cloacal glands of 15 males were measured every 4 hours for 24 hours. The other 15 males were also measured every 4 hours for 24 hours but the timing of the initial measurement was advanced 2 hours relative to the first study. Two days after the cloacal measurements, wing vein blood samples were collected every 4 hours for 24 hours from 6 different groups each consisting of 5 birds. A broad peak in testosterone levels (2.7~0.5 ng/ml) occurred in the dark (0200-0600 h) with a nadir (0.9+0.2 ng/ml) at the end of the light period (2200 h). Peak cloacal gland area occurred at midday (1200-1400 h) with a nadir in the dark (0100-0300 h). Analysis of mean cloacal gland area fit an equation for a sine curve.

The relationship between testosterone and cloacal gland size was further investigated by inserting 4-25 mm subcutaneous testosterone implants. Comparison of the difference in cloacal gland size 3 days after insertion of the implants and before the implants showed that the relative amplitude of the sine curves decreased (21.2 vs. 18.4, 28.1 vs. 19.0) and the relative grand mean of the sine curves increased (156.5 vs. 172.3, 168.1 vs. 185.1). Thus, testosterone treatment had reduced the range of variation in cloacal gland area as the gland approached a maximal size. Studies

are in progress to determine the effects of testosterone implants after 7 weeks on raising testosterone levels and in turn further stabilizing cloacal size at its maximum.

EXCAVATIONS AT THE JOEL N. LEE FARMSTEAD: RURAL HISTORY IN UPSTATE NEW YORK. Dr. Ann Morton, Department of Anthropology, St. John Fisher College, Rochester, New York 14618

Excavations at the Joel N. Lee Farmstead site in Wayne County, New York, over the past seven years, have revealed a wealth of information about everyday life in a 19th century farming community.

A team of college students, high school students and local individuals interested in discovering their own past, spent five weeks over the summer of 1997 recovering the ordinary history of ordinary Americans, from the period of 1827-1936.

At the same time that they were asking localized questions about local events, the very typical nature of the site lead to questions about the rural background of Americans as a whole, and how the farming/small town life familiar to most people in the 19th century shaped the America we see today.

This brief paper will review the history of a project which has increasingly become the "archaeology of the everyday," and discuss some of the benefits and drawbacks of a program which encourages local enthusiasts of all ages to work with college students in "recovering history."

A SUMMER ARCHAEOLOGICAL FIELDSCHOOL IN THE CITY OF KAMIANETS-PODILSKY, UKRAINE. Dale Rickard, Department of Anthropology, St. John Fisher College, Rochester, New York 14618

This paper will describe the activities and achievements of a student's summer fieldwork in an urban, historical archaeological site. Problems created by doing excavation in an urban area, dealing with the city's population while handling archaeological methods, and working with the Kamianets-Podilsky Foundation which was funding the project, will be described. Major finds during the summer will be described and the significance of these will be discussed.

A DESCRIPTION OF THE A. M. STEWARD COLLECTION AT ST. JOHN FISHER COLLEGE LIBRARY. Gina Hossen, Department of Anthropology, St. John Fisher College, Rochester, New York 14618 York

The St. John Fisher College library contains the collection of A. M. Stewart's papers and this report is a description of what this collection contains. As an internship project under the college reference librarian, Nancy Martin, and the library Director, Karen Junker, the collection is being organized arid indexed. Over a thirty year period during the first half of this century, Stewart studied the influence of the French in this region. His papers include varied information on French Jesuit missionaries and French explorers, local monuments, and information on the Seneca and other Iroquois and Algonquin groups. An overview of the contents of the collection will be given and some possible uses of this information will be discussed.

SOME LINGUISTIC MISCONCEPTIONS. John Rhoades. Department of Anthropology, St. John Fisher College, Rochester, New York 14618

Language has apparently been coming back as a topic of public discourse. However, discussion about language capability and acquisition appearing in such forums as NEWSWEEK and SCENCENEWS manifest several errors about language as a phenomenon. This paper will discuss some of these misconceptions. The first concerns the nature of how human speech is organized. The misconception is that human learn to speak by learning discrete sounds. The second concerns the process by which speech is acquired and when this can occur. The misconception is that this process can begin prior to birth through the (late term) fetus sensing speech sounds in the womb. The third is the question of the presence of a genetic "grammar" which enables infants to learn a well-formed language despite the speech behavior in its

environment. This particular misconception involves the application of faulty reasoning to the use of "baby talk". The fourth concerns the question of establishing English as the official language of the United States. The misconception is that this will reduce the potential for language-based conflict and enhance national unity. Finally, the fifth conceals the goal of learning a second language and the capability of achieving this. The misconception is that this is a process which must aim toward "fluency" and it has only a limited window of opportunity which ends in the mid-teens.

THE EFFECT OF LEAF POSITION ON THE RATE OF PHOTOSYNTHESIS IN HIGHBUSH BLUEBERRY CANOPIES. James Hefti and Elizabeth Newell. Biology Department, Hobart & William Smith Colleges, Geneva, NY 14456

The LI-6200 portable photosynthesis system was used to compare the photosynthetic rates of upper and lower leaves of highbush blueberry (*Vaccinium cozymbosum*) in Zurich Bog, Wayne Co. The purpose of these comparisons was to determine if a physiological difference exists between leaves in different positions within the canopy.

Field (1983) demonstrated that leaves of a deciduous shrub that received the most light were allocated the greatest supply of nutrients, resulting in higher maximum rates of photosynthesis than observed in more shaded leaves. It was expected that highbush blueberry shrubs would possess a similar strategy for carbon gain, especially given the low supply of nutrients typically found in a bog.

Unexpectedly, upper and lower canopy leaves had very similar rates of photosynthesis when exposed to both high light and low light conditions, suggesting that these leaves are not physiologically different. Nitrogen analyses of leaf tissue helped explain these results; upper and lower canopy leaves did not differ significantly in nitrogen concentration.

THE RELATIONSHIP BETWEEN RATES OF PHOTOSYNTHESIS AND SOIL NITROGEN CONCENTRATIONS IN TWO SPECIES OF SPHAGNUM MOSS UNDER VARYING LIGHT ENVIRONMENTS. Maithreyi Krishnaswami and Elizabeth Newell. Biology Department, Hobart & William Smith Colleges, Geneva, NY 14456

Sphagnum achieves its maximum growth rate at less than full light intensity (Clymo & Hayward 1982). It is hypothesized that the low nitrogen availability typical of the moss's habitats limits its photosynthetic rate, even in high light, and thus its growth rate. Here we test that hypothesis by measuring the rates of photosynthesis of two species of Sphagnum growing in different light environments and soil nitrogen levels in Zurich Bog, Wayne Co.

Two small quadrats of each type of moss were located in dense shade and in full sun sites. One quadrat in each environment received weekly applications of ammonium nitrate fertilizer. Photosynthetic measurements were made on individual shoots of moss, using a LiCor 6200 portable gas exchange system. Some shoots were collected and grown in peat in a growth chamber and received varying concentrations of fertilizer. Photosynthetic measurements were made on these shoots as well.

Both species were found to reach their maximum photosynthetic flutes at less than full light intensity. However, there was no clear relationship between light level and photosynthesis. Fertilized specimens of species A from the sun had higher rates of photosynthesis than unfertilized plants when measured in the field and in the growth chamber. Species B showed a similar response in the field though the effect of fertilizer was not as marked when photosynthetic rates were measured in the growth chamber. We conclude that nitrogen does limit the rate of photosynthesis of these Sphagnum plants, especially in the sunny habitats of Zurich Bog.

A 177-YEAR PITCH PINE (Pinnis rigida) TREE RING HISTORY FROM AN IRONDEQUOIT BAY FOREST. Christine S. Sweeney and Bruce A. Gilman, Department of Environmental Conservation/Outdoor Recreation, Finger Lakes Community College, 4355 Lakeshore Drive, Canandaigua, New York 14424-8395

In 1995, the discovery and documentation of an old growth forest community growing along the northeastern bluffs of Irondequoit Bay was reported at these meetings. Later that year, a

large pitch pine (d.b.h.=25.7") adjacent to the forest died, presumably from canopy damage and disease infestation following a severe ice storm in 1992. Examination of annual growth increments on the stump revealed several periods of unusual growth response. We speculate that pitch pine rooted in a droughty soil will produce annual rings sensitive to growing season precipitation. Release events indicated in the tree ring chronology may also be related to fire effects and changes in canopy competition for light with neighboring trees.

A MATHEMATICAL MODEL OF TUMOR VASCULARIZATION. Sophia A. Maggelakis, Department of Mathematics and Statistics, Rochester Institute of Technology, Rochester, New York 14623

Tumor vascularization is stimulated by a growth factor called Tumor Angiogenesis Factor (TAF). This growth factor is produced by the viable proliferating tumor cells and has the capacity to stimulate the nearby blood vessels to send out capillaries that grow towards the tumor and finally penetrating it. Tumor cells also release chemical substances that have the effect to inhibit and regulate angiogenesis (the formation of new blood vessels). A mathematical model, which relates directly the production of TAF and growth inhibitors to tumor angiogenesis and vascularization, is presented. This model is using diffusion equations in spherical geometry to model the production and diffusion of these chemical substances and to determine their effects on the rate of growth of the capillary boundary which moves towards the tumor boundary and marks the onset of vascularization.

HIGH-RESOLUTION STRATIGRAPHY AND FAUNAL EVIDENCE FOR CYCLIC SEA-LEVEL CHANGES IN THE JAYCOX SHALE OF WEST-CENTRAL NEW YORK. Thomas D. Palmer 270 Greenhaven Terrace, Tonawanda, New York 14150

The Jaycox Shale Member of the Middle Devonian Ludlowville Formation of west-central New York was examined at three locations. The interval at each location was measured centimeter-by-centimeter to distinguish all recognizable beds. These were described and sampled for fossils to be used for faunal counts. Recognized beds were correlated across the study area to provide a precise chronostratigraphic framework. The gathered data will be used to interpret the relationships between faunas, lithology, and environmental condition.

For each bed, all identified macrofossil species are being counted, and relative abundance data are being plotted on cumulative frequency diagrams to allow interpretations of small-scale environmental changes. Previous investigations of the slightly older Wanakah Shale Member suggest that faunal dominance data presented in such a manner allow recognition of small scale (less than 20,000 years) sea level fluctuations. The present study will attempt to apply this technique to other rock units such as the Jaycox Shale.

INTERNAL STRATIGRAPHY OF THE LATE SPORRAN PITTSFORD SHALE (VERNON FORMATION, SALINA GROUP) AT THE WEGMANS SUPERSTORE SITE ALONG THE ERE CANAL, PITTSFORD, NEW YORK. Samuel J. Ciurca, Jr., 44 Stonington Drive, Pittsford, New York

The lower Vernon Formation of the Late Silurian Salina Group is the repository of immense numbers of fossil arthropods, brachiopods and pelecypods. The fauna of the Pittsford Member, first described by Clifton Sarle in 1903 from excavations in the Erie Canal near the Brighton-Pittsford town line, is of interest because it preceded the better-known faunas of the Late Silurian Bertie Group that extends nearly across the entire state.

Temporary exposures of a portion of the lower Vernon Formation were available for study during the interval August 1996 through October 1997. Construction of a new Wegmans Superstore in Pittsford, New York (not far from the type Pittsford Shale behind the Spring House) necessitated extensive excavating, especially along the outer wall of the Erie Canal that was to form one of the main walls of the new superstore. The trench that was excavated (over 300 feet long by about 12 feet across and several feet deep) revealed an excellent section of the Pittsford Member of

the lower Vernon Formation, superjacent waterlimes and redbeds and subjacent shales and dolomitic mudstones.

As interpreted herein, the Pittsford Member consists of a complex of 80 cm. of dark gray and black mudstone and shale with intercalated lenticular and thin waterlime units and a resistant bed of dolostone near the middle. Upper beds are heavily mudcracked and eurypterid debris appears to have fallen into some of the cracks before being covered by the next sedimentary event. Of particular note are the lower 10 cm. These contain abundant impressions of halite crystals indicating the hypersaline conditions that existed during much, if not all, of the deposition that resulted in the formation of the Pittsford Shale. Ironically, this bed also contains arthropod trackways that are currently under study. Immediately below these black shales occurs the Clam Bed, a thin resistant dolostone containing abundant pelecypods.

The Pittsford Member appears to contain eurypterid remains throughout. There also appears to be a decrease in the abundance of *Hughmilleria socialis* toward the top of the member and a corresponding increase in the occurrence of *Eurypterus pittsfordensis*. At least one ,'mass mortality" horizon occurs and was observed within the lower 15 cm of the member.

Work in progress will lead to an improved stratigraphic column of the lower Vernon Formation inclusive of the faunally important eurypterid-bearing units and a geological map along the outer wall of the Erie Canal. The paleontology of beds overlying and underlying the Pittsford Shale is the subject of a paper currently in preparation.

I wish to thank Carl A. Rosati of CME Associates, Inc for access to the site so that I could measure the newly exposed strata, photograph the various units including the Pittsford Shale and collect various sedimentary structures and fossils.

INTERPLANETARY DEBRIS AND THE THREAT OF A COLLISION WITH EARTH. James J. Carr, 14 Tall Meadow, Painted Post, New York 14870-9105

An intriguing coincidence of events these past ten years has revived serious contemplation of asteroid, meteor and comet collisions with Earth. Until recently it was only an academic exercise, likely to instill fear and dread in those burdened with the knowledge. But ironically, thermonuclear weaponry, guided missile technology, and (Spy satellite advances developed during the Cold War may be employed in a future mission no less important than avoiding world destruction.

The Reagan Administration's Strategic Defense Initiative (SDI), affectionately known as Star Wars was conceived in the early eighties and (probably) led to Soviet policies of Glastnost and Perestroika in the late eighties. At least in part, this contributed to a dismantling of the Union of Soviet Socialist Republics (USSR) in 1991. That forced military strategists in the NATO alliance to look for a new threat from the stratosphere -other than Soviet missiles. Then in July, 1994 comet Shoemaker-Levy 9 blasted into Jupiter as a series of about 20 fragments. A surprise first-strike barrage from the solar system. Astronomers around the world watched awestruck, as nature delivered a reminder of the forgotten enemy from interplanetary space.

This presentation reviews circumstances surrounding the threat of a collision between Earth and space debris. Although extraneous objects enter Earth's gravitational sphere of influence daily, they usually range in size from grains of sand to stones. These objects generally incinerate in the upper atmosphere, are deflected back into space, or simply fall harmlessly to the ground. But on rare occasions large, high-velocity objects have struck Earth with enormous destructive power. Organized programs are now being discussed to avert a future disaster some have described as Doomsday.

GEOLOGICAL IMPLICATIONS OF THE EXTRINSIC EXTINCTION OF THE DINOSAURS. Susan Hoffmire, 50 Latchmere Drive, Victor, New York 14564

Recent scientific research into a huge crater in the ocean's floor has now revealed proof positive that, indeed, a massive asteroid colliding with the Earth 65 million years ago brought about mass extinction of more than two-thirds of all life forms at that time, including the dinosaurs, and affected dramatic changes in our global geology. It has been determined that this immense hole in the Earth was formed during the interval of geologic time known as the K-T boundary, marking

the end of the Cretaceous (K) period and the beginning of the Tertiary (T) period. From sample sediments taken at the impact site of this "blast from the past," and evidence of scattered debris, there is justification that extrinsic forces did, in fact, trigger major global extinction of 75-90% of all marine and land life and affect major catastrophic change in our planet's geological history.

STATUS OF PIPING PLOVER (*Charadrius melodus*) RECOVERY ALONG CAPE COD, MASSACHUSETTS. Kevin J. Lowry, Department of Environmental Conservation/Outdoor Recreation, Finger Lakes Community College, 4355 Lakeshore Drive, Canandaigua, New York 14424-8395

The Piping Plover is a small, stocky shorebird with a pale sand-colored back and a single, dark neck ring. Breeding occurs in coastal beaches Tom eastern Canada to North Carolina. During winter months, the species migrates along the southeastern coastal plain and occasionally moves as far south as the Bahamas. On January 10, 1986, the Piping Plover was listed as a protected species under the Endangered Species Act. They are considered threatened along the Atlantic coast. Population declines are attributed to habitat disturbance caused by increased commercial and residential development as well as recreational use of beaches. In 1988, the Cape Cod region only had 13 nesting pairs. Six years later, the number had increased to 72 nesting pairs. In 1996, as an intern with the Massachusetts State Fish and Wildlife Service, I participated in a breeding recovery program and population survey at the Cape Cod National Seashore. Key elements of the recovery were: predation barriers, reduction of human disturbance and public education. As a result of the Piping Plover recovery program, the future status of this species and other rare shorebirds has been improved.

ORIGINAL LAND SURVEY DATA SUPPORTS NATURAL ORIGIN OF NORTHERN NEW YORK ALVAR LANDSCAPES. Bruce A. Gilman, Department of Environmental Conservation/Outdoor Recreation, Finger Lakes Community College, 4355 Lakeshore Drive, Canandaigua, New York 14424-8395

Alvar landscapes occur north of the glacial boundary where horizontally bedded limestone/dolostone are covered by little or no soil. The scant vegetation is exceptionally diverse, and includes many State rarities. Studies of regulating environmental conditions and local floristics have been undertaken to describe the modem vegetation patterns but the role of site history had not been examined until now. Original vegetation patterns, prior to European settlement, are based on lot descriptions of Macomb's Great Tract #4 conducted from 1796 to 1798. Data includes surveyor's comments on site quality, landscape openness and witness trees. These data were geographically compared to modern alvar occurrences, and analyses support a natural origin of northern New York alvar landscapes. In addition, post-settlement data encountered while conducting this research allowed for an assessment of probable historic anthropogenic impacts on the alvar landscapes.

EFFECTS OF GRAZING BY *Aedes triseriatus* LARVAE ON BACTERIA AND FUNGI OF WATER FILLED TREEHOLES. Stephen N. Bland; SUNY. Brockport, Department of Biology, Brockport, NY 14420; Michael G. Kaufman; Kellogg Biological Station, 3700 E. Gull Lake Drive, Hickory Corners, m 49060

Phytotelmata are discreet, non-ephemeral, aquatic ecosystems which host a unique community of animals and microorganisms. Because they are much smaller and far less complex than streams and lakes, these habitats simplify the study of interactions between micro-floral and eso-faunal communities. Water filled treeholes are the most common type of phytotelmata to be found in eastern deciduous forests. Our report examines the effect of invertebrate grazing on microbial communities and decomposition rates.

In this laboratory experiment, we raised hatchlings of *A. triseriatus,* the Eastern Treehole Mosquito, in microcosms which physically and chemically mimicked the treehole waters of an old growth oak/hickory forest. Microcosms were inoculated with a slurry from treeholes in the field and allowed to incubate for five days before hatching were introduced in three levels of density: no larvae, 20 larvae per microcosm, and 40 larvae per microcosm. We hypothesized that larvae would

feed predominantly on bacteria, having no nutritional requirement for decaying leaves alone, and lacking physiological mechanisms with which to feed on fungi efficiently.

Three microcosms from each treatment type were analyzed weekly for bacterial numbers in the water column and on leaf surface biofilms, bacterial productivity in the water column in biofilms, fungal biomass in the water column and the leaf matrix, leaf decomposition and where appropriate, larval development. Bacterial numbers were determined using DAPI stain and epifluorescence microscopy. Bacterial productivity was determined by measuring the incorporation of 3H into leucine via gas chromatography. Relative fungal biomass was determined by measuring ergosterol via high pressure liquid chromatography. Leaf decomposition was measured by taking the development was determined visually, and measured according to instar stage. Statistical analyses were completed with a three-way ANOVA on Systat software.

We found significant differences in bacterial numbers and productivity in leaf biofilms and microcosm waters. Larval development was significantly higher in low density microcosms. No differences were found in leaf decomposition or fungal biomass.

To our knowledge, this is the first study to examined the relationship between mosquito larvae and fungi. Previous studies have examined the relationship between mosquito larvae and bacteria with results similar to ours.

We discuss the nutritional requirements of *A. triseriatus,* focusing on the sterols found within the Kingdom Fungi. We conclude that fungi are present in large numbers in treehole ecosystems, protected from *A. triseriatus* by their ability to colonize the matrix of leaves. Future research will examine the relationship between bacteria and fungi, in the absence of predation.

AN ANALYSIS OF THE PHYSICAL CONDITION OF WHITE-TAILED DEER IN DURAND EASTMAN PARK, MONROE COUNTY, NY. Jim Eckler, Bureau of Wildlife, New York State Department of Environmental Conservation, 6274 East Avon-Lima Road, Avon, New York 14414

White-tailed deer (*Odocoileus virginianus*) taken during five years of a selective culling program in Durand Eastman Park and the Town of Irondequoit in suburban Rochester, New York were examined by the New York State Department of Environmental Conservation, Bureau of Wildlife. The 390 hectare Park and 43 square kilometer Town had lacked management of deer prior to 1993 due to Town restrictions on the discharge of hunting implements and County Park prohibitions on the act of hunting. High deer numbers have been confirmed by: excessive car/deer collisions, high winter mortality, poor condition of the herd, habitat degradation, and public complaints of damage to agricultural lands, landscape plants and gardens. Deer killed in the selective culling program were processed for venison, which was distributed to public shelters and soup kitchens. Sharpshooters shot 641 deer (433 females: 208 males) in five years of selective culling; over 8 tons of venison was donated. Measurements of fat reserves, reproductive rates, and body weights show an improving condition factor for deer within the area affected by the culling. Fawn femur marrow fat percentages increased by 1 19% from 1993 to 1997. Reproductive rates for adults climbed by 35%, and average weights for female fawns increased by 20% over the same period. Additional measurements confirm improved population health as a result of management efforts.

BOG TURTLE RECOVERY EFFORTS IN WESTERN NEW YORK. Jim Eckler, Bureau of Wildlife, New York State Department of Environmental Conservation, 6274 East Avon-Lima Road, Avon, New York 14414

The bog turtle (Clemmys muhlenbergi) is listed as endangered under New York Conservation Law and has been recently listed as threatened by the United States Fish and Wildlife Service. Historically, the bog turtle has been reported from approximately 80 sites in New York, but now is known from less than 20 sites. Only one of the eight historic sites in western New York is occupied. Threats to survival of New York's smallest chelonian in addition to biological characters are habitat loss and illegal collection. A cooperative project was instituted recently which involved partners in conservation from the Seneca Park Zoo, Burnett Park Zoo, SUNY Brockport, SUNY Oswego, Nazareth College, the Bergen Swamp Preservation Society, Monroe County

Parks Department, and the New York State Department of Environmental Conservation. Restoration efforts include: (1) site surveys, (2) measures of turtle movements and population dynamics, and head starting to increase survival of immatures in the occupied site, (3) studies of the co-generic spotted turtle (Clemmys guttata) at an historic site, and (4) studies of release methods of captively-reared or confiscated specimens in historic or apparently suitable habitats. Future efforts may provide opportunities for additional partners in the academic community.

IMPLEMENTING A GAME USING JAVA GUI CASE STUDY: MASTERMIND. T. M. Rao and Sanded R. Mitra; Department of Computer Science, SUNY College, Brockport NY 14420

The game of mastermind is played by two rival players: the Code Maker (CM) and the Code Breaker (CB). The CM sets up a Secret Code (SC) and the object of the game for the CB is to figure out what the SC is using the clues provided by the CM. The players initially agree on a maximum number of guesses. If the CB breaks the code within this maxim, the CB wins; otherwise the CM wins. In the actual game, the SC is an arrangement of colored circles. The number of circles (i.e. the number of slots or length of the code) and the number of colors and the set of colors from which they are chosen are all agreed to at the beginning of the game. For each guess made by the CB the CM responds with two clues: the number of right colors in the right slots (commonly referred to as bulls) and that of right colors in the wrong slots (cows). The game terminates when the CB breaks the code (i.e. gets all bulls) or is unable to do so within a previously set number of attempts.

In this paper, we discuss algorithms for the computer to play CB using an artificial intelligence technique: constraint satisfaction. The algorithm has been implemented using Java and its GUI facility, namely the Abstract Windowing Tollkit (AWT). Our implementation is very flexible: it allows the human player to play either CM or CB; the player is also allowed to select the level of complexity by choosing the game parameters such as the number of colors, slots and a limit on the number of turns at an appropriate level. The roles of CB and CM are implemented as separate frames. The opening frame provides three choices: Rules, Play Code Breaker and Play Code Maker. When the user makes a choice, appropriate additional frames open up and the game continues. Our implementation allows the user to give up or even stop the game at any time. Further, the game is enhanced by the addition of some color images and sound. The game can be accessed at our web site: http://www.cs.brockport.edu/cs/java/apps/mmind/mmind.html. We recommend that the Hot Java browser be used to play the game as other browsers present some problems.

CONFORMATIONAL ANALYSIS OF MET-ENKEPHALIN ANALOGS BY COMPUTER SIMULATIONS AND NMR STUDIES. Dawn I. DiGiugno, Alison R. Hussey, and David W. Craig, Department of Chemistry, Hobart and William Smith Colleges, Geneva, New York 14456

Experimental and Computational analysis was performed on the Met-enkephalin analogs, Tyr-Tyr-Gly-Phe-Met-Arg-Phe and Tyr-Tyr-Gly-Phe-Met-Arg-Gly-Leu, to determine their solution conformation. The two analogs as well as Met-enkephalin have been shown to promote induced tumor cell death in cancer cells. Since conformation determines receptor selectivity of the enkephalin in targeting these cells, a search for common conformational features of these three bioactive enkephalins should reveal the features necessary for optimum biological activity and maximum receptor selectivity.

Hyperchem 4.0 and ChemPlus were used to conduct confirmational searches of the peptides in both polar and non-polar environments.

Experimental solution structure measurements are being examined through proton NMR.

SELECTIVITY OF THE BINDING OF ENKEPAHLINS. Kenneth Page and David Craig. Department of Chemistry; Hobart and William Smith Colleges; Geneva, NY 14456

Recent developments have shown that the analgesic properties of enkephalins, short peptides, in humans are the result of binding to specific opiate receptors. The mu-receptor is one

such receptor that specifically produces strong analgesic effects. The selectivity for binding to this site varies tremendously for natural enkephalins and several analogs. We hypothesize that this selectivity is a function of the conformation and confirmational flexibility of these peptides. Cyclic enkephalins are much more conformationally constrained and have greater receptor selectivity. The cyclic, mu-selective enkephalins are therefore the focus of this research. The conformation that binds to the mu-receptor is currently unknown. However, through the use of computational confirmational searches performed on both mu- and delta-selective cyclic enkephalins, we have determined the critical backbone angles for the mu-selective conformation.

PSYCHOPHYSICAL DISCRIMINATION WITH ARTIFICIAL NEURAL NETWORKS. Alejandro B. Engel, Department of Mathematics and Statistics, College of Science, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, N.Y. 14623.

Psychophysical Discrimination is the process by which nerve cells recognize the largest stimulus in a set of simultaneous stimuli. Early this century several models for the nerve cell were proposed. The most popular of them was the McCulloch-Pitts Model. As one application, these models showed networks capable of some Psychophysical Discrimination. These networks were 'hard wired" from the onset, since the early models of the neuron were all based upon the typical biological "all-or-none" response. Thus, their output was a Heaviside function.

The change of the Heaviside output function to a differentiable sigmoid function made it possible to use regular optimization theory as a "training" procedure. The possibility of training made Neural Networks a useful tool in many areas, particularly in pattern recognition.
The main objective of this work is to train, with supervision, an Artificial Neural Network using regular gradient descent (or back propagation) so it will perform Psychophysical Discrimination. Among the problems that will be addressed one can mention the minimum size of the training set, the minimum difference in input intensity needed for a successful discrimination and a comparison with the hard wired networks of the past.

ISSUES OF SOLUBILITY CHARACTERISTICS OF CARBOXYMETHYLCELLULOSE IN THE PRESENCE OF DI- AND TRI-VALENT CATIONS. J Todd Henderson, Dr. Laura Tubbs (advisor), Rochester Institute of Technology, College of Science, I Lomb Memorial Drive, Rochester, NY 14623

Sodium Carboxymethylcellulose (CMC) is a water soluble polymer. It is a flow control or thickening agent that is used for a wide range of applications in food and pharmaceuticals.
The focus of the research is to evaluate the issues of solubility trends in CMC based solutions in the presence of di- and tri- valent cations. Through variations in solution preparation, CMC behavior in divalent ionic solutions and trends between cations in solution and cations involved in electrostatic associations are being studied.

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Honors and Recently Elected Fellows

RICHARD E. ALBRECHT
HONORARY LIFE MEMBERSHIP
1995

In recognition of his many years of service, as an officer, advisor and participant, to the Astronomy Section, Rochester Academy of Science, the current membership and officers take this opportunity of Friday June 2, 1995 to thank Richard E. Albrecht and bestow to him life membership to the Section and all the benefits and privileges included.

JUNE C. FEDER
FELLOW
1992

The natural world around us has long been a strong and compelling lure to this Fellow candidate. She graduated from Wayne University and then completed graduate studies at the University of Michigan where she earned a Master's degree in bacteriology. Her work since then as a microbiologist and medical mycologist at the University Medical School and at Rochester General Hospital led to her meeting the requirements to become a Specialist in Microbiology.

Paralleling her work with microbiology has been an interest, since childhood in photography. The subjects of her picture taking have included wildflowers and birds which led to a deep interest in these areas of natural history. She has presented many professional quality slide shows to local groups such as garden clubs, the Burroughs Audubon Nature Club, and the Ornithology and Botany-Entomology Sections of the Rochester Academy of Science. Her photography has won numerous prizes at local and international salons. It is a real treat to experience one of her slide shows and see how she interprets the nature scene which she loves so much.

She has been a long time member of the Academy and has served the Ornithology Section and the Burroughs Audubon Nature Club as a tireless worker in many capacities.

It is indeed a pleasure for the Rochester Academy of Science to welcome June C. Feder as a Fellow.

RICHARD THOMAS O'HARA
FELLOW
1992

Richard T . O 'Hara was born and raised in Rochester, N. Y. and graduated from Aquinas Institute. He attended the University of Rochester and graduated with a B. A. in history in 1949. He taught social studies at East High School from 1949 to 1959, meanwhile continuing his education at the U. of R.. He earned a Master's Degree in Education in 1952. In 1959 he transferred to John Marshal 1 High School and was a guidance counselor for 27 years until he retired in 1986.

Dick was a charter member of the Genesee Ornithological Society which was formed in 1938" He was president of the G. O. S. in 1954, after serving as treasurer and vice president. He was chairman of the statistical committee in 1953" His interest in bird statistics continues even today, and he still serves on that committee. Birding has been a constant and life--long avocation for him, and he has led many field trips over the years for the G . O . S . .

He wrote a paper entitled, "The Christmas Bird Census in Rochester" for the S .Proceedings the Rochester Academy of. Science in 1964 (Vol. 11, No. 1, p 33~50). This article summarized the Christmas bird counts from 1902 to 1963.

Rick and his wife, Mary Beth, raised six children. Upon retiring, the family moved to the Braddock Bay area to be near the center of good birding. Dick is now in the field almost ever day,

watching for early arrivals and the elusive rarities that make ornithology so fascinating and challenging.

For his contributions in the field of ornithology and his service to the Genesee Ornithological Society and the Rochester Academy of Science, we are pleased to make Richard T. O'Hara a Fellow of the Rochester Academy of Science, Hick and his wife, Mary Beth, raised six children. Upon retiring, the family moved to the Braddock Bay area to be near the center of good birding. Dick is now in tile field almost ever day, watching for early arrivals and the elusive rarities that make ornithology so fascinating and challenging.

For his contributions in the field of ornithology and his service to the Genesee Ornithological Society and the Rochester Academy of Sciences we are pleased to make Richard T. O'Hara a Fellow of the Rochester Academy of Science.

DAVID B. STRONG
FELLOW
1993

David B. Strong is a native Rochesterian, He attended local schools and graduated from the University of Rochester in 1952 with a major in chemical engineering. He received a Master's Degree from the University of Rochester in Business Administration in 1964. He is presently employed at Xerox Corporation where he has worked for 37 years. His present position is in Operations Planning for the multinational plants operated by Xerox. This involves much traveling to other Xerox facilities in the United States, Canada, Brazil, Holland, and Spain.

David's interest in birds began when he married Grace. Her mother was an active member of Buffalo Audubon Society and persuaded David to join in the field trips David's travels in his work at Xerox give him the opportunity to look for birds in other countries. He has also joined birding trips to Costa Rica.

His membership in the Genesee Ornithological Society has expanded his interest to conservation and preservation of critical wildlife habitats in foreign lands. He is a member of The Thousand Acre Swamp Preservation Committee, having served as chairman for two years and as chairman of the committee to revise the Master Plan of the Sanctuary. He was elected a member of the Board of Directors of the Western Chapter of the Nature Conservancy. His concern for the environment locally is indicated by his membership in the Town of Penfield Watershed Management Committee. He has been a Scoutmaster for the Boy Scouts in Penfield and presently is counselor for the Bird Study Merit Badge.

He and Grace lead birding hikes in The Thousand Acre Swamp Sanctuary and other areas for the Genesee Ornithological Society. They are chairmen of the G.O.S. exhibit for the Rochester Academy of Science at the Science Exploration Days held at St. John Fisher College. David has been a leader for 12 years on the Christmas Bird Census in Various area locations and on waterfowl count at Hemlock Lake . He has interested Boy Scouts in making, locating, and maintaining bluebird houses and wood duck nests at the Thousand Acre Swamp Sanctuary.

As a member of the Research Committee at The Thousand Acre Swamp Sanctuary, he has initiated and carried out a 5 year project on control of purple loosestrife sponsored by the New York Chapter of The Nature Conservancy. His study of the relationship between the proliferation of purple loosestrife in wetland areas, and the populations of birds and reptiles in nose areas together with his means of controlling the loosestrife have been published and circulated to other preserves. He has written numerous articles on birds for local publications.

Not only is Grace his partner in birding, but their three adult sons have caught their enthusiasm for birding and the environment. All are engaged in research in these fields.

For his contributions in the field of ornithology and especially in the study of avian population trends in western New York, we are pleased to make David B. Strong a Fellow of the Rochester Academy of Science.

MARK CHARLES TORRENS
FELLOW
1993

The Astronomy Section of the Rochester Academy of Science has been the grateful recipient of the talents of Mark Torrens since he first joined the organization. He has served the Section with energy and distinction in the various committee capacities of Section Reorganization, and Fund-Raising, and in the leadership capacities of Membership Chairman, Section Vice-Chairman, and Section Chairman.

Mark is a graduate of Indiana University with a Bachelor of Science degree in Geology. Some of the Jurassic and Cretaceous age fossil specimens that he collected in Germany, while in the U. S. Army Security Agency are now part of the permanent fossil collection of Indiana University. He has also earned a Bachelor of Science degree in Electrical Engineering Technology at the Rochester Institute of Technology, where he was admitted to Tau Alpha Pi, the Engineering National Honor Society.

He is an accomplished computer aficionado, using this skill to format the Academy "Bulletin" before he and his wife, Diana, toyed her comprising the entire Academy Circulation Committee, fold, staple, label and mail each edition to our membership .

tie arid Diana have long been interested in cross-cultural exchange programs having hosted a total of 7 foreign exchange students in their home. They now edit and publish, "Connections", the quarterly newsletter of the Rochester-Wurzburg Sister City Committee. He is also an active member of their. Board of Directors.

His interest in Astronomy predates and includes the sight of Sputnik. One of his most lasting memories is that of a spectacular "all-sky" aurora, stretching from the northern horizon far into the southern sky.

For his service to the Academy did the Astronomy Section, we are honored to extend the hand of Fellowship to Mark Torrens. Citation by Steve Weber.

CHARLES P. SPOELHOF
FELLOW
1994

To warrant recognition, one must contribute to the betterment of a community, at a regional or national level. Charles P. Spoelhof has provided that service al all levels. Throughout his distinguished career Charles has managed the complex operations at Eastman Kodak company from many levels. Culminating in 1985 as Vice President Director of Technology Assessment, Charles has been recognized as a valuable source Or advice and guidance in technical scientific, educational and managerial areas.

Charles is a 1951 graduate from Calvin College, Grand Rapids, Michigan. He went on to the University or Michigan Ann Arbor for four years, extending his educational foundation by earning a B.S. in engineering physics, a B.S. in engineering mathematics and an M.S. in physics. Starling in 1954, he attended the University Of Rochester, studying optics, and also beginning his work at Kodak. Starting out in research and development, Charles worked through a proving ground at Kodak, becoming Manager of Government Products in 1972 and then Director of Research and Engineering of the Kodak Apparatus Division Research Labs in 1973. In 1975 he became Manager of Business and Professional Products and then Vice President, Assistant General Manager Of the Kodak Apparatus Division from 1982 to 19X5.

Among other governmental committees, Charles has worked on the Scientific Advisory Committee, with the Defense Intelligence Agency and most recently on the N.A.S.A. Hubble Space Telescope Optical Systems Board of Investigation. Charles is a member of the National Academy ski Engineering; the Rochester Institute Or Technology Institute Of Fellows; the Optical Society of America and the Soeicly for Imaging Seicnec and Technology.

On a more local level, Charles has worked with the Rochester Christian School as a former President. He has held the Vice President's position for the Rochester Christian Reform Church,

as well as [or the Heritage Christian Home. He has been a board member of the New York Slate Epilepsy Association and President of the Epilepsy Association of Greater Rochester. Charles has served the Rochester Academy of Science as a director for three years and has been a member on the Astronomy Section since 1955. From filial lime he has served the Astronomy Section as Vice Chairman far a year and as Chairman for two years.

As in the past Charles continues to contribute to the Astronomy Section's publication, The Rochester Astronomer", and to give lectures to the organization. Currently Charles is on the Advisory Board of the Calvin College Engineering Department. He is Adjunct Professor of Astronomy at Roberts Wesleyan College and sits on the long range planning committee of the Penfield Symphony Orchestra.

It is to the Academy's betterment that we bestow with pleasure to Charles P. Spoelhof the title of Fellow of the Rochester Academy of Science.

INGABORG WELLER
FELLOW
1995

Ingaborg Weller has served the Rochester Academy of Science and the scientific community at large for the last 2;2 years. In this time she has been a faithful supporter of the Botany/entomology and Mineral Sections as well their personal emissary to a variety of regional national and international groups; carrying the educational principal of her science to these meetings
.

As an active member of the Botany/Entomology and Mineral Sections Ingaborg has served on both of their hospitality committees. She has been Vice chairman for programming in the Botany/Entomology for two years and is currently Chairman of the Section. Ingaborg has participated in many of the field trips of both Sections.

Ingaborg has been involved with virtually every committee of the Mineral Section over the years . She served three years as Vice Chairman of the Section and a few stints as acting Chairman . She has helped with the Hospitality Mineral Show committee Mineral Show demonstrations Mineral Symposium committee and led mineral and plant field trips.

Ingaborg's written work has included direct and indirect contributions to the section newsletters and has contributed to modest handouts for public e kilts updated checklists and species inventories etc.

An avid field collector and micro-mounter Ingaborg has maintained and improved her knowledge of minerals and crystal systems by attendance at Symposia and Mineral Shows throughout the United States and Canada and has been a regular contributor to the Mineral Study Group since its inception several years ago. In addition to tier participation in outside events related Go her scientific interests , Ingaborg had been a member and/or significant contributor to the Rochester Lapidary Society, the Canadian Micromineralogists Association, New Haven (CT) Mineralogical Society, Canadian Fieldtrippers, Wildacres (NC) Workshop, Rochester Orchid Society, etc.

Ingaborg believes that "Science Exploration Days" is the most important way that the Academy shares our interests With young people and adults. She has been crucial in maintaining Mineral Section participation in this event. Her energy and persistence has resulted in different up-to-date displays each year. Without held we would have fallen by the wayside.

Madam President, Academy Board Member, Members of the Academy and Friends; In recognition of her outstanding contributions to the Rochester Academy of Science, her extensive community service accomplishments, and her commitment to education her fellow scientists, as well as young enthusiasts entering the scientific community, it is with great pleasure that I recommend to you, Ingaborg Weller - Fellow of the Rochester Academy of Science.

STEVEN CRAIG CHAMBERLAIN
FELLOW
1995

Dr. Steven Craig Chamberlain was born December 13,1946 in Everett, PA. He became interested in science at an early doe and pursued a scientific career. He received his undergraduate education at the Massachusetts Institute of Technology specializing in electrical engineering. Acquiescing to his early interest, he also studied mineralogy and learned much from a great teacher, Martin Buerger. Steve continued to pursue electrical engineering within a unique specialty anatomy! In 1978, Steve became Dr. Chamberlain, in recognition of his research on Neuroanatomy of the Visual Afferents in *Limulus polyphemus,* at Syracuse University. Subsequently, Steve has continued applying his engineering knowledge toward the understanding of the eye. In this specialty he has received and administered numerous research projects funded by millions of dollars. Steve his laboratory and his student Friend have contributed much to the understanding of the eye and in recognition of his research results, Steve has received awards for the quality of these contributions.

Characteristically men of great talent contribute to a spectrum of human endeavors. Particularly, Steve's persuasive effective and warmly received teaching abilities have been recognized through numerous awards of excellence. It is a special credit that a great researcher can be a great teacher .

A third aspect of Steve's contributions includes his public service. He has acted as an editor- and/or officer of various institutional professional and/or amateur scientific committees and societies. As an author he has contributed several hundred research articles and abstracts and an equal number of oral presentations to a wide variety of scientific societies and journals.

In particular The Rochester Academy of Science has greatly benefited frown Steve's science and service. The Mineralogical Symposium of the Mineral Section has enjoyed Steve's input as worker presenter and co-chairperson over the last fifteen years and he has done much to improve the international stature of the event.

On a personal note Steve is thoroughly compassionate human being. While holding strong views on a Niche variety of scientific to personal aspects of life. Steve has been an indefatigable supporter of his students and friends who have needed him and he has never failed in advising those whom he loves in finding a better path .

Madam President, Academy Board Members, Members of the Academy and Friends: In recognition of his outstanding scientific achievements his extraordinary service accomplishments both to the Rochester Academy of Science and to the scientific community in general and his humanitarian qualities it is with great pleasure I recommending to you Dr. Steven Craig Chamberlain - Fellow of the Rochester Academy of Science. Vandall -T. King FRAS

Clark Lewis III
Fellow
1996

At the June 7th Annual meeting of the Academy, Vice President .Matthew Sinacola presented Clark Lewis III who was recently elected a Fellow of the Rochester Academy of Science by the Board of Directors.

Matt quoted Clark as saying ,'I was one of those 1960's kids who went "bonkers" over the Mercury Space Program.,' This and the right kind of influence from all encouraging teachers maneuvered Clark into a life-long love of astronomy. His first telescope was an Edmond Space Conqueror, a little 3 inch, f/10 reflector . But WON with a name like that, just think what you could see! Observing comets eclipses, and everything else astronomical, propelled Clark through the 1960's. He ground his first telescope mirror, built his own telescope, entered Astronomy projects at science fairs aid of course traveled to Stellafane, "Mecca" for amateur astronomers.

Prior to earning a By at Salisbury State University in 1977, Clark had; ended Franklin aid Marshall College in Lancaster PAW While there he was sale to feed his astronomical hunger by

obtaining a caretakers position at the nearly unused observatory near the campus. Inside were all eleven inch refractor and a ten inch Cassegrain reflector of which he made good use.

Moving to Rochester 1980, Clark Joined the Astronomy Section . He built a new telescope and invented his own version of a binocular observing chair which was recognized at Stellafane. He served as Vice-chair of the Astronomy Section in 1986-87, and as chairman theme two following years. Starting in 1987, His monthly column "Stargazing" has been appearing regularly in the Democrat and Chronicle. He was directly involved and largely responsible in obtaining, for the Astronomy Section, the excellent 12 inch Tinsley telescope which lead belonged to the University of Rochester in 1988.

Following his Section chairmanship, Clark went back to college and earned a Masters degree. He now teaches high school as Swell as his astronomy course at the Gannett school.

For his service to the Academy, the Astronomy Section and the Community of Continuing Education and Science Education in the public schools we are honored to extend the hand of Fellowship to Clark Lewis III.