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PROGRAM ABSTRACTS

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AUTHOR INDEX (CONTRIBUTED PAPERS ONLY)

GENERAL SESSIONS

I. Halley and the Exploration of Comets

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Halley's Comet will make its once-in-76 years appearance in late 1985 and 1986. In a related event, Comet Giacobini-Zinner will be visible in late 1985. Plans for extensive scientific investigation of these comets have been prepared by many countries.

The U.S. effort consists of the following possibilities:

1) The fly-through of the tail of Comet Giacobini-Zinner on September 11, 1985 by the ISEE-3 spacecraft.

2) Photographs and ultraviolet spectra of Comet Halley during the near perihelion time January-March, 1986, by the repaired Solar Maximum Mission.

3) The flight of the ASTRO-1 package of ultraviolet instruments and visual wide-field cameras in March of 1986. This time period coincides with the in-situ investigation of Halley's Comet by the European Space Agency, Japan, and the Soviet Union.

4) The International Halley Watch (IHW), the coordinating agency for extensive ground-based observations of Halley's Comet. Networks of ground-based observatories should provide (weather permitting) near-continuous coverage of the comet.

One aspect of the IHW includes provision for participation by amateur astronomers. Amateurs can make an important contribution through serious participation with some of the networks. The principle need is for amateur astronomers living on islands in the South Pacific Ocean, the South Atlantic Ocean, and the Indian Ocean. It may be possible to provide some observing equipment and instructions for amateurs on these islands willing to make a dedicated effort for the International Halley Watch.

II. The Eighth Head of the Hydra and the Dawn of Modern Biology

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Research in biology often makes its greatest strides through the intensive investigation of a small number of organisms. For example, in genetics there are the fruit flies, bacteria, and viruses; in physiology the white rat. The simple fresh-water hydra occupies a special place in the history of biological discovery. Not only were such fundamental biological processes as regeneration, grafting, and phototaxis (the movement toward light) by eyeless animals first discovered using hydra, but the man who made those discoveries, Abraham Trembley, in 1744 set the stage for modern experimental biology. The speaker will describe both Trembley's still challenging experimental approach and some of the remarkable discoveries made with hydra since Trembley's time.

III. Agriculture, Science and the Iowa Economy

ROBERT W. JOLLY

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The current financial crisis must be considered first. Financial restructuring of agriculture and associated government policies may have a major impact on the character of the agricultural sector. Second, excess capacity--an inability to sell all what we are capable of producing--may require the retirement of resources. Third emerging biological and information technologies may exacerbate excess capacity problems in the short run. However in the long run advances in these areas may lead to an improved competitive position and increased diversification of Iowa's economy. Fourth, macroeconomic policy may influence Iowa agriculture more than agricultural policies or technologies. Monetary policy will influence interest rates and exchange rates--factors that offset Iowa's competitiveness in export markets. Fiscal policy--in particular the budget deficit, will continue to cause regional economic problems. Increased funding of defense research and development may distort both the national economy and the research agenda as well. Fifth, development of the Iowa economy must become an explicit focal point of applied agricultural sciences. Finally, preservation and management of our soil, water and energy resources will strongly influence our productivity in the future.

SYMPOSIA

Iowa Science Foundation

A. Life history, ecology, and behavior of a threatened species in Iowa, the small-mouthed salamander (Ambystoma texanum).

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A small-mouthed salamander population at Flaming Prairie Preserve in southeast Iowa

showed highly synchronous migration and breeding patterns. These results provide the first such data for an Iowa population and help to resolve the courtship and breeding controversy in which this species is embroiled. Life history data suggest habitat requirements for breeding adults and for larvae include wetlands with open water in early spring for breeding, relatively warm temperatures for quick larval growth, and few aquatic predators. Conservation efforts designed to protect this species in Iowa are facilitated by their synchronous migration; however, since ephemeral wetlands are a deteriorating resource in Iowa and also provide optimal habitat for this species, a conflict in management practices is inevitable.

B. ^{31}P-Nuclear magnetic resonance spectroscopy studies of various spermatozoa

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^{31}P-NMR has been used to study spermatozoa of the following animals: the horseshoe crab (Limulus polyphemus), rainbow trout, boar, bull, ram, goat, and the blue crab (Callinectes sapidus). Aerobic respiration of each species' spermatozoa was examined before and after a motility period. Concentration peaks of high-energy compounds (ATP, ADP, phosphagens) were measured and compared as were intracellular pH and free Mg++ concentrations. Our objective was to relate these compounds to the mechanisms of an energy shuttle system for flagellar movement. For such a system, the Limulus and trout spermatozoa were found to use phosphagens (phosphoarginine and phosphocreatine, respectively) whereas the mammalian spermatozoa have no phosphagen but directly transport ATP made available in large quantities by mitochondria. The Callinectes sperm, however, which is non-motile and has few mitochondria, also has no phosphagens. Glycerylphosphocholine was also found in high concentrations in mammalian spermatozoa and there may be a direct relationship between it and high semen quality.

C. A current astronomy information display

L. A. KELSEY

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The details of an Iowa Science Foundation grant to create a Current Astronomy Information Display for the public will be explained.

D. Outdoor teaching laboratories at Iowa State University

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Iowa State University has long recognized the importance of outdoor instruction in its curriculum. Throughout the University's history, sites on and near campus have been designed and developed to enhance outdoor teaching. These areas are currently under the guidance of the University Committee for Outdoor Teaching Laboratories. This committee is charged with identifying, maintaining, and promoting appropriate use of these areas. To this end, and with the aid of the Iowa Science Foundation, we are producing a booklet describing these areas. For each area, a map, photographs, and text will describe the area's principal features, history, and appropriate use. The booklet will be made available to ISU students, faculty, and administration, and to other institutions in Iowa.

E. Demography of compass plant (Silphium laciniatum)

J. M. Pleasants

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Silphium laciniatum, compass plant (family Asteraceae), is a polycarpic species of the tall grass prairie. The population dynamics (demography) of prairie plants, and of polycarpic species in general, is poorly known. Flowering and seed production in S. laciniatum are sporadic. The percent of plants in bloom in any year may range form 0-20%. Individual plants exist as a basal rosette of leaves for a number of years before sending up a tall (avg. 1.5m) flowering stalk. Potential seed output by an individual is low due to the small number of flowerheads per stalk (avg. 10.2) and possible seeds per head (25-30). After a plant has flowered for the first time, it cannot flower again the following year. A scar forms on the rhizome where the flowering stalk was located and 2 new stem shoots develop. With repeated flowering episodes, the plant becomes a collection of connected, but independently flowering, stems. Preliminary data on the stem size threshold for flowering, the lag time between successive flowering by a plant, and the change in plant size between years will be presented.

F. Specimen data retrieval from the herbaria of Iowa.

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The labels on plant specimens from Iowa contain much valuable basic biological, historical, and geographic information. The ultimate goal is to retrieve these data from the herbaria at Iowa ed-

ucational institutions. These data, in a specific format, would then be entered into the BIOBANK data management system which already contains data from the UNI and Iowa Lakeside Laboratory herbaria. Once in the BIOBANK system, these specific data can be used to construct species distribution maps, evaluate species abundance, and analyze habitats.

Toward this overall goal, the Iowa Science Foundation supported an initial label data collecting project (ISF #85-12) at the University of Iowa herbarium (IA). One taxonomy graduate student was funded to photograph the label data on Iowa specimens, one label per frame, using color film in a super-8 movie camera. Questionable identifications were either corrected, or noted for additional study. The procedure worked very well and the project was completed.

G. Origin of cherts in the Burlington Limestone (Middle Mississippian) of southeastern Iowa and western Illinois

L. S. SEIGLEY

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Origin of the cherts in the Burlington Limestone of Iowa and adjacent states has been controversial since first investigated (Tarr, 1917). Nodular and brecciated cherts have been interpreted variously as primary nodules that were precipitated on the sea floor, secondary replacement features, and diagenetic nodules reworked by storms. Much progress has been made in the understanding of chert genesis during the past decade through application of petrographic and geochemical techniques, in particular the use of hydrogen and oxygen isotopic signatures to interpret temperature and salinity of the silica-bearing solutions. Paired samples of limestone/dolomite and chert as well as samples illustrating diverse aspects of silicification were analyzed isotopically. This in addition to petrographic examination of the rocks was used to gain insight into the source of silica, the manner in which the silica moved from its source to its site of precipitation, the factors controlling silica precipitation, and timing of silica precipitation relative to deposition and diagenesis.

H. Geochemical study of a layered igneous body near Matlock, Iowa

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A layered mafic to ultramafic igneous complex occurs in the subsurface near Matlock, Iowa, in association with an Archean terrane which formed more than 2.5 billion years ago. Core samples from the complex reveal gross similarities to both layered continental intrusions and ophiolites. It is important to determine which of these types the Matlock complex represents because, even though they are similar in gross characteristics, the two different rock associations represent fundamentally different geologic processes: in situ crystallization of multiple pulses of magma within the continental crust vs. crystallization in an oceanic environment with subsequent tectonic emplacement of the solid mass at a continental margin. A detailed geochemical study has been initiated to provide information necessary to distinguish between the two types of rock bodies. Initial data confirm microscopic observations that significant alteration, mainly hydration and carbonation, has affected these rocks. This alteration has obscured many of the most subtle, but most diagnostic, chemical characteristics. Modelling of the effects of alteration is being done in an effort to remove these post-crystallization overprints and allow evaluation of the primary chemical signature.

I. Behavior of northern pike in West Okoboji Lake.

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The research objectives are to determine movement behavior patterns of free-swimming pike (Esox lucius) with reference to home range, habitat selection, and seasonal and daily movements. The behavior of ten adult pike was studied by use of ultrasonic telemetry from spring to fall 1985. The fish maintained summer home ranges of about 300 to 900 m in diameter, typically in water less than 5 m deep. These areas had dense growths of aquatic macrophytes, but the fish generally avoided the thick vegetation. The fish were typically active and constantly moving. Home range overlap and occasional close proximity of some fish indicates that the pike were not territorial. Previous telemetry studies of two other top predators in West Okoboji Lake, walleye (Stizostedion vitreum) and muskellunge (Esox masquinongy) suggest that the three species occupy different habitats in summer, thus minimizing potential competitive and social interactions.

Ground Water

A. Losses of fertilizer nitrogen from Iowa soils

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Nitrogen fertilizers are essential for profitable crop production in Iowa and the economy of Iowa is dependent on the benefits of N fertilizers. However, more than half of the fertilizer N applied to Iowa soils is not recovered during crop harvest. Although some of the unrecovered N may be converted to soil organic matter and remain in soils, much of this N is lost from soils by processes that provide no benefit to farmers. Some of the N lost poses no threat to the environment. But some is lost by leaching, a process that poses a threat to groundwater supplies.

Recent studies using isotopic tracers show that leaching may be more important as a mechanism of N loss from soils than has been generally believed. They also show that losses of fertilizer N may be more rapid than has been generally believed.

The results of recent studies suggest a great need to reevaluate the fertilization practices currently used in Iowa and make a greater effort to discourage use of inefficient fertilization practices.

B. Factors affecting pesticide fate and groundwater contamination

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Very nearly all the row-crop pesticides used in Iowa are soil-applied. Once a pesticide is applied, processes such as diffusion, volatilization, and transformation begin to take place. In addition, water movement from excess precipitation can cause pesticide movement and losses in surface runoff and subsurface flow.

Pesticide properties, particularily those affecting adsorption and persistence, determine to a large degree the fate of a pesticide. Weather, soil properties, the hydrology of the system, and management (e.g., rate or method of pesticide application) are important in determing losses with agricultural drainage. Measured and expected concentration and loss data for various pesticides will be discussed relative to the forementioned factors. The potential impact of increased use of conservation tillage will be considered. Need for an assessment as to whether presense means pollution will be emphasized.

C. Ag-chemicals and groundwater in the Big Spring Basin, Iowa

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Iowa Geological Survey, 123 North Capitol St., Iowa City, IA 52242

The water quality, landuse, and hydrogeology of the Big Spring groundwater basin have been studied since 1981. The basin is strictly agricultural, with an average of 60% of the area cropped to corn. Nearly 90% of the groundwater in the basin discharges from the Big Spring, which issues from the karstic Galena aquifer. The aquifer is recharged by infiltration and run-off to sinkholes; these recharge mechanisms deliver different ag-contaminants. Monitoring of discharge and ag-contaminants has shown that infiltration is the predominant recharge mechanism for the aquifer, and delivers the greatest mass of ag-contaminants to groundwater. NO_3 concentrations are highest in infiltration recharge, while pesticide concentrations are highest in runoff recharge water. Losses of NO_3-N in surface and groundwater have been equivalent to 33-50% of the fertilizer-N applied. Both losses and concentrations of NO_3-N are strongly tied to water flux. Losses of the widely-used herbicide atrazine are about 1-5% of that applied. Flow-weighted mean atrazine concentrations, while below 1 µg/l, have increased by over 50% per year during the study, independently of water flux.

D. Areal and vertical distribution of non-point pollutants in the Iowa River alluvial aquifer

M. G. DETROY

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The study addresses the occurrence and distribution of NO_3 and selected herbicides in a thin (15-30') phreatic sand aquifer. Initial test drilling and water sampling indicated the areal distribution of NO_3 in the aquifer was extremely variable. Concentrations ranged from <0.1 mg/L to 19.0 mg/L of NO_3 as N. No areal pattern was definable.

Detailed sampling of vertical profiles by well nests, indicated NO_3 and selected herbicides were not well dispersed throughout the saturated thickness. Larger NO_3 concentrations were found at shallow depths in the aquifer, while at greater depths the NO_3 concentration was close to zero. Herbicides, particularly the triazines, atrazine and metribuzin were detected at concentrations of <0.1 to 8.1 µg/L at a few of the sampled sites.

Possible explanations for variations in chemical concentration are: 1) NO_3 is not a conservative constituent in ground water and may be lost from the system by denitrification and 2) local aquifer conditions prevent significant vertical mixing.

E. Water quality in alluvial aquifers in Iowa

C. A. Thompson

Iowa Geological Survey, 123 N. Capitol, Iowa City, Iowa 52242

A total of 66 nested monitoring wells have been installed in three alluvial systems in northwest Iowa. These are sampled monthly or bimonthly for nitrate and coliform bacteria. Nitrate concentrations rise in response to an increase in effective precipitation. Vertical stratification of nitrate is found in all of the alluvial systems sampled. Generally, nitrate levels decrease with depth and highest concentrations are found in the top ten feet of the saturated section. Denitrification may be a factor. Several pesticides have been detected both in the project wells and in samples collected from municipal supplies utilizing alluvial groundwater. Pesticide varieties determined include: Atrazine, Lasso, Dual, Bladex, Dyfonate, Counter, and Sencor. Atrazine is the most persistent being found in water samples at all times of the year, many of the others are found only in the spring and summer months. Coliform bacteria is present in the aquifer regardless of depth. Many of these organisms may be nonfecal soil coliform, however, some wells have tested positive for fecal coliform as well.

F. Little Sioux River synthetic organic compound municiple well sampling survey

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In May of 1985 water samples were collected from wells serving public water supplies along the Little Sioux River in northwestern Iowa. Twenty-five wells from twelve public drinking water supplies were sampled. The samples were analyzed for the presence of 64 synthetic organic compounds including 35 commonly used pesticides. Nine of the 25 wells sampled were found to have one or more contaminant(s) present. These nine wells served six public water supplies. Pesticides were the most frequently detected contaminants. There was an inverse relationship between well depth and the appearance of contaminants. Wells finished to the Little Sioux alluvial system appeared to be the most susceptible to contamination.

The findings of this survey strongly support work previously done by the Department of Water, Air and Waste Management and the Iowa Geological Survey.

G. Agricultural drainage well impacts in Iowa

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Agricultural subsurface drainage is necessary for row crop production in much of northcentral Iowa. Agricultural drainage wells (ADWS) are being used in this area to remove subsurface drainage, and sometimes surface drainage, by injecting water directly into the aquifer below. Monitoring of water being injected has shown 85% of the samples exceed the 10 mg/l NO_3-N drinking water standard. ADWS appear to increase the NO_3-N levels in wells nearby. Pesticides were detected in some of the injection water samples, but the level was less than 1 µg/l in most samples. Higher levels were detected in surface runoff samples, up to a maximum of 80 µg/l.

H. Management practices influencing N fertilizer recovery by continuous corn in Iowa

RANDY KILLORN, G. O. BENSON, R. D. VOSS

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"Best management practices" for nitrogen (N) fertilizer must be based on the need for obtaining profitable yields along with minimizing the environmental impact of N that may not be utilized by the growing crop. Because of the variability associated with the soils and climate of Iowa, general management practices cannot be recommended statewide. Rather, management practices need to be developed for each individual field, and even for management units within large fields.

It is critical that the interaction between cultural practices, ie. time of planting and established plant population, N fertilizer rate and climate be defined so the relative importance of each factor on N recovery can be estimated. Results from a study conducted at the Shelby-Grundy Research Center near Beaconsfield, Iowa, from 1981-1985 can be used to estimate the cultural practice x N rate x climate interaction.

I. An overview of ag-chemicals and groundwater in Iowa

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Studies in Iowa have clearly shown that nitrates and some pesticides are leaching through the soil into shallow groundwater and are now affecting aquifers which supply drinking water to municipalities as well as private individuals. Poor well construction, ag-drainage wells, waste disposal, etc., contribute to individual or local problems. The regional contamination of groundwater is the result of the conventional usage of ag-chemicals and constitutes a nonpoint source pollution problem. Such contamination is clearly occuring throughout Iowa and the corn belt. While attention has focused on NE Iowa the greater problems may occur in NW Iowa, because of more intensive row cropping and dependence on shallow aquifers. Regionally, nitrates in groundwater have increased in a direct, linear fashion, paralleling the increased use of N-fertilizers. While pesticide data are limited, residues in groundwater appear to be rising; but still occur in very low concentrations. The magnitude of NO_3-N losses is an economic, as well as an environmental concern. Further research on health effects, economics, and management practices is urgently needed.

CONTRIBUTED PAPERS

Agricultural Sciences

1. *Induction-heat and solvent extraction methods for the analysis of pesticide residues in fabric*

C. A. POPELKA, H. M. STAHR, AND J. F. STONE

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The quantitative recovery of pesticide is a necessary part of research establishing pesticide residue levels in pesticide applicator's clothing. The extraction of pesticides from fabric requires methodologies that take into account fiber properties and textile geometry.

The research objectives were to establish solvent extraction rates for the recovery of fonofos from cotton denim, to control for potential sources of fonofos loss due to the fabric structure, to develop a methodology for extracting fonofos from cotton denim using an induction-heat furnace, to establish induction-heat extraction rates for the recovery of fonofos from cotton denim, and to compare the extraction rates obtained by the two methods. Significant relationships were noted for all variables in the solvent extraction studies. Induction-heat extraction could become a method of screening for fonofos from fabric. Methodologies, solvent extraction variables, induction-heat extraction variables, and control procedures will be discussed.

2. A little-known forest resource of Iowa: The Populus gene pool.

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Depts. Forestry; and Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, Iowa 50011.

During the late 1940's and the 1950's, Iowa collections were made of cottonwood (Populus Deltoides) cuttings and seed lots for use in western European Populus breeding programs. Records of the program in the Netherlands indicate that about 26% of approximately 13,000 hybrid clones under test in 1983 contained at least one of these Iowa cottonwoods in their genetic background. Of the named clones in the nursery trade in Europe, 14 hybrid clones have Iowa germplasm. Another group of famous Populus hybrids is a number of natural hybrids between P. grandidentata and P. alba. These hybrid aspens were found in clonal stands in southeastern Iowa during the 1950's. Four clones, Crandon, Shimek, Sherrill and Hansen have been researched intensively in North America. The Crandon clone has had wide distribution and is used in Populus culture throughout the world.

3. Silver maple as a potential bottomland crop.

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Acer saccharinum, silver maple, is a native bottomland hardwood species that has been neglected until recently. The species has many advantages including fast growth, high wood density, few pest problems, good competitive ability, tolerance of flooding, and good resprouting ability when cut. Our research plots indicate that unselectedplanting stock can yield 2.75 dry tons of wood growth per acre per year and selected material could improve that to 3.5. In recent years the Amana Society has begun converting its flood prone cropland to maple plantations and this work is yielding a great deal of information on management strategies. Potential markets include fuelwood, furniture lumber, and wafer board.

4. Cicer milkvetch yield and nutritive quality evaluation.

K. D. Kephart and D. R. Buxton

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Cicer milkvetch (Astragalus cicer L.) is a forage legume which has received considerable interest because it is long lived, non-bloating, and rhizomatous. It was evaluated for yield and nutritive quality in 1984 and 1985. Alfalfa (ALF) and birdsfoot trefoil (BFT) grown under a 3-cut per year management were compared with cicer milkvetch (CMV) grown under 2-cut and 3-cut per year managements. The average seasonal dry matter yield of ALF, BFT, 3-cut CMV, and 2-cut CMV was 11.5, 8.5, 6.9, and 9.2 Mg/ha, respectively. Greater yields of CMV are obtained with a less frequent harvest schedule. Seasonal in vitro digestible dry matter (IVDDM) concentration of 3-cut CMV was 8% and 7% greater than ALF and BFT, respectively. However, the IVDDM of 2-cut CMV was 2% and 4% less than ALF and BFT, respectively. CMV from both cutting managements contained less cell wall and lignin than the other two species. The differences in IVDDM coincide with differences in crude protein concentration. With the proper harvest management, CMV may produce adequate yields for use as a forage crop. The nutritive quality characteristics of CMV are often superior to other species.

5. Multiple testing of oat breeding material for reaction to Puccinia coronata

M. D. SIMONS, K. J. FREY, L. J. MICHEL AND G. A. SCHULER

A.R.S., U.S. Dept. of Agriculture, Dept. of Plant Pathology, Iowa State University, Ames, IA 50011

Advanced lines in the oat breeding program at Iowa State University are tested with Puccinia coronata for: (a) seedling reaction; (b) reaction of older plants in the field; and (c) quantitative response in replicated hill plots. For the hill plots, yield and seed weight values obtained from rust-free controls are divided into corresponding values from rusted plots to give resistance indexes. 150, 250, and 220 lines were evaluated in 1982, 1983, and 1984, respectively, and 35, 22, and 32%, respectively, had seed weight indexes significantly above the respective overall means. The lines fell into several categories, including seedling susceptibility in combination with relatively good resistance indexes, and apparent resistance in combination with significant damage from the disease.

6. Improvement in Resistance of Soybeans to Brown Stem Rot

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Brown stem rot (BSR) resistant soybeans have been developed and released for commercial production since 1979. Resistant cultivars include BSR 301, BSR 302, BSR 201, and BSR 101. Resistant germplasms include A3, A4, and A8. These soybeans were developed by breeding for combined BSR resistance and higher yield. In 1985, uniform testing in a single diseased environment showed that these lines differed in relative resistance. Resistance increased with each subsequently developed and released cultivar as a result of continued breeding and selection. Recently released susceptible cultivars showed an increase in susceptibility over their predecessors that was greater than the increase in resistance shown by the new resistant lines.

7. Variation in resistance of soybean cultivars to Corynebacterium flaccumfaciens

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Bacterial tan spot of soybean, caused by Corynebacterium flaccumfaciens, produces large lesions on leaves of susceptible cultivars. This bacterium can be destructive when infecting very susceptible cultivars. Forty-five soybean cultivars currently grown in the northern soybean belt were tested for resistance to C. flaccumfaciens. The experimental design was a randomized block with four replications. Plants of each cultivar were grown in rows 2m long, and spaced 1m apart. Two to five plants were inoculated with the bacterium at the ends of each row, and in the center. Plants were scored for resistance 5 weeks after inoculation. None of the cultivars were very resistant, 12 (27%) were resistant, 20 (44%) were slightly susceptible, 11 (24%) were susceptible, and only Clay and CN 290 (4%) were very susceptible. Only the cultivars in the last two categories (28%) are considered to be at risk for significant yield loss from tan spot.

8. Cultural and environmental influences on stalk rot of maize

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Nine years of data have been accumulated on the effects of various cultural practices and environmental conditions on stalk rot and crown rot of maize. The data are consistent with the concept that stalk rot severity is directly related to kernel numbers and intensity of plant growth stresses after pollination. Plant growth stress that occurred prior to pollination caused reduced kernel numbers and generally resulted in less stalk rot than with post-pollination stress. Conservation tillage practices, especially no-till, decreased stalk rot compared to conventional tillage, but conservation tillage was also associated with lower yields and kernel numbers. Plant genotype has a very significant influence on the severity of stalk rot but within a genotype the above concept prevailed. When individual plant data were used in the analyses, the highest yielding plants often had the largest kernel numbers and minimal stalk rot.

9. Mechanical properties of the structural tissue in relation to stalk breakage of maize

D. C. FOLEY AND C. A. MARTINSON

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Intuitively, it seems that the selection of hybrids with low percentages of broken stalks should, over time, result in the reduction of the problem. Hybrids developed and released for commercial use occasionally have unacceptable levels of stalk breakage due to stalk rot. Thus, stalk rot continues to be a major problem restricting the improvement of maize. The application of elements of strength of materials can show why failure per se is not an efficient way to select for non-failure. The near linearity of the proportionality of stress to strain in the rind of maize stems permits the application of theory to thin-walled tubes to partially rotted stalks. Maximum strength type tests of unrotted stalks do not predict the standing performance of stalks. "Effective rind thickness" or flexural rigidity of the rind is heritable and selection for increased thickness is an effective method to increase the standing ability of stalks.

10. Seed transmission of Goss's wilt in corn

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This paper is a continuation of our work on Goss's wilt, a bacterial disease of corn, which we have been investigating for possible seed transmission. Infected seed was generated in the field from leaf inoculated plants, which became systemically colonized with Corynebacterium michiganense subspecies nebraskense (CMN). This seed was found to contain up to 10^6 cfu of CMN/gm kernel fresh wt. Percentage seed infection with CMN was variable and ranged from less than 1% to 55%. In greenhouse growout tests, using this seed, there was no evidence of seed transmission of CMN. No seedlings showed symptoms of Goss's wilt. No pathogenic isolates of CMN were recovered from samples of ground symptomless plants. However, in greenhouse growouts, using kernels artificially inoculated under vacuum

with a suspension of CMN, seedlings showing symptoms of Goss's wilt were observed. In this experiment the highest level of seed transmission was 0.8%. These data suggest that seed transmission of CMN, in naturally infected seed, if it does occur would be at a very low level.

11. Divergent mass selection for ear length in maize.

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Mass selection has been effective for the improvement of some traits in maize (Zea mays L.), but consistent results have not been realized for yield. It was suggested that improvement of yield could be facilitated with selection for a trait having higher heritability and was correlated with yield. Divergent mass selection for ear length was initiated in 1963 in the BSLE maize population to determine the effects of selection for ear length on grain yield. Selection for ear length was effective for both longer (0.38 cm $cycle^{-1}$) and shorter (-0.46 cm $cycle^{-1}$) ear length. Indirect selection based on ear length was not, however, effective for increasing grain yield. Grain yield decreased 1.04 q $ha^{-1}cycle^{-1}$ with selection for shorter ears and decreased 0.44 q $ha^{-1}cycle^{-1}$ with selection for greater ear length. Hence, 15 cycles of selection for increased ear length were not effective for increasing grain yield. There was no evidence that genetic variability in BSLE was reduced after 15 cycles of selection for ear length.

Anthropology

12. Ideology and action: dilemmas in community development

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A seven month ethnographic study of a community development corporation in small-town Iowa revealed the inconsistency between the organization's ideology and its practices. Although publicized as a "broad-based effort at community planning and development," it has, in actuality, been controlled by a select group of decision makers. As the corporation moves from a formation period into its "implementation phase" the Board of Directors has begun to confront the conflict between a "grassroots" ideology and unilateral action. The corporation's strategy for resolving this dilemma is described in detail.

13. The rise and fall of environmental determinism in western thought

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Since the time of the ancient Greeks, theories of geographic determinism of human variability have been used to resist intellectual change, rationalize racism, and defend Biblical accounts of creation. The last influential American geographic determinist was Ellsworth Huntington, whose theories on climatic causation aroused critical attention. Deterministic theories failed to achieve nomothetic status because they could not explain known variation of sociocultural phenomena. Anthropology in the twentieth century has rejected determinism and accepted frameworks that emphasize limited environmental causation and allow for greater sociocultural variability. Julian Steward's cultural ecology exemplifies this trend. An analysis of Huntington's work and the coincident developments in Anthropology reveals this trend away from environmental determinism toward ecological paradigms.

14. Time in a bottle: Chronological configurations of glassware from archaeological site 13M010, Buxton, Iowa

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Glass and the industry which produces it have both changed through the centuries. The changes however, were seldom so drastic as those which occurred at the turn of the century with the introduction of modern machinery. Mechanization allowed for the production of large quantities of relatively inexpensive glass containers.
Like most new technologies, wide acceptance can be slow and older technologies may occur side by side with the new. The analysis of glassware from the archaeological site of Buxton, Iowa (13M010) revealed an array of manufacturing techniques and container styles.
Buxton is a well documented site which existed from 1900 to 1926. The configuration of glassware styles and manufacturing techniques serves as a data base for comparison and it provides insight to the speed of technological innovation in the midwest at the turn of the century.

15. A use-wear analysis of chipped-stone artifacts from 13WS61

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An analysis of ten utilized flakes from a Late Woodland site in southeast Iowa was conducted using the Scanning Electron Microscope in an effort to determine tool function. Previous research, including photomicrographs, was used as a guide to establish the types of use-wear present on the artifacts and the material the tool was used to process. The tools were cleaned in dilute acids and coated with gold-palladium prior to study. It was found that this process did not significantly alter the organic remains present on the artifact surfaces or impair the observation of polishes and striations. Utilized flakes appear to have minimal amounts of polish and striations present, but the flakes do retain small amounts of organic remains on their surfaces which may aid in further identifying tool function.

Biotechnology

16. Organellar changes associated with the ms_3 gene during microsporogenesis in soybean [Glycine max (L.) Merr.].

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Microsporogenesis was studied in the ms_3 and normal lines of soybean using transmission electron microscopy. Changes in the size and relative number of organelles were analyzed by morphometry. There were significant differences in the sizes of mitochondria and plastids between the two lines from meiosis to the post-tetrad stages. By the latter stage, a refractive material builds up in the tapetum and locule that precedes degeneration of the tapetum and abortion of the male cells. DNA analysis of the nuclei of both the tapetum and male cells, and protein and enzyme analyses of the mitochondria from both lines showed no perceptible differences. These results suggest that the ms_3 gene may influence a tapetal organelle, possibly the plastids, during late meiosis. Disruption of its function leads to a buildup of one of its products which causes premature degeneration of the tapetum, and ultimately male sterility.

17. ^{31}P-NMR studies of erythrocytes isolated from the peanut worm P. gouldii

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Erythrocytes were isolated from the sipunculid, P. gouldii, and analyzed non-invasively by ^{31}P-NMR. These cells were found to contain 2-aminoethylphosphonic acid (2-AEPA), phosphorylethanolamine, and free nucleotide triphosphates under both aerobic and anaerobic conditions. In each of these states, intracellular pH values of 7.36± .10 and 6.54± .10 respectively were found. Using UV-visible spectroscopy, phosphorylethanolamine was shown to be an effector (negative cooperativity) of the oxygen storage protein hemerythrin carried within these erythrocytes. This is the first natural effector of hemerythrin found to date. Preliminary results describing its effect and that of 2-AEPA on hemerythrin will be presented.

18. Cadmium as a Growth Factor

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We have used subconfluent serum-starved monolayer cultures of 49F NRK cells to test the stimulatory effect on DNA synthesis and cell division of cadmium, EGF and combinations of these. Our initial findings indicate that cadmium has growth factor activity. Our results show that Cd^{++}, like TGF-β (transforming growth factor), works synergistically with EGF to stimulate colony formation in soft agar. Recently it has been found that TGF-β alone stimulates the growth of NRK in monolayer, but not past the first round of replication. Our results show Cd^{++} to follow this pattern and may indicate similar modes of action with TGF-β.

Further experimentation will include using gel electrophoresis to observe any differential protein production (gene expression) between treatments, and cell survival tests to test toxic effects after exposure to the treatments. Elucidation of the pathways and mechanisms used will prove valuable for investigation of pharmacological and toxicological responses to Cd^{++}. Using our data, a model for the action of cadmium as a growth factor will be discussed in the context of its similarity to TGF-β.

19. ^{31}P-NMR spectroscopy of spermatozoa of the rainbow trout

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^{31}P-NMR was utilized to study spermatozoa isolated from the rainbow trout. These spermatozoa are immotile upon collection and can be rendered motile by exposure to fresh H_2O or ringer. The spectrum obtained under aerobic conditions revealed the pre-

sence of phosphomonoesters, inorganic phosphate (Pi), phosphodiesters, phosphocreatine (PCr), free nucleotide triphosphates (principally ATP), and bound nucleotide triphosphates. The anaerobic spectrum was characterized by an increase in the Pi resonance and by the disappearance of the PCr and free ATP peaks. Upon reoxygenation, the aerobic spectrum was once again observed. Preliminary studies on aging of spermatozoa were performed and the presence or absence of a PCr peak was found to be correlated with motility. These findings will be analyzed in terms of the PCr shuttle and its role in the maintenance of motility in the spermatozoa of invertebrates. The value of the free Mg++ within these cells has been determined and this ^{31}P-NMR methodology will be discussed.

20. In vitro growth of birdsfoot trefoil and alfalfa

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Parameters of in vitro growth of birdsfoot trefoil (Lotus corniculatus L.) and alfalfa(Medicago sativa L.) were determined by placing different explant sources and genotypes on various culture media. Birdsfoot trefoil 'KOU 77' nodal explants were placed on 2 basal media, 1 containing .05 mg/L Benzyladenine(BA) and 2.0% sucrose, the other containing 50 mg/L adenine sulfate and 0.5% sucrose. BA-containing medium produced 2.6 shoots/explant while adenine sulfate-containing medium produced only 1 shoot/explant. The mean shoot length of explants on the BA-containing medium was approx. 1/3 the size of explants on the adenine sulfate-containing medium. Growth of birdsfoot trefoil cultures was dependent on explant source, explant size, and genotype. Both birdsfoot trefoil and alfalfa callus cultures were established, but birdsfoot trefoil callus regenerated shoots much easier than did alfalfa.

21. **Somatic embryogenesis in corn - use for selection at the cellular level**

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The parameters which condition somatic embryogenesis in corn are growth conditions of corn plants which donate explant tissue, source tissue used to start cultures, culture medium, and genetic potential to form somatic embryos. Plants grown under optimum conditions are best for inducing somatic embryogenesis. Immature embryos of 1.5-2.0 mm size are the best source tissue. The plant hormone, 2,4-D and amino acid, proline, induce greater numbers of somatic embryos than other hormones or amino acids. Production of somatic embryos is under genetic control and is conditioned by qualitative genetic factors. Somatic embryos can proliferate in vitro for up to one year or can be induced to form complete corn plants by media manipulation. Somatic embryos can be used for selection at the cellular level for agricultural traits such as herbicide, disease and stress resistance.

22. Cellular changes associated with somatic embryogenesis from immature embryos of corn

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Somatic embryos can be induced to form from immature embryos under certain culture conditions. Embryos of 1.5-2.0 mm size from Pioneer brand hybrid were cultured in vitro, fixed at daily intervals and paraffin embedded for light microscopy. The objective of this study was to determine the effects of 2,4-D and proline on regions of the embryo which undergo somatic embryogenesis. In immature embryos cultured in the presence of 2,4-D, by day 5 of culture, a distinct epidermal cell layer with dense meristematic cells was apparent on the scutellum and some well-formed somatic embryos were observed at the coleorhizal end of the scutellum. The addition of proline to the culture medium enhanced the frequency, but did not change the nature of this response. Immature embryos cultured in the absence of 2,4-D did not produce any somatic embryos. The cells at the scutellar surface became vacuolate and did not develop further. Knowledge of the factors important in somatic embryogenesis of maize may allow for more efficient use of somatic embryos for application of agricultural biotechnology in selection and genetic engineering.

23. Use of DNA restriction fragment length polymorphisms in maize strain characterization

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Genotype fingerprinting has as its objective the unique characterization of all variants (inbred lines, hybrids, varieties) of a species using descriptors that are independent of environmental interactive effects. We are investigating the utility of DNA Restriction Fragment Length Polymorphisms for this purpose. The polymorphisms revealed by this technique are variations in the length of restriction enzyme-generated DNA fragments that hybridize to specific radioactive nucleic acid probes. In the present study DNA probes were chosen which were 1) repeated 20-40 times in the maize genome and 2) highly polymorphic with several restriction enzymes. These probes were used to fingerprint 40 maize strains, including both closely and distantly related inbreds and their hybrids. With only 2 such probes it was possible to unambiguosly identify most of the inbreds and hybrids with additional discrimination between them possible by the use of more probes. The results indicate that DNA RFLPs will be useful in the complete identification and characterization of maize for both legal and research purposes.

Botany

24. An ecological survey of the terricolous bryoflora of a central Iowa woodland

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An ecological survey of the terricolous bryoflora of a central Iowa woodland was conducted. Species cover was recorded along 1 by 50 m transects in 23 plots representing 5 vascular plant communities. Temperature, evaporation and soil moisture were recorded over the growing season in each of the vascular plant communities. The greatest cover of mosses (12.5%) and the highest diversity (28 species) were found in the mesic Tilia americana vegetation type occurring on north slopes. The lowest cover (0.1%) and lowest diversity (11 species) were found in the xeric Quercus alba vegetation type occurring on ridges and south slopes. Dry sites were characterized by Rhynchostegium serrulatum, Brachythecium oxycladon and Amblystegium serpens. Mesic sites were characterized by Anomodon attenuatus, Taxiphyllum deplanatum, Bryhnia graminicolor, Climacium americanum and Mnium affine var. ciliare. Maximum temperatures differed between the most mesic (north slope) and most xeric (south slope) sites, with the most pronounced difference (9°C) during spring and fall in the absence of a leaf canopy. North slopes had lower evaporation rates but only slightly higher soil moisture.

25. The comparison of Heritage trail prairies and remnant hill prairies to Curtis' prairie types

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Small prairies along Heritage Trail, an abandoned railroad right-of-way in Dubuque County were ~~were~~ studied.

The prairies were sampled with meter square quadrats using presence.absence data and were characterized in terms of slope, exposure and soil ph.

Prairies along the trail were analyzed in comparison to remnant hill prairies of Mississippi River bluffs in Dubuque and in comparison to Curtis' (1959) five prairie types ranging from wet to dry, and Curtis' weed community.

The prairies along the right-of-way were similar to Curtis' wet/wet mesic prairies and contained significant weed components. The remnant prairies were very similar to Curtis' dry/dry mesic prairies.

26. Plant communities of Heritage Trail, Dubuque County

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Heritage Trail is an abandoned railroad right-of-way between Dubuque and Dyersville that has been converted into a trail for recreational and educational purposes. A study initiated in 1984 has been used to document the diverse array of biotic communities along the trail which include marshes, prairies from wet to xeric, mesic forest rich in spring ephemerals and American yew (Taxus canadensis), bluff communities, a meandering stream, and a number of rare plants including the only known natural population of prairie dock (Silphium terebinthinaceum) in Iowa. The greatest immediate potential for vegetation management is prairie maintenance and restoration, especially on the western extent of the trail.

27. Subterranean sporophytic gemmae in Botrychium subg. Botrychium

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A newly described moonwort, Botrychium campestre W. Wagner, proliferates vegetatively by subterranean gemmae. Rhizomes of plants with emergent leaves typically have 25 to 50 attached gemmae; the surrounding soil contains hundreds more in various stages of development into new sporophyte plants. Mature gemmae are spheroidal, approximately 0.4 to 0.8 mm in diameter, and loosely attached to the parent rhizome by a few parenchymatous cells. Internally the gemma has an organized subapical meristem and an endophytic fungus or actinomycete. Upon germination a gemma elongates, then produces a root laterally. The area of the juncture of gemma and root remains meristematically active, producing additional roots and additional gemmae. After production of 4 to 6 roots, a leaf-producing meristem is formed. Similar production of gemmae occurs in three other taxa, B. campestre subsp. michiganense W. Wagner, B. minganense Victorin, and B. echo W. H. Wagner.

28. Remnant prairies of Effigy Mounds National Monument

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The National Park Service is currently engaged in studying grassland remnants within the park system. In 1985 all old fields and bluff areas overlooking the Mississippi and Yellow rivers were studied for remnants of prairie flora. Woodland and bottomland areas were also searched for rare plants. Over twenty bluff prairie sites have been documented and six are exceptional in terms of flora and aesthetic values. A number of rare plants have also been found, primarily in the woodland areas. With the documentation of these resources the National Park Service must now develop a management plan to protect and enhance its biotic resources as well as the archeological features of Effigy Mounds National Monument.

29. Kernel smut of big bluestem in Iowa

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The first observations in Iowa of kernel smut of big bluestem, a disease caused by Sphacelotheca occidentalis (Seym.) Clint, were at Caylor prairie, Dickinson County, in August, 1978. Since that time the smut has been consistently present at Caylor prairie, and has also been observed at six additional prairie sites in Iowa. Four of these are native prairie sites in northwestern Iowa, two are planted big bluestem stands in central Iowa.

Diseased plants are colonized by systemic mycelium. They may survive for several years, each year producing stunted culms with smut sori developing in diseased florets. Not only do such diseased plants fail to develop seed, they also produce an annual supply of teliospores which may be distributed by the wind to adjacent healthy susceptible plants.

30. A preliminary report on the plant parasitic fungi of three northwestern Iowa prairies

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During the past five years, at least one collecting trip has been made each year during the summer and/or fall to three native prairie sites in northwestern Iowa, Caylor prairie preserve and Freda Haffner Kettlehole preserve in Dickinson County and Kalsow prairie preserve in Pocahontas County. Diseased plants were collected, and the disease inducing fungi identified later in the laboratory. The rust fungi, the Uredinales, are not included in this discussion. Also fungi potentially present in the cooler, more humid spring are not represented because of our observation times.

Many of the prairie plants have one or more common leaf spotting fungi, often the same one/s on a host plant from at least two of the sites. Of the 48 species of parasitic fungi recorded, 22 were not reported in either Gilman and Archers' 1929 paper on the plant parasitic fungi of Iowa or in the supplements compiled by Gilman in 1932 and 1949.

31. The use of monoclonal antibodies to assay for plant growth regulators.

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Hybridoma cell lines that secrete monoclonal antibodies (McAbs) against members of the cytokinin family of plant growth regulators (PGRs) have been isolated. Because PGRs are such small molecules, they must be attached, as a hapten, to a carrier before presentation to the immune system. To avoid steric interference from the side chains on the protein carrier, bovine serum albumin (BSA), the PGR was conjugated to the BSA via a spacer arm. In this way, McAbs with high affinity and little or no cross-reactivity can be produced. Conjugation strategies have also been devised for attachment of indole-3-acetic acid and abscisic acid to BSA. Once McAbs have been raised against all three classes of PGRs, they will be used in an enzyme-linked immunosorbent assay to measure changes in PGR concentration during different phases of tree seedling growth and development. The advantages of this assay system are its simplicity, low cost and sensitivity to nanomolar levels of PGR.

32. Effects of triarimol and ancymidol on abscisic acid biosynthesis in Cercospora rosicola

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The comparative effects of the two substituted pyrimidines, ancymidol (a growth retardant) and triarimol (a fungicide) on abscisic acid (ABA) production and the growth of the fungus Cercospora rosicola were studied.

Fungus cultures were filtered, acidified, and extracted with ethylacetate. The organic extract was concentrated and ABA was purified by HPLC. The presumptive ABA was methylated with diazomethane and further purified and identified by gas chromatography with a mass selective detector.

Fungus cultures grew at a linear rate from the fourth to the sixth day and accumulated large amounts of ABA during the same period. Both

substituted pyrimidines were shown to inhibit ABA production and growth in 6-day-old cultures. Triarimol was shown to be more effective than ancymidol in inhibiting both ABA production and growth. 10^{-6} M triarimol reduced ABA production by more than 90% while 10^{-4} M ancymidol was required to give the same effect.

33. In vitro propagation of kohlrabi from leaf, hypocotyl and cotyledon explants

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Many different species of the genus Brassica have been successfully grown in tissue culture. Reports of the in vitro growth of kohlrabi (Brassica oleracea L. var gongylodes), however, have been very limited. We have investigated the requirements of plant growth regulators for the regeneration of plants from explant tissues (leaf, hypocotyl and cotyledon) of kohlrabi. Explants produced either callus, callus and roots, or callus, roots and shoots when cultured on Murashige and Skoog (MS) media with various combinations of auxins and cytokinins. Optimal shoot production occurred from leaf explants cultured on MS medium containing 1 mg/L napthaleneacetic acid (NAA) and 10 mg/L benzylaminopurine (BAP). Regenerated plants were grown to maturity in the greenhouse and their morphology and chromosome number was compared to seed grown plants.

34. Sink development influences soybean leaf photosynthesis

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Normally, the photosynthetic capacity of a soybean leaf increases as the leaf expands, attains a maximum at full expansion, and then declines as the leaf senesces. During senescence leaf carbon dioxide uptake diminishes concurrently with declining in vitro rubisco activity, chlorophyll content and photosynthetic electron transport. The initiation of rapid reproductive growth delays the decline in carbon dioxide uptake and extends the leaf's peak photosynthetic capacity for up to three weeks. How this "sink effect" is wrought is not understood.

35. Glyceraldehyde 3-phosphate dehydrogenase activity in shoot apical meristems of Brassica campestris L. during transition to flowering

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Shoot apical meristems of vegetative and evoked plants of Brassica campestris L. were histochemically assayed for glyceraldehyde 3-phosphate dehydrogenase (G3PD) activity. A zonate pattern of G3PD activity was observed at the vegetative, the transition, and the floral stages. High enzyme activity was localized in island-like areas of the peripheral zone at the prefloral stage. This was before the morphological initiation of flower bud primordia at incipient floral primordia (IFP) sites. The capacity of the glycolytic pathway fluctuates during evocation and parallels the citric acid cycle and the electron transport system only at the prefloral stage. It is proposed that high G3PD activity at IFP sites marks the end of evocation. The results are discussed in regard to carbohydrate assimilates.

36. Phloem development in tissue cultures

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Cell cultures of Streptanthus tortuosus can be grown as fine suspensions of undifferentiated parenchyma cells. When transferred to a phloem-inducing culture medium, phloem sieve elements are formed.

During the differentiation of phloem sieve elements, plasmodesmata connections are broken between the sieve elements and the surrounding parenchyma cells. The phloem, therefore, lacks symplastic connection to the surrounding parenchyma cells. The sieve element cell wall is greatly thickened during development, and this appears to be associated with the truncation of the plasmodesmata.

The loss of symplastic connections during development result in a requirement for apoplastic uptake mechanisms for phloem loading, and suggest a modification in invertase activity in the phloem cell wall.

37. **Sucrose uptake by isolated phloem cells.**

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Phloem sieve elements have been isolated from cell cultures of Streptanthus tortuosus using cellulase and pectinase enzymes. The thickened cell walls of the phloem sieve elements are slightly resistant to the action of the cell wall-degrading enzymes, while the cell walls of the surrounding parenchyma cells are quickly broken down by the treatment. As a result, the parenchyma cells are liberated as cell wall-free protoplasts and can be separated from the clusters of phloem cells yielding an enriched population of phloem cells.

Sugar uptake by the cells was measured using isotopically-labelled glucose and sucrose. The parenchyma protoplasts take up glucose at a higher rate than they take up sucrose. The isolated phloem cells, however, take up sucrose at a high rate but do not show uptake of glucose. These results indicate that phloem loading by these cells is specific for sucrose, and that isolated sieve elements are functional.

38. The status of Lespedeza leptostachya at the Freda Haffner Kettlehole Preserve.

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One of the rarest legumes of the tallgrass prairie biome is the Prairie Bushclover (Lespedeza leptostachya Engelm.), which has a scattered distribution over five states in the upper midwest. Iowa has at least 20 of the documented occurrences for this species. One of these exists at The Nature Conservancy's Freda Haffner Kettlehole Preserve in Dickinson County, Iowa. The size, structure, and distribution of this Prairie Bushclover population was studied in depth during August of 1985 to establish baseline figures to be used in future work on the response of this species to burn management. Results from this analysis, including plant community associations, will be documented. Over 1100 individuals of this species were noted, apparently making the Freda Haffner population the largest in the state, and one of the five largest in the world.

39. Effect of season of fire on reproduction and establishment in cool and warm season grasses

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Prairies are usually managed by spring fire, but historical evidence shows that natural fires have occurred throughout the growing season. Timing of fires could affect the structure of the prairie community. Treatments of no burn, and spring, early summer, late summer, and fall burns were applied to season of fire on sexual reproduction and tillering in Poa pratensis, Sorghastrum nutans, and Andropogon gerardii, and seedling establishment of all species, were examined. Amount of flowering and tillering within treatments was species specific. Number of seedlings varied with amount of litter, but fire treatments greatly reduced the number of dicot seedlings.

40. Population structure of a Buffaloberry (Shepherdia argentea (Pursh)Nutt.) stand along a forest-prairie boundary in the Loess Hills.

J. PEARSON

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A long-term study of the population structure of the state-threatened species Sheperdia argentea was initiated in a 10m X 50m strip along the boundary between prairie and forest communities in Stone State Park, Woodbury County. The entire living population of 185 stems was marked with numbered tags in July 1985. Three subpopulations were recognized: stems under the forest canopy (n=32), along the forest edge (n=66), and in the open prairie (n=87). Analysis of variance indicated significant ($p<.01$) differences in basal diameter, height, and proportion of live crown among the subpopulations. The prairie subpopulation consisted of small, short, individuals with nearly full crowns, while the forest subpopulation consisted of large, tall individuals with senescent crowns. The edge subpopulation was intermediate for all variables. Stems with a basal diameter $\leq$ 2.5cm were concentrated (61%) in the open prairie. The entire population will be monitored to track changes in the position of the forest-prairie boundary over time.

41. Herbaceous flora of widespread distribution at Wild Cat Den State Park, Muscatine County, Iowa.

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The herbaceous flora of Wild Cat Den State Park, Muscatine County IA, was sampled to determine which species have a widespread distribution. Within 45 randomly located 1m x 1m quadrats the frequency, density, coverage, and nearest-neighbor distance for each species were measured. The slope angle and orientation of each quadrat were recorded, as was understory and overstory composition. Of the 218 herbaceous species which previously had been collected at the park, about 20 are widespread. Species associations and distributional relationships with slope and canopy will be presented.

42. An initial study of the germination requirements of Petalostemon villosum

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The effects of seed viability, scarification, light, and temperature were examined. Seed coat color was found to be a distinct indication of seed viability. Approximately 85% of light tan to greenish-tan seeds were viable, whereas only 10 to 20% of brown to dark brown seeds were viable. The presence of intact carpels totally prevented germination. Removal of the carpel without damaging the seed coat enhanced germination by approximately 30%. When the carpels were removed and seed coats

scarified, 100% germination occurred. Scarified seeds were used for the remainder of the study. The presence or absence of light appeared to have no significant effect on germination. Germination was observed over the entire temperature range studied (8C to 32C), with a maximum germination rate occurring at 24C. Some germination occurred within 24 hours at all temperatures, with 100% germination occurring within 96 hours at 24C. At the temperature extremes, 100% germination required several weeks.

43. Differential dispersal of the three different types of seeds produced by Amphicarpaea bracteata L. (Fabaceae)

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I examined the dispersal of chasmogamous (CH), aerial cleistogamous (CL) and subterranean cleistogamous (SUB) seeds from Amphicarpaea bracteata. In nature, CH pods are significantly higher above the ground than aerial CL pods. However, the initial velocities of seeds from the two types of explosively dehiscent pods are not different. Dispersal distributions were derived by combining the height and velocity distributions and assuming a constant firing angle and no air resistance. Aerial CL seeds are dispersed significantly further than CH seeds, despite the height disadvantage. This result reflects the overriding influence of the initial velocity distributions. The dispersal distances of the SUB seeds were measured in the field and is intermediate between the two types of aerial seeds. These results suggest that the benefits of increased production of CH flowers relative to CL flowers as plant size increases, is not the result of enhanced dispersal by CH seeds.

44. Influence of ortet age, cutting position, planting date, and rooting condition on the first year growth and biomass production of two Populus clones.

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First year growth and biomass production was compared for rooted and unrooted cuttings of two Populus euramericana hybrids, collected from the top, middle and bottom of whips from one and five-year-old ortets that were planted on five different dates on an upland and bottomland site. Barbatelle cuttings, produced in a bare-root nursery, were also compared to the rooted and unrooted cuttings. Generally, rooted and barbatelle cuttings had better survival, height and diameter growth and biomass production than unrooted cuttings throughout all planting dates except the first date which showed little differences. Cuttings from the middle and bottom positions of one-year-old ortets performed better than the top position from five-year-old ortets. There were no clonal differences. Cuttings on the bottomland site grew better than those on the upland site.

45. Pre-Columbian Bihemispheric Cultural Diffusion? Botanical Evidence.

D. ISELY

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The traditional diffusionist view that the American Indian civilizations received cultural stimulation from the Old World, yet maintained by some scholars, is not supported by botanical evidence. Seemingly, not a single food or fiber plant transported by man, was common to both hemispheres prior to 1492. This statement is supported by the fact that the origin or pre-Columbian distribution of possibly dubious plants (e.g., the coconut, peanut, sweet potato, gourd) has been reasonably established by studies that last 20 years. The agriculture of a culture and its plants, on which everything else depends, are primary attributes; the social organization, economic system, religious beliefs, nature of its art, etc. are necessarily derivative and secondary. Analagous cultural attributes, common to the Old and New Worlds represent parallel innovations.

46. Some Aquatic Hyphomycetes from Maricao River at Maricao State Forest, Maricao, Puerto Rico

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Twenty three species of aquatic hyphomycetes were collected from foam and dead leaves at the western mountains of Puerto Rico at Maricao river at Maricao State Forest, Puerto Rico. Alatospora acuminata Ing., Anguillospora crassa Ing., Anguillospora longissima (Sacc & Syd) Ing., Articulospora tetracladia Ing., Brachiosphaera tropicalis Naw., Clavariopsis aquatica de Wild., Clavatospora tentacula (Umphlett) Nils., Campylospora parvula Kuz., Flagellospora curvula Ing., Flagellospora penicilloides Ing., Flabellospora verticillata Ales., Heliscus submersus Hud., Itsmotricladia gombakiensis Naw., Lemonniera aquatica Ing., Lemonniera cornuta Ran., Lemonniera terrestris Tub., Phalangispora constricta Naw., Scorpiosporium angulatum (Ing) Igbal., Scorpiosporium angulatum (Ing) Igbal., Scorpiosporium gracile (Ing) Igbal., Tetrachaetum elegans Ing., Tetracladium marchalianum de Wild., and Triscelophorus monosporus Ing.

47. A degree day model to estimate ascospore productivity by Mycosphaerella populorum Thompson.

C. J. Luley

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Ascospores of Mycosphaerella populorum are produced in pseudothecia that mature in overwintered Populus leaves in the spring. Spore levels peak in May and decline to extinction later in the summer. Cumulative ascospore productivity

was determined to be directly related to degree day accumulation, if adequate moisture was available. A model ultilizing degree day accumulation (base 0 C) from the time ascospores first matured was developed to describe the relationship. Spore productivity was quantified at 9, 16 and 21 C in controlled temperature chambers and during both 1984 and 1985 within a Populus plantation with an ascospore liberation tunnel and petroleum coated microscope slides. A Gompertz transformation -ln(-ln (y)) linearized the ascospore productivity-degree day curve. The model estimated ascospore productivity closely in 1984 when adequate moisture was available. Dry spring weather in 1985 slowed spore production and resulted in significant deviations from the model. Utilization of historic degree day data allows the model to predict ascospore productivity and subsequent infection of Populus stems and leaves.

48. Pennisetum petiolare, a pseudopetiolate grass in Iowa

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Pennisetum petiolare (Hochst.) Chiov. is a tropical grass known from the Sudan and Ethiopia. A single seedling of this species grew in the author's yard, directly under a bird feeder charged with Niger thistle seed (= Guizotia abyssinica Cass.). Seed of this species is commonly used for winter feeding of small birds, and is apparently mostly imported from Africa. The seedling was transplanted to the Botany Greenhouse, where it has flowered twice. The plants are striking because the leaf blades are borne on elongated pseudopetioles.

An aliquot of the seed lot used in the bird feeder was separated by the Iowa State University Seed Laboratory. The material contained about 16 taxa of small seeds and fruits, including several spikelets of P. petiolare.

Pseudopetioles are rare in grasses, occurring mostly in the Bambusoideae, and occasionally in other tribes, including the Centotheceae and Arundinelleae. Because of their intercalation between the sheath and blade and their internal anatomy, they are not homologous with the petioles of Dicots.

49. Variations in pine seedling root morphology

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Tree seedling establishment depends on elongation and/or initiation of roots. Bareroot red and white pines, popular species in Iowa, have root systems consisting of a weak taproot, few first-order laterals, and little or no fibrous development. These systems may not be capable of rapid early growth in the field. Consequently, establishment rates are often disappointing.

A greenhouse study is underway to identify pine species with sturdier, more vigorous root systems. Observations of the developing root systems of pine species grown in bookplanters indicate the following:

Red and white pines have weak taproots with few, thin lateral roots which elongate relatively slowly.

Ponderosa and southwestern white pines have strong taproots with fewer, thicker laterals which elongate rapidly.

Scotch and jack pines have weak taproots with still fewer, thin laterals but exhibit the greatest fibrous development.

Seedlings will be planted this spring in Ames to identify the most successful of these species.

50. Root system morphology of tree seedlings planted in newly reclaimed strip mine land in south central Iowa.

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Containerized and bare-root seedlings of green ash (Fraxinus penn.) and hybrid poplar (Populus x euramericana) were planted in newly reclaimed strip mine land in south central Iowa in 1983. Seedlings were excavated in 1984 using two methods. Slow, meticulous excavations were conducted, preserving the approximate in situ distribution of the roots in the soil. A much quicker method was then used which allowed recovery of sufficient seedlings to analyze root system morphology, at the expense of recording the roots in situ distribution. The species by stock type interaction appears to be most significant and so forms the basis for further analysis. From the slower excavations significant differences in the sums of root weight, length, cross-sectional area, and circumference were found by depth and distance from the stem. From the quick excavations important differences were found in root density, number of first and second order lateral roots, root-to-shoot ratios, root lengths, root cross-sectional areas, and root circumferences.

51. Root morphology of Pinus resinosa and Picea glauca in several seedling containers

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Containerized conifer seedlings may be an alternative to bareroot nursery stock in Iowa. Seedlings in containers often have better shoot:root ratios, and the less disturbed root systems become more rapidly established after outplanting. Container dimensions will influence root morphology of the developing seedling. In this study we compare the effects of bookplanters, Leach pine cells, Japanese paperpots, and styroblocks on root development of Pinus resinosa and Picea glauca. Although these containers are comparable in volume, they vary in depth and diameter. Shorter, wider paperpots

produce compact root systems, with many, evenly-distributed, branched laterals. Deeper, narrower Leach cells and styroblocks have fewer and longer laterals, mainly along the upper portion of the taproot. Laterals are deflected downward at the container wall. Bookplanters produce root systems similar to Leach cells and styroblocks, but deflection is not as pronounced. These morphological differences may influence seedling success once outplanted this spring.

52. The Iowa State University Botany Department greenhouses: problems and solutions

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The Iowa State University Botany Department greenhouses occupy 12,000 square feet on the roof of Bessey Hall. The head house occupies ca. 2000 square feet, and there are ca. 10,000 square feet under glass. This includes three temperature zones, nominally at 60, 70 and 80 degrees F. There are 17 separate houses, allowing the maintenance of various conditions of temperature and light. Several houses are illuminated with high intensity sodium lights to alter daylength for better plant growth during the short-day portion of the year. Controlled condition chambers and curtained short-day benches are provided. A considerable portion of the greenhouse is devoted to a permanent teaching and research collection. Individual research areas are also available. We have recently completed a computerized catalogue of the permanent collection of over 800 species. This is the outstanding institutional collection in the Midwest. We would be pleased to provide copies of this catalogue when it is published and will attempt to provide propagation material to other educational institutions on an exchange basis.

53. Distribution of paraveinal mesophyll in Erythrina (Fabaceae: Papilionoideae: Phaseoleae)

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Paraveinal mesophyll is a two-dimensional cell layer found in the leaf mesophyll of legumes. This tissue connects the vascular bundles at the level of the phloem, and has been shown experimentally to be the preferred pathway for photosynthate transport from the chlorenchyma to the leaf veins. Although widespread in the family, paraveinal mesophyll is not found in some genera of legumes, thus making it a useful taxonomic character. Although first reported in 1892, there are fewer than ten published studies, some of which report conflicting observations. According to Lackey (Bot. Gaz. 139:436-46, 1978), Erythrina corallodendrum does not have paraveinal mesophyll. I have examined Lackey's microscope slides and disagree with his conclusion. I have also looked at E. herbacea, which does have paraveinal mesophyll. Detailed observations of leaf clearings, resin sections, and scanning electron micrographs of selected Erythrina species (including E. corallodendrum and E. herbacea) will be presented.

54. An investigation of extra-floral nectaries of Aphelandra golfodulcensis (Acanthaceae)

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These glands fit Zimmerman"s designation of "flachnektarium" or "surface nectary". Two gland clusters occur on the bract, each composed of 3-5 secretory units. Units arise from localized divisions of protoderm cells which culminate in a layer of columnar secretory cells beneath which is a sub-secretory layer of lightly staining, heavily cutinized cells. The entire gland is covered by a thick cuticle.

The nectary lacks its own vascular supply. The pattern of cutinization and the compact tissue structure suggest that the "pre-nectar" must be routed via the sub-secretory cells to the secretory layer. The ultrastructure of both these cell types is discussed.

55. Internal secretory spaces in Conyza canadensis (Asteraceae: Astereae)

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Thick plastic sections and clearings were made of leaves, stems and roots of Conyza canadensis (horseweed), a common annual weed. Files of short cavities, instead of the ducts or canals usually described for the family, were found in all vegetative organs. Cavities contain oil and have a double epithelial layer. In leaves, cavities occur in crowded files abaxial to major bundles and are progressively smaller, sparser, and more lateral in successively minor vein orders. Cavities of minor veins form from bundle sheath cells, and some occur free in the mesophyll. Stem cavities are crowded in vertical files external to each extension of a median leaf trace. Fewer cavities occur associated with lateral leaf traces. Scattered cavities occur in the pith. Root cavities are sparse. Files of cavities found in all organs of Conyza canadensis have not been previously described in Asteraceae.

56. Cavities and ducts: ambiguous interpretations past and present, and new questions for the future

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Recent collaborations with J. D. Curtis have provided detailed descriptions of the 3-D structure of internal secretory spaces in some Asteraceae, and revealed features previously unknown. A concomitant review of literature shows that cavities of plants in general are described merely as "short" and ducts as "long." The latter may "anastomose." Textbooks add only that ducts develop schizogenously; this is exclusively from cross-sectional studies. Of almost 100 studies of Asteraceae, all but five describe ducts from an unstated, but often obviously small, number of cross-sections; the five that do describe 3-D structure provide unstated or ambiguous evidence. A similar situation exists in Umbelliferae, the other family in which oil spaces have been studied most. Questions about duct length, mode of duct elongation and anastomosis, and why duct epithelial cells remain alive and sometimes swell, are among those that have not been asked previously.

57. Inflorescence and floral development in male and mixed inflorescences of Zea diploperennis

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Department of Biology
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Cedar Falls, IA 50614

Scanning electron microscopy and light microscopy were used to investigate the ontogeny and histogenesis of the tassel spikes, spikelets and florets of diploperennial teosinte. The apex of the tassel spike produces bract primordia in acropetal sequence. These bracts subtend axillary branch primordia which bifurcate unequally forming two spikelets, pedicellate and sessile. The sessile spikelet is interpreted as a branch of the pedicellate spikelet. The developmental pattern of a mixed inflorescence shows a transition from four-rowed staminate spikelets to two-rowed cupulate fruitcases. At the transition node a staminate pedicellate spikelet and a sessile fruit is observed. The patterns observed in these inflorescences will be compared to those reported for the tassel and ear of maize.

58. Inflorescence and floral development in female inflorescences of Zea diploperennis

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Department of Biology
University of Northern Iowa
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Scanning electron microscopy and light microscopy were used to investigate the ontogeny and histogenesis of the female spikes, spikelets and florets of diploperennial teosinte. The apex of the female spike produces bract primordia in acropetal sequence. These bracts subtend a single spikelet branch. The bract enlarges to form the outer glume which becomes part of the cupulate fruitcase. There is only one observable spikelet and no recognizable rudiment of a second, either pedicellate or sessile. The pattern observed in female spikelets will be compared with those found in the male and mixed inflorescences. The implications of this work will be discussed with reference to the origin of the maize ear.

59. Plant survey results of Kelsam Prairie

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Iowa City, IA 52243

Kelsam Prairie in Story County, Iowa, is a mixture of dry habitat species intermingled with marsh species. Eighty-eight native and eleven introduced species were identified. The presence of Solidago ridellii is of special note, since it proved to be a Story County record.

Chemical Education

60. Project SERAPHIM software and laboratory modules.

KENNETH A. HARTMAN

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Project SERAPHIM is a NSF-DISE funded program to improve the use of computers in chemical education. The newest release of available software will be discussed. In addition, the new laboratory modules for interfacing microcomputers to laboratory activities will be presented.

61. Strings and things: a method of presenting the wave-mechanical model of the electrons in atoms to beginning students

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A non-mathematical method for teaching the electronic structure of atoms using the electron-wave model will be presented. The method begins with the single postulate made by Schroedinger: Electrons in atoms are standing waves. The properties of standing waves are demonstrated using a string which is set in oscillation at various frequencies. Using analogies drawn from observations made on the behavior of this vibrating string, the nature of the electron waves in atoms, the orbitals, are visualized and the following concepts are developed: quantization of orbital energies, relative order of orbital energies, orbital population, orbital 'shape', electron density, and the meaning of quantum numbers.

62. Computer-assisted general chemistry laboratory instruction.

S. HEIDEMAN AND W. HUTTON

Chemistry Department, Iowa State University Ames, IA 50011

The use of computers in the chemistry classroom has become increasingly prevalent over the last decade. The most extensive use of computers has been in the lecture/recitation portion of the course, particularly as computer-assisted drill or problem solving exercises. The use of computers in the laboratory has centered on computer interfaced experiments.

This paper will describe the use of the computer as a tool to assist the teacher with the task of laboratory instruction. The reasons for using the computer in this way, our goals for this project, and a schematic view of the operation of this system will be presented. The results of the first year of operation will be discussed.

63. Chemical waste disposal plan for the Iowa schools

GERLOVICH, JACK

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The state and federal regulations for the disposal of chemical wastes will be discussed. Procedures for the collection and distribution of chemical wastes through the AEA's and eventual disposal through approved hazardous waste companies will be presented.

64. A unique way of writing and revising chemistry laboratory exercises using student feedback.

M. E. WISHART AND F. STURTEVANT

Traditional laboratory experiments, while scientifically correct, often are merely exercises in following written directions. In many cases they contain too much information for the average student to process, and they do not ask the student to make any statement of learning.

In this presentation, we will share the beginnings of a manual being written following a format suggested by McDowell and Waddling in "Improving the Design of Laboratory Worksheets," J1 Chem Ed, November 1985.

Unique features of the manual are:
- *Computer graphics which parallel procedure
- *Concise presentation of information
- *Pre-lab exercises
- *Questions which require analysis/synthesis
- *Safety precautions
- *Teacher notes--including rationale, preparation of solutions, sample data

The manual is being written and revised through student testing and input.

65. Chemical demonstration as a means of motivating chemistry students

D. E. MURPHY AND T. M. SCOTT

Hoover High School and Lincoln High School, Des Moines, IA 50315

Chemical demonstrations have long intrigued both students and teachers alike. A series of activities will be performed to show how demonstrations may be used to generate questions and stimulate discussion, improve observational skills and supplement laboratory experiences. Discussion will also be given to safety considerations involved in performing demonstrations.

66. Laboratory experimentation involving the use of a microcomputer-interfaced spectrophotometer: the study of the reaction kinetics of chromic acid oxidation of alcohol

D. C. HAMPTON

Department of Chemistry, Wartburg College, Waverly, IA 50677

During the past few years, students in the sophomore-level organic chemistry classes have studied the rate of reaction of selected alcohols with chromic acid using routine spectrophotometric methods of analysis and manually sampling and plotting the data to determine the rate constant for the reaction. In the last two years the students have been assigned one alcohol to be studied by the conventional technique (manual data acquisition) and assigned a second alcohol to be studied using a microcomputer-interfaced spectrophotometer (Spectronic 21) with printer for data acquisition and plotting. A microcomputer program has been developed to plot and print out absorbance/time curves and to calculate, plot and print out the pseudo first order rate constant for the reaction. The effect of structure on the reactivity of the alcohol is examined in the experiment.

Chemistry C

67. Fiber optic ammonia gas-sensing probe

T. D. Rhines and M. A. Arnold

Chemistry Department, University of Iowa Iowa City, Iowa 52242

The goal of this research is to build and optimize an ammonia gas-sensing probe using optical fibers. Some of the advantages of such a probe over current sensors would be its small size, faster response time, and possibly a lower limit of detection.

The probe consists of two optical fibers, a gas-permeable membrane, and an indicator solution. The optical fibers bring light from a source to the tip of the sensor and then take a fraction of the incident light to the detector. The indicator

solution consists of one or more colorimetric dyes in a solution of ammonium chloride. The gas-permeable membrane allows ammonia gas in the sample to pass into the indicator solution which raises the pH of the indicator solution and produces an increase in the nonprotonated form of the dye.

Currently the effects of several parameters on the performance of the probe are being studied by experimentation and computer simulation. The results of these studies along with details of the design of the probe will be discussed.

68. The design of a static hanging mercury dropping electrode

B. LYON AND E. B. BUCHANAN, JR.

Chemistry Department, University of Iowa, Iowa City, IA 52242

This paper describes the design and fabrication of a static hanging mercury dropping electrode. The electrode is constructed of plastic so that, with the exception of the electrical contact no metal comes in contact with the mercury. The timing of the electrode activity is under the control of a computerized square wave voltammetric analyzer.

A brief discussion of the precision of the drop formation will be included.

69. Determination of selected impurities in spent caustic arising from the chemical cleaning of coal

C. D. CHRISWELL, D. R. MROCH, R. RICHARDSON, AND R. MARKUSZEWSKI

Fossil Energy Program, Ames Laboratory, Iowa State University, Ames, IA 50011

Reaction of coal impurities with molten sodium or sodium/potassium hydroxide leads to coal product free of virtually all ash-forming minerals and sulfur. Recovery of unreacted caustic and regeneration of caustic from mineral salts in the spent caustic is required for the process to be economically feasible. In order to recover and regenerate the caustic efficiently, components of spent caustic must be characterized. Procedures for the determination of most components in spent caustic are outlined. Procedures developed especially for the characterization of sulfur forms and of total sulfur are discussed in detail. Determination of total sulfur is accomplished by a two-stage oxidation process followed by determination of sulfate by ion chromatography. This novel two-stage oxidation process is required for the quantitative conversion of sulfur species to sulfate for subsequent determination.

70. A direct method for the determination of organic oxygen in coal

K. A. YOUNKIN, G. A. NORTON, W. E. STRASZHEIM, AND R. MARKUSZEWSKI

Fossil Energy Program, Ames Laboratory, Iowa State University, Ames, IA 50011

Preliminary results indicate that the organic oxygen content of coal can be determined directly by using a scanning electron microscope (SEM) with energy- and wavelength-dispersive x-ray analysis. Several coals from different geographic locations in the U. S. were ground, dried, and then analyzed using this SEM technique. Energy-dispersive x-ray analysis was first used to screen the sampled areas for the absence of elements which are indicative of common minerals associated with coal to ensure the absence of mineral phases. Thus, only the organic phase was analyzed. Then, wavelength-dispersive x-ray analysis was used to determine the oxygen content of the sampled area. Two areas within each of 12 different coal particles were analyzed, and the average organic oxygen concentrations were calculated, as well as estimates of inter- and intra-particle variations. These results were compared to organic oxygen values obtained by standard ASTM techniques and by Fast Neutron Activation Analysis.

71. Development of a numerical prefilter to optimize infrared library searches

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As capabilities for collecting infrared spectral data increase, so does the need for automated interpretation of that data. A common interpretation approach, the library search, involves the point-by-point comparison of an unknown spectrum with each spectrum in a reference library. Previously, to make searching more efficient, spectra have been compressed or selectively edited to include only essential information. In the work presented here, a prefilter is constructed to reduce the number of reference spectra to which the unknown spectrum must be compared. Using vector-space techniques, a multidimensional space is constructed that encodes pertinent spectral information. The distance of each reference spectrum to this space is computed and stored once. In processing an unknown spectrum, the distance to the space is computed, and the subsequent library searching is directed to consider only those reference spectra which possess distances similar to that of the unknown. The basis for the multidimensional space will be described, and results from several trials will be presented.

72. Specific detection capabilities for GC-IR analyses

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Spectra obtained by gas chromatography-infrared spectroscopy (GC-IR) contain a wealth of information about the components of complex mixtures. By using automated processing methods to detect specific structural characteristics, information about mixture components can be obtained quickly, reducing the need to analyze fully the many spectra obtained in a GC-IR experiment. One automated method for obtaining structural information from an IR spectrum is based on encoding spectral information as a set of numerical parameters that are characteristic of the spectral response of a particular structural feature. In the work presented here, methods are demonstrated for integrating the absorbance area in spectral regions, for determining the shape of those regions by polynomial least-squares, and for determining the width of a spectral region by statistical moment calculations. The results of this work will form the basis for implementing a specific detection capability for GC-IR instruments. The effectiveness of the methodology will be discussed, and future directions will be forecast.

73. Application of HMO theory to aid the simulation of ^{13}C NMR chemical shifts

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Computer-based spectral simulation of ^{13}C NMR chemical shifts shows promise as a powerful tool for structure-elucidation. The relationship between ^{13}C NMR chemical shifts and carbon chemical environments forms the basis for one spectrum simulation method. This method is implemented through linear models that relate numerical structural parameters to observed chemical shifts. Existing applications of this methodology have focused on saturated systems. Characterization of aromatics, whose chemical shifts are affected by a number of intermolecular effects, would greatly extend the applicability of the scheme. As a first attempt to encode essential aromatic structural information, parameters will be developed based on simple Huckel Molecular Orbital calculations. Results will be presented for an initial application of this methodology to eighteen substituted naphthalenes. The ability of the calculated models to simulate accurate spectra will be evaluated using a set of aromatic compounds not used in the model development.

74. Automated detection of misassigned chemical shifts in ^{13}C NMR spectroscopy

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Models that relate ^{13}C NMR chemical shifts to structural features can be quite useful in structure-elucidation studies. The development of reliable models requires a set of correctly assigned chemical shifts. Shift assignment is a nontrivial task, with assignment errors often resulting in skewed models. Chemical shifts that are "significantly" different from shifts associated with similar structural environments exhibit a high probability of misassignment. For any set of correctly assigned spectra, there should be a distribution of chemical shift differences as a function of the most similar chemical environments. In the work presented here, environments are encoded as numerical vectors, and the difference between any two environments is found as the Euclidean distance between the vector representations of those environments. Misassigned shifts should appear as differences on the tails of the distribution curve. These distribution characteristics will be evaluated, and the potential for discriminating between correctly assigned shifts and those misassigned will be demonstrated.

75. Simulation of ^{13}C NMR spectra of disaccharides using computer-based methodology

M. K. McINTYRE, G. W. SMALL

Department of Chemistry, University of Iowa, Iowa City, IA 52242

There are three principal factors which make the interpretation of ^{13}C NMR spectra of carbohydrates difficult: (1) the possible presence of several diastereomers in a given sample; (2) the common occurrence of a large number of spectral resonances in a small chemical shift region; and (3) the visual similarity among spectra of compounds that have slight structural differences. The growth in availability of laboratory computers has motivated research in computer-based spectral interpretation. In our laboratory, recent work has demonstrated that spectral simulation procedures can be useful as a structure elucidation tool for monosaccharides. Spectral prediction accuracies of 1.0 ppm or less have been consistently obtained. In the present work, these simulation procedures have been extended to encompass disaccharides. The spectra of these compounds represent a challenging simulation problem, as chemical shifts are affected by ring junctions and generally more complex chemical environments. The prediction results will be analyzed to forecast future work.

76. Equilibrium and kinetic studies of the aqueous solution chemistry of some chloro complexes of platinum(II)

R. G. LARSEN AND L. E. ERICKSON

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The aqueous solution chemistry of three compounds of the type cis(N,S)-Pt(DMSO)(L)Cl, where L is glycine, sarcosine, or dimethyl glycine, was investigated by potentiometric techniques. The rate of silver(I)-assisted hydrolysis (k_{AG}) was determined by monitoring the silver(I) ion concentration (with a silver electrode) versus time using an ADAC lab computer to collect and store the data. The rate of displacement of water by chloride ion (k_2) was then determined, through chloride ion (KCl) concentration jump relaxation kinetics on the aquo species, using a chloride ion specific electrode to monitor the reaction. The equilibrium values of [Cl^-] and pH were used to determine the hydrolysis constant (K_h), the acid dissociation constant (K_a) of the aquo species, and the dimerization constant (K_d) for formation of the hydroxide bridged dimer.

77. Equilibrium and kinetic study of the dimerization of aquadiethylenetriamine platinum(II)

T. Y. MEYER AND L. E. ERICKSON

Department of Chemistry, Grinnell College, Grinnell, Iowa 50112

The dimerization via a hydroxy bridge of $Pt(dien)OH_2^{2+}$ was investigated. Equilibrium and kinetic data for the reaction of the deprotonated species with the acidic aquo complex were obtained by monitoring the slow pH change following the addition of base to a solution of the aquo species. Pseudo first-order rate constants for the reversible dimerization were determined. Kinetic data and the details of the analysis will be presented.

78. Reactions of $FeCp(CO)_2(\overline{COCH_2CH_2N})$ with organic electrophiles

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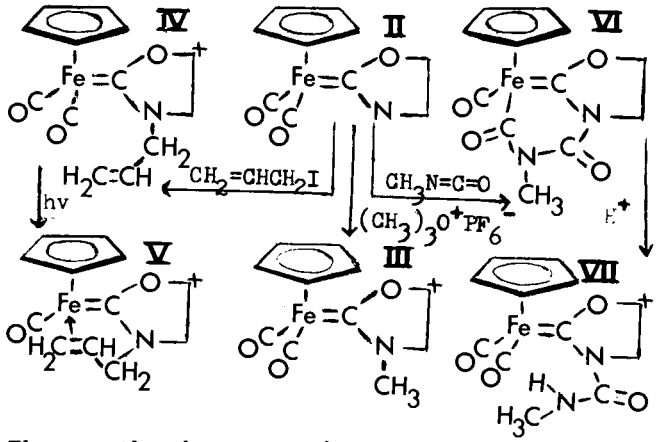
Department of Chemistry and Ames Laboratory -DOE, Iowa State University, Ames, Iowa 50011



The synthesis, reactions, and spectroscopic properties of several new organometallic carbene complexes resulting from reactions of II with organic electrophiles will be discussed.

Chemistry D

79. 2-Aminopurines: synthesis and activity

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2-Aminopurine nucleosides are important biologically-active compounds. They are precursors to a variety of novel, potentially active purine nucleosides. However, a good methodology for the synthesis of these compounds is not currently available. This paper reports on a new and highly efficient synthesis of 2-aminopurine ribonucleoside. A key step in this methodology is a photoinduced reductive dehalogenation reaction. Such reactions have not been reported previously in nucleic acid base chemistry. Details of the synthetic steps including mechanistic implications will be presented. The biological relevance of these compounds will be discussed.

80. Novel fluorescent dihydropyridines

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Department of Chemistry, University of Iowa, Iowa City, IA 52242

1,4-Dihydropyridines are formed in the modification of amino acids by malondialdehyde. We have investigated plausible mechanisms for these transformations and details of these studies will be presented. Extension to other systems containing amino groups will be discussed. The interesting fluorescence properties (including quantum yields) of these dihydropyridines will be presented. Preliminary biological activity data for some of these compounds will be mentioned.

81. Relatedness of Plasmid Replication Initiator Proteins and DNA Binding Proteins

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When the primary amino acid sequence of six different proteins thought to be essential for initiating or controlling the replication of R6K, RK2, P1, mini rts, mini F1, pSC101, and pSa plasmid DNA molecules are compared, all are observed to be basic proteins of similar molecular weight and to resemble each other as well as DNAa, gene 32, and O proteins to varying degrees when compared one-to-one using the method of Kanehisa. When searched for a sequence of amino acids similar to the DNA-binding domain of such DNA-binding proteins as cro, repressor, or E. coli CAP protein on either a one-to-one basis using the method of Magnus and Lattman or a new method described here which allows simultaneous comparison of a test sequence with a reference set of n other sequences, some relatedness between the plasmid replication proteins and a reference set of fourteen DNA binding proteins is observed. When the entire protein primary sequence data base of Dayhoff is searched to find other sequences homologous to the 22 amino acid DNA binding-domain of the reference set, several strongly homologous sequences are found, representing proteins previously thought to interact with DNA or proteins of previously unknown function.

82. Formate reduction of NAD^+ analogues

J. E. C. HUTCHINS, D. A. BINDER AND M. M. KREEVOY

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Formate is dehydrogenated to CO_2 by 10-methylacridinium ion (I) or substituted benzylquinolinium ions mimicking its reaction with NAD^+ catalysed by formate dehydrogenase. The hydrogen and carbon kinetic isotope effects with I are 2.74 and 1.027 in 20% aqueous DMF (v/v) at 50°, similar to those found in the previously studied enzymatic reaction. Transition states in both cases have similar structures and involve rate-limiting H^- transfer.

1 - benzyl-3-cyanoquinolinium ion is also reduced by formate in 20% aqueous IPA at 25° giving both 1, 4 - dihydro and 1, 2 - dihydroquinoline products.

An attempt is made to correlate the measured reaction rates for a series of benzyl-substituted compounds with calculated values of the equilibrium constants for H^- transfer, following the Marcus treatment.

83. Absolute configuration of the isomers of $Co(III)(NH_3)_3ATP$

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$Co(III)(NH_3)_3ATP$ exists as 4 tridentate complexes which can be separated by column chromatography on cross linked cycloheptaamylose. The absolute configuration at the α and B phosphates for each isomer were determined from the size of ^{18}O-induced shifts in ^{31}P NMR peaks when either R_P-α-[^{18}O]-ATP or Sp-B-[^{18}O]-ATP was used to form complexes. The configurations in order of elution from cycloheptaamylose are Λ endo Δendo Δexo Λexo. NMR and CD spectra parameters are reported. The chiral ^{18}O ATP is made by desulfurization of ATP-αS or STP-BS with Br_2 at pH below 3. Now that the absolute configurations of these complexes are known they can be used as probes of enzyme substrate specificity for those enxymes that use tridentate Mg ATP.

84. The isolation and examination of α-lactalbumin mRNA from mouse mammary glands.

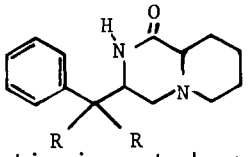
R.L. HERBER, AND B.K. VONDERHAAR

Previous studies have shown that milk separated from mammary gland tissue contains two forms of α-lactalbumin. Milk which is secreted from the mouse contains only one form of α-lactalbumin. To determine the number of messages for α-lactalbumin the RNA from mouse mammary glands was isolated by cesium chloride gradient centrifugation. The RNA was resolved into bands by gel electrophoresis and an autoradiograph was prepared. The autoradiograph exhibited a single band of RNA, indicating a single message for α-lactalbumin. These results are conclusive within the sensitivity of this method for distinguishing multiple bands.

85. The synthesis and identification of 3-(2-phenyl-2-propyl)-1-oxo-octahydro-2H-pyrido[1,2a]pyrazine: a structural analogue of the naturally occuring fungal metabolite; Verruculotoxin.

K. E. COUCH AND J. G. MACMILLAN

Chemistry Department, University of Northern Iowa, Cedar Falls, Iowa 50614



1. R = H
2. R = CH_3

In a continuing study on the structure-activity relationship of verruculotoxin (1), the synthesis of 3-(2-phenyl-2-propyl)-1-oxo-octahydro-2H-pyrido[1,2a] pyrazine (2) was accomplished in a five step synthesis starting from 2-amino-3-phenyl-3-methylbutanoic acid. The latter amino acid was prepared by the method of Jonsson and Mikiver.

Infrared and 360 MHz proton and carbon NMR allowed the identification of the structures of the intermediates and final compound.

86. Catalytic Properties of Erythrocyte Acetylcholinesterase in muscular dystrophy

L. L. HENDERSON, B. K. WAX, R. B. ROSENBERG

Chemistry Dept., Drake Univ., Des Moines, Ia., 50311

Erythrocyte acetylcholinesterase (AChE) from normal and dystrophic mice was solubilized with Triton X-100 and purified by affinity chromatography. Kinetic studies were conducted on the crude triton extracts and on the purified enzymes. Comparison of the Km's of normal and dystrophic AChE showed a decreased affinity of the dystrophic AChE for its substrate. For example, the crude normal AChE has a Km of 0.06 mM while the crude dystrophic AChE has a Km approximately 5 times that value. Comparison of purified preparations to crude preparations showed a higher Km for purified AChE, probably reflecting a dependence on the hydrophobic membrane environment for optimal activity. For example, the Km of the crude normal AChE is 0.06 mM while the pure normal has a Km of 0.20 mM.

87. Erythrocyte Acetylcholinesterase in muscular dystrophy

L. L. HENDERSON, W. LYON, B. K. WAX

Chemistry Dept., Drake Univ., Des Moines, Ia., 50311

Erythrocyte acetylcholinesterase (AChE) from normal and dystrophic mice was solubilized with Triton X-100 and compared by polyacrylamide gel electrophoresis (PAGE) and sucrose density gradient centrifugation. PAGE gels were stained for AChE activity. Normal AChE preparations showed 5 bands while dystrophic AChE preparations showed 3 bands. Gradient centrifugation revealed 5 AChE peaks for each preparation. The distribution of AChE differed, however, between normal and dystrophic preparations. The dystrophic AChE had a greater proportion of the activity in fractions corresponding to smaller sized aggregates while the normal AChE had an increased proportion in fractions corresponding to intermediate sized aggregates.

Conservation

88. The effect of sex and age on fall dispersal in Fox Squirrels (Sciurus niger) in Iowa woodlots

K.T. DeLong

Department of Biology, Grinnell College, Grinnell, Iowa 50112

Intensive live-trapping of 61 individuals indicated a sharp peak in dispersal by adult males in October, by immature females in October and November, and by immature males in November. All adult males captured prior to October were residents, whereas 50% of those captured in October were caught only once and 70% of the immatures of each sex were caught only once. All squirrels present were identified during the winter. Simultaneous trapping of an adjacent woodlot indicated that these movements were not local. Radio-telemetry (from July to December) of collared adult females confirmed live-trapping data that all adult females were residents and none dispersed from the woodlot or altered the location of their home range.

89. Intensive Trapping With Removal for Rodents in the Loess Hills

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Department of Biology, Mount Mercy College, Cedar Rapids, IA. 52402.

A grid of 390 live traps was established in a 5000 m area on the Loess Hills Wildlife Area near Turin, Iowa. The traps were checked and re-baited daily for 13 days. Animals caught were recorded by number of individuals per species and transported away from the trapping site. It was hypothesized that species composition might change on successive days because the

most common, competitive species would be the first caught. As trapping continued, less common and less competitive species would then be caught. No significant changes in species composition were noted and no rare species were captured. An increase in trap success was noted following thunderstorms. The results add evidence to the rarity of some small mammals in the Loess Hills.

90. Foraging strategy and food habits of a threatened species in Iowa, the small-mouthed salamander (Ambystoma texanum).

S. R. McWilliams and M. Bachmann

Dept. of Animal Ecology, 124 Sciences II, Iowa State University, Ames, Iowa 50011

A field study supplemented with lab experiments of larval small-mouthed salamander foraging strategies showed urodele larvae are opportunistic predators which will select prey under certain prey densities and prey-type conditions. Larvae feed predominantly on relatively slow moving prey affiliated with the substrate with little significant diel shift in food habits. Ontogenetic food habit shifts are conspicuous; however, whether this is the result of foraging strategy changes, morphological development, or prey population shifts is unclear.

91. Effect of weather on breeding success of vesper sparrows

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Iowa State University
Ames, IA 50011

Breeding success of vesper sparrows (Pooecetes gramineus) in corn and soybean fields is affected not only by farm operations but also by weather. Activities of vesper sparrow pairs were monitored during summers of 1984 (an unusually wet season) and 1985 (an average-to-dry season). Breeding success and territory characteristics were recorded for 37 pairs each year. Vesper sparrows produced fewer successful nests in the dry season. Factors affecting nesting success included number of cultivations by the farmer, length of breeding season, and amount of crop residue. Annual variation in these factors can be attributed to the season's weather.

92. Energy flow and community dynamics in an agriculturally impacted stream ecosystem II: Invertebrate dynamics

T. E. Robertson and R. W. Bachmann

Department of Animal Ecology, Iowa State University, Ames, Iowa 50011

The upper reach of the Big Creek ecosystem (Boone Co.) was the subject of an intensive field study from June 1982 through November 1983. An important component of the study included the analysis of the functional characteristics of the invertebrate community. Quantitative samples of the invertebrates were taken from June 1982 through November 1983 at regular intervals. The invertebrates were classified into functional groups according to the classification scheme utilized by Cummins. The abundance of each functional group, their seasonal dynamics and relationship to the functional dynamics of the Big Creek ecosystem are discussed.

93. Reintroduction of river otters in Iowa

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Iowa Conservation Commission, 1203 North Shore Drive, Clear Lake, IA, 50428

On March 19, 1985, sixteen river otter (8 males and 8 females) were released at the Red Rock Reservoir in an effort to determine if they could be reestablished on inland habitat in Iowa. A radio transmitter was surgically implanted into the body cavity of each otter to monitor survival, movement and habitat use.

Beaver lodges and dens and brush piles were utilized by otter over 60 percent of the time. The oxbows and other backwaters of the Red Rock Reservoir are important components of summer and fall otter habitat.

Two known mortalities have occurred. One otter died of complications associated with the implanted radio and one was caught in a snare set for a raccoon approximately 20 miles upstream from the reservoir. Two otters moved from the Des Moines River Drainage to the Skunk River drainage. One animal moved downstream approximately 35 miles from the release site. An additional 120 will be introduced at 6 different sites over the next 3 years.

94. Action-grid analysis in recreation management

W. H. Gilbert

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Simpson College; Indianola, Iowa 50125

In the summer of 1985, the U.S. Army Corps of Engineers carried out a large-scale survey of visitor satisfaction within the campgrounds of their recreational facilities in Iowa and other states. I did the survey at Lake Red Rock (Marion County) using the method of action-grid analysis develop-

ed by Larry Lawrence, of the Recreation Research Program at the U.S. Army Waterways Experiment Station in Vicksburg, Mississippi.

Purpose of the action grid is to reveal services that are considered to be (1) important and done well, (2) not important, but done well (overkill), (3) important but not done well (try harder), and (4) not important and not done well. This paper will focus on the methods and results of action grid analysis at Lake Red Rock, where visitation is over 1.1 million annually and five campgrounds include over 400 class A units for family & group camping. However, this method of analysis lends itself well to recreational facilities at local, county, & state parks, or any other facility where assessment of user satisfaction is needed.

Engineering

95. Demonstration of a Process for Decomposing Waste Gypsum.

C.-W. FAN, K. FLOY, AND T. D. WHEELOCK

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A potentially useful industrial process for decomposing waste gypsum to produce sulfur dioxide and quicklime was demonstrated in a small pilot plant which utilized a unique two-zone fluidized bed reactor operating at 1100°C. This process provides a means for utilizing vast quantities of waste gypsum produced by the chemical and fertilizer industries. The sulfur dioxide produced by the process can be utilized for the production of sulfuric acid required by these industries and the quicklime can be utilized for neutralizing acid soils, stabilizing road building materials, and treating power plant stack gases.

96. Carbochlorination of metal oxides in a fused salt slurry reactor

M. S. DOBBINS AND G. BURNET

Ames Laboratory and Department of Chemical Engineering, Iowa State University, 135 Sweeney Hall, Ames, IA 50011

The feasibility of chlorinating metal oxides by slurrying the reactants in NaCl-$AlCl_3$ melts at 530-800°C and then sparging chlorine into the melt has been investigated. A mechanically agitated, semi-batch reactor was used to test the effect of temperature, oxide and carbon loading, salt composition and gas flow on the reaction rate.

Chlorination of pure alumina was found to be kinetically controlled at temperatures below 650°C, while gas-liquid mass transfer controlled at higher temperatures. The chlorination rate of the mixed oxides found in coal fly ash was also mass transfer limited at higher temperatures and alumina conversions of less than 50%. At higher alumina conversions, the overall rate was limited by the rate of ash dissolution into the melt. Conclusions about the reaction mechanism and feasibility of the fused salt reactor concept will be presented and discussed.

97. Performance of lime-soda sinter process residue in the manufacture of sulfate-resistant portland cement

J. A. CHESLEY AND G. BURNET

Ames Laboratory and Department of Chemical Engineering, Iowa State University, 271 Metals Development, Ames, IA 50011

The residue from the Ames Lime-Soda Sinter Process for recovering alumina from power plant fly ash consists largely of dicalcium silicate and shows promise as a raw material for the manufacture of a low-alumina, sulfate-resistant portland cement. A laboratory burnability study has been conducted to determine the best way to utilize this raw material from both a clinker quality and economic perspective. The amount of unreacted lime in the clinker was used as a measure of the reactivity of raw mixes by indicating the extent to which the cement reactions had progressed.

Conditions of residence time and temperature used for the burnability tests were chosen to simulate actual cement kiln operation. A factorial experimental design included the parameters of burning temperature, lime content, and alumina (flux) content. Preliminary results indicate that a raw mix made from the sinter residue yields a satisfactory cement.

98. Stabilization of coal cleaning wastes by a sintering process

A. J. GOKHALE AND G. BURNET

Ames Laboratory and Department of Chemical Engineering, Iowa State University, 275 Metals Development, Ames, IA 50011

The primary objective of this investigation was the stabilization of coal cleaning and mining wastes by aggregation and sintering to form impervious, vitreous granules. The result is an inexpensive method for eliminating environmental problems caused by dusting, leaching, and smoldering at waste disposal sites. The process utilizes the energy (fuel) and sintering materials inherently present in the wastes.

The study was based on coal cleaning waste from the River King Coal Preparation Plant in Freeburg, IL. The coal and waste are similar to those from Iowa mines.

Characterization and grinding of the waste, the formation and testing of green granules for strength and durability, the design and operation of a fixed bed sintering furnace, and preliminary evaluation of the sintered granules formed will be discussed.

99. Physical property variability of Class C fly ash from a single source

J.W. AUSTIN, K.L. BERGESON, AND T. DEMIREL

Civil Engineering Department, Materials Engineering Section, Town Engr. Bldg., Iowa State University, Ames, IA 50011

Past research conducted at Iowa State University had indicated that the ASTM C-618 physical and chemical test results, on fly ash from a single source, remained relatively consistent over time. Current research on fly ash paste mixes from a single source revealed 28 day compressive strengths varying significantly from 600 pounds per square inch to 5200 pounds per square inch with no apparent differences evident from ASTM C-618 test data. From x-ray diffraction testing of hydrated samples, significant differences in type and quantity of cementitious reactions products was determined. Results of these tests will be presented and discussed along with postulated mechanisms of reaction product formation.

100. Morphological characterization of Indian fly ash at site #1

L. D. BLANKENFELD, A. U. DOGAN, A. F. VETTER AND R. RAJAGOPAL

Center for Particulate Material Processing Sciences Chemical and Materials Engineering Department, 1153 Engineering Building, University of Iowa, Iowa City, IA 52242

Fly ash is the non-combustible material from coal that is carried out of the bed by the flue draft. It contains several metal oxides that can be recovered. Analysis of the morphological characteristics of the fly ash could yield a better understanding of its nature and a cost-effective design to extract these metals and eliminate the toxic elements.

Fly ash samples were collected from a five stage electrostatic percipitator of a power generating facility in India. Complete morphological characteristics including equivalent radius, not-roundness, roughness, morphic aspect ratio, C-2 symmetry, C-3 symmetry, and C-4 symmetry were determined using the Shape Analyzer and a scanning electron microscope. The composition was analyzed using X-ray microanalysis.

Preliminary study indicates a relationship between morphic features and composition of the Indian fly ash.

101. Application of Mathematical Programming to an Agricultural Production - Distribution System

M. ZUO, WAY KUO AND K. L. MCROBERTS

This paper reports an application of mathematical programming method to production planning for a large seed corn production system. The system consists of production plants and sales regions in five geographical production divisions, each of which operates independently. An analysis of the current situation reveals that total production and transportation costs could be minimized by growing hybrids in geographical areas that provide maximum yields at the same time satisfying system operating restrictions. To help the management to make production decisions, several iterative linear programming models along with heuristic discussions were developed. From these models the optimal or suboptimal solutions and an accompanying sensitivity analysis provide the management with significant potential savings.

102. Preparation of silicon nitride by ammonolysis of silica

B. G. DURHAM, M. J. MURTHA AND G. BURNET

Ames Laboratory and Department of Chemical Engineering, Iowa State University, 270 Metals Development, Ames, IA 50011

Silicon nitride is of interest as a structural ceramic for use in adiabatic heat engines because of its toughness, high strength, low coefficient of friction, low thermal expansion, and thermal shock resistance. Most prior work on the preparation of silicon nitride has dealt with the reaction of highly pure silicon powder with nitrogen for prolonged periods of time at high temperature. An alternate method would be the reaction of SiO_2 with NH_3 in the presence of C. The thermodynamics and kinetics look attractive.

A bench scale reactor has been designed and built to carry out the gas/solid reactions involved at temperatures up to 1500°C. A direct coupled gas chromatograph is used to analyze the off-gases. Results from tests in which the SiO_2:C ratio, particle size and surface area, temperature and NH_3 flow rate were varied will be discussed.

103. Thermotransport of cobalt in thorium

S. C. AXTELL AND O. N. CARLSON

Ames Laboratory and Department of Materials Science and Engineering, Iowa State University, 124 Metals Development, Ames, Iowa 50011

The mass transport of cobalt in thorium resulting from an applied temperature gradient was investigated over the temperature range 1000-1270°C. Thermotransport of cobalt was towards the hot end of the sample. The heat of transport appeared to be temperature dependent, increasing with increasing temperature from -91.6 to -40.6 kJ/mol.

104. Effects of crystallization conditions on crystal habit

A.D. Ah Chin, J.K. Beddow, A.F. Vetter and D.W. Luerkens

Chemical and Materials Engineering, 1153 EB, University of Iowa, Iowa City, IA 52242

The crystallization conditions of sugar crystals were varied and the effects on crystal morphology, size and size distribution were experimentally studied. Crystal samples were recrystallized, and before-and-after comparisons of shape and size were conducted.

105. A study of the effect of chemical complexation in precipitation processes

C. M. NIMAN, D. W. LEURKENS

Center for Particulate Material Processing Sciences Chemical and Materials Engineering Department, 1153 Engineering Building, University of Iowa, Iowa City, IA 52242

Two state continuous precipitation experiments have been carried out to study the effect of chemical complexation in precipitation processes. The precipitation kinetics and morphological properties of the resulting solid product are related to the formation of chemical complexes during precipitation. The chemical systems of interest are those in which anions of weak acids are used to precipitate cations from a strong acid media.

106. Photoresponsive polyethylene

D. E. HAUENSTEIN, J. T. TULLER, S. HOEFS, D. DEVINE, M. ETRINGER, AND D. G. RETHWISCH

Department of Chemical & Materials Engineering, University of Iowa, Iowa City, IA 52242

There has been an interest in the use of photoisomerizable molecules, capable of reversible trans-cis isomerism, as a means of photocontrolling the physical properties of polymers. Polymers containing such photoresponsive molecules may undergo conformational changes upon photoirradiation, reversibly converting physical and chemical properties of the polymers and their polymeric solutions. Polyethylene materials with an azo dye, or diazo dye, incorporated in the polymer matrix have been examined for physical modifications upon photoirradiation. Preliminary studies exhibit varied dimensional changes dependent upon the dye-to-polymer ratio and the particular dye used.

107. Purification of vanadium and niobium by solid state refining

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Vanadium and niobium metals can be purified by three different solid state refining techniques: external gettering, vacuum degassing and electrotransport purification. The reasons for the interest in high purity V and Nb and the principles on which these purification processes operate are described.

The advantages of each process and the degree of purity attainable by each is discussed. The results of the electrotransport purification of several metals are compared with those for V and Nb. The use of the residual resistivity as a method for characterizing the purity of a metal is reviewed and a correlation between RRR values of vanadium and the chemically analyzed purity is presented.

An apparatus for purifying multiple bars by electrotransport is described.

108. VLSI NMOS PLA implementation of four points parallel input/output fast Walsh-hadamard transform processor

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It is well known that Walsh-hadamard transform takes only binary values and is widely used in signal processing and image processing areas.

The designed processor implements Walsh-hadamard transform by using the fast algorithm compatible with FFT (Fast Fourier Transform) and uses parallel input/output data bus to make design modularity, easy for further expansion to larger system.

NMOS NOR-NOR PLA technique was used since premitive NOR gate operates faster than NAND gate and PLA folding option gives optimal realization for large system. Two phase non-overlap timing scheme was chosen to eleminate racing and the potential of hazard, a sort of carrier look ahead circuit was utilized to reduce the operation cycles from four to two.

The highest operation speed of the processor is 10Mhz with low power consumption (137 mW at 5 Volts), and the test pattern by using CAD (Computer Aid Design) tools MOSSIM and CRYSTAL gives the result which is matched to the software implementation result.

109. Economic developments in Iowa stemming from the center for particulate material processing sciences

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Particulate Science and Technology has been a subject of teaching and research at the University of Iowa for most of the last twenty years. More recently the Center for Particulate Material Processing Sciences has been conceived and is in the process of start-up. Particle technology is ubiquitous in US industry including those in the State of Iowa. In addition the establishing of the Center has facilitated corporate start-ups in Iowa. This paper describes the features of the Center and discusses the potential of its impact on commercial and industrial development in this State.

110. Adhesion of particulate contaminants

K. W. MONTZ, J. K. BEDDOW AND P. B. BUTLER

Fine Particle Research Group
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A novel approach is reviewed for the removal of contaminant particles from various substrates. A wide variety of engineering applications could be found for such a technique specifically in the electronics industry.

The dependence of particulate contamination removal as a function of the particulate material properties, the substrate properties, and surrounding environment will be presented. Preliminary results from an SEM study to visualize the contact type and environment will be discussed.

111. Application of texture analysis on size distribution of powders

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In this paper, Texture Analysis is used to characterize particle size distributions of powders. Statistical texture parameters are correlated with the particle size distribution parameters of powders under both static and dynamic conditions. This work will provide a basis for potential on-line characterization of powders.

112. Relationship between depositional setting and morphic descriptors of the Parkman sandstone

A. D. BLANKENFELD, D. U. DOGAN AND A. F. VETTER

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Previous work to establish the relationship between depositional environment of ancient sandstone and its morphic characteristics proved inconclusive. Ancient sandstones tend to cement with different types of clay; the effect of these clays on the morphic features of the sandstone were not taken into account.

Relationships between depositional environment, autogenic minerals, and their morphic characteristics were established. Morphic descriptors including equivalent radius, not-roundness, roughness, and several fold symmetry were analyzed using the Shape Analyzer. Detailed surface features and clay minerals were identified using scanning electron microscopy and X-ray microanalysis.

It is proposed that eliminating the effect of clay on the morphic descriptors yields a more accurate model.

113. The abrasive wear resistance of ultra-high molecular weight polyethylene

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The abrasive wear resistance of Ultra-High Molecular Weight Polyethylene (UHMWPE) is examined and compared to that of several other materials. Laboratory studies using the Dry Sand Rubber Wheel Abrasion Test standard ASTM procedure are presented. Also discussed is preliminary field test data of the volume loss of UHMWPE in a severely abrasive industrial environment.

Results indicate that although the resistance of UHMWPE to three body abrasive wear can be considered relatively good, it does not outperform such materials as hard chromium plating and hard steels.

114. On-line inspection of ferromagnetic material methods

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Irreversible magnetic effects can be used for nondestructive characterization of the microstucture of ferromagnetic materials, like iron, steel, nickel, etc. Discontinuous motion of domain walls in ferromagnetic materials generates bursts of magnetic induction (magnetic Barkhausen noise, MBN) and bursts of acoustic emission (magnetomechanical acoustic emission, MAE) during magnetization. MBN has been used extensively in Finland for on-line grain size measurement of steel.

Our results of MBN and MAE in nickel show that these techniques can be used for evaluating the microstructural parameters, like dislocation density, extent of recrystallization, grain size, etc. Thus these techniques pose a great potential for on-line nondestructive evaluation of ferromagnetic materials. The magnetic NDE techniques and the results will be discussed.

115. Solution for apparent cohesion in ideal soil

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The surface tension of water causes attractive forces to develop between the particles of a partially saturated soil. This attraction is generated by the tension that developes within the curved liquid-vapor interface of moisture films surrounding the soil particles and is directly proportional to the surface tension of water and the curvature of the liquid-vapor interface. The tension developed creats effective compressive stresses between soil particles and thus imparts an apparent cohesion to the soil mass.

In this paper the determination of the apparent cohesion for an ideal soil composed of uniform spheres as a function of moisture content is presented.

116. Property averaging in heterogeneous solids

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Rigorous formulas for averaging the transport and elastic properties of multiphase solids hold only for the simplest kinds of microstructures. When microstructures are complicated, engineers and designers often resort to a suggestion by Bruggermann's whereby a fixed value of n (between +1 and -1) is inserted in the equation

$$\gamma^n = \sum_{i=1}^{k} \nu_i \gamma_i^n.$$

Then it is solved for γ which is the average or overall value being sought. The subscript i ranges over all k phases in the microstructure, ν_i denotes the volume fraction of each and γ_i is the property value for each individual phase.

Certain mathematical pitfalls with this approach are noted and recommendations for avoiding them are given. For example, if n comes out too close to zero, one should use the geometric mean,

$$\gamma = \prod_{i=1}^{k} \gamma_i^{\nu_i}.$$

117. **Prescale film pressure quantification**

D.R. PEDERSEN, D.D. ANDERSON, R.J. SINGERMAN and T.D. BROWN

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Prescale is a thin two-part pressure sensitive film used to assess contact areas. Inference of absolute pressure magnitudes has relied either upon gross visual comparisons with stains produced by known pressures, or upon a pre-calibrated densitometer with a 3 mm diameter optical field. Since prescale is potentially applicable to very small contact regions, such as human articular joints, a technique was developed to assess staining intensities using a high-resolution digital scanner. The method assigns weighted RMS values to a series of known loads. These sequential known values define a calibration curve which is used to quantitate the distribution of unknown stresses within the experimental contact region. Comparisons between an analytical Hertzian solution and stain intensity measurements from an experimental contact model show the method to be an improvement over currently available invasive methods of contact stress assessment.

118. Analysis of positive photoresist using the scanning electron microscope

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Central Electron Microscopy Facility,
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Iowa City, IA 52242

Positive photoresists are used extensively as an imaging material for integrated circuit fabrication in the microelectronics industry. Analyzing, improving, and optimizing a photoresist process is greatly enhanced by the ability to observe its microscopic characteristics and topography.

High resolution scanning electron microscopy is used to examine detailed surface features of photoresist patterns on a silicon substrate. The effects of postbaking the photoresist, exposure to ultraviolet radiation, and conductive coating uniformity and thickness were investigated. Preliminary study suggested a satisfactory method for observing positive photoresist patterns.

119. Development of a conductometric test for frost resistance of concrete.

B. W. GUNNINK

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Freezing and thawing is the basic cause of a widespread form of concrete deterioration due to formation and growth of ice in pores of concrete. Vulnerability of concrete to frost damage is governed by the size distribution of the pores.

A method has been developed which allows the pore size distribution of saturated porous materials to be determined. The method is based on a thermodynamic model of freezing in capillary size pores and the resultant change in the electrolytic conductance of the material. Changes in the pore size distribution of concrete which occur as it deteriorates can also be determined.

120. Ned Ashton: An engineer's life-work preserved

S.T. GRANT and W.D. ASHTON

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Ned L. Ashton (1903-1985) spent a productive career as a civil engineer working privately and serving, for a time, as a professor of engineering at the U. of Iowa. A strong advocate of building on the strengths of existing structures, Ashton rehabilitated and designed numerous bridges including many large Mississippi River bridges. His advancements in early welding techniques allowed him to design the first all-welded girder bridge. He was among the first to use aluminum extensively in bridge construction. Most of his work involved creative design applying basic engineering concepts to the advancements of engineering construction methods. Among his achievements was the design of a 140 ft. diameter radio telescope currently in service in Greenbank, West Virginia. Ashton carefully documented his work and, during his career, saved original tracings, calculations, blueprints, photographs and work records; thousands of which have been donated to the Iowa State Historical Department. This collection represents both the life-work of an eminent Iowa engineer as well as a valuable resource to engineers, students, city and *state governments* and historic preservationists.

Geology

121. Lithofacies indicative of a braided stream environment in a Late Wisconsinan (LW) valley-train terrace on the Iowa River

D. J. Quade

Iowa Geological Survey, 123 N. Capitol St., Iowa City, IA, 52242

Valley-train outwash deposits in a LW terrace of the Iowa River near Belmond, Iowa were studied close to their outwash source, the Altamont End Moraine System. Deposition by a rapidly aggrading braided stream, is suggested by numerous channel fills and bar forms. Three successive increments were exposed in the upper portions of this terrace. The lower increment consists of solitary sets of large-scale cross-bedded sand to pebble gravel with complex upper and lower contacts, and simple channel fills that are in places incised into the cross-beds. The middle increment consists of simple and multi-storey channel fills of pebble to cobble gravel, as well as large scale solitary sets of planar and wedge cross-beds. The upper increment is a massive cobble gravel truncated in places by large-scale, simple channel fills. This increment grades upward to a massive sand and loam unit less than .5 m thick which has the modern soil developed into it.

122. Origin of cherts in the Burlington Limestone (Middle Mississippian) of southeastern Iowa and western Illinois

L. S. SEIGLEY

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Origin of the cherts in the Burlington Limestone of Iowa and adjacent states has been controversial since first investigated (Tarr, 1917). Nodular and brecciated cherts have been interpreted variously as primary nodules that were precipitated on the sea floor, secondary replacement features, and diagenetic nodules reworked by storms. Much progress has been made in the understanding of chert genesis during the past decade through application of petrographic and geochemical techniques, in particular the use of hydrogen and oxygen isotopic signatures to interpret temperature and salinity of the silica-bearing solutions. Paired samples of limestone/dolomite and chert as well as samples illustrating diverse aspects of silicification were analyzed isotopically. This in addition to petrographic examination of the rocks was used to gain insight into the source of silica, the manner in which the silica moved from its source to its site of precipitation, the factors controlling silica precipitation, and timing of silica precipitation relative to deposition and diagenesis.

123.Deposition and diagenesis of the Lower Silurian Waucoma Limestone Formation

P. R. Bowman

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The Lower Silurian Waucoma Limestone Formation in northeastern Iowa is stratigraphically equivalent to dolomites of the Tete des Morts, Blanding and lower Hopkinton Formations in the dolomite sequence to the south. The Waucoma is comprised of bioturbated limestones, dolomitic limestones and dolomites and is characterized primarily by skeletal wackestones and packstones. An abundant and diverse fauna suggests deposition occurred in a normal marine environment. Diagenesis, including dolomitization and silicification, may be explained by progression from the marine phreatic to mixing zone, saturated meteoric phreatic and undersaturated meteoric phreatic environments, to the meteoric vadose environment coincident with or following marine regression. Rapid regression affording limited residence time in the mixing zone environment is suggested for partial dolomitization.

124. Interpreting histories of cementation of healed brittle structures in the Plum River Fault Zone (PRFZ) of the Upper Mississippi Valley

G. A. LUDVIGSON

Iowa Geological Survey, 123 North Capitol Street, Iowa City, Iowa 52242

The 180 km -long, east-west trending PRFZ cuts obliquely through the outcrop belts of Ordovician, Silurian, and Devonian carbonate strata in eastern Iowa and northwestern Illinois. Regional stratigraphic studies of these rocks indicate that the PRFZ was the locus of episodic deformation through most of the Paleozoic Eon. Secondary pore networks in zones of cataclastic deformation and fractures within the PRFZ are filled by carbonate sediments and cements that record differing physicochemical conditions during separate episodes of deformation along the structure. Different stages of fracture-filling carbonates have been distinguished by fabric criteria, characterization of Mg, Fe, Mn, and Sr distributions, and measurement of $\delta^{18}O$ and $\delta^{13}C$ values. Examples of fracture-filling phases include: (?) L. Ord. dolomite extension veinlets in the Dubuque Fm. (L. Ord.); (?) M. Dev. calcite veinlets and neptunian dikes in the Cedar Valley Fm. (M. Dev.); and (?) L. Penn. calcite, siderite, goethite, and pyrolusite veinlets in the Scotch Grove and Hopkinton fms. (Sil.).

125. Mississippi-Valley-Type (MVT) sulfide mineral deposits associated with Plum River Fault Zone (PRFZ) of Upper Mississippi Valley (UMV)

G. A. LUDVIGSON

Iowa Geological Survey, 123 North Capitol Street, Iowa City, Iowa 52242

Three MVT deposits are known to have genetic relationships to the PRFZ: 1) FeS_2-ZnS-$CaCO_3$ deposits at the Martin Marietta Quarry (MMQ) in Linn Co., IA; 2) FeS_2 deposits in an area of former Pb prospecting near Preston (PC) in Jackson Co., IA; and 3) FeS_2-PbS-ZnS deposits in an area of former Pb mining near Mount Carroll (MTC) in Carroll Co., IL. Structural styles include veinlets filling normal mesofaults synthetic to the PRFZ (MMQ and MTC), and breccia deposits within the PRFZ (PC). The former, located on the proximal upthrown side of the PRFZ, were formed during a period of N-S extension. Mean $\delta^{34}S$ values (E. Ripley, Indiana U.) for the deposits are: MMQ=19.7°/oo (n=7); PC=15.9°/oo (n=2); and MTC=-3.1°/oo (n=5). Unique evolutionary histories are indicated for each deposit, although $\delta^{34}S$ values from MMQ and PC overlap those documented from UMV Zn-Pb ores. Pb isotopic ratios (T. Millen, N. Ill. U.) from MTC conform to isoratio maps published for radiogenic Pb in UMV ores. Linear covariance between $\delta^{34}S$ and $^{206}Pb/^{204}Pb$ in MTC galenas suggest transport and precipitation from a single solution.

126. Stratigraphy and paleontology of the upper Cedar Valley Formation in northern Iowa

J. E. Day, B. J. Witzke, and B. J. Bunker

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Devonian strata of the upper Cedar Valley Formation in northern Iowa formerly included in the Coralville Member are now recognized to be younger than the type Coralville. These strata had been informally referred to the "Bloody Run Stage" of the Cedar Valley by Belanski (unpub. notes) and Fenton (1919) in the early part of this century. The upper part of the Cedar Valley is characterized by complex interbedded marine limestones and dolomite and restricted marine limestones, in part laminated to intraclastic (including lithograph stone beds at Lithograph City, Floyd Co.). The conodont Pandorinellina insita ranges throughout these strata suggesting a latest Givetian to early Frasnian age. A moderately diverse brachiopod fauna in the upper part of the sequence (including: Allanaria, Athyris, Eleutherokomma, Floweria, Strophodonta, Variatrypa, and others) allows correlation with early Frasnian faunas of Canada and the western U. S. The Geological Society of Iowa field trip following the IAS session will examine surface exposures of these rocks.

127. Restoring a large collection of mine maps: problems and solutions

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The Iowa State Historical Department, in cooperation with the Iowa Geological Survey and the Department of Soil Conservation, began restoring 1500 maps of abandoned Iowa coal mines in 1984. Whereas restoration of most of these blueprints and original maps proves routine, many present challenges. Removing tape is most time consuming with masking tape being especially stubborn. Most maps are washed, dried and flattened. If they cockle they are rehumidified and re-flattened. Japanese tissue mends cause blueprint paper fibers to expand and contract differently. "English" or "Dacron" backing allows piecing a whole map together onto a new back. Such backing is useful when a map has torn or deteriorated into many pieces. All coal mine map information is necessarily kept intact as original. The maps are then protected by encapsulation, an awkward process if maps are very large. Producing well-protected, restored maps while respecting integrity of information remains the goal in restoring these valuable resources.

128. A review of types of coal mine subsidence and related factors in development of subsidence.

P. E. VanDorpe

Iowa Geological Survey, 123 N. Capitol St., Iowa City, IA 52242

Coal mine subsidence, lowering of the ground surface due to lack of support within the mine, can result in depressions (troughs), cracks, and pits (craters or sinkholes) at the land surface. Attributed to roof collapse, pillar crushing, and pillar punching (or floor heave), subsidence threatens 398,600 urban acres in 18 states at a potential stabilization cost of almost $12 billion dollars. Models or theories of subsidence are generally limited to surface displacement above active mines. Descriptive models of earth movements associated with abandoned mines have been developed for certain areas, most notably in Illinois. Documented case histories of subsidence show that sinkhole development does not occur where overburden thickness is greater than 175 feet, whereas trough subsidence dominates below about 125 feet. Subsidence has been attributed to lack of competence of overlying rock units, physical conditions, or engineering properties of the rocks, structural features, groundwater conditions, geochemical properties, and overburden relationships.

129. "Classic" and different types of coal mine subsidence in Iowa.

P. E. VanDorpe

Iowa Geological Survey, 123 N. Capitol St., Iowa City, IA 52242

In Iowa, coal mine subsidence is well documented, however it has not been well studied in terms of physical characteristics or geologic control. Subsurface and mining information is generally inadequate to document either causal relationships or physical conditions. In Iowa, "classic" bell-shaped sinkhole development is dictated by geological conditions only grossly similar to those described in Illinois in loess terrain. Other sinkholes are noticeably smaller and, in some cases, may have gone unrecognized as attributable to mine collapse. Trough subsidence has yet to be confirmed in Iowa, but at least one potential site exists. Zones of compression and tension have not been delineated, rather differential surface movement may be the dominant characteristic. Variations of classic sinkhole development have been observed in Iowa, here informally termed whole-room collapse. Surface expressions are extremely subtle. Earth movements like these are potentially more likely to occur and may affect more property than the classic sinkhole- or trough-type subsidence.

130. Tectono-stratigraphy of the North Anatolian Fault in Bolu Province, Turkey

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The North Anatolian Fault (NAF) is a broad zone that extends across northern Turkey and is interpreted as marking the northern boundary of the Anatolian plate. There have been over 30 shallow earthquakes of M≥6 since 1906; at least ten of these were associated with right slip active faulting in Northern Anatolia.

The study area is in the western extension of the fault at Mudurnu Valley. Three contrasting stratigraphic assemblages divided by strands of the fault and corresponding geologic columns such as the "northern", "central", and "southern" assemblages, and their geologic histories were established. The recent earthquakes have been compared with geological faults. The northeast-southwest trending faults strike at high angle to the NAF, have no surface rupture, and are not likely to move. Faults trending subparallel to the NAF are all likely to move. Some faults may be the beginning of a stepped right enchelon offset of the NAF.

131. Interstratal caves in the St. Peter Sandstone

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Middle-Ordovician St. Peter Sandstone in and near the Paleozoic Plateau (Driftless Hill Land) of the Upper Mississippi Valley Region contains many small, partially breakdown-filled caves with fracture-controlled walls and ceilings. These caves occur beneath hilltops in southwestern Wisconsin and southeastern Minnesota, along valley floors in northeastern Iowa, and hundreds of feet beneath the bedrock surface in central Iowa. They are not oriented toward modern drainage and appear to have evolved from solutional voids in the underlying Shakopee Dolomite.

Apparently, water moving in the St. Peter sometimes mixed with water of different chemical composition in the Shakopee and, at those places, dissolved out mixture-solution caves. These caves probably were formed at widely varying times by water circulating regionally at great depth within the aquifer. Analogous caves occur stratigraphically lower in the same aquifer, near the contact of the Oneota Dolomite and the New Richmond Sandstone.

Caves in the St. Peter Sandstone in the Twin Cities area are soil pipes, not interstratal caves.

132. Compositional variation in the ophiolites along the North Anatolian Fault

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The study area in the Kastamonu Province, Turkey is accompanied by a large amount of ophiolites in great diversity along the North Anatolian Fault (NAF). The Elekdag Metaophiolite in the north and the Kargi Ophiolite in the south of the fault are generally composed of two different groups of ophiolites. The first group is called the sequence type ophiolites which usually form layered masses showing a more or less regular stratigraphic sequence of ultrabasic to diabase from the bottom upwards. The other group has no definite stratigraphic sequence. In between, metamorphic terrains are so chaotically disturbed that reliable interpretation of the field relations of ophiolites is difficult.

Quantitative and semi-quantitative spectrochemical analyses were made using x-ray fluorescence, an electron probe microanalyzer, and a solid state detector of a scanning electron microscope. Analysis of the major elements such as Fe, Al, Si, Mg, and trace elements such as Ti, Zr, Y, Nb, Sr, Cr showed differential trends in the different ophiolites. These trends could lead to a better understanding of the tectonic history and paleogeographic reconstruction of the NAF.

Nursing

133. Coronary artery bypass surgery: Quality of life during early convalescence

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The purpose was to determine the impact of bypass surgery on the quality of people's lives and which factors influence recovery. Quality of life (QOL) was conceptualized in terms of life satisfaction (LS). Both objective and subjective indicators were assessed. Exercise tolerance was measured by the treadmill test. Results showed a discrepancy between subjective reports of improvement and objective health indicators which were less than satisfactory. Subjects were highly satisfied with domains rated as most important (symptom relief and family) but were less satisfied with physical activity and leisure. Ability to return to work was rated as least important while sex was least satisfying. Regression analysis revealed that mood, wealth, and symptom relief were the greatest predictors of LS. QOL was enhanced for the majority because of relief of angina, but unrealistic expectations of surgery may hinder some from altering their life styles. The study has implications for patient teaching, strengthening support systems, encouragement to follow the exercise regimen, and follow-up care.

134. Responses in siblings of hospitalized children

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The effects of the hospitalization of an ill child on his/her siblings are not well known. This study examined response in these siblings and the relationship of response to selected variables. The measure of response used was changes perceived by siblings since hospitalization of an ill child, called a Perceived Change Scale (PCS). Data were collected from 80 siblings who ranged from 5-17 years of age. Siblings 5-10 years of age were interviewed, and siblings 11-17 were administered a questionnaire. The variables that accounted for 43% of the variance in the Change Score reported by siblings 5-10 years of age were parenting changes, newly diagnosed progressive illness, and previously diagnosed progressive illness. Variables that accounted for 51% of the variance in Change Score for siblings 11-17 years of age were previously diagnosed progressive illness and illness length. Fear of illness approached significance ($F=3$, $df=2$, $p=.056$). Results of this study suggest that those siblings who are most in need of help are younger, have parents who are changing their patterns of parenting, and have brothers or sisters with a progressive illness.

135. Music as a nursing intervention during painful procedures

P. K. CLINTON

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A study to explore the effectiveness of prerecorded music on subjects aged 4-18 years, during painful procedures was conducted. 25 children were observed during bone marrow aspirations, lumbar punctures, venipunctures, or during tubbing and debridement for burns. For all subjects listening to the tapes, while pain ratings tended to be slightly lower following the procedure, there was not a significant difference in the pre and post procedure pain ratings. When age is considered as an intervening variable, significant differences are found. Children aged 7 or below had significantly lower postprocedure pain ratings ($p<.0002$) than children aged 8 or above. These findings are supported further among children who have had 15 or fewer procedures. The results of this study suggest that in young children who have not developed other means of coping with painful procedures the intervention was beneficial.

136. A study of preventive health education as an intervention in child sexual abuse

P. L. SLAVIK

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Many researchers contend that child sexual abuse (CSA) is the most under-reported and under-diagnosed type of child abuse. The purpose of this study was to determine if a preventive health education program about CSA would affect the incidence of report in school-age children and to measure the students' knowledge of preventive measures. One hundred and two fifth and sixth grade students from two rural midwestern communities were studied using a pre-test/post-test format in a two group experimental design. A questionnaire containing three sections, "Student Knowledge Form, Student Attitude Form," and a Biographical questionnaire measured the effect of the independent variable ("You're in Charge Program") on the dependent variable (report of CSA).

The reports of CSA disclosure on the questionnaires represented a significant increase over past official reports. A Pearson's Correlation Coefficient found statistically significant relationships between certain student attitude measures and student knowledge.

137. Nurses' projected use of home health care for patients with terminal illnesses

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The study examined nurses' projected use of home health care for clients suffering terminal illness. The use of home health care referrals was determined by an experimental design using a vignette technique, manipulating the severity of the client's illness.

An analysis of nurses' responses indicated that home health care was a consideration and expressed strong concerns for following the clients' and families' wishes in planning care.

This is an important contribution toward our efforts to make our nursing care more holistic and to help clients take responsibility for their care. In addition, under the current payment system, those with terminal illnesses are being cared for in the home setting more frequently causing health care workers to reformulate their thinking.

138. Assessing attitudes about health beliefs

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Experience and knowledge has indicated a need for the integration of transcultural beliefs, values and practices into health care systems. Assessing nurses' attitudes about culturally diverse beliefs and practices is a beginning step in developing ways of increasing the quality of care for these clients. This study developed a scale to test nurses' attitudes about health beliefs. Standards of scale construction based on psychometric theory were used for the final standardized measure that consisted of a self-report, seven-step Likert type, summative model scale with agreement/disagreement anchors. The scale was given to 300+ nurses and reliability and validity studies done. Some of the problems investigated were: 1) Will a measurement scale give a reliable and valid assessment of nurses' attitudes? 2) Do most nurses feel that culturally specific practices or requests as expressed by patients are reasonable or unreason-able? 3) Do nurses' attitudes about cultural beliefs affect their responses in carrying out care? and 4) Does age, racial background, education, experience with other cultures, or geographic regions influence nurses' attitudes?

139. Knowledge and Use of Folk Remedies Among Ethnic Aged

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This paper reports Phase II of a larger investigation of ethnic elderly of European descent: Old Order Amish, Czech, Greek and Norwegian. Data were collected during participant observation and semi-structured interviews with 160 individuals (40/community). While the majority of all groups reported detailed knowledge of folk remedies, the groups differed significantly in use patterns including: proportion of population using folk remedies, types of conditions treated and actual therapies used. Implications of these findings for medical anthropologists and health care providers are discussed.

140. Nursing care planning: Adaptation and derivation of psychometric data

D.K. STORY

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The baccalaureate nursing graduate is assumed to have competence in planning, providing, and evaluating nursing care. However, current literature reveals deficiencies in patient care plans.

An early study found a discrepancy in attitude and performance. Baccalaureate nursing students had favorable attitudes but were not competent in planning nursing care. The discrepancy may have been due to the fact that attitudes were not adequately measured.

A visual analog scale was utilized in place of the Likert scale in the existing instrument in order to increase sensitivity. Psychometric date generated related to discriminative power, validity, and reliability.

The psychometric data and practical application of the scale will be discussed.

141. Role conceptions among hospital discharge planners and their employers: Implications for care

K. KELLY

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Among the health provider roles most influenced by recent changes in health care funding regulations is that of the hospital discharge planner. Current research indicates dissatisfaction and perceived ineffectiveness among practicing discharge planners. This is attributed to lack of influence within the organization and inadequate understanding of roles.

The presentation will include: A framework for determining role conceptions among discharge planners and others in their practice setting; the relationship of role clarity to practice; and plans for further investigation of role conceptions as they relate to providing continuity of care. With the aging of America and implications for effective, affordable, long term health care, these are timely issues.

142. Sobriety, leisure, and gay American men

R.J. KUS

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For many alcoholics contemplating chosing sobriety, the fear of leisure without alcohol is great. Will life be boring? Will I be boring? What will I do to fill up my time?

The purpose of this study was to examine how sobriety affected the leisure of gay American men recovering from alcoholism.

Twenty gay American recovering alcoholic men were interviewed in depth and recorded verbatim in Chicago, Iowa City, Oklahoma City, and Seattle. Content analysis was performed on the data.

It was found that for the majority of men, sobriety produced high quality leisure not experienced while drinking. Trying out new endeavors, making new friends, and being more productive were experienced in sobriety.

Clinicians can reassure newly recovering gay alcoholic men that their leisure in sobriety should be very rewarding and better than ever.

143. Validation of a leadership measurement tool for nurses.

B. K. SMOLA

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The Leadership Behavior Tool, developed by Yura, (1970), was analyzed using a chi-square statistic to test the hypothesis of no relationship between selected categories of frequency data reported in the original study. The instrument was then administered to senior level BSN students to collect data for an item analysis and a factor analysis. Using the results of these analyses, the instrument was refined, that is, the irrelevant or ambiguous items were eliminated or clarified. The items not elimiated were reworded into a self-report format. Content and construct validity of the new self-assessment tool were established as follows; content validity through a panel of judges; construct validity through the use of contrast groups. The judges used a modified semantic differential scale to rate each item on clarity and relevance. Inter-rater and intro-rater reliability was established. A pilot test-retest procedure provided data for the Cohen's Coefficient K statistic to reflect the reliability of this criterion referenced instrument.

144. Regional brain membrane-bound sialomacromolecules in Macaque mulatta of different ages.

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A previous study in this animal model revealed age differences in brain capillaries suggestive of a decreased work capability of the blood-brain barrier (BBB). An alteration in the effectiveness of the BBB would be likely to affect the microenvironment of neuronal membranes. The present study was designed to investigate possible age differences in glycolipid- and glycoprotein-bound sialic acid content. It has been previously hypothesized that ganglioside sialic acid may serve as an index of synaptic integrity. Preliminary results obtained from samples of frontal and occipital cortex from

Macaque monkeys of four different age groups (2, 6-8, 13-15, and 20-22 years) suggest that there may be age-related differences in membrane-bound sialoglycomacromolecules. Because of the importance of these molecules in synaptic fine structure and function, the findings from this study have implications for future research related to cognitive disorders of development and aging.

Physics

145. Analysis of live and dead guitar strings

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Wound guitar strings often become "dead" after intensive use for a few weeks or less. Very small particles (as e.g., extremely fine potter's clay ~1 micron) between the turns of the winding are an important factor in causing the dead sound from a plucked string even if it is wiped "clean." To standardize laboratory test conditions the string is mounted on rigid supports on a steel beam, a mechanical plucker is used, and the string motion is detected with an optical system. Vibration amplitude as a function of time after the pluck is measured for frequencies up to 20 kHz. The major differences in decay times between a live and dead string show up in the frequency region above 2.5 kHz (i.e., above about the 20th harmonic). The temporary partial restoration observed by a guitarist when a string is removed and reinstalled is verified by the decay time measurements. Effects of the particles on inharmonicity of the vibration modes will also be discussed.

146. Ray tracing through holograms

D. W. OLSON

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A ray tracing procedure for transmission holograms will be described. The procedure closely resembles traditional ray tracing through lenses. The first of two procedures to be described involves a parallel ray and an undeviated ray like standard ray tracing through lenses described in elementary textbooks. This method was first described by Abramson.[1] The second method uses the thin-grating equation which for thin-transmission holograms plays a role analagous to Snell's law for lenses. Only mathematics at a level common to high school and noncalculus college physics courses is used. Since the working equations for this second method can be derived from elementary wave interference principles the usefulness of holography for teaching basic principles of wave optics is increased. A written description of the methods will be available for distribution.

[1]Nils Abramson, The Making and Evaluation of Holograms, Academic Press (1981).

147. Atomic Arrangements and Density of Sodium Borate Glasses

A. KARKI, S. FELLER, J. STARK, AND P. HUN LIM

Coe College, Physics Department, Cedar Rapids, Iowa 52402

Experimental results for density over a wide range of glass compositions will be given. A quantitative model will also be presented which connects the macroscopic density to the atomic arrangements found in these glasses.

148. Radon measurements in homes in central Iowa

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Concentrations of radon-222 have been measured in 42 homes in the region of Des Moines, Ames, and Grinnell, with the Terradex track etch cup method for air and the liquid scintillation method for tapwater. The arithmetic mean radon in the air of the homes for April through October 1984 was 2.75 pCi/L. For radon in water, 7 private wells on loess averaged 360 pCi/L, 13 private wells on glacial till averaged 790 pCi/L, and 12 different public supplies averaged 230 pCi/L. The results for wellwater indicate that waterborne radon is not a significant source of radon to the air, but that radon in soil gas surrounding the home foundations can be high enough to diffuse significantly into the air in the homes. Factors controlling radon in homes in this region of Iowa will be discussed.

149. Numerically modeling the dispersion of the Space Shuttle acid cloud

E. S. TAKLE

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The ground-level cloud generated at launch by the solid rocket boosters of the Space Shuttle consists of copious amounts of HCl. The complex and highly variable mean and turbulent atmospheric flow fields at the Air Force shuttle launch site at Vandenberg AF Base may create hazardous conditions for personnel and property near the launch complex. A numerical model based on the conservation of momentum, conservation of energy, conservation of mass, and the equation of state has been developed for simulating various characteristics of the mean and turbulent flow fields at Vandenberg. Preliminary tests show that the model correctly predicts the time dependent behavior of the horizontally homogeneous atmospheric boundary layer and produces a sea-breeze simulation in agreement with qualitative observations.

150. Freezing rain and freezing drizzle in Iowa

K. HARDING AND E. S. TAKLE

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Freezing rain and freezing drizzle (FR/FD) cause hazardous conditions for transportation and commerce in Iowa. Meteorological observations for the 20 winters from 1965 through 1984 from the Des Moines office of the National Weather Service were reviewed to determine the occurrence and conditions surrounding FR/FD. During this period, 95 events were recorded, with December being the most probable month averaging 1.8 events per year. Average number per year for other months were January (1.4), February (0.7), March (0.4), November (0.2), and April (0.1). The most frequently observed meteorological pattern leading to FR/FD was an east-west stationary front through central Missouri with a large temperature gradient across the front (31%). Other major causes include frontal passage (29%), and cyclone passage (22%). Surface and upper air data have been analyzed to provide a statistical picture of conditions surrounding these events.

151. Area and magnitude of convective rain patterns

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In an ongoing investigation of statewide seasonal "dry" and "wet" areas, it was observed that single precipitation events show broad total area differences but their primary cell cores seldom varied in area by more than a factor of two. Differences in characteristics of these areas have been examined using three spatial and temporal scales. A one-minute rate observation within a 42 km^2 matrix comprised of equally spaced rain gauges; the total life of single summer rain observed across a portion of Iowa and Missouri; and monthly rainfall totals from all climatic rain gauge sites within Iowa during extreme dry and wet summer months were examined. Preliminary results show a very small range in primary core areas irrespective of core intensity. The total area or peripheral outline had little or no relationship whether high or low volume rain coverage occurred. The major components of precipitation events as defined here are: area coverage which is conservative component ranging in area by a factor of two or three resulting from upper level winds, and rain intensity, a wide ranging dynamic parameter frequently having a swing of several orders of magnitude.

Physiology

152. Mechanism of naloxone-induced hypothermia during exercise

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Healthy male subjects were exercised at 60-70% VO_2 max on a cycle ergometer for 10-15 minutes in an ambient temperature of 22-24 C following a 5 minute warm up. Naloxone (2-20 mg) or saline was administered intravenously immediately prior to the warm up period. Measurements of sweat rate and forearm blood flow were made using resistance hygrometry and venous occlusion plethysmography, respectively. Heart rate, oxygen intake and skin, rectal and esophageal temperatures were also monitored. Administration of 10-15 mg of naloxone did not attenuate the rise in esophageal temperature during exercise but increased the slope of the sweat rate-esophageal relationship. There were no characteristic changes in heart rate or forearm blood flow. We conclude that naloxone administered intravenously to exercising humans enhances the sweating response. Supported by a NIH Biomedical Research Grant.

153. Greater. lumen-to plasma, duodenal, ^{45}Ca, active transport T in male, Sprague-Dawley rats reared 4 days in simulated, high gravity

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We tested the hypothesized, increased T [10^5 counts/min of net flux per hr per gram of dry duodenum ± S.E. (number of rats)] in the mechanism whereby gravity guides development of bone strength. We previously reported (1983 IAS Meeting, Abst. # 148) a transient increase in C (% Ca in wet, upper, femur quarter) peaking at 4 d relative to ad lib. controls and occuring prior to improved strength. In both experiments, chronic, 3-G centrifugation began at 28 d of age. In the present experiment, T (determined by the everted sac technique) increased ($p < 1\%$, paired sample, ranked by femur mass) only as compared to pair-fed controls and only during the d 4 of 3-G exposure.

DAYS AT 3 G		3	4	5
EXPERIMENTAL	C	10±1 (4)	14±1 (4)	13±1 (4)
	T	18±3 (3)	19±2 (4)	17±4 (4)
CONT. (AD LIB.)	C	8±1 (6)	9±1 (6)*	10±1 (5)
	T	16±2 (4)	17±2 (4)	15±1 (4)
CONT. (PR.-FED)	T	22±1 (3)	13±2 (4)*	13±1 (4)

*Sig. dif. from experimental

154. Latency of vocalization after cutaneous electrical shock as a measure of central nervous system development in fant rats exposed to ethanol in utero.

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Shock-elicited vocalization latencies in two and nine day old rat pups were acoustically recorded using Hewlet-Packard 3964A four channel instrumentation recorder and Bruel and Kjar 4133 free-field concenser microphone. Alcohol was administered prenatally in 2 parallel studies by gastric gavage (days 1-14 of pregnancy) or by alcohol in the drinking water (days 2-21 of pregnancy). Controls were given calorically equivalent doses of glucose. No differences were detectable in pups at two days of age. In nine day old pups, little improvement in the shock induced vocalization latency was seen in the alcohol exposed pups; however, the controls showed significant improvement in the vocalization latency. Shock induced vocalization latency may be a very early indicator of FAS (Fetal Alcohol Syndrome) in the rat model and indicate that ethanol exposure during critical periods of differentiation and refinement can have negative impact on brain development.

155. Ausculatatory measurements of systolic blood pressure P (mm Hg) vs. arm circumference c (cm)

C. C. WUNDER (1) and W. J. MORESSI (2)

PRL, Oakdale Campus, University of Iowa, Oakdale, IA 52319 (1) and Winthrop College, Rock Hills, SC 29733 (2)

The standard cuff assumes c of 35. Male, student P's from laboratory exercises regress to
$P = 73 \pm 2 + 1.46 \pm 0.46\ c$.
Corrected pressures, P + 1.46 (35 - c), agree better between sexes and with handbook values.

SEX	MALE	FEMALE
NUMBER OF STUDENTS	40	27
P	116	106
S.E. OF P	2	2
CORRECTED P	125	122
HANDBOOK VALUE	123	116
c	29	24
S.E. OF c	0.5	0.4

156. Elastic properties of the aortas of the horseshoe crab, Limulus polyphemus

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Very little is known of the mechanics of circulation in open circulatory systems. The elastic properties of Limulus aortas were examined in order to assess the role of these vessels in the regulation of blood flow and pressure. Static stress-strain measurements on ring segments gave elastic moduli of $1.46 \pm 0.78 \times 10^4$ and $5.35 \pm 1.77 \times 10^4$ Pascals over a physiological blood pressure range of 5 to 30 cm H_2O respectively. Hysteresis curves indicated that 65-75% of the elastic energy stored in the aorta during heart systole was delivered to the blood as elastic recoil during heart diastole. Although thinner and less stiff, the Limulus aorta appears to play a role in the regulation of blood pressure and flow similar to that of vertebrate aortas.

157. Effect of xylazine on isolated canine papillary muscle

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Xylazine is used as a veterinary sedative and as an α_2-adrenergic agonist in pharmacological research. In this study, 6 isolated canine papillary muscles with a 90% preload were each treated with xylazine. Afterload curves were recorded with the muscle contracting isotonically under stimulation. P_0; contraction and relaxation velocities; latencies from stimulus to start, peak and end of contraction and contraction amplitude were measured. Velocity responses to a dose were combined to select a best-fitting polynomial approximation determining V_{max}. We found that P_0, the maximum isometric force, and work both increased at low then decreased at high xylazine doses from 1.4×10^{-7} to 4.5×10^{-6} M. The α-adrenergic effect of xylazine was investigated by exposing muscles to prazosin, an α_1- blocker or yohimbine, an α_2-blocker. The same parameters were measured and responses combined from 5 muscles. These results will be discussed.

158. Hydatoxi lualba: a human parasite?

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A heretofore unindentified organism, Hydatoxi lualba, has been reported in the blood of humans (Am J Ob & Gyn ('83)145:15-26). This organism was uniquely identified with a toluidine-blue-O stain (TBO).

Our study represents a preliminary investigation of this purported organism with reference to its incidence in healthy adults. Thick smears of peripheral blood were prepared from samples obtained from 60 normal adults. The smears were stained with TBO-metanil yellow or giemsa (as in the above report) or with periodic-acid-shiff (PAS).

Analysis of the TBO stained smears revealed the presence of the reported Hydatoxi lualba. Though the giemsa and PAS stains revealed suspicious

structures, they could not be identified positively. Since the organism is only observed with the TBO and not with the PAS stain its identity as a true organism must remain in question.

This study was funded by a grant from the University of Osteopathic Medicine and Health Sciences.

159. Comparisons among calves reared by different methods: hematologic and acid-base balance variables and performance

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Four methods of feeding calves were compared as follows: 1) nursing on cows with access to hay, grain and water, 2) milk-replacer only with restricted movement, 3) hay, grain, and water, and 4) milk-replacer only with freedom of movement. No significant differences were noted for the acid-base balance variables (sampled while resting). An iron deficiency, microcytic, hypochromic anemia developed in the calves receiving milk-replacer only. Absolute numbers for lymphocytes were significantly higher in those calves that were nursing cows. Average daily gain, carcass grade, and sale price were superior for calves receiving only milk-replacer with freedom of movement as compared to those with restricted movement.

160. Mechanisms for transintestinal expulsion of dummy transmitters implanted in channel catfish.

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Animals normally encapsulate implants placed in the abdominal cavity, but some fish species are unique in exhibiting transintestinal expulsion of the implant. To study the mechanisms for transintestinal expulsion in channel catfish, silicone rubber or paraffin-coated polystyrene transmitter capsules (0.5% or 2.0% of the fish's body weight) were surgically implanted into the peritoneal cavity of 74 adult channel catfish. At necropsy (14-23 days), 14 transmitters had been expelled through the intestine. In the process of expulsion, the transmitter is first encapsulated by proliferation of fibrous connective tissue from the serosal surfaces of the intestine and peritoneum. Contraction of myofibroblasts, a prominent component of the fibrous capsule, forced the transmitter through the intestine into the lumen. Once there, normal peristaltic contractions rapidly expelled the transmitter through the anus. Transintestinal expulsion occurred with both light and heavy transmitters and both types of coatings.

161. Monoclonal antibody for radioimmunodetection of rat pancreas cancer

M. L. GOURLAY, R. H. STEVENS, H. F. CHENG AND G. G. BECKER

Radiation Research Laboratory, Department of Radiology, University of Iowa, Iowa City, IA 52242

Monoclonal producing hybridomas have been developed employing the immunizing cells from a nafenopin induced rat transplantable pancreatic carcinoma, and the nonsecreting mouse myeloma cell line NS1 (P3-NS1-1). Preliminary antibody selection resulted in an apparently specific IgG for the tumor determinants. Bio-distribution studies of the radio-iodinated (^{131}I) antibody indicate tumor localization. Concentrations of the immunoglobulin were 10 to 15 times greater in the cancerous tissue than measured in the pancreas or non-tumor tissue. These findings suggest the selected hybridoma cell culture may be producing antibodies useful for the radioscintiscanning of pancreas cancer. Supported by PHS Grants # CA36903 and CA30967 awarded by the National Cancer Institute.

162. Circulating blocking factors in rats exposed In Utero to Iodine-131

G. C. BECKER, R. H. STEVENS, H. F. CHENG, M. L. GOURLAY AND R. E. PETERSON

Radiation Research Laboratory, Department of Radiology, University of Iowa, Iowa City, IA 52242

We have been testing the hypothesis that there develops a genealogical memory to a perinatal radionuclide exposure by evaluating immunological changes. Our current findings suggest there develops circulating blocking factors (BFs) that may compromise the immunological responses to cancer. The model being investigated consists of the exposure of pregnant Fischer F-344 inbred rats to iodine-131 during 16 to 18 days gestation. BF activities were established by enumerating the degree of inhibition of T-lymphocyte cytotoxicity by serum from the test animal. A significant decrease (up to 100%) was observed for both males and females of the F1, F2 and F3 offsprings, thus suggesting a heritage of the radionuclide insult. Supported by PHS Grants # CA30967 and CA36903 awarded by the National Cancer Institute.

163. Inhibition of growth of malignant mouse mammary epithelial cells by isolated plasma membranes

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The growth of sparse cultures of MCF-8, a line of malignant mouse mammary epithelial cells, can be inhibited by the addition of a plasma membrane enriched fraction prepared from confluent MCF-8 cells. Inhibition is proportional to the concentration of membranes added over a range of 2.5 to 25 ug/ml protein; 2.5 ug/ml membrane protein causes a 45% reduction in cell number after 72 hours of treatment. Insulin has been shown to be a mitogen for MCF-8. This mitogenic effect is competitively inhibited by the addition of membranes. The growth inhibitory actions of the steroid dexamethesone and the plasma membrane fraction is additive. These findings suggest that the membranes act on cell surface sites, and can substitute for whole cells in producing contact inhibition of growth.

164. Thyroid status and contractile response in the hepatic portal vein of the rat

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Young male Sprague-Dawley rats were treated daily for two weeks either with 200 ug injections of L-thyroxine (TRX) or 0.1% propylthiouracil (PTU) in their drinking water. Rings of hepatic portal vein were mounted in muscle baths and isometrically contracted either by passing a monodirectional square wave pulse of 0.5 msec duration through the solution surrounding the preparation while increasing the frequency by 2 Hz increments from 2 to 16 Hz or by adding norepinephrine in half log increments from 10^{-12} to 10^{-4} M. Frequency/response curves to transmural nerve stimulation showed consistantly higher tension development in rings from control rats at all frequencies than in those from TRX treated rats. Tension development in rings from PTU treated rats was lower than TRX rats. Concentration/response curves to norepinephrine showed greater tension development in rings from control rats than in rings from TRX and PTU treated rats. These data suggest that changes occurred either in the sympathetic nerve endings, the adrenergic receptors, and/or the intrinsic contractile machinery of the vascular smooth muscle cells themselves.

165. Purification and partial characterization of amphibian insulin

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Rana catesbeiana(bullfrog) tadpoles and adults have measurable amounts of insulin-like immunoreactivity(ILI) in both their serum and pancreas extracts. Although the ILI is immunologically similar to mammalian porcine insulin, the structure and biological function have not been determined. Pancreas tissue from approximately 200 bullfrogs was collected. The tissue was extracted with acid ethanol and protein was precipitated at -10°C with absolute ethanol and anhydrous ether. The resulting precipitate was solubilized in 0.1 N acetic acid and passed over a gelfiltration column of Sephadex G-50 SF. Four fractions were obtained. Sephadex fraction 2 contained measurable ILI and could be fractionated into four peaks by reverse phase HPLC(C_{18}). Only HPLC peak 2 contained ½ cystine residues. The peptide contained 52 amino acids and 6-½ cystine residues. Amino acid composition was similar to alligator insulin.

Psychology

166. Family therapy with some individual clients

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The use of family therapy with individual clients is seen by some therapists as incompatible. Although there is some literature revealing an increased willingness to utilize a family therapeutic approach with some individual clients. The decision for or against such a combination has been left largely to the intuition or preference of the individual therapist. This paper suggests there are individually-centered presenting concerns which reflect familial influences. Therefore, the selective and integrated use of a family therapeutic approach may achieve a more pluralistic view of intervention for some individual clients.

167. Utilizing T-JTA individual crisscross testing in individual therapy

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This paper purports to present an integrated conceptualization of how the Taylor-Johnson Temperament Analysis (T-JTA) may be used in therapy with individual clients. The T-JTA is described as an instrument designed to serve as a fast and efficient approach for assessing nine personality traits. It is constructed to assist therapists in assessing the significance and role of these traits in the general presenting or emerging problem. The T-JTA's crisscross testing method provides a measure of interpersonal perception. Traditionally this method is used in pre-marital, marital and family therapy. It is proposed that the T-JTA's crisscross testing method has implications for individual therapy.

Science Teaching

168. "Where the wild things aren't"--planning and conducting successful field trips for elementary students

D. J. EIGE

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A successful field trip for elementary students happens when careful planning and preparation are done prior to making a field trip. The procedures for carrying out a field trip and post trip discussion are also basic to success.

A model for planning, preparation and procedure based on classroom management components of content, conduct and context will be discussed.

Teachers can be just as effective in the field as in the classroom. They do not need to fear that instead of going to study "wild things" that their students will become "wild things."

169. Energy education with electricity task cards

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The study of electricity and energy education can be effectively combined for grades 4-6 students. The packet of task cards provides students with the principles of electricity. The energy education component includes reading a meter, electrical energy conservation strategies, and values activities.

Practical applications for the packets will be discussed in relation to science, technology, and society. Participants will receive a copy of the packet.

170. Techniques for organizing and operating an elementary science (2nd graders) club

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Procedures for organizing and operating an elementary science club for 2nd graders will be discussed. Meetings for this club were scheduled at 8:15 AM (before school convened at 8:45 AM) on each Thursday. Students voluntarily became members. Parents and students were informed about club activities and membership via an informational "membership" letter.

Parents, science specialists, and students were active participants to make the club operate. Activities used with the student members will be shared.

171. Providing forestry programs in a state with few trees - a focus on high school students

R. E. Hildebrandt

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Several programs exist which can help high school teachers who have little or no background in forestry to teach forestry-related topics. Materials to be discussed will include: Project Learning Tree; Forestry Extension's mazes, wordfinds; and new Vo Ag materials on woodland management. The newly developed program entitled, "Governor's Arbor Day Program" will be discussed.

Suggestions for incorporating the materials into the classroom will be given. Appropriate contacts for obtaining the above materials or for getting involved in the above programs will be provided. Some informational handouts will be available.

172. Iowa - quality units for earth science teaching

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Earth science is a "new" curriculum area in science. There is no long history or tradition of earth science classes or an earth science teachers organization.

The development of contemporary Iowa earth science teaching materials is proposed as a method for stimulating improved earth science teaching.

The creation of an earth science section of the Iowa Academy of Science is proposed as a method whereby earth science teachers will be supported and encouraged to maintain and extend the number and quality of earth science classes in Iowa.

Proposed teaching unit topics and progress toward their development as well as the "mechanics" of organizing an earth science section will be discussed.

173. Comet Halley viewed from the southern U.S.

L.A. KELSEY

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The results of the UNI astronomy group's expedition to study Comet Halley from Big Bend, Texas will be presented. In March, ten UNI students and two instructors journeyed to the southern U.S. to examine the comet through a variety of instruments. Photographs, movie film, and video of the event will be shown.

174. Photo displays in elementary science

D. L. FAGLE

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Photographs can be used effectively as a reporting medium in almost any setting. Photo displays are very useful in elementary science. These photo displays can serve as records of science activities or they may be used for public relations efforts. A variety of photo display modes will be described in this paper.

175. Developing an elementary science curriculum that fits and works for the local district

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A science curriculum that fits the local community works best. More and better science is taught when such a match is achieved. A step-by-step process of how to develop such a curriculum for an elementary school district will be discussed.

Clarke Community School District's K-6 procedure of formulation, implementation, and evaluation of their developed K-6 elementary science curriculum will be shared.

176. Indirect observations and scientific inquiry

R. P. STOUT

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Most scientific experiments yield indirect information; a single piece of information which, along with many others, must be placed into its proper position before the puzzle can be solved. This step, interpreting the results of an experiment and placing them into proper perspective, is perhaps the most crucial part of scientific investigation, and among the most difficult to teach.

This process can be demonstrated by eliminating the most obvious method of solving a puzzle, and forcing students to think about what alternate methods might be used. One way of doing this is to have students deduce the contents of a box without looking inside. This method will be demonstrated along with a discussion of various ways to introduce the demonstration so as to illustrate specific points in the process of scientific discovery, or in fact to illustrate the entire scientific method.

177. The "Columbo charisma" and the "enhancement of lives".

R.E. MITCHEM

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"Stepping down" to the student's level is vital in maintaining an open atmosphere in the classroom. Visuals/demos/audios such as the overhead projector, video screen, and discrepant events can be used as a motivator as well as supporting objectives. Daily or weekly classroom changes, student support teams, and student recognition can help maintain high student interest and achievement. We must be cognizant of "talking down" to out students and collegues. Teacher time control is a key factor and demands attention. The "Columbo Kiss" method for teacher record-keeping of student daily achievement might be an answer to teacher time control.

178. Humorous teaching tools - Polypopbeads

R. P. STOUT

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Polymer science is among the most important scientific disciplines industrially, and among the least often covered in many schools and colleges. The basic concepts of polymers are easy to convey, but some of the details important in practical applications of polymers are far more subtle and difficult to communicate.

While streptozotocin has been useful in creating insulin deficient diabetic mammalian models, it has not proved to be useful in bullfrogs.

189. Changes in populations of two turtle species in response to predator removal

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A relict population of yellow mud turtles, (Kinosternon flavescens) and sympatric painted turtles, (Chrysemys picta) suffer heavy raccoon predation of nests on a preserve south of Muscatine, Iowa. Raccoons were removed from the preserve in 1979 and the nesting areas remained raccoon free for two nesting seasons. Mark and recapture studies of the mud turtles in 1979 and 1985 support other evidence of an approximate 50% increase in the population. Similar studies of painted turtles in 1980 and 1985 indicate an increase of approximately 75%. These results provide additional evidence that raccoon removal may be an effective method of enhancing turtle populations where raccoon predation of nests is significant.

190. Water exchange and nest environment fluctuations of painted turtle (Chysemys picta) eggs during natural incubation.

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Painted turtle eggs (Chrysemys picta) have been presumed to incubate in soils with water potentials in excess (more negative) of -100 kPa; such that, the eggs may typically lose water during incubation; however, there are few reports of egg water balance during natural incubation. We measured the water content, water potential and temperature in soils incubating Chrysemys eggs and the mass of eggs as well as temperatures in the clutch during incubation. We found the water potential to vary from 0.0 kPa to -77.0 kPa while temperature fluctuations ranged from 14.50 - 34.50 degrees C. Average mass change of the eggs that hatched was + 12.68%. The maximum mass increase was 63.32% of initial mass while the maximum mass loss was 15.14% of initial mass.

We conclude that painted turtle eggs typically experience much wetter soils than reported for laboratory studies and are likely to experience an increase in mass during incubation.

191. Ecological studies of Iowa small mammals in eastern Massachusetts.

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Habitat selection was assessed for three species of Iowa small mammals, Peromyscus leucopus (white-footed mouse), Microtus pennsylvanicus (meadow vole), and Zapus hudsonius (meadow jumping mouse), in eastern Massachusetts.

In one study where the three species are sympatric, differential habitat selection may serve as a partial means of the species' coexistence.

In a second study of Z. hudsonius, Z. hudsonius showed no habitat preference in relation to eight vegetational communities or microhabitats.

In a third study of age, sex, and residential classes of P. leucopus, the population, adult males, adult females, and adult permanent residents preferred two of three vegetational communities, whereas juveniles, adult temporary residents, and adult transients showed no apparent habitat preference.