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Program Abstracts, 99th Session, Iowa Academy of Science, April 24-25, 1987

Iowa Academy of Science

PROGRAM ABSTRACTS

99th Session

IOWA ACADEMY of SCIENCE

April 24-25, 1987

Grinnell College

GENERAL SESSIONS

I. Impact of biotechnology on agricultural production

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Biotechnology is a diverse array of technologies which today are in various stages of evolution and development. To understand them and the potential application of these technologies to agriculture it is helpful to consider them in a historical perspective. In addition, it is important to understand the interdependence of biotechnologies on traditional, well developed technologies.

The commercial development of biotechnology is more difficult than imagined even as recently as five years ago. Also, the problems being addressed generally demand a much better understanding of the physiology and biochemistry of the plant and animal systems under study. Nonetheless, there is a significant opportunity to impact production per se as well as lowering costs of production and creating products with added value.

II. I, the great Paracelsus

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This is a dramatic reading of a monologue which has been prepared by collecting and editing the writings of the 16th Century physician and alchemist, Philipus Aureolus Theophrastus Bombastus Paracelsus von Honenheim, otherwise known as Paracelsus. Paracelsus is credited with being the first alchemist to advocate the formulation of medicines. A self-taught doctor who wrote and lectured in German rather than Latin, he is also credited with being the first to describe occupational illness and to propose that doctors study diseases of the mind and of women. He also advocated careful attention to the dosages of medicines, measurement of quantities when preparing formulas, and reliance on experimentation rather than theories. His volatile temperament made him the subject of much controversy.

III. The Gaia hypothesis: the basis for a new kind of global biological science

L. MARGULIS

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The Gaia hypothesis is a theory of the atmosphere and surface sediments of the planet Earth taken as a whole. This hypothesis, in its most general form, states that the temperature and composition of the Earth's surface are actively regulated by the sum of life on the planet--the biota. This regulation of the Earth's surface activities by the biota and for the biota has been in continuous existence since the earliest appearance of widespread life--for at least 3 billion years. This gaian view is a radical departure from the former scientific concept that life on Earth is surrounded by and adapts to an essentially static environment. A gaian view not only has important implications for understanding life's past but it is relevant to the design and interpretation of observations and experiments on present life.

SYMPOSIA

Iowa Science Foundation

A. Study of Conotrachelus seniculus life history in the laboratory and develop a method of rearing

R.L. WILSON AND D.L. OLSON

USDA, Plant Introduction Station, ISU, Ames, IA 50011

A potential insect pest on the crop amaranth is the weevil, Conotrachelus seniculus. This insect feeds upon the leaves and roots of the plant.

Eleven experimental diets were tested for a medium that would provide proper nutrition for rearing the weevil. An olfactometer was used to determine if chemical extracts of plant material would attract the weevil.

Neonate larvae are small and difficult to find on the plant. The larvae seem to prefer a diet with a thick consistency for chewing, however, no diet tested was sufficient to produce adults. The olfactometer tests indicated the adult weevil is attracted to amaranth stems, leaves, roots, and plant chemical extractions of the stems. By studying the weevil we will gain useful information that will aid in development of pest control measures.

B. Preliminary alluvial pollen record from Roberts Creek, Clayton County, Iowa.

C.A. CHUMBLEY AND R.G. BAKER

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Pollen analysis of fine-grained alluvium in small basins along the Roberts Creek floodplain reveals a 15,000-yr record of vegetational changes. A Picea-Larix forest prevailed from 15,000 to as late as 8990 yr B.P. Deciduous forest dominated by Quercus and Ulmus was present at least until 6170 yr B.P. Prairie elements including Poaceae, Ambrosia, and other Asteraceae, began to replace forest taxa by 5470 yr B.P., and dominated until 1820 yr B.P. Deciduous forest with Quercus and minor amounts of Platanus and other taxa became

more prominent within the last 1820 years. Wood and other plant-macrofossil identifications from several sites support this picture.

All of these changes in vegetation were delayed at Roberts Creek by 2000-3000 years compared to sites in central Iowa and Minnesota, indicating that the vegetation of the area has been out of phase with surrounding areas throughout the Holocene. The Roberts Creek study demonstrates the complex nature of time-transgressive vegetational changes in the Midwest.

C. An ISF Project Report: Density and Atomic Arrangements in Borate Glasses

STEVEN A. FELLER

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This Iowa Science Foundation Project has allowed several students to enjoy a research experience. The project involves forming glasses, measuring the density of the glasses, and quantitatively connecting the density to the microscopic atomic arrangements. Progress has been made on sodium, potassium, and rubidium borate glasses and will be briefly reviewed. Students have participated in the writing of journal papers and presented talks at national meetings. In part, as a result of the support provided by the foundation, additional funding has been secured from NSF.

D. Leaf orientation in Silphium laciniatum, a compass plant.

J. M. PLEASANTS AND HANZHONG ZHANG

Dept. of Botany, Iowa State Univ., Ames, IA 50011

Silphium laciniatum (Asteraceae), which is found in mid- to tall-grass prairies, is one of several species known as compass plants. The dissected leaf of this species has a rachis which is positioned vertically and leaf blades which face east and west. The possible advantages of this orientation have been examined for only one other compass plant. In field studies we compared leaves that were constrained to an abnormal orientation (blades facing north and south, or up and down) to normally oriented leaves. Normally oriented leaves had reduced temperatures at midday and higher photo synthetic rates during morning and afternoon periods. Leaves do not have an innate compass orientation. Leaves that are expanding in the spring begin with an orientation that is dictated by their position on the stem. As expansion proceeds they gradually assume a compass orientation. We have been studying the development and mechanism of orientation using seedlings whose first leaf orients accurately. At this date we can say that leaves orient in response to sunlight cues, not earth's magnetic field cues, and the orientation becomes fixed at the end of the leaf expansion.

E. Phosphorus-31 and carbon-13 nuclear magnetic resonance studies of sperm metabolism during anaerobic conditions

G.G. BROWN AND P-M.L. ROBITAILLE

Department of Zoology, Iowa State University, Ames, Iowa 50011

Phosphorus-31 NMR studies were used to examine sperm metabolism in semen collected from the rainbow and the brown trout. Samples were examined during aerobic and anaerobic conditions. The latter at temperatures of 1, 5, 10, 15, and 20°C. Changes in the concentrations of high energy phosphorus-continuing compounds (ATP, ADP, phosphocreatine) were monitored. Under anaerobic conditions, the concentration peaks of PCr and ATP decreased at a rate dependent on temperature. However, the PCr peak decreased drastically before the concentration peaks of the ATP were significantly affected. Also, the percentage of spermatozoa capable of becoming motile rapidly decreased during anaerobic conditions. Aeration of such semen increased the PCr peak and the percentage of motile spermatozoa. Sperm metabolism was also examined with carbon-13 labeled glucose during aerobic respiration in the semens of Limulus polyphemus, boar, and the rainbow trout. These results aided in initial cryopreservation studies. Work was supported by Grant ISF-86-52 and the Iowa Conservation Commission.

F. Understanding groundwater in the driftless area of Northeast Iowa

D. R. MENKEN, G. R. WOODLEY

Osborne Conservation Education Center, Clayton County Conservation Board, RR #2 Box 65A, Elkader Iowa, 52043

The Clayton County Conservation Board is concerned about the lack of knowledge and understanding of groundwater. This project will generate better understanding of the groundwater in Northeast Iowa's Driftless Area.

The three phases of the project are;

1. Research and Study of existing materials to compile usable information to advance the;
2. Development and Construction of eight folding displays that;
3. Demonstrate and Interpret groundwater problems and solutions through public exposures and schedules of a traveling Groundwater Showcase Exhibit.

G. A systematic inventory of selected natural areas of Clinton County, Iowa.

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An inventory of natural areas of Clinton County was undertaken during the 1986 growing season. Approximately 30 sites were selected for an extensive floristic evaluation. These sites consisted of both privately and publicly owned land and represented a wide spectrum of habitats. Over 100 species of vascular plants were documented to clarify their frequency and floristic distribution in Iowa. Several species

were determined to be the first known documentation from Clinton County. The data from this study will be used by the Clinton County Conservation Board for land acquisition, preservation, management, and long range planning. This research was funded by a grant from the Iowa Science Foundation (ISF-86-25).

H. Holocene stratigraphy and geomorphic history of the Ames Bog drainage, Story County, Iowa

J. VAN NEST

Department of Geology, The University of Iowa, Iowa City, Iowa 52242

Cutbank exposures, auger holes, and fifteen radiocarbon dates permit the preliminary reconstruction of the geomorphic history of this sidevalley to the South Skunk River. A gravel or stone line forms the base of the Holocene section. During the early Holocene (?) and certainly prior to 6300 years before the present (BP) the valley had cut through deposits associated with the Des Moines Lobe and began to erode into Peoria Loess and Pre-Illinoian till. Poorly sorted colluvial deposits accumulated along the valley margins during this time. By ca. 6300 BP deposition of gray loam and silt loam was underway in the middle reaches of the valley. A period of relative stability lasted until at least 6000 BP and likely until 5500 BP as represented by the formation of an A/C soil profile at some locales. A lengthy hiatus followed. Active channel incision and headward expansion into Des Moines Lobe deposits occurred between ca. 3000 to 2000 BP. Thick, organic-rich soils and localized deposition of muck and peaty muck characterize the latest Holocene. The stream began its latest episode of downcutting during the Historic period.

I. Purchase of laboratory demonstration equipment for Science Station museum programs

J. KARN, S. MCDERMOTT

Science Station, 427 First St. SE, Cedar Rapids, IA 52401

Science Station opened in August 1986 as a hands-on participatory science museum in downtown Cedar Rapids. Exhibits are designed to involve visitors in fun and challenging experiences which demonstrate basic physical principles. As part of the plan, family-oriented programs have been developed and presented to supplement the exhibit experience.

Iowa Science Foundation supported the purchase of laboratory demonstration equipment for use in public programming and special activities for school children. Local science educators provided advice about anticipated needs in equiping the science laboratory. Apparatus relating to electricity and optics was acquired to complement the exhibit themes at Science Station.

More than 17,000 visitors enjoyed Science Station exhibits during the first five months of operation. Weekday school programs and Sunday afternoon family activities have become a regular part of Science Station operations.

J. Lyme disease: An emerging public health problem in Iowa

N. WILSON

Department of Biology, University of Northern Iowa, Cedar Falls, IA 50614

Over 750 mammals of 22 species were examined for ticks between 15 April-30 November 1986. Slightly over 19% were infested with 1,169 specimens of 8 species.

Eventually 211 specimens of Amblyomma americanum (1) and Dermacentor variabilis (210) were tested for Borrelia burgdorferi, the Lyme disease spirochete. All tests were negative.

K. Traditional and modern evidence for the age of the Turkey River Valley (TRV), northeast, Iowa

C. M. HUDAK

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Deeply entrenched river valleys of NE Iowa have been considered pre-Illinoian since the late 1800's. Traditional evidence to suggest an early Quaternary age include: 1) valleys filled with "red-weathered drift", 2) valleys cut deeply into bedrock, and 3) topographic changes in valley profiles supposedly related to glacial advances. Problems with these interpretations are: 1) red oxidation colors can form quickly, 2) valleys were interpreted as any lowland below the so-called "peneplains", 3) no till-outwash interfingering has been found between upland and valley deposits or within the valleys, and 4) valley topography is bedrock controlled. Current work on the TRV of NE Iowa shows the oldest and relatively high-level Quaternary units to bear Late Sangamon Paleosols (LSP). The TRV truncates the LSP relatively high in elevation and must be younger than Illinoian below the point of truncation. TRV deposits traditionally interpreted as pre-Illinoian revealed no till and are Late Wisconsinan and Holocene in age as determined by fossils and C^{14} dates. Traditional "evidence" has been interpretive, while modern TRV evidence suggests the majority of bedrock incision occurred during the Wisconsinan.

L. The Iowa Centipede Project

D. J. PERSCHAU

1116 16th Street
West Des Moines, Iowa 50265

This study is the first ever investigation of the Class Chilopoda in Iowa. Its objectives are to collect centipedes from a wide variety of habitats in the state, to identify the centipedes, preserve and label them, and catalog them into a systematic collection. Collecting is being done from July through May and some previously collected material will be included. A variety of collection techniques are being used. To date more than three hundred specimens of about thirty species from more than thirty counties have been included.

M. 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 principle features, history, and appropriate use. The booklet will be made available to ISU students, faculty, and adminstration, and to other institutions in Iowa. A slide/tape presentation is being produced as a companion to the booklet and to serve as an introduction to the outdoor teaching laboratories available at Iowa State University.

Iowa's Interior Streams

A. Iowa's interior river valleys: a geological overview

E.A. BETTIS III

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

Iowa's landscapes are primarily the result of fluvial erosion, except for the glaciated Des Moines Lobe region in northcentral Iowa. All of the state's rivers and adjacent valley landscapes share some common features. However, there are important differences resulting primarily from dissimilar Wisconsinan histories. Causes for these differences include the direct effects of glaciation, the presence or absence of glacial meltwater in the watershed, thickness and extent of Wisconsinan loess, and the nature and extent of erosion surface development. Differences in interior valleys will be shown by contrasting river valleys from different landform regions: the Little Sioux Valley of W. IA., the Des Moines Valley of C. IA., the Turkey Valley of NE. IA., and the Iowa Valley of C. and E. IA. Different morphologies, deposits, and land use in these river basins result in different demands on alluvial aquifers, aquatic habitats, and economic deposits. Only a better understanding of the inter-relationships among the geology, hydrology, and ecology of our rivers will permit intelligent management of the state's riverine resources.

B. Iowa's riverine wetlands

R. A. BISHOP

Iowa Department of Natural Resources, Wallace State Office Building, Des Moines, Iowa 50319-0034

Iowa's early history is deeply centered around Iowa's rivers. Early Iowans settled along its many rivers. Rivers served as major arteries of transportation, while woodlands along the river corridors provided lumber for building, wood for fuel and abundant wildlife and fish provided food. Starting in the early 1900's, many rivers were straightened to allow water to escape faster and to allow farmers to farm bottom land and land between the river bends. In 1906, USDA inventories estimated 930,000 wetland acres but by 1955, Mann estimated only 138,000 acres of wetlands. A rough estimate of existing riverine wetlands, excluding flood control reservoirs, is 40,000 acres. Many of these wetlands are periodically wet and dry. We have approximately 6,600 miles of inland warm water streams and 620 miles of border rivers. Our real challenge lies ahead. Will we act to protect our riverine wetlands that still exist? They constitute the largest wetland acreage in private ownership. These wetlands are very valuable for holding water and providing habitat for a variety of fish, wildlife and plant species.

C. Fish communities and abundance in Iowa's interior rivers

B. W. MENZEL AND V. L. PARAGAMIAN

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Fish populations in Iowa streams and rivers were surveyed by seining, electrofishing, and rotenoning from 1980 through 1985 in two separate studies. The distribution and abundance of Iowa's fishes are related to the state's glacial history, present climatic and landscape features, and recent habitat alterations. Greatest species diversity occurs in northeast drainages where over 100 species have been recorded. In general, stream habitats and fish communities of this region are similar to those occurring in forested watersheds east of Iowa. Mean value for the Index of Biotic Integrity was 45 in northeastern stream systems, and average standing stocks ranged to 631 lbs/ac. Fish communities in western drainages have strong faunal affinities with plains stream communities, are less speciose and support lesser standing stocks than those of central and eastern drainages. In these systems, standing stocks averaged 116 lbs/ac.

D. The Disribution of Iowa's River Turtles

J. L. CHRISTIANSEN

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A total of 12 of Iowa's 13 turtle species have been found in Iowa's rivers. Of these, two, the yellow mud turtle and Blanding's turtle occur only occasionally in rivers, their primary habitat being ephemeral ponds and marshes respectively.

The remaining 10 range from pond turtles that are frequently found in rivers (painted turtles) to river turtles that are rarely found in ponds in Iowa (smooth softshells). The distribution of Iowa's river turtles appears to be affected by stream size, substrate, mean annual water temperature, and geographic origin of the species. The distribution of the only terrestrial turtle found in Iowa, the ornate box turtle, is influenced by sand or loess deposits associated with rivers.

E. Iowa's protected water areas program

K. R. SZCODRONSKI

Iowa Department of Natural Resources, Wallace State Office Building, Des Moines, IA 50319-0034

Iowa's Protected Water Areas Program is designed to maintain the scenic and natural qualities of designated river corridors, lakeshores, and marshes. Resource protection is afforded by willing landowners through long-term, customized agreements such as conservation easements, leases, state preserve dedications, property tax incentives, and land acquisition. Public access onto privately-owned protected areas is not necessarily allowed by these agreements. Recreation facility development is kept to a minimum in order to maintain the area's quality resources.

The Protected Water Areas Program was authorized in 1984 by the enactment of Chapter 108A, Code of Iowa. A 25-mile segment of the Boone River in Hamilton County was designated in May 1985. This designation has been well-received by public officials in the county, and by most landowners along the river. Progress on the Boone River and other areas nominated for designation will be discussed.

Biotechnology: Impact on Iowa's Agricultural Economy

A. U.S.D.A. regulatory policies for testing and marketing genetically engineered microorganisms, plants, and animal products.

T. L. MEDLEY

Biotechnology and Environmental Coordination Staff
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
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The U.S. Department of Agriculture regulates the products of agricultural biotechnology under the authority granted by statutes which were enacted to prevent the introduction or dissemination of an animal or plant pathogen. The Virus-Serum-Toxin Act of 1913 and the Act of 1903 are applicable to the release of genetically engineered microorganisms which present a risk of the introduction or dissemination of an animal pathogen. The Federal Plant Pest Act of 1957 and the Plant Quarantine Act of 1912 are applicable to the release of genetically engineered microorganisms and plants which present a risk of the introduction or dissemination of plant pathogens.

The regulations pursuant to these statutes applicable to the testing and marketing of genetically engineered microorganisms, plants and veterinary biologics are discussed in detail.

B. An industry perspective on testing and marketing genetically engineered microorganisms, plant, and animal products

N. FREY

Department of Biotechnology Research, Pioneer Hi-Bred International, Inc., P.O. Box 38, Johnston, Iowa 50131

Biotechnology promises to increase profits in agriculture, although to date the costs of research and development have exceeded the benefits accrued from those products. New and useful products must enter the marketplace soon if the research investment is to be sustained. Regulations that go beyond insuring public safety and product efficacy, or lawsuits which delay product development, significantly increase the cost of those products.

Reasonable regulatory requirements should be consistent with the risks associated with the product. If regulatory costs exceed profit potential for a product, research and development will cease.

Agricultural industry, government regulatory agencies, and the public must work together to insure that beneficial technology is delivered to the farmer at a reasonable cost, with minimal delay, and with acceptable risk.

C. Economic changes from the use of biotechnology in production agriculture.

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A high rate of technological change results in excess resources in agricultural production which then exhibit low average rates of return. The distribution of those returns are greater, however, creating higher incomes for innovators compared to what they would experience under stagnant technological change.

Whether cost reducing technological change is beneficial to agriculture compared to output enhancing technological change depends upon the economic environment. Under the classical perfect competition paradigm the impacts are identical. Deviations from those assumptions may produce dissimilar results. In any case, supply is increased and prices fall so that consumers benefit. Society may benefit depending upon adjustment costs.

D. The land-grant mission, biotechnology and rural welfare

A. D. KLINE

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There is at least a primafacie moral tension between universities asserting land-grant principles and simultaneously sponsoring biotechnology. The core of the problem is the likely deleterious ecomic effects of biotechnology on rural communities - the very constituency whose welfare is supposedly promoted by land-grant institutions. Considered are a number of responses to this tension including efforts to show that the tension is only apparent or that it can be eliminated through various public policies. It is argued that these "solutions" fail.

The upshot is that if the land-grant label is to be taken seriously, those institutions should begin allocating considerable resources to anticipating the social consequences of the technologies they sponsor, honestly inform the public of those consequences and encourage the kind of creative programsthat will offset the downside of biotechnology in rural communities. It is likely that these programs will have little to do with the traditional emphasis on agricultural productivity.

Teaching for, of and about thinking skills in science

A. Teaching for, of and about thinking skills in science

A. SWARTZENDRUBER

West Des Moines Schools, 1101 5th Street, West Des Moines, IA 50265

This symposium will include the following topics: how to structure the classroom to effectively manage instruction for thinking; seven ways to organize the classroom for the instruction of thinking; responsiveness behaviors which create a climate for thinking; developing your repertoire of teaching strategies for thinking; taking the existing curriculum and changing the teaching activities; the need and opportunities for staff development.

A speaker, a videotape and small group activities will be utilized to present this symposium. Each participant will also receive a packet of materials.

CONTRIBUTED PAPERS

Agricultural Sciences

1. Hickory Grove Park, Story County, short rotation intensive culture (SRIC) demonstration.

R. C. Schultz, J. C. GREBASCH, R. B. HALL, J. P. COLLETTI, R. WALTERS

Department of Forestry, 251 Bessey Hall, Iowa State University, Ames, Iowa 50011-1021

The SRIC project is a joint effort between the Story County Conservation Board, the Forestry Division - Iowa DNR, the Department of Forestry, and the Iowa Natural Heritage Foundation. The objective is to show area farmers that fast growing hardwoods can be planted as alternative crops for energy or fiber production. Populus hybrids, NC 5326 and NC 5328 and Acer saccharinum, silver maple, are planted at 3 x 6 and 6 x 6 foot spacings for harvesting at 3-5 and 7-10 year rotations, respectively. Bare rooted hardwood cuttings and seedlings were planted. Unrooted hardwood cuttings of Populus hybrid NC 5271 were planted at a 1 x 1 foot spacing in a "wood-grass" design for an annual harvest. Goal and Surflan herbicides were broadcast over the Populus and Goal, Surflan and Princep over the silver maple the day after planting. The "wood-grass" harvest in December, 1986 yielded about 8533 wet lbs./acre of chips. Yields in subsequent years should be greater.

2. The economics of a wood energy demonstration at Hickory Grove Park

J. P. COLLETTI, R. C. SCHULTZ, G. GREBASCH, R. B. HALL, AND R. WALTER.

Department of Forestry, Iowa State University, 243 Bessey Hall, Ames, Iowa 50011-1021

Three short rotation, intensive culture (SRIC) tree plantations were established in 1986. The establishment costs for the annually harvested "wood-grass" system (unrooted Populus, 1x1 foot spacing) totaled $2860.76/acre. It costs $667.25/acre and $673.81/acre to establish rooted Populus and silver maple seedlings on a 3x6 feet spacing with harvest in 3-5 years, respectively. It costs $413.80/acre and $420.15/acre to establish rooted Populus and silver maple seedlings on a 6x6 feet spacing with a 7-10 year rotation, respectively. An economic breakeven method applied to each SRIC system to determine the woody biomass production in oven-dry tons/acre/year required to cover all costs for a 20-year period will be discussed.

3. Seed production of genetically improved black alder (Alnus glutinosa L. Gaertn.)

R. N. NYONG'O AND R. B. HALL

Department of Forestry
Iowa State University
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European black alder has a great potential in intensive culture of biomass for energy in the U.S. In addition to its fast growth rate, coppice regeneration, and nitrogen fixing ability, it is also a heavy seed producer. Therefore, less seed orchard acreage will be needed to produce sufficient quantities of seed. Seed collections made from seven selected trees in the fall of 1985 and 1986 gave a total seed yield of 3.6-7.4 million seeds (5629-11,693 g). Laboratory germination tests of the 1985 crop had a germination range of 24-60% with an average of 48%. A study of the best time for seed collection indicated that harvests can be made in early fall, but that different trees mature their seed at different rates.

4. Development of new oilseed crops

W. W. ROATH

North Central Regional Plant Introduction Station, Iowa State University, Ames, Iowa 50011

Most US produced oilseed comes from established crops and is used for food products. Very little of this production, about 5% of soyoil for instance, is used for industrial purposes. The vast majority of industrial oils are made from petroleum or from imported vegetable oils.

Several plant species have been identified by workers at the Northern Regional Research Center at Peoria, IL as having different plant oils which have potential for a wide range of industrial uses. These include: 1. long-chain fatty acids from crambe, meadowfoam, Honesty, and low glucosinolate rapeseed, 2. short - to medium - chain fatty acids from Cuphea spp. and species of the Umbelliferae family, 3. hydroxy fatty acids from Lesquerella, 4. wax esters from jojoba, crambe, and meadowfoam, and 5. epoxy fatty acids from Vernonia, and stokes aster. These species are in various stages of development, with rapeseed in commercial production, and crambe nearly ready for commercial production. Crambe and perhaps Cuphea and Lesquerella appear to be the best adapted for production in Iowa.

5. Fungicidal control of Kabatiella zeae in maize

C. A. MARTINSON

Dept. of Plant Pathology, Iowa State University, Ames, IA 50011

Eyespot disease of maize has become a serious problem during the past 17 years. It can be controlled partially by cultural practices and resistance, but certain seed production parents are very susceptible. Eight fungicides have been field tested one or more years during the past five years for their efficacy against eyespot. Propiconazole, thiabendazole, benomyl, and mancozeb were the most effective and reduced eyespot most effectively when applied immediately after first symptoms of eyespot were evident. Two or more applications were needed with heavy disease pressure and weather that favored K. zeae activity. Significant yield increases were obtained with fungicide sprays.

6. Resistance of Curtobacterium flaccumfaciens to three antibiotics

J. M. DUNLEAVY

U.S. Department of Agriculture, Agricultural Research Service, Dept. of Plant Pathology, Iowa State University, Ames, IA 50011

Curtobacterium flaccumfaciens is a bacterium that causes a disease of soybean called tan spot. It infects soybean leaves, from which it can enter the vascular system and, eventually, infect seed. C. flaccumfaciens is susceptible to the antibiotics, rifampicin (RIF), kanamycin (KAN), and streptomycin (STR). Occasionally a few bacteria are found in a population that are resistant to one or more of these antibiotics. Such isolates can be useful to study seed transmission of C. flaccumfaciens. Five field isolates of the bacterium were tested for resistance to KAN (300 µg/ml), RIF (100 µg/ml), and STR (500 µg/ml). Three of the isolates were resistant to RIF, one to KAN, and one to STR, and one isolate (RS) was resistant to both RIF and STR. This isolate was used to inoculate plants of four soybean cultivars grown in the field. The RS isolate was recovered from mature seed of three of the four cultivars tested, indicating seed transmission.

7. Observations of higher incidence of brown stem rot of soybeans after corn-soybean rotation than with continuous soybean.

TACHIBANA, H., and K. G. BIDNE.

USDA-ARS, and Dept. of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011.

Higher levels of brown stem rot (BSR) of soybeans were observed after corn-soybean rotation than after continuous soybeans. Previously, frequent or continuous soybean cropping practice was reported as the factor for development of BSR and crop rotation was the control method. The latter was interpreted to include the current corn-soybean rotation of Midwest agriculture. During the introduction of BSR-resistant soybeans for BSR control by the prescribed resistant cultivar method, a common reply by producers was that they do not have BSR because they rotate corn and soybeans. Thus, previous continuous soybean research plots that were used for screening for BSR resistance were changed from continuous soybean to soybean-corn rotation in 1985. Based upon three experiments with the change, BSR was found more severe after corn rotation than after continous soybeans in 1986.

8. The relationship between soybean yield and soil populations of soybean cyst nematode in Iowa

T. L. NIBLACK

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The soybean cyst nematode (SCN), Heterodera glycines, has emerged as a significant pest capable of limiting production of soybeans in Iowa. The known distribution of the nematode increased from 14 to 23 counties in 1986. Field studies were conducted in Boone, Hancock, and Story counties in 1986 to evaluate soybean yield losses due to SCN and to determine a pre-plant threshold value for population levels of SCN likely to cause significant yield loss.

In Story County, known levels of SCN were applied as eggs to soil in microplots subsequently planted to SCN-resistant and susceptible cultivars. The damage threshold was estimated to be between 10 and 50 SCN eggs/100 cm^3 soil. The natural SCN infestations in the Boone and Hancock County sites both exceeded this level, and yields were negatively correlated with pre-plant populations of SCN. Yield losses in SCN-susceptible soybeans ranged from 6 to 39%.

9. Climatic variability and change as indicated by record temperatures

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The annual number of record temperatures broken for six Iowa stations during the period 1900-1980 were used to determine climatic variability and change. This study was done to see if record temperatures can be used to diagnose climatic change. The number of record temperatures broken each year were "normalized" by dividing the actual number of record temperatures broken by the expected number of record temperatures broken to obtain a ratio. The expected number is expressed as 730 / number of years from beginning year.

A ratio of one specifies a year of normal climatic variability. Ratios greater or less than one specify greater or less climatic variability, respectively. The results showed that all stations experienced greater than normal climatic variability in the thirties, with less than normal climatic variability since 1940. The new method is useful for discriminating between years with abnormally warm and cold conditions.

10. Leaf thickening before and after final leaf expansion

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Leaf thickness influences both photosynthetic capacity and transpiration rates. However, the effects are not identical. The implications of leaf thickening on productivity and water conservation were studied. Velvet leaf (Abutilon theophrasti Medic.) and soybean [Glycine max (L) Merr.] were grown at high and low intensities. A group of plants were transferred from each environment into the other environment just before full leaf expansion. Leaf thickness and dimensions were measured on single leaves. Leaf thickness was influenced by light intensity both before and after final leaf expansion. Transpiration rates were measured at high light intensity. There was no significant difference in transpiration between thick and thin leaves. Implications of leaf thickness on photosynthesis and water use efficiency are discussed.

11. Fly ash effects on crops grown on Muscatine Island

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Field experiments to study the use of fly ash as a liming material were conducted at the Iowa-Illinois Gas and Electric Company Louisa Generation Station on Muscatine Island during 1985-1986 as part of an ongoing project. Fly ash is a fine, silt-sized, alkaline residue collected from the flue gas stream by electrostatic precipitation after coal is burned for electrical power generation.

The alkalinity of fly ash indicates it may be used as an alternative to limestone to increase the soil pH of sandy soils on Muscatine Island. In addition, some fly ash constituents are essential plant nutrients while others may be harmful to plants.

Fly ash and limestone application were made on soils where agronomic and horticultural crops were grown under irrigation.

The effects of the fly ash and limestone applications on soil, crop yield, and crop chemical composition will be compared.

12. Twin ear expression in maize

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Yield components contributing to grain yield of maize include ear length, kernel size, kernel depth, number of kernels per ear, kernel row number, and number of ears per plant. An increase in number of kernels per plant has been emphasized either by increasing ear size or number of ears per plant. Number of ears per plant was increased by encouraging development of an ear at each node below the top ear bearing node.

Recently, a strain was isolated that produced two ears (twin) at each node. In contrast to the faciated and ramosa ear types, each of the ears had a separate shank attached to each node. Selection has been practiced to increase the penetrance and

expressivity of twin earedness. Some cultures have been isolated that produce twin ears on nearly 100% of the plants within a culture. The number of kernels per plant is increased. The potential of twin earedness is not known, but it may contribute to yield and provide greater flexibility in matings of an individual plant.

13. Linkage tests with chlorophyll-deficient mutant y9 in Glycine max (soybean)

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Linkage tests were made between chlorophyll-deficient mutant y9 and three other morphological traits and eight isoenzyme traits. Morphological traits tested were root fluorescence (Fr1 or fr1; Fr3 or fr3), flower color (W1 or w1), and pubescence tip (Pb or pb). Isozyme traits tested were seed coat peroxidase (Ep or ep), malate dehydrogenase activity variant (MDH A or MDH B), and the following mobility variants: isocitrate dehydrogenase (Idh1-a or Idh1-b; Idh2-a or Idh2-b), diaphorase (Dia1-a or Dia1-b), aconitase (Aco4-a or Aco4-b or Aco4-c), phosphoglucomutase (Pgm1-a or Pgm1-b), and malic enzyme (ME A or ME B). The progenies from two cross combinations, Minsoy x y9y9 and PI424078 x y9y9, were observed in the F1, F2, and F3 generations. Linkage was detected between y9 and pb and was calculated to be approximately 28% in both populations. This represents a new linkage group in soybean.

14. Occurrence of plant-parasitic nematodes associated with corn, prairies, and woodlands

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Nematodes associated with corn, prairies, and woods were monitored from 404, 119, and 358 samples, respectively. Samples were collected from all parts of Iowa, except prairies in the southeastern part of the state. Samples (100 cm^3 of soil) were processed by centrifugal-flotation. The numbers of plant-parasitic species found in corn, prairie, and woodland habitats were 27, 43, and 44, respectively. Similarity (Sorensen's index) of species was highest for the corn-prairie habitats (0.488), compared with corn-woodlands (0.225), or prairie-woodland (0.368) habitats. Nematode communities were most diverse in prairies with a Shannon-Weiner (H') index of 2.743, compared with 1.653 and 1.068 for woodlands and corn habitats, respectively. Evenness of species (J') was 0.405, 0.784, and 0.477 for corn, prairies, and woodlands, respectively.

15. Occurrence of four plant-parasitic nematodes in Iowa woodlands

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Of 358 soil samples collected in Iowa woodlands, Criconemella macrodora, Crossonema menzeli, Helicotylenchus platyurus, and Xiphinema rivesi were among the most common plant-parasitic nematodes found. Based on trees sampled ten or more times, the largest mean numbers of C. macrodora/ 100 cm^3 of soil were associated with Pinus strobus, Ostrya virginiana, Carya ovata, and Acer saccharum in that order. On the same basis, the highest mean counts of C. menzeli were around Quercus alba and Tilia americana, for H. platyurus around Juniperus virginiana and Prunus serotina, and for X. rivesi around A. saccharum and C. ovata. Irrespective of the times a tree species was sampled, the highest counts in an individual sample were 3000 C. macrodora around O. virginiana in Woodman Hollow State Preserve, 850 C. menzeli around Celtis occidentalis in Brush Creek Canyon State Preserve, 850 H. platyurus around P. serotina in Pilot Knob State Park, and 760 X. rivesi around Juglans nigra in Idlewild Park, Floyd County.

16. Population changes of plant-parasitic nematodes in maize and soybean cultivars

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Numbers of plant-parasitic nematodes in or around three maize and three soybean cultivars were significantly fewer in plots treated with aldicarb (Temik) than in nontreated plots. Greater numbers of Pratylenchus spp. occurred in well-drained loess soils than in more heavily textured ones. Significantly greater numbers of parasitic nematodes were associated with corn than with soybeans in adjacent experiments in three soil types. Cultivars within a host species supported different numbers of nematodes in the same soil type. Yields of both maize and soybeans were greater in treated than in nontreated plots.

Anthropology

17. Perceptions of community in a development town

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Newtown is a development town whose population has doubled in the last 15 years, due to the MidWales Development Board's efforts. In order to identify some of the effects of changes in housing and population on Newtownians' perception of community, I focused on middle-aged, indigenous Newtownians in the relatively new housing estates. I conducted formal and informal interviews, as well as participant observation in a variety of settings. Through domain analysis, I found that many of the local people partially attribute significant loss of community to the influx of "outsiders." But rather than rejecting the outsiders and preserving their old community, these locals symbolically construct a new kind of environment in which they feel comfortable, and which oversteps physical boundaries. The study refutes some of the stereotypical claims by other groups that locals cling to tradition and are in cliques.

18. Elderly in the community, cared for by the community, a working example in Montgomery, Powys Co., Wales

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A high percentage of the population of Montgomery--a small rural community in Wales--are elderly persons living alone. Services and other forms of assistance from the national and local governments, supplemented by formal and informal community aid keep the elderly a part of Montgomery and functioning independently. Both formal and informal aid may come to the elderly either directly or with the mediation of, family, friends, neighbors, and the local clubs. With the emphasis on the community as a source of, and channel for, elderly care, those factors which affect people's sense of that community become particularly relevant for social policy makers. Current trends--government programs for rural development, privatization, the encouragement of new businesses--portend a dubious future for Montgomery's tradition of caring for its independent elderly. Based on recent fieldwork in Wales.

19. The impact of economic planning on the Welsh farming village of Caersws

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Economic planning in large core towns has had an impact on the small farming village of Caersws in the Development Region of Mid-Wales. Two manufacturers were recently allowed premises in the village by the district council, and an airport will soon be built on the village outskirts. The indigenous inhabitants of the village resent these modern developments and the influx of unemployed workers from English and Southern Welsh cities who have moved into the area because of job opportunities in Mid-Wales. They feel that the rural atmosphere and lifestyle of Caersws are being threatened by development and the newcomers it brings. A model of the changing class structure of the village will be presented, and the indigenous villagers' response to current changes will be discussed through the presentation of taxonomies that illustrate insider/outsider and rural/urban distinctions that they make.

20. Life is with tourists: a comparison of Iowa's Amana Colonies and a Swiss mountain village

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This paper compares the impact of tourism on two small communities -- Amana, Iowa, and Saas Almagell, Canton Wallis, Switzerland -- in terms of the rate of growth of the tourist industry, its impact on land use, its impact on local customs and way of life, and the extent and nature of local control over tourism. Whereas in Saas Almagell the impact of tourism is moderated by a tradition of decision-making based on communal interests, a similar tradition in Amana was rendered inoperative in 1980 through a legal challenge. The result has been a dramatic proliferation of tourist businesses in Amana and a greater disruption of traditional community patterns there than in Saas Almagell. The cases differ especially in the degree of involvement of external authority and in the degree to which natives perceived the tradition of communal values as continuing to work in their interests.

21. Ethnic origins of Buddhism

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Many features of Buddhist belief and ritual on the Indian subcontinent can be related to archaeologically and ethnographically documented aboriginal practices. The proposition that early Buddhism be seen as a revitalization movement of India's native peoples in reaction to Aryan domination provides a basis for clearer understanding of this movement's characteristic form of monastic organization, its rapid spread

across the subcontinent, and its eventual persecution and eradication there. The character of Buddhism as it emerged from the subcontinent into greater Asia was indelibly marked by this heritage of ethnic alignment and nativist rebellion, and the containment strategies evolved in the dominant Brahminic/ Hindu tradition became a key part of the ethos of classical Indian civilization.

Biotechnology

22. Genotypic differences in growth of suspension cultures of Zea mays

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The growth characteristics of rapidly growing embryogenic cultures in maize are relevant to their use for in vitro selection and/or transformation. Embryogenic suspension cultures of two genotypes, one a B73 cell line and the other a (G35 x B73) x B73 cell line, were passively sieved through a screen of 500 um pore size. Cultures were sampled before and after sieving. These samples were fixed, dehydrated, and embedded in paraplast. The (G35 x B73) x B73 suspension culture contained small clusters of meristematic cells that were similar in morphology to the embryogenic regions of cultured immature embryos. The B73 suspension culture contained large groups of cells often consisting of several hundreds of cells. Both cultures were adversely affected by sieving with the (G35 x B73) x B73 culture recovering more quickly. These studies indicate that suspension cultures have characteristic features which may affect their use in in vitro selection and transformation.

23. Molecular markers as tools for maize breeding and genetics

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Genetic maps based on isozymes and restriction fragment length polymorphisms (RFLPs) have been developed for maize. With these markers, plant breeders and geneticists have an unprecedented ability to describe the genetic constitution of maize germplasm. Unique attributes of these molecular markers make them a powerful tool for plant improvement programs. Basic and practical applications of molecular markers will be discussed.

24. Morphogenetic potential of leaf, internode, and root explants from Populus alba x P. grandidentata plantlets

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Morphogenetic responses of explants of Populus alba x P. grandidentata plantlet depend significantly upon the explant source and upon the combination of exogenously applied plant growth regulators. Two clones of this hybrid poplar, Crandon and Hansen, exhibited interclonal variations in their morphogenetic responses in leaf, internode, and root explant cultured at various benzylaminopurine (BA) and naphthalene-acetic acid (NAA) combinations. Among the three explant sources, leaf explants were the most responsive to the BA and NAA combinations tested, and root explants were the least responsive. Abaxial side culture of entire leaf explants was best suited for inducing adventitous shoot buds from two clones of this hybrid poplar. Other aspects associated with the biotechnology applications of in vitro cultured plantlets will also be discussed.

25. Genetic Mapping In Maize: Using RFLPs To Map Genes In The Absence Of Identifiable Mutants

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Genetic maps, derived through analysis of recombination frequencies between pairs of phenotypically expressed mutants, have been invaluable tools for both basic and applied studies. However, this method has proven unsatisfactory for the analysis of multilocus traits. We are investigating the utility of DNA Restriction Fragment Length Polymorphisms to study these traits with the goal of mapping each of the individual genetic components of a complex trait. To accomplish this we must prepare a linkage map composed of random, unidentified RFLP probes, correlate this map with the conventional genetic map, and locate agronomically important loci relative to these markers. To demonstrate this approach, we have mapped a gene (Css, constitutive sucrose synthetase) which has no phenotype observable at the whole plant level. A genomic clone of Css, identified by McCarty et al. (PNAS, in press) was used as a hybridization probe and mapped relative to Sh1 and Wx1, two loci previously placed on chromosome 9 by conventional genetic analysis. Css mapped near the centromere, 32 $\pm$ 4 cM from Sh1 and 11 $\pm$ 2 cM from Wx1.

26. Phosphorus-31 nuclear magnetic response studies of trout sperm metabolism during storage

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Phosphorus-31 NMR studies were used to study sperm metabolism during storage of semen collected from the rainbow and the brown trout throughout

their fall breeding period. Sperm counts, eosin-B dye exclusion tests, seminal volumes, and sperm motility were measured in freshly collected samples and continued for 3-4 weeks. Changes in the concentration peaks of high energy phosphorus-containing compounds (ATP, ADP, phosphocreatine) were monitored. A close correlation existed between the percentage of living sperm determined by dye exclusion tests and the percentage of spermatozoa capable of becoming motile. As long as motility percentage was high (75-100%), PCr and ATP were measurable although their levels decreased during storage. The quality of fresh semen for the two species was found to remain fairly constant during the respective breeding season. During storage the quality of semen gradually declined in 2-3 weeks. These studies aided in the understanding of the basic metabolism of trout spermatozoa during unfrozen storage and preceded cryopreservation studies. Supported by Grant ISF-86-52 and ICC.

27. **Protein phosphatases and the control of cell function**

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The phosphorylation of proteins on serine, threonine and tyrosine residues is a primary mechanims for regulating the activity of enzymes and other proteins. The steady state level of phosphorylation of any given protein is determined by the balance of the protein kinase and protein phosphatase activities toward the protein. There are at least 13 protein phosphatases which dephosphorylate cellular proteins, 6 are specific for proteins phosphorylated on serine and threonine residues and the remainder act on phosphotyrosyl-proteins. Six of the protein phosphatases are regulated by mechanisms which are thought to be of physiological significance. Two are activated by micromolar concentrations of calcium ions. One enzyme is regulated through its direct phosphorylation by a protein kinase and four are regulated by heat-stable proteins which specifically inhibit the target enzymes. The properties and regulation of the protein phosphatases will be discussed.

28. Pathogenic mechanisms of Mycoplasmas

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Virulence factors of mycoplasmas seem to be associated with the cell-cell interactions established at the mucosal cell membrane interface during infection. Therefore an understanding of pathogenesis requires knowledge about the properties or activities observed on their outer membrane surfaces. These organisms have several membrane properties of pathogenic potential, including hemagglutination (HA), hemolytic (HL) and nuclease activities.

The virulence factors of several mycoplasmas are presently under investigation, including *Mycoplasma pulmonis*, a rodent pathogen; *M. hyopneumoniae*, a swine pathogen; and *M. gallisepticum*, a poultry pathogen. Data indicate that *M. pulmonis* binds to eukaryotic cells in a multiphasic manner, and that hemolysis may be related to acquisition of cholesterol from its host cell membrane. Future studies will take a genetic approach to the solution of mycoplasma diseases of swine and poultry through an understanding of virulence factors and development of recombinant vaccines directed at those factors.

29. Further understanding "Turkey Viral Enteritis" by using biotechnology techniques.

D. L. REYNOLDS

Within recent years, an enteric disease of undetermined etiology has become an increasing concern to turkey producers and to those involved with poultry health. This disease, most commonly referred to as "turkey viral enteritis", is observed in poults from 1 to 4 weeks of age. Clinical signs of diarrhea, nervousness, and litter eating appear during this period. Mortality is low, but morbidity, resulting in stunting and flock uneveness is moderate to high. Although not well documented, this disease is thought to cause major economic losses throughout the turkey industry.

Recently, a number of viruses have been incriminated as etiologic agents for this enteric disease. Such viruses include rotaviruses, rotavirus-like virus (RVLV) and astroviruses. Astroviruses have been shown to produce enteric disease in turkey poults in the absence of other recognized enteropathogens. Furthermore, recent surveys have shown that astroviruses and RVLVs are the most prevalent viruses infecting poults with "turkey viral enteritis", and Astroviruses and RVLV's seldom occur alone, but generally occur in combination with each other.

Practical application of biotechnology techniques to be used in the diagnosis, control and further understanding of "turkey viral enteritis" will be presented.

30. Plant recovery from type I and II embryogenic callus in maize

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Efficient plant recovery from Type I and II embryogenic maize callus varies among inbred lines. Embryogenic response and regeneration from 25 lines were analyzed following culture of ca. 200 immature embryos per line onto medium similar to N6 with 1400 mg/l proline, 800 mg/l asparagine, and 0.75 mg/l 2,4-D. Type I and II response was taken 14 days after initiation. At 14 days, all Type I embryos were transferred to regeneration medium with 5.0 mg/l IAA. After 7 days, these embryos were put in the light on regeneration medium containing no IAA. At 14 days, all Type II embryos were subcultured onto initiation medium until day 28 when embryogenic response was taken. Type II embryos were then transferred to regeneration medium as above. Among all lines, the best Type I response was in P57 with a plant recovery of 0.045 plants/embryo cultured. The best Type II response was in K29 with a plant recovery of 0.268 plants/embryo cultured. Type I embryogenic responses are not predictive of plant recovery from maize callus whereas Type II are.

Botany

31. Some aquatic hyphomycetes from the Republic of Colombia, South America.

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Twenty five species of aquatic hyphomycetes were collected from foam samples in two streams from Colombia's Andeans mountains.

Alatospora acuminata Ing.; Anguillospora crassa Ing.; Anguillospora longissima (Sacc. & Syd.) Ing.; Anguillospora pseudolongissima Ran; Campylospora chaetocladia Ran; Campylospora parvula Kuz; Clavatospora longibrachiata (Ing.) Nils ex Marv.; Dendrospora erecta Ing.; Flabellospora crassa Alasoadura; Flagellospora penicilloides Ing.; Heliscus submersus Hudson; Lemonniera aquatica De Wild; Lemonniera pseudofloscula Dyko; Lemonniera terrestris Tubaki; Lunulospora curvula Ing.; Phalangispora constricta Nawawi; Pyramidospora casuarinae Nilss; Sigmoidea sp.; Tetracladium apiense Sincl; Tetracladium marchalianum De Wid; Tetracladium setigerum (Grove) Ing; Tetraploa aristata Berk & Br. and Triscelophorus monosporus Ing. The species reported during this survey have not been previously reported from this country.

32. Vittaria graminifolia, a new fern species (?) for the United States

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Species of the fern family Vittariaceae differ from most ferns in having gametophytes (the tiny, haploid generation of the life cycle) which can reproduce themselves without cycling through the sporophyte generation. This is accomplished through gametophytic production of vegetative propagules, gemmae. As a consequence, gametophyte colonies can exist indefinitely without producing sporophytes. Such independent colonies were collected on the bases of beech trees (Fagus grandifolia) in St. Helena Parish, Louisiana. Morphological characteristics and enzyme electrophoresis patterns, compared with tropical American species, indicate that these are gametophytes of Vittaria graminifolia Kaulf. a species common in Central America but unknown in the United States. Does this occurrence warrant listing Vittaria graminifolia as a member of the Louisiana and U.S. flora?

33. An Early Pennsylvanian Flora from Wyoming Hill, Iowa.

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During the Spring and Summer of 1984 the relocation of Iowa Highway Rt. 22 in the Wyoming Hill area near Muscatine, Iowa resulted in extensive excavation of coal-bearing strata. With assistance from the Iowa Department of Transportation, the authors were able to make collections of plant fossils from a distinctive, finely laminated sandstone/shale.

Among the most common and well-preserved plant fossils were Megalopteris dawsoni, Lesleya cheimarosa, Lacoea seriata, Palaeopteridium reussii, Sphenopteris pottsvillea, Sphenopteris tenerrimum, Alethopteris lonchitica, Alloiopteris gracillima, and Cordaites principalis. These plant macrofossils and the microfossils from the associated coals suggest an Early Pennsylvanian, Morrowan (Namurian B-Westphalian A) age. The Wyoming Hill flora is unlike that known from any other Iowa locality, but is similar to that reported from the Allied Stone Company located in Rock Island Co., Illinois.

34. Aquatic hyphomycetes from the Skunk River and on Central Campus, ISU, Ames, Iowa

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A survey of the aquatic hyphomycetes of the Skunk River near Ames, of Lake Laverne and College Creek on Central Campus was conducted in 1986. Leaves in various stages of decomposition were retrieved and maintained in the laboratory to observe spore formation. Eight species and one unknown were observed during summer and fall sampling. Lemonniera aquatica was the most common species. Parthenocissus leaves supported a wide range of species while Acer and Quercus leaves were the least colonized substrates. These results differ from the observations reported by Dyko in a 1971-72 study. Also Triscelophorus monosporus was found during fall as well as in summer. Skeletonized leaves were as well colonized as less decomposed leaves.

35. Field performance of conifer seedlings: Bare-root versus containerized stock

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Containerized seedlings of Pinus resinosa and Picea glauca are suggested as an alternative to bareroot stock for reforestation in Iowa. Advantages of containers are longer planting seasons, protection of root systems at time of planting, and more rapid growth of seedlings. However, the containers can initially distort root development, from which the seedling may not recover following outplanting.

Bareroot seedlings were compared with seedlings grown in bookplanters, Leach pine cells, Japanese paperpots, and styroblocks. Height, root length, root collar diameter, and shoot and root dry weights were measured. First season survival rates are comparable for all stock. Although the bare-root seedlings are initially larger than the container stock, due to age differences (3 years versus 6 months, respectively), all container stock parameters have greater growth rates than their bareroot counterparts. While the differences among container types are narrower, root configuration varies with container and species.

36. Floristic comparison of fens in eastern and western Iowa

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Of 148 species (A) of vascular plants and bryophytes inhabiting fens in northwestern Iowa, 108 of them (c) also occur in "hanging bogs" and other wetland plant communities on organic soil in eastern Iowa (in turn, containing 201 species). A floristic overlap of 45% is calculated with Jaccard's Index of Similarity [c/(A+B-c)], a relatively high value within the range of 25-50% used in phytosociological literature to equate plant communities. Floristic similarity is greatest ($\geq$ 48%) within graminoid-cyperoid and forb components and least ($\leq$ 25%) among shrub, tree, and bryophyte components. This Index of Similarity (45%) is 4X greater than a value of 11% evident in a comparison in 1978 by Lammers and Van der Valk, resulting largely from increased botanical inventory of eastern fens in the last decade.

37. Rare fen plant discoveries in Iowa during 1986

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The year 1986 was a bonanza for rare fen plant discoveries. The majority were located on private property. Thirty-three new records on 18 sites in 8 counties were found in Iowa Erosion Surface fens. These include Betula pumila, Eriophorum angustifolium, Galium labradoricum (not collected since 1952), Gentianopsis crinata, G. procera, Menyanthes trifoliata, Mimulus glabratus, Parnassia glauca, Salix candida, S. pedicellaris, and Valeriana edulis. Twenty-nine new records on 8 sites in 3 counties were found in western Des Moines Lobe fens. These include Eriophorum angustifolium, Gentianopsis procera, Juncus alpinus, Lobelia kalmii, Parnassia glauca, Rhynchospora capillacea, Triglochin maritima, and T. palustre. Mimulus glabratus was found on a fen in the Lake Calvin Basin. Future work, using soil surveys, promises to produce additional rare fen plant sites.

38. Statistical characterizations of the atrazine-induced, photosynthetic inhibition of a freshwater diatom.

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The effect of atrazine on the photosynthetic O_2 evolution of 3 geographical races of Cyclotella meneghiniana was investigated. Cells were removed from steady-state cultures, placed in a reaction vessel possessing an O_2 electrode, and subjected to increasing atrazine concentrations. Percent photosynthetic inhibition, as measured by decline in O_2 evolution, was characterized for each race using regression, probit, and logit models. A differential sensitivity to atrazine was observed among the geographical races; two races exhibited immediate and similar asymptotic, inhibitory responses while one race exhibited a delayed linear, inhibitory response. The EC_{50} values estimated by the regression models were greater than values estimated by probit and logit models for all races. However, since atrazine-induced inhibition is a continuous rather than a quantal response, the use of probit and logit models to statistically characterize herbicidal effects on algal photosynthetic capability is not recommended.

39. Measurement of protein solubilized from non-green plant tissues with urea and NP-40 for 2-D PAGE

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A method has been developed to quantify protein concentration of small masses of non-green plant tissue utilizing bicinchoninic acid (BCA) (Smith et al., Anal. Biochem. 150:76-85, 1985). By elimination of 2-mercaptoethanol and Ampholines from the standard urea solubilization for 2-D PAGE (Anderson et al., ANL-BIM. Argonne., 70-2, 1979; Dunbar et al., Electrophoresis, 6:39-43, 1985) prior to the protein assay, we showed that the protein concentration can be directly determined for samples subjected to isoelectric-focusing (IEF) and SDS-PAGE. Analyses of 2-D PAGE gels verified the polypeptide patterns were not different from the standard urea protocol. Proteins were solubilized from 10-20 maize inflorescence sections in 100 ul of 9 M urea containing 4% NP-40 by 7 freeze-thaw cycles during 2 h; homogenates were centrifuged at 90,000 rpm for 2 h. Five ul of supernatant were added to 20 ul of 9 M urea (with 4% NP-40) and 500 ul of BCA working reagent. Reactions were performed at room temperature for 20 h. Absorbance at 562 NM was corrected using interference blanks containing urea and NP-40. The assay was sensitive enough to quantify as little as 1 x 10^{-2} ug/ul of protein using bovine serum albumin (Pierce) as a standard. Samples for IEF were incubated with 2% 2-mercaptoethanol and 2% Ampholines. We routinely load 8-12 ug of protein sample for IEF. It is now possible to quantify the amount of solubilized protein in the same small plant tissue mass used for 2-D PAGE. Using this method we have recently examined the polypeptide patterns associated with the early stages of maize inflorescence development.

40. Protein analysis of early inflorescence development in maize utilizing two-dimensional electrophoresis

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Numerous developmental events are known to be influenced or controlled by alternations in gene expression; the protein products of these expressions can be correlated to morphological differentiation. Data to elucidate protein products can be gathered, via 2-D PAGE and silver stain technology, from different stages of maize inflorescence development. We have analyzed the first two stages of ear and tassel development to test the morphogenetic model of maize inflorescence differentiation (Postlethwait and Nelson, A. J. B. 51:238-243, 1964; Heslop-Harrison, Brookhaven Symp. Bio. 16:108-125, 1964) that differential gene expression accompanies the switch between morphological stages. Of the approximate 600 (ear) to 900 (tassel) polypeptides detected, several (27-ear; 23-tassel) showed qualitative and possible quantitative changes associated with a specific stage of inflorescence development: apex$\longrightarrow$ branch primordia$\longrightarrow$spikelet primordia. Approximately 65% of the qualitative changes were novel to the spikelet primordia. Another 15% (tassel) - 25% (ear) of the polypeptide changes were novel to the apex. Most of the polypeptides observed at the branch primordia stage were detected in the spikelet primordia. We do not know the function of these stage-associated polypeptides; however, they may be useful in providing markers for inflorescence differentiation. The appearance and disappearance of polypeptides that were observed may indicate that gene expression or post-translational activity is required to modulate a morphological switch during development. We are currently examining the polypeptide complement associated with other developmental stages of a maize inflorescence.

41. Tree root distribution.

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Tree roots take-up water and nutrients, provide mechanical support, and produce growth regulators which influence plant growth. Root systems are dynamic, changing in response to changes in their environment. Some roots exhibit secondary growth, increasing in diameter, and may exist for the life of the tree. Other roots are ephemeral.

This presentation deals with the distribution of tree roots. This distribution depends upon species, soil conditions, competition, age, and other factors. Generally, fine-feeder roots proliferate in the upper part of the solum where conditions for root growth and nutrient uptake are usually most favorable. Some larger roots may extend deep into the solum to take-up water, especially during dry periods.

42. Effects of phytotropins on auxin induced growth and on the photodestruction of IAA

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The auxin inhibitors TIBA, DPX 1840, CPP, and CFM as well as fluorescein and the related compounds rhodamine, mercurochrome, and eosin are active in initiating a positive curvature response in the Avena coleoptile in the presence of high endogenous auxin levels. These compounds are also competitive with IAA when tested in the negative curvature bioassay and analyzed by the Lineweaver-Burk method.

Rhodamine, eosin and mercurochrome added to solutions of IAA and maintained in the light show evidence of the photodestruction of IAA as determined through thin layer chromatography. Mixtures of fluorescein and IAA do not show evidence of photo-destruction. The sulfhydral reagent iodoacetic acid also gives positive curvature and is competitive with IAA. Iodoacetic acid also degrades IAA photo-chemically.

43. Pellucid palisade idioblasts: a new cell type in leaves of Erythrina (Leguminosae;Papilionoideae)

C. L. BRUBAKER and N. R. LERSTEN

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The typical palisade parenchyma of Erythrina (tribe Phaseoleae;subtribe Erythrininae) consists of 3-4 layers of columnar cells found just below the adaxial epidermis. Interspersed among these cells are large colorless cells we have designated as pellucid palisade idioblasts (PPIs). The paraveinal mesophyll, a single horizontal cell layer unique to legumes, separates the palisade chlorenchyma from the spongy mesophyll. As seen in resin sections, the PPIs are wider and longer than the typical palisade parenchyma. The PPIs abut the adaxial epidermis but do not come into contact with the paraveinal mesophyll. There are typically 1-4 PPIs in each areole occurring either singly or clustered. The thin peripheral cytoplasm with few chloroplasts surrounds a large central vacuole. Using sodium hydroxide/chloral hydrate clearings, 100+ species in eight of the nine genera were surveyed. PPIs have only been observed in Erythrina. The function of PPIs is unknown. Accumulations of calcium oxalate, calcium carbonate, tannins, oils, or carbohydrates have not been observed. A review of the literature indicates that this is a previously undescribed cell type.

44. The flora and vegetation communities of Dolliver State Park, Webster County, Iowa.

C. L. JOHNSON-GROH, D. Q. LEWIS, AND J. F. SHEARER

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The flora and vegetation communities of Dolliver State Park were surveyed and compared to Ledges State Park and Woodman Hollow State Preserve. 406 species of vascular plants have been identified for Dolliver State Park, several of which are unusual for central Iowa. A vegetation map of the park was constructed using the vegetation types defined for the Ledges State Park. The structure of the vegetation in Dolliver differs from that of Ledges, with a much greater development of hill prairies at Dolliver State Park. The prairie savanna influence is strong in Dolliver as evidenced by the higher cover of Quercus macrocarpa. Four new vegetation types were described for Dolliver State Park.

45. Rare plant discoveries on state land in 1986

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Iowa's state forests, state parks, and wildlife management areas contain a number of rare plants. The Bureau of Preserves and Ecological Services is conducting a long term inventory of state land to discover new rare plant sites. This past year produced new sites for Angelica atropurpurea, Jeffersonia diphylla, Mimulus glabratus, Phlox bifida, Platanthera psycodes, Polygala polygama, and Spiranthes ovalis on seven state park and wildlife areas in four counties. In addition, old records for Dodecatheon amethystinum and Vaccinium angustifolium at a state park and wildlife management area were reconfirmed.

46. Orange Fungus in a Black Hole at Red Rock

W. H. Gilbert III, J. K. Moody, and..

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The cave-like environment of the 'grout gallery' within the concrete depths of Red Rock Dam (U. S. Army Corps of Engineers; Marion County), harbors a profuse and peculiar population of the soil fungus *Epicoccum nigrum*. When growing on leaf-litter of a forest floor, this fungus is inconspicuous; but when grown on agar medium, it has an orange color. *Epicoccum nigrum* at Red Rock forms conspicuous mats of burnt orange strands clumped along the shallow gutter that drains water from the gallery. VIsitors on tours through this gallery often comment about these orange blobs. Curiously, each mat is adjacent to a drill hole (down through the concrete) that drains surficial ground water from beneath the dam. Information about this fungus and the water surrounding it will be presented.

47. The prairies of the St. Croix National Scenic Riverway

D.C. Glenn-Lewin and J. Ver Hoef

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More than 60 small prairies are located along the St. Croix River from its confluence with the Mississippi River at Hastings, Minnesota, north about 150 river km to Highway 70, near Grantsburg, Wisconsin. Of these, 8 are old fields, but with a definite prairie aspect. The native prairies fall into three distinct groups: hill prairies on steep slopes of Cambrian sandstone, basalt balds, and sand pine barren prairies on the old sands of Glacial Lake Grantsburg. These three types exhibit different structures, diversities, and compositions; only 7 species are shared as leading species by the three types. The hill prairies are similar to those of northeastern Iowa, but not as large, nor generally as rich. Cryptogams are very important on basalt balds, and exposed blocks of basalt are interspersed with prairie species. Numerical analysis indicates that within-type variation is greatest in the basalt type.

48. Pattern analysis of three prairie types along the St. Croix River

J.M. Ver Hoef and D.C. Glenn-Lewin

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One characteristic location of each of the three main grassland types (hill prairie, basalt bald, sand prairie) along the St. Croix River was sampled by 300 contiguous 10 x 10 cm quadrats to determine: 1) associations of plant species within each type, 2) small scale pattern of these associations, 3) relationships of patterns within types, 4) possible causes of the small scale pattern, and 5) differences in pattern between the types. Results indicate that there are several associations within a prairie type, and these may occur at several scales. The relationships of associations depend upon site types: associations may be nested in a hierarchy or independent of each other. Small scale patterns may be caused by various environmental factors or plant-plant interactions.

49. The Iowa morel - false morel survey - a three year report

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A morel - false morel survey was conducted in Iowa during the spring in the years 1984, 1985, and 1986. Persons throughout the state contributed specimens by sending them directly to identification centers at Iowa State University or at Central College or by submitting them to Iowa State via their county extension office. Significant material was contributed each year by members of the Prairie State Mushroom Club individually or during the group forays held each spring.

During the three years, collections from seventy four counties were processed. Each species collection, whether consisting of a single specimen or several dozen individuals, was photographed, field data noted, and microscopic and macroscopic information on individual specimens recorded. Fruiting period for all species was during the four or five weeks from mid-April to mid-May.

During the three years, five species of Morchella, two species of Verpa, and two species of Gyromitra were collected. Three of the species were collected in only two of the three years.

50. The plant parasitic fungi of Hayden Prairie - a preliminary report.

JUDY SHEARER AND LOIS H. TIFFANY

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Although many aspects of native prairie have been described, evaluated and studied, the fungal parasites of prairie plants have received little attention. Gilman and Archer's 1929 compilation of the fungi parasitic on Iowa plants does include some prairie plant parasites, particularly rust fungi.

We intensively collected diseased plants from Hayden Prairie in June, July, and September, 1986.

Based on examination of this material and of collections accumulated over the past few years, basic information about the parasitic fungus population of this prairie is being developed.

51. Buffalo Slough rediscovered.

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Department of Natural Resources, Des Moines, IA 50319, and University of Northern Iowa, Cedar Falls, IA 50614

Buffalo Slough, located in Mason City, Cerro Gordo County, Iowa, was the site of many vascular plant collections by Bohumil Shimek during the early part of this century. Some of the species collected are today exceedingly rare in Iowa. In recent decades, field botanists thought the site was no longer extant. In June, 1986, the authors were asked to visit the site to determine if any rare species would be impacted through a peat mining project. During a brief inventory, the following rare plant species were found: Northern Bedstraw (Galium labradoricum), Bogbean (Menyanthes trifoliata), Sage Willow (Salix candida), and Angelica (Angelica atropurpurea).

A portion of the site, which occurs in a narrow channel of an ancient river, is owned by the city of Mason City; the remainder is owned by a complex of private landowners. Attempts to protect the site through registration, easement, or preserve dedication are being made.

52. The flora of an abandoned RR right-a-way in Sioux County located in Northwest Iowa

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A study of the vascular flora of an abandoned RR right-a-way was carried out during the summers of 1985 and 1986. The two mile stretch is located between Alton and Orange City. Two hundred and twenty five species were found. Seventy percent were native species. A number of uncommon plants to the area were found. Several county records were recorded. The top five families and corresponding species numbers were: Asteraceae, 44; Poaceae, 38; Fabaceae, 16; Polygonaceae, 12; and Brassicaceae, 7.

The roadbed has been converted into a hiking and nature trail. Trees and shrubs have been planted in areas overrun by introduced grasses and seeds of native grasses and forbs have been planted in the disturbed areas.

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

L. A. JOHNSON AND D. C. GLENN-LEWIN

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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 or mid-summer, late summer, and fall burns were applied to small plots in replicate blocks during a two year study. The effects of 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, and responses were also seen the second year following the burns. Number of seedlings varied with amount of litter, but fire treatments reduced the number of dicot seedlings. Germination was enhanced in burned plots during the second year after the burns.

54. Patterns of occurrence of corticolous bryophytes and lichens in relation to tree communities and microclimate.

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The corticolous bryophytes and lichens of a woodland in central Iowa were studied to assess the patterns of distributions of epiphytes relative to distributions of phorophyte species and microclimate. Five species of trees were sampled from the ground to a height of one meter in fifteen plots representing five vascular plant communities. Comparisons between the epiphytes and the vascular plant communities were made to address the role of vascular plant species in determining epiphyte distributions; e.g., does the white oak in a white oak community supports the same mosses and in the same quantity as the rare white oak in the red oak community. Most epiphytes were not restricted to a particular tree species or tree community, but the quantities of species varied with the tree species, community and microclimate. The greatest species diversity and cover of epiphytes were found on Quercus rubra. Epiphyte distributions correlated with individual phorophytes and phorophyte communities less than with the microclimate.

55. Internal secretory reservoirs (ducts) of two types in giant ragweed: stem, leaf, flowers

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Dimorphic internal ducts have not been reported in plants before, but they coexist in Ambrosia trifida, as shown by paraffin and resin sections. One type consists of oil-filled reservoirs, with a single epithelium, occurring in irregular files in stem pith, adjacent to xylem, and within the phloem. In leaves, they occur in phloem as well as near the xylem, of the 3 major bundles and the 2nd order bundles. In 3rd order bundles, only a single file of reservoirs occurs above the xylem; they are absent from smaller veins, vein endings, and all flower parts. A second type consists of elongate but non-anastomosing reservoirs with red polyacetylene contents. These occur outside phloem and have a double epithelium. They begin in the lower third of the leaf, then follow major bundles down through the petiole, and end near or at the node, or extend down an additional 1-2 internodes. The ends are often a swollen sac. Short, broad forms occur in bracts and petals; other flower parts lack them.

56. Internal secretory reservoirs (ducts) of two types in giant ragweed: cotyledons, hypocotyl and roots.

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Giant ragweed cotyledons, hypocotyls and roots have two types of secretory cavities. One consists of several large, elongate non-anastomosing reservoirs (ducts) in the cortex of roots and hypocotyl. Two of these cavities extend into each cotyledon; others end at the cotyledonary node or extend into the stem a short distance above the cotyledonary node. The reservoirs are visible on living specimens because they contain a dark red polyacetylene. In the hypocotyl and cotyledons, the epithelial cells are also dark red. In the hypocotyl, these reservoirs are evenly spaced; in the root they occur in two to four parallel linear arrays of five to seven each. Reservoirs of lateral roots are independent of those of parent roots. The second type of cavity occurs in primary or secondary phloem of hypocotyl, but not in roots or cotyledons. These cavities are smaller, shorter and contain an oily secretory product.

57. Distribution of paraveinal mesophyll in Erythrininae (Leguminosae;Papilionoideae;Phaseoleae)

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Paraveinal mesophyll (PVM) is a single cell layer, found in the leaf mesophyll of many legumes, which extends between vascular bundles at the level of the phloem. It has been shown experimentally in soybean to be the preferred pathway for photosynthate transport from the chlorenchyma to the leaf veins. Although common in the Leguminosae, PVM is not found in some genera of legumes, thus making it a possible taxonomic character. In the heterogenous subtribe Erythrininae, little is known about the PVM. Using a sodium hydroxide/chloral hydrate clearing procedure, supplemented by resin sections and scanning electron microscopy, 100+ species in eight of the nine genera were surveyed for the presence or absence of PVM, making this the most intensive survey of PVM in a subtribal taxon. With 1 or 2 exceptions, all genera in the Erythrininae have PVM. The range of variation in shape and size of PVM among the genera was also determined. PVM is invariably flattened horizontally, but with considerable variation in the thickness of the cells, the size of the intercellular spaces, and the degree of branching. The taxonomic significance of this variation is unclear as yet.

58. Extrafloral nectaries in Erythrina and Mucuna (Phaseoleae), and a general hypothesis for legumes

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Among the 3 legume subfamilies, extrafloral nectaries (EFNs) seem rare in Papilionoideae. They are reported only in Vicia (Vicieae) and 9 genera of Phaseoleae. Erythrina (4 species) and Mucuna pruriens (both subtribe Erythrininae of Phaseoleae) grown in an ISU greenhouse have EFNs differing from any described previously in legumes. Light and scanning microscopy show that Macuna has slender, filiform stipels, each with a central vascular bundle sheathed by septate fibers. Small clavate trichomes scattered from base to tip are the secretory units. Erythrina stipels are thick and protruding, with abaxial surface variously corrugated or invaginated into a single deep bowl. Small nectar-secreting trichomes, identical to those of Macuna EFNs, line these depressions. Mimosoideae and Caesalpinioideae have large EFNs with a common secretory epidermis and specialized vasculature. EFNs of Papilionoideae are hypothesized to have evolved independently, involving various aggregations of individual nectariferous trichomes.

59. Characterization of two vacuolar systems associated with the genesis of plant calcium oxalate.

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Plant calcium oxalate crystals typically form within specialized cells called crystal idioblasts. These cells, depending on the plant species, characteristically form in specific organs and tissues. Even though various studies implicate several possible functional roles for crystal idioblasts and the crystals, all include the involvement of calcium regulation. Developmental studies conducted with the electron microscope so far identify two types of machinery that are formed prior to crystal appearance. The first system involves the production of a cytoplasmically-derived amorphous mass in the vacoule which gives rise to a membrane complex and paracrystalline bodies. From these latter bodies develop crystal chambers in which crystals form. The second system involves de novo synthesis of a flocculent material in the vacuole from which arises crystal chambers, some membranes and tubules. These two systems are structurally different and may represent evolutionary trends as well as adaptations to environmental parameters and the genetics of the plant. Elucidation of these two systems may help to clarify the functional role(s) of crystal idioblasts.

60. Moss gametophyte and sporophyte esterase isozymes

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Esterase isozymes of gametophyte and sporophyte tissues of Iowa populations of Atrichum undulatum (Hedw.) P. Beauv., Brachythecium oxycladon (Brid.) Jaeg. & Sauerb., Entodon seductrix (Hedw.) C. M., and Mnium cuspidatum Hedw. were studied utilizing starch gel electrophoresis.

Although in each taxa the same isozymes were found in the sporophyte as were observed in the gametophyte, there were differences between the gametophytes and sporophytes of individual populations. A. undulatum and E. seductrix exhibited these differences with the addition and deletion of isozymes in the sporophyte as compared to the gametophyte. The other taxa showed the deletion but not the addition of esterases in the sporophytic tissues.

61. Receptor sites and light stimuli in soybean leaf movement

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Soybean (Glycine max L.) seedlings move their leaves, varying the amount of light received by the leaf blade. The leaf movement is controlled by the pulvinus, an organ at the base of the leaf. The plants receive a light signal that causes movement which can increase or decrease the amount of light received. We located the receptor sites by covering portions of the leaf blade, petiole, and pulvinus with India ink, and observing the effect on leaf movement. The pulvinus was the receptor site for both light seeking and light avoiding leaf movements. The role of specific wavelengths in light seeking and light avoiding was determined by using filters which removed broad bands of light. Blue light was necessary for both light seeking and light avoiding. Reception of blue light by the pulvinus contributes to the control of leaf movement and thus the amount of light received by the leaf.

62. Surface waxes and sensitivity to acid precipitation: cabbage cotyledons and leaves

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Cotyledons of cabbage (Brassica oleracea L.) are markedly more sensitive to damage from acid precipitation than true leaves of the same species. One possible explanation for this involves differences in the amount or type of wax in the cuticles of cotyledons and leaves. Surface waxes were obtained from cotyledons and leaves by dissolving the wax in chloroform, then evaporating the solvent. The waxes were separated into compound classes by thin layer chromatography. All those compound classes present in the leaf wax were also found in the cotyledon wax, although the proportions were different, with an increase in the proportion of the more polar compounds in the cotyledon wax. Three additional compound classes were present in the cotyledon wax. Leaves had very much more wax per unit surface area than did cotyledons. The low amounts of wax and the different composition may explain the differences in sensitivity to acid precipitation between cabbage leaves and cotyledons.

63. Effects of drought stress and light intensity on soybean leaf orientation

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Soybean (Glycine max L.) seedlings change leaf orientations when exposed to different environmental conditions. The relationship between leaf orientation and plant water status, and the effect of light level on this relationship, were studied in the greenhouse and the laboratory. The angle of the leaves was measured with a protractor, and the plant water status was measured using a pressure chamber. The light level was varied by placing layers of screening over the plants. The relationship between leaf angle and water status was determined for four light levels. The amount of light intercepted by the leaves decreased as the plants became drier. The response to drought was more pronounced at the higher light levels, but was apparent at 25% of full sun. The ability to change leaf orientation enables soybeans to reduce radiation load on the leaves during periods of drought and high light intensity.

64. Manipulating foliar development in red pine through exogenous applications of cytokinin.

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The components of a carrier solution needed to introduce cytokinins into red pine (Pinus resinosa Ait.) seedlings have been identified. Using a foliar dip, 200 mg/l 6-benzylaminopurine (BAP) resulted in the proliferation of adventitious buds near the seedlings' apex, but in little other foliar development. With successively lower BAP concentrations, an increasing percentage of the induced buds flushed. Seedlings treated with 2.5 mg/l BAP set a terminal bud which flushed earlier than in control seedlings. These same seedlings formed adventitious buds at the base of their cotyledons, but an apical cluster of adventitious buds was not observed. When the same concentration series was applied to the roots, a nearly 100-fold increase in the level of BAP was needed to produce the same response in the roots as in the shoots. We are currently trying to identify the changes in sensitivity to BAP throughout early ontogeny and the minimum number of treatments needed to induce bud formation. This work could lead to the development of a micropropagation technique for red pine.

231. Biogeographic implications of refugial communities in eastern Iowa.

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In Iowa, refugial communities are primarily formed due to unique geologic conditions which influence local microclimates. These microclimate refugia primarily contain disjunct taxa more common in other regions. Analysis of the floristic composition of such refugia will provide insight into the origination and change of the flora of eastern Iowa from early Holocene to present. On the basis of the time of colonization, the refugia can be designated as either paleorefugia or neorefugia. Examples of paleorefugial communities, such as dripping cliffs of Silurian-age dolomites, limestone ridge prairies and sand prairies exist in eastern Iowa. Discovery by the author of fen peatlands in eastern Iowa in 1983 documented an additional refugial community for this region. The geology and floristics of these other refugial sites will be discussed, with special reference given to the statewide distribution of fen communities and their distinctive floras. Analysis of these data may uncover the factors influencing the distribution of the rare taxa found on these sites.

Chemical Education

65. Buffers: A Demonstration

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This demonstration can be used when one is discussing acid-base relationships with buffered and unbuffered systems. In this demonstration, a buffer is constructed with acetic acid and sodium acetate. The process is monitored with a digital pH meter large enough for class visualization. Effects of the addition of strong acid or base to the buffer will be shown. A comparison will be made showing addition of strong acid and base to an unbuffered system while monitoring pH changes.

66. Rediscovering the cryophorus

B. HUTTON

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The cryophorus, first described in 1876, is an excellent device for demonstrating phenomena associated with many fundamental topics discussed in general chemistry: the Boltzman distribution of kinetic energies, the relationship between the absolute temperature and the average kinetic energy, the dynamic nature of equilibria, enthalpies of vaporization, and intermolecular forces of attraction. The use of a cryophorus will be demonstrated and a discussion of how the observed phenomena can be used as a basis for discussing these concepts will be presented.

67. The rainbow connection: having fun with simple acid-base indicators

B. HUTTON

Iowa State University, Ames, IA 50011

A demonstration which employs simple acid-base indicator phenomena in an entertaining and, to some, a mystifying fashion will be presented. The success of this demonstration in chemistry "shows" as well as the classroom will be discussed.

68. Red, White and Blue

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When two pennies are added to a three flask system containing unequal amounts of colorless solutions, a number of visual changes occur. After 20 minutes the solution in the flasks are equally distributed and appear red, white and blue.

The two pennies react with the concentrated nitric acid in flask three to produce a large volume of nitrogen dioxide gas. The pressure from this gas production forces air from flask number three into flask number two which forces one-half of the dilute nitric acid and phenolphthalein from the middle flask to the first flask. As the phenolphthalein mixes with the more conc. sodium hydroxide solution, flask number one turns red. As the solution in flask three cools and the nitrogen dioxide gas dissolves, one-half of the red phenolthalein solution in flask one is pushed into the nitric acid in flask two and, at the same time, this colorless solution turns blue upon entering flask three due to the presence of copper II ions from the reacting pennies.

69. Gas laws with cryogenics + extras

M. F. FEDDERSEN

North High School, Sioux City, Ia. 51104

I. Determination of absolute zero using John's Apparatus. Record pressure of apparatus at room temperature, in boiling and ice water, in a dry ice acetone bath, and liquid N_2. Students plot the graph of temperature vs. pressure to find absolute zero.

II. Gas volumes at low temperatures and the buoyancy of air are shown using balloons filled with CO_2 and O_2. Mass of the empty balloons and mass of the full balloons are recorded. Balloons are placed in liquid N_2 and allowed to cool (CO_2 solidifies). The cold balloon with CO_2 is placed on an electronic balance, and the mass noted periodically.

III. Demonstrate the characteristics of materials at very low temperatures, such as apples and oranges, (smash when frozen, the cells are prevalent), banana (use as a hammer on a nail), flowers (crush), rubber tubing (cracks when hit), metals (some become superconducting at low temperatures).

70. Measurement of the activity of human salivary amylase: who's got the activity?

B. J. WHITE, Biochem/Biophys, Iowa State Univ., Ames, IA 50011

Human saliva contains an enzyme, termed amylase, which digests starch. The action of amylase on starch may be followed by the change in color when tested with iodine. Amyl se gives an intense blue with iodine because iodine deposits inside the amylose helix. The disappearance of the blue, due to the hydrolysis of amylose helices, is the criterion for the measurement of amylase action.

Measurement of amylase activity: 1 ml of 0.25% starch, 0.5 ml of 0.5M phosphate buffer, pH 7, and 0.5 ml of 0.1M NaCl are mixed. One ml of saliva, which has been diluted 5-10 times with water, is added and mixed. At exactly 30 second intervals, 0.1 ml aliquots are removed and transferred to a spot plate containing 1-2 drops iodine solution (0.1N iodine in 0.15M KI) in each well. The disappearance of the last trace of violet is chosen as the end point. A control without amylase is a reference for the color.

Each student gives a sample of saliva. Amylase activity varies greatly in humans and the samples must be diluted to measure activity. Dilutions of 0 to 1000 are necessary so that it takes 2-10 min for the digestion of starch to give an end point of the last traces of color.

71. Right-To-Know Law Influence on chemical instruction.

H. W. LYON

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Iowa's Right-To-Know Law is now in effect. Acquisition and maintenance of material safety data sheets, identifying hazardous chemicals and their effects and upgrading labels is becoming routine in most institutions. What is new to most of us is the requirement to monitor for exposure limits, the recognition of signs and symptoms of exposure, to demonstrate that our handling procedures have a scientific base, and the provision of appropriate protective devices.

This paper will show how the University of Northern Iowa has moved to comply with this law and how our chemical instruction is changing as a result of our new approach to chemical safety.

Chemistry C

72. Reactions of $(\eta^6\text{-}C_6Me_6)Mn(CO)_2^-$ with Organic and Organometallic Electrophiles

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Infrared spectral studies of various derivatives of $(\eta^6\text{-}C_6Me_6)Mn(CO)_2X$, Mr'X, suggest that the metal center has higher metal electron density than is found with analogous derivatives of the isoelectronic species $(\eta^5\text{-}C_5Me_5)Fe(CO)_2X$, Fp'X.

The high electron density on manganese is also observed in the chemistry of the anion Mr'$^-$, made by deprotonation of Mr'H. Mr'$^-$ reacts with formic acetic anhydride to give *exo*-$(\eta^5\text{-}C_6Me_6H)Mn(CO)_3$. The mechanism of this reaction, thought to proceed by initial formation of the metal formyl $(\eta^6\text{-}C_6Me_6)Mn(CO)_2C(O)H$, will be discussed. The reaction of Mr'$^-$ with other electrophiles, including organic acyls and alkyl halides, Me_3SnCl, and transition metal centers will be discussed.

73. Reactions of $(\eta\text{-}C_5Me_5)Fe(CO)_2CN$ with Hydride Sources

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$(\eta\text{-}C_5Me_5)Fe(CO)_2CN$ (1), Fp'CN, has been observed to react with several complex borohydrides to produce nearly quantitative yields of the anionic metal formyl, $(\eta\text{-}C_5Me_5)Fe(CO)(CN)C(O)H^-$ (2). In THF at 25°C, the reaction is complete in 3 min with KEt_3BH and $K(s\text{-}Bu)_3BH$, but takes 11 min with $K(i\text{-}PrO)_3BH$. The half-life for the decomposition of 2 to Fp'H under these conditions is 125 min. The reaction of 1 with a KH slurry in THF at 25°C proceeds quantitatively, over a period of several hours to yield a mixture of products. During the course of this reaction, 2 is not observable. The nature of this reaction will be discussed.

The hydride transfer capability of 2 has been demonstrated by transformylation reactions with $Re_2(CO)_{10}$ and $Fe(CO)_5$. The reactions of 2 with alkyl halides, aldehydes, and ketones, will be discussed.

74. Synthesis, characterization and reactivity of $(\eta\text{-}C_5Me_4R)_2Ta_2(\mu\text{-}Br)_4$ (R=Me, Et)

C. TING AND L. MESSERLE*

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Reduction of $(\eta\text{-}C_5Me_4R)TaBr_4$ in toluene with 2 equiv. of Na/Hg affords the doubly-bonded dimeric species $(\eta\text{-}C_5Me_4R)_2Ta_2(\mu\text{-}Br)_4$ (1a, R=Me; 1b, R=Et) as shown by ^{1}H-NMR, mass spectrometry, single crystal X-ray diffraction, and elemental analysis.

This ditantalum species reacts with simple olefins (ethylene, propylene) to give dinuclear vinyl hydride complexes through intermolecular C-H bond activation; for example, with C_2H_4 the product is $(\eta\text{-}C_5Me_4R)_2Ta_2Br_4(\mu\text{-}C_2H_3)(\mu\text{-}H)$ as evidenced by ^{1}H and ^{13}C-NMR, mass spectrometry, and elemental analysis. 1 reacts more slowly with p-$MeC_6H_4CH{=}CH_2$ and butadiene to give mononuclear complexes.

1 exhibits a rich and diverse range of reactivity associated with the Ta=Ta. Results of reactions of 1 with hydride sources (e.g. $LiBH_4$, 2 and 4 equiv.) carbenoid precursors [e.g. 2 and 4 equiv. of $(p\text{-}MeC_6H_4)_2CN_2$], alkylating agents (e.g. Me_3CCH_2Li) and small molecules (e.g. CO, PMe_3) will be discussed.

75. Group 4 and 5 coordination chemistry of $R_2PCH_2PR_2$

B. A. FERM AND L. MESSERLE*

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We have been examining the potential binucleating ligands $R_2PCH_2PR_2$ (R=Me, dmpm; R=Et, depm) in early transition metal chemistry as a means of synthesizing bimetallic, metal-metal bonded complexes. The approaches taken to synthesize such complexes include reaction of the ligand with preformed, dinuclear tantalum and zirconium complexes and reductive ligation starting with the parent metal halides.

$Ta_2Cl_6(PMe_3)_4$ reacts with depm to form a ditantalum complex as evidenced by ^{31}P NMR spectroscopy and mass spectrometry. The structure of this product and results of studies with $Zr_2X_6(PEt_3)_4$ and ZrX_4 will be discussed.

76. Carbon monoxide migratory insertion studies with mono(peralkylcyclopentadienyl) alkyl complexes of zirconium and hafnium

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Carbon monoxide migratory insertions into early metal bis(cyclopentadienyl) alkyl complexes have been shown by numerous investigators to lead to η^2-acyl complexes in which both the carbon and the oxygen are coordinated to the metal. We have been examining the reactions of the analogous coordinatively and electronically unsaturated monocyclopentadienyl complexes of these metals.

Cp^*MNp_3 ($Cp^*=\eta$-C_5Me_5; $Np=CH_2CMe_3$; M=Hf,Zr) and Cp^*HfNp_2Cl react with excess carbon monoxide to form new acyl complexes as shown by ^1H NMR, IR, and mass spectrometry. Reactions of carbon monoxide with mono alkyl species are complicated by alkyl redistribution. The structures and reactivities of these novel acyl complexes will be discussed.

77. Equilibria and rates of formation of mono-aquo complexes of platinum II

I. E. BURGESON, AND L. E. ERICKSON

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Oligimers (dimers and trimers) of aquo species have been identified as significant species in aquous solutions of the anti-tumor drug cis-$Pt(NH_3)_2Cl_2$. Whether such species are significant or not depends on both their equilibrium stabilities and their rates of formation. We have employed both pH and nmr techniques to investigate the equilibrium and kinetics of the dimerization process for the simpler mono-aquo complexes obtained by hydrolysis of cis(N,S)-Pt(AA)(DMSO)Cl, where AA= glycine, sarcosine, and N,N-dimethyl glycine. Equilibrium constants (K_d) and rate constants (k_d and k_{-d}) have been obtained for the reversible dimerization, formulated as

$$Pt\text{-}OH_2^+ + Pt\text{-}OH \longrightarrow Pt\text{-}OH\ Pt^+ + H_2O$$

Experiments were carried out over a range of temperatures to obtain thermodynamic data and activation energies for the reactions.

78. Rapid dissolution of coals for subsequent spectrophotometric determination of nitrogen

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Iowa State Mining and Mineral Resources Research Institute and Ames Laboratory, Iowa State University, Ames, Iowa 50011

A simple and rapid method for the colorimetric determination of nitrogen in coal was developed which gave values that were comparable to those obtained with a commercial "CHN" analyzer. For the dissolution step, the coal sample was first carbonized with H_2SO_4 and then digested with a peroxy reagent consisting of a 4:1 mixture of 50% H_2O_2 and concentrated H_2SO_4. Sample digests were then filtered to remove undissolved silicates, and the resulting solutions were treated with Nessler reagent to develop the color for subsequent spectrophotometric determination of ammonia nitrogen. Maximum nitrogen recovery was obtained when 20-40 mL of the peroxy reagent were used after boiling the sample for at least 4 minutes during the carbonization step. Altering the heat setting on the digestion apparatus substantially changed digestion times, but it had little effect on nitrogen recovery. Relative standard deviations of 1 to 2% were obtained by this method.

79. Characterization of gases evolved during the molten caustic leaching of coal

JAMES L. HOFER, NAVIN D. SHAH, COLIN D. CHRISWELL, AND RICHARD MARKUSZEWSKI

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

Ash-free, sulfur-free coal can be prepared using a molten caustic leaching process. Various gases and condensible liquids which evolve during the leaching process can be collected and analyzed. In the present work, mass spectroscopy was used to characterize the gases, while gas chromatography was used to quantify the results. A quench tank was used to recover the condensible liquids. The leaching process was studied under different reaction conditions and using various coals. Usually, the process yielded approximately 5 to 20 liters of gases per 25g of coal. These gases were predominantly hydrogen and methane. It is possible that the fuel value of the gases could be used to heat the molten caustic reactor during chemical desulfurization of coal.

80. Determination of sulfide and carbonate in spent caustic solutions arising from the molten caustic leaching of coal

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During the cleaning of coal by molten caustic leaching, large amounts of carbonate ($CO_3^=$) and sulfide ($S^=$) are formed. The sum of these components in the spent caustic is determined by potentiometric acid-base titration. In the past, $CO_3^=$ levels were high, and $S^=$ levels were considered insignificant. When process changes decrease the carbonate formation, the relative amount of sulfide becomes significant, and a rapid and simple means is required to determine both $CO_3^=$ and $S^=$. Thus, a method was developed for the independent determination of $S^=$ in spent caustic in the presence of $CO_3^=$. In this method, (1) spent caustic is acidified and purged with nitrogen, (2) the stripping gas is passed through a $Pb(OAc)_2$ solution where PbS and some $PbCO_3$ are precipitated, and (3) total sulfur is determined in the precipitates. Carbonate is then found by difference from the total obtained by titration. Tests of the procedure on standard solutions show it to be reproducible, accurate, convenient, and rapid.

81. Solvent effects in room temperature phosphorescence

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Room temperature phosphorescence (RTP) is a technique in which solutions containing organic phosphors are applied to filter paper and dried in the absence of oxygen. Adsorption to the paper inhibits molecular vibrations and promotes phosphorescence. Although the solvent must be removed by volatilization before phosphorescence can occur, it appears that the nature of the solvent affects the intensity of the resulting phosphorescence. We examined the room temperature phosphorescence of p-aminobenzoic acid in several different solvents including water, acetone, methanol, and methylene chloride. The correlation between RTP intensity and solvent properties such as boiling point, ability to hydrogen bond, and miscibility with water will be discussed.

This research was supported by the Iowa Science Foundation.

82. Application of Pulsed Amperometric Detection to high performance liquid chromatography of sulfur-containing pesticides

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Pulsed Amperometric Detection (PAD) has proved to be a sensitive method for determination of many kinds of compounds including carbohydrates, amino acids, aminioglycosides, as well as many inorganic and organic sulfur compounds. The method is based on a three-step potential waveform with alternate anodic and cathodic polarizations of the electrode followed by amperometric detection at a potential centered between the polarization potentials.

By applying PAD, sulfur-containing pesticides are found to be detectable at a gold electrode applied in flow injection analysis with detection limits in the ppb levels. Practical applications of this technique will be discussed for the detection of sulfur-containing pesticides after HPLC separation on a C-18 reversed phase column. For example, Aldecarb and Parathion can be detected at concentrations of 80 and 10 ppb respectively.

83. Fate of heavy metals in an Iowa oxbow lake.

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Water, algae, aquatic plant, zooplankton and sediment samples were collected from New Lake, near Sioux City, Iowa, and analyzed for chromium, copper, lead and zinc using atomic absorption spectroscopy. There was significant concentration of the heavy metals in the lake sediment, with chromium showing a distinct variation with sediment depth. Biomagnefication of the metals occurred in the simple life forms at the lake. Plants and algae had metals content 100 to 6500 times greater than that found in the water. Zooplankton had biomagnefication factors between 1500 and 8500.

84. An examination of the physical effects of chemical etching on optical fibers

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Iowa City, IA 52240

Chemical etching has been performed on optical fibers to increase the sensing ability of fiber optic probes. Graded index and quartz fibers were heated to produce a homogeneous sphere at the fiber tip in an effort to eliminate preferential etching that occurred in previous work. Graded index fiber spheres were etched using three techniques. Quartz fibers were etched with HF vapors, the preferred technique. All fibers were examined using Scanning Electron Microscopy.

Preferential etching at the graded index fiber sphere tip indicates that homogeneity was not achieved. Etching patterns on the quartz spheres preliminarily indicate preferred etching of the cladding, followed by etching of the core. Future work will involve application of parameters affecting waveguide physics and signal processing techniques.

85. Simulation of ^{13}C NMR chemical shifts of aromatic ring systems

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The combination of modern computing capabilities and sophisticated data analysis techniques has led to the development of ^{13}C NMR spectral simulation as a tool for structure-elucidation. One approach to spectral simulation involves the use of regression techniques to generate linear models that relate observed ^{13}C NMR chemical shifts to numerical parameters that encode aspects of the chemical environment of the corresponding carbons. The developed models are subsequently used to predict the individual chemical shifts comprising the spectrum of a proposed chemical structure. The current research extends this methodology from saturated systems to aromatic ring systems. Development of parameters particularly suited to encoding the chemical environment of pi systems will be discussed. Description of model development using thirty-six one, two, and three ring benzoid compounds will be presented. Use of the calculated models to simulate accurate spectra for compounds not included in the model development will be described.

86. Optimization of a Spectral Prefilter for Infrared Library Searching

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

As the number and size of spectroscopic data bases increases, so does the need for performing efficient library searches. Conventional searches which compare an unknown spectrum with each member of a spectral library consist largely of comparisons between dissimilar spectra. Spectral prefilters are designed to eliminate these unfruitful comparisons. Principal components analysis of a FTIR library has shown promise in the development of such a prefilter. This is a vector space technique which constructs a multidimensional space that describes the overall spread of information across the spectral library. The distance of each reference spectrum to the space is computed and stored. In this way, the spectra are separated spatially. The function of the prefilter in processing an unknown spectrum is to restrict comparisons to those library reference spectra which are judged to be near the position of the unknown in the space. Previous work has involved the use of OR logic in choosing among a series of 2-dimensional spaces. The use of AND logic has improved the performance of the prefilter. Results from trials of both types of prefilters will be presented.

87. A diagnostic tool for the evaluation and optimization of spectral library searches

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

Computer-based library searches are an integral part of modern spectral processing. Library searches provide an automated means for selecting compounds with spectra similar to that of an unknown. Unfortunately, most existing algorithms for judging spectral similarity often do not yield compounds that are structurally similar to the unknown. If this limitation is to be overcome, it becomes critical to have some means of quantitatively evaluating a set of search results in terms of the structural similarity of the compounds. Given this diagnostic capability, search algorithms can be modified in order to enhance their performance. Fortunately, many spectral libraries also contain the structure for each compound stored in the Wiswesser Line Notation (WLN) format. The WLN system is a formalized method for encoding chemical structures in a unique character string. In the work presented here, a procedure is introduced for processing two WLN strings and computing a score which reflects the structural similarity of the compounds. The use of this procedure will be demonstrated by evaluating a series of existing library search algorithms.

88. Development of an enhanced ^{13}C NMR library search procedure

S. E. CARPENTER, G. W. SMALL

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

^{13}C NMR spectroscopy is an important tool for solving structure elucidation problems. Library search procedures represent one approach to automating the time-consuming spectral interpretation process. Two factors have complicated the use of existing searches for ^{13}C NMR spectral comparisons: (1) chemical shifts can vary due to experimental and structural effects; and (2) structurally similar compounds may produce spectra with different numbers of resonances. The work presented here introduces a new ^{13}C NMR library search procedure which selects clusters of resonances in the unknown spectrum and compares them to the corresponding regions in each library spectrum. The best matching of lines is accomplished using a sophisticated mapping algorithm which allows some variation in exact resonance position, but seeks to maintain the overall pattern integrity of the selected region. This new search also includes reverse search capabilities to aid in identification of mixture components or sample impurities. The presentation will include a discussion of the unique features of this algorithm and will present results demonstrating its capabilities.

89. Near-infrared and calorimetric studies of the hydrogen bonding behavior of t-butyl alcohol.

P. E. RIDER AND K. TSUTSUMI

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

The hydrogen bonding interaction between molecules plays an important role in determining the properties of molecular systems. Near-infrared methods for investigating the thermodynamic changes when bonding occurs have advantages over the fundamental infrared method, which has been commonly used to carry out such studies. NIR has not been used with t-butyl alcohol and organic base systems to any extent.

These studies involve using both NIR and solution calorimetry to study the thermodynamic changes for hydrogen bonding between t-butyl alcohol and representative types of organic bases.

The results allow comparison of these methods used on the systems of interest to other methods used to study the same and similar systems. Additionally the results allow useful information relative to the matter of constructing molecular polymers that have hydrogen bonding capacity which can play a role in the adhesive property of the polymer.

Chemistry D

90. Induction and inhibition of double-strand DNA break repair in Tehrahymena Pyriformis

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The protozoon Tehrahymena pyriformis is highly resistant to ionizing radiation. The mode of resistance was investigated by a kinetic study of the induction and inhibition of the repair of double-strand DNA breaks caused by a split x-ray dose (10 Gy and 90Gy, with an one hour incubation between doses). The kinetic analysis of repair was performed by viscoelastometry and revealed one "early" and one "late" phase of repair. Inibition studies showed that 3-aminobenzamide and sodium butyrate, both at 10 ug/ml concentration, inhibited repair, whereas novobiocin, at the same conservation, reduced repair and antipain, also at the same concentration, increased the repair capacity of Tehrahymena pyriformis. Thus, it was inferred that poly (ADP-Ribose) and histone synthesis appear to be essential components of the repair process, whereas topoisomerase and protease appear to be dispensible. A model will be presented to account for these obervations.

91. An antifungal compound from Poronia punctata

S. M. TRUCKENBROD and J. B. GLOER

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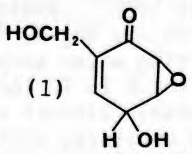
The fungus Poronia punctata (NRRL 6457) is known to be involved in a competitive hierarchy with other coprophilious fungi which colonize cattle dung in Western Colorado. P. punctata, a late colonist, is proposed to employ antifungal agents to inhibit the growth of its competitors. We have confirmed that culture filtrates of this fungus display inhibitory activity against Sordaria fimicola (NRRL 6459), an earlier colonist which it succeeds.

The compound responsible for this activity has been isolated from laboratory cultures of this organism using chromatographic techniques. This metabolite has been identified (1) using mass spectrometry and NMR spectroscopy, and other spectroscopic techniques.



(1)

Details of the bioassays employed, and the isolation and structure determination of this compound will be discussed.

92. Rates of hydrogen atom abstraction from organic solvents by phenyl radical.

J. E. SWARTZ and K. M. MARR
Grinnell College, Grinnell, IA 50112

We previously observed that hydrogen atom abstraction from the solvent, dimethyl-sulfoxide, and from the supporting electrolyte, tetra-butyl ammonium ions, were major termination pathways in electrochemically initiated $S_{RN}1$ reactions of bromobenzene (J. Swartz and T. Stenzel, Journal of American Chemical Society, 1984, 106, 2520). In the current work phenyl radicals were generated by thermolysis of phenylazotriphenylmethane in deuterated dimethylsulfoxide; the relative rates of hydrogen atom abstraction from added solutes to deuterium atom abstraction from DMSO-d6 were reflected in the yields of benzene and deuterobenzene. Absolute rate constants for the hydrogen atom abstraction by phenyl radicals from a variety of organic solvents were thereby determined. The rates of hydrogen atom abstraction from the solvents were compared to the rate of hydrogen atom abstraction from t-butyl ammonium ions at typical electrochemical conditions to assess the relative importance of the solvent and tetra-butyl ammonium ion as a source of proton.

93. Coupling of arene-chromium complexes

W. J. Scott

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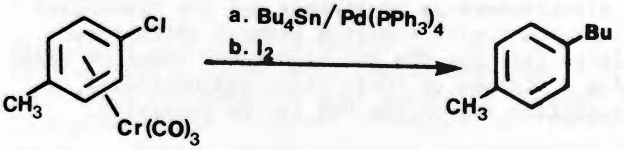
The inability to utilize aryl chlorides in palladium catalyzed coupling schemes remains a limitation to this chemistry. By employing chromium tricarbonyl complexes of aryl chlorides the arene is activated toward oxidative addition, thus allowing palladium catalyzed coupling reactions of aryl chlorides to occur under gentle conditions. Treatment of chloroaryl chromium tricarbonyl complexes with organostannanes in the presence of catalytic palladium leads to coupled products. Treatment with olefins in the presence of palladium leads to styrene derivatives.



94. Novel 2-Substituted Purine Nucleosides

V. NAIR* AND G. S. BUENGER

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The discovery of the antiviral and anticancer chemotherapeutic value of a number of structurally modified purine nucleosides has stimulated considerable interest both in the synthesis of novel nucleosides and in the development of efficient methodologies for their preparation. Synthetic access to some biologically interesting classes of 2-substituted purine nucleosides has been restricted because of limitations in synthetic

methodology available to obtain them. This paper reports on the development and application of new approaches to some rare 2-substituted purine nucleosides.

95. Functionalization of Inosine

V. NAIR* AND A. G. LYONS

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Carbon-carbon bond forming reactions are potentially useful approaches to the synthesis of unique, biologically interesting nucleosides. However, this methodology has seen limited usefulness in the chemistry of purine nucleosides. This paper will describe the synthesis of novel functionalized analogues of natural inosine through a new methodology of carbon-carbon bond formation in nucleoside systems.

96. Isolation of plasmid DNA and mapping with restriction endonucleases - a lab protocol

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Plasmids are small, double stranded circular DNAs commonly found in bacteria. They are useful as cloning vectors, capable of carrying foreign DNA into a host cell and allowing replication of the DNA. Plasmid DNA can be isolated from chromosomal DNA because the much larger genomic DNA is extracted from cells in the form of broken, linear molecules and has solubility different from the intact, circular plasmid DNA. Treatment with heat and/or base will break the H-bonds in the linear DNA molecules and cause the strands to entangle and precipitate. The small circular DNA molecules will regain their native structure when cooled and return to neutral pH. Ten microgram of plasmid DNA can be purified from 1 ml of cell culture in 90 min.

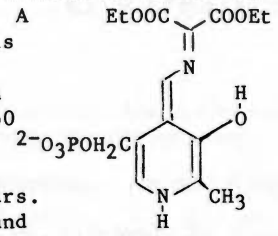
Plasmids can be digested by restriction endonucleases, commercially available enzymes which hydrolyze double stranded DNA at highly specific palindromic sequences. The products of the digestion are termed restriction fragments and can be separated by electrophoresis in agarose gel and visualized by treatment with ethidium bromide which intercalates into the DNA and fluoresces under UV light. Using a mixture of restriction endonucleases, a restriction map of the DNA can be generated.

97. Formation of quinonoid structures from pyridoxal 5'-phosphate and amino acid esters

A. G. Harris, C. M. Metzler, V. C. Chen, and D. E. Metzler.

Department of Biochemistry and Biophysics, Iowa State University, Ames, IA 50011

Enzymes containing pyridoxal 5'-phosphate (PLP) as a coenzyme often react with substrates or inhibitory quasi-substrates to form red or intensly yellow intermediates with characteristic absorption spectra attributed to quinonoid structures. We have studied by UV-visible spectroscopy the system diethylaminomalonate:PLP in water as a function of pH. A large fraction of the PLP is converted into a quinonoid form (structure shown) with an absorption maximum at 460 nm. This absorption band appears very rapidly but decays over a period of hours. The reactions of O-methyl and N-methyl PLP derivatives were investigated to determine the tautomeric structures and state of protonation of the quinonoid species. The relationship to the forms seen with aspartate aminotransferase and tryptophanase and to catalysis by these enzymes will be discussed.



Conservation

98. Potential light limitation of stream algal production

A. L. RAFLO

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

Artificial shading of the water surface was used to determine the potential for light limitation of attached algal production in a nutrient-rich stream. Chlorophyll a accumulation on clay tiles under full sun was compared to accumulation under 4 levels of shading. Preliminary results indicate possible limitation during the fall, but no limitation in summer.

99. Nitrogen and phosphorus dynamics within an agricultural nonpoint source stream

D. R. SHERIDAN AND R. W. BACHMANN

Nitrogen and phosphorus dynamics within Onion Creek, Boone and Story Counties, Iowa, were monitored from 17 January to 31 December 1986. Longitudinal and seasonal changes in NO_3+NO_2-N, NH_4-N, TN, and TP were determined by analyzing water samples obtained 2 to 4 times per month from 8 to 12 locations along a 20.5 km stretch of stream. Diurnal changes in nitrogen parameters were monitored monthly from June to September using 24-hour automatic water samplers. Nitrogen loss due to microbial action within stream sediments was evaluated by monitoring nitrate loss in filtered stream water overlying sediment cores from five locations of varying substrate. The results and their implications for nonpoint source pollution research and control will be discussed.

100. Biomagnification of Heavy Metals (copper, chromium, lead, and zinc) in the Missouri River near Sioux City, Iowa

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Science Undergraduate Research Program
Morningside College
1501 Morningside Avenue
Sioux City, Iowa 51106

Samples of fish, periphyton and macroinvertebrates were collected from the main channel border habitat at two sites on the Missouri River near Sioux City, Iowa, and analyzed by atomic absorption spectroscopy for Cu, Cr, Pb and Zn. Significant concentrations of all metals in the range of 1-100 ppm were observed in all three aquatic communities. Metal concentrations in fish were 50 to 3,500 greater than those measured in the water. Biocencentration factors were greater for periplyton (400 to 5,000) and macroinvertebrates (500 to 7,500). Significant biomagnification of these heavy metals was indicated by the results of this study.

101. Toxicity of fenvalerate and its constituent isomers to fathead minnows and bluegill

SYMONIK, D.M., J.R. COATS, S.P. BRADBURY and G.J. ATCHISON

Interdepartmental Toxicology Program
Departments of Animal Ecology and Entomology
Iowa State University, Ames, IA 50011

Fenvalerate is one of the most widely used of the recently developed synthetic pyrethroid insecticides. These compounds are extremely toxic to fish, with LC_{50} values generally less than 10 ug/L. Stereochemical structure of the pyrethroids has a great influence over their toxicity to insects and mammals. This study used a static, acute exposure to fathead minnows and intraperitoneal injection to bluegill to determine the effect of stereochemistry on the toxicity of fenvalerate to fish.

Fenvalerate was found to racemize spontaneously at the α-carbon in water, methanol, ethanol, dimethyl sulfoxide and dimethyl formamide. Only those isomers with an S configuration in the acid moiety were found to be toxic, with the 2S, αS isomer being 100 times more toxic than the 2S, αR isomer. Due to this great difference in toxicity, it is unknown whether the 2S, αR toxicity noted was due to actual toxicity, in vivo racemization to 2S, αS, or trace isomer contamination.

102. Habitat use by salt marsh birds and response to Open Marsh Water Management

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We examined the numerical responses of salt marsh birds to Open Marsh Water Management (OMWM), a habitat alteration technique designed to control salt marsh mosquitoes without destroying the salt marsh habitat. As expected, OMWM had little long-term effect on bird populations on two 3-ha plots in MA monitored for three years after alteration. Shorebirds increased at first, probably due to use of mudflats resulting from construction activities, but then declined to pre-alteration numbers. Numbers of marsh-nesting birds declined temporarily due to marsh alteration, while other bird groups were not affected. We conclude that 1) OMWM maintains overall habitat quality and 2) studies should monitor altered plots for at least three years to avoid temporary trends due to marsh disturbance.

103. Post-release survival and movements of captively reared common barn-owls in Iowa

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Iowa Department of Natural Resources
Wildlife Research Station
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Thirty-six common barn-owls were equipped with radio transmitters and released at 5 sites in Iowa during the summers of 1985 and 1986. At the end of 3 months post release, 24 (67%) of the released owls were known dead, 5 (14%) were known alive, and the fates of 7 were unknown. Predation was the primary cause of mortality accounting for 18 of the released owls. Barn-owls remained near release sites (within 15 km) for extended periods (up to 6 weeks), but 3 individuals made extensive movements during late September. The largest straight line distance moved by a released barn-owl during the study was 94 km.

104. Estimating survival rates in an exploited raccoon population using failure time analysis

J. J. HASBROUCK and W. R. CLARK

Department of Animal Ecology, 124 Science II, ISU, Ames, IA 50011

This study investigates causes and time of mortality in a raccoon population in Iowa. Each year since 1983 radio transmitters were placed on 20 adult and 30 young-of-year raccoons. Transmitters contained a motion sensitive switch allowing determination of day and cause of death. Survival rates were determined for age/sex groups using failure time analysis. Survival was greater for adults than young-of-year animals. Hunting and trapping accounted for over 70% of known mortalities. Road kills caused nearly 20% of deaths, primarily young-of-year males in fall and one-year-olds or older in spring. Other causes of mortality include attacks by farm dogs, predation, disease and drowning. Survival rates were high in winter following harvest, decreased somewhat in sping, were high in summer and decreased dramatically in late fall. Differences in survival rates between age/sex groups, year and time of year will be discussed.

105. Iowa's forest area in 1832--a reevaluation

G. W. THOMSON

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Concern for the reliability of the acreage of Iowa's forest cover at the time of settlement prompted an investigation of authorship of the map of original forest cover, the county tabulation of forest area and the technique used in area determination.

Remeasurement of the 1832-1859 General Land Office township maps from eight test counties confirms that transecting of the township lines was the technique used in 1935 by State Forester G. B. MacDonald. The results found in remeasurement differed from 1 percent to 50 percent for individual counties but tended to agree well enough in aggregate to make the earlier data acceptable.

However, rereading of the original survey notes suggests that an unknown but possibly sizable amount of land identified as forest in 1832 would not be considered forest in 1987.

Elementary Science Teaching

106. The case of the looted laundry

S. KELLY AND J. PRITCHARD

Meeker Elementary School, 20th and Burnett, Ames, IA 50010.

Seventeen investigative lab stations for manipulative science skills designed around, "The Case of the Looted Laundry."

Emphasis of session will be on organizing and conducting such labs in upper elementary or middle school classrooms. Participants can experience sample labs and receive suggestions for procedures to use with students.

Labs include tests for monosaccharides, iodine, and acids/bases; classification of fingerprints, lip prints, typewritten messages, paper samples, and handwriting samples; miscroscope work with fabric swatches and hair samples; and other tests with sound, mass measurement, chromatography, etc.

107. Magnetism attracts fourth graders to the Science Station

B. FELLER, J. KARN and S. STEPHEN

Science Station and Cedar Rapids Community Schools, 427 First Street, S.E., Cedar Rapids, IA 52401

Fifteen hundred fourth graders from Cedar Rapids Community Schools participated in an innovative, hands-on science experience. This informal educational program took place in the new Science Station museum in downtown Cedar Rapids.

A special experimental curriculum was designed to ensure that each student had a chance to go through a complete set of observations on electromagnetism. In addition, activity sheets which related museum exhibits to fourth-grade science objectives were completed by the students.

Engineering

109. Microcharacterization and elemental analysis of fly ash

A. U. DOGAN, E. M. HAWORTH, L. D. BLANKENFELD, M. DOGAN, R. RAJOPOPAL

Central Electron Microscopy Facility, University of Iowa, 1-367 BSB, Iowa City, IA 52242

Power plant furnaces produce huge quantities of non-combustable amorphous coal residue which requires disposal. The fine fly ash fraction, which consists of micrometer sized spheres, also poses a potential threat to human and aquatic organisms.

The elemental distribution of fly ash was determined using both energy dispersive x-ray analysis and flame analysis with HF and HNO_3 sample digestion. The single particle morphology was obtained using scanning electron microscopy. The results from these techniques will be discussed showing the complete distribution of data and the wide variation of elements between various particles.

110. Ceramic silicon nitride by reaction of silica, carbon, and ammonia

M.J. Murtha and G. Burnet

Ames Laboratory and Department of Chemical Engineering, Iowa State University, 272 Metals Development, Ames, IA 50011

The major appeal of silicon nitride lies in its unique combination of high temperature properties. Proposed applications include components for heat engines, turbines, compressors, and heat exchangers.

Work at the Ames Laboratory on the carbothermal reduction of silica with subsequent nitridation using ammonia shows promise of providing an effective method for producing silicon nitride powder for subsequent sintering into dense forms. Key variables are the reaction temperature and time, ammonia flowrate, and surface area of the solid reactants, fumed silica and carbon black. The effect of these variables, particularly surface area, on the reaction rate and yield of silicon nitride are discussed.

111. Codisposal of coal solid wastes by a granulation/sintering process

A. Gokhale and G. Burnet

Ames Laboratory and Department of Chemical Engineering, Iowa State University, 268 Metals Development, Ames, IA 50011

Coal cleaning and coal combustion solid wastes pose serious environmental problems due to leaching, dusting and smoldering at disposal sites. The wastes can be stabilized by a granulation/sintering process that yields impervious, vitreous pellets resistant to environmental degradation.

Work is reported for mixtures of coal cleaning waste and power plant fly ash. The sintering is carried out using primarily the energy (fuel) inherently present in the cleaning waste. The cleaning waste is from the River King Coal Preparation Plant in Freeburg, IL and the fly ash from the Ottumwa Power station.

Characterization of the wastes, grinding of the coal cleaning refuse, the formation and testing of green granules for durability, small and large scale sintering tests, and evaluation of the sintered granules using standard leaching and freeze/thaw tests will be discussed.

112. Solidification of coal cleaning refuse/FGD sludge mixtures

R.F. Meisinger and G. Burnet

Ames Laboratory and Department of Chemical Engineering, Iowa State University, D3A Lab, Ames, Iowa 50011

EPA source standards require that all power stations for which construction began September 1, 1973 or later be equipped with stack gas SO_2 abatement systems. The most common abatement method in the U.S. is wet scrubbing with a limestone slurry. This is resulting in the production of large amounts of flue gas desulfurization (FGD) sludge and great difficulties in its disposal.

This investigation deals with the solidification of FGD sludge and coal cleaning refuse mixtures using a granulation/sintering process that derives most of the energy required from the fuel inherently present in the refuse. The refuse is from the River King Coal Preparation Plant in Freeburg, IL and the sludge from the LaCyne station of the Kansas City Power and Light Company.

Characterization of the refuse and sludge, the formation and testing of green granules for durability, small and large scale sintering tests, and preliminary evaluation of the sintered granules using standard leaching and freeze/thaw tests will be discussed.

113. Effect of oxidation on the surface properties and oil agglomeration characteristics of coal

J. M. DRUDING, T. D. WHEELOCK AND R. MARKUSZEWSKI

Department of Chemical Engineering, 231 Sweeney Hall
Iowa State University
Ames, IA 50011

Oxidation of Upper Freeport coal deleteriously affects the oil agglomeration process for the beneficiation of fine coal. In this process, fine coal is suspended in water and contacted with a small amount of oil. The hydrophobic nature of the unoxidized coal surface leads to bridging of the coal particles by the oil while the ash forming minerals tend to be more hydrophilic and are not agglomerated. Subsequent recovery of the larger coal aggregates on sieves is then possible. Surface oxidation, by air in a laboratory oven at 150°C, renders the coal surface more hydrophilic and reduces the recovery dramatically. Surface oxidation leads to an increase in oxygen-containing functional groups which seems to cause the increase in hydrophilicity. Analytical chemical techniques revealed increasing concentrations of both carbonyl and hydroxyl groups and FTIR spectroscopy revealed similar trends. The surface of oxidized coal can be rendered less hydrophilic by incorporating trace amounts of sodium oleate which leads to enhanced recovery of the oxidized coal.

114. Fluidized bed combustion of coal liquid fuels prepared from Iowa coal and limestone

R. C. Brown, J. E. Foley, and W. H. Buttermore

Department of Mechanical Engineering and Energy and Mineral Resources Research Institute, Iowa State University, Ames, Iowa 50011

The objective of this research is to evaluate the use of Iowa coal and limestone in liquid coal fuels for fluidized bed combustion. Commercial liquid coal fuels have generally been formulated for combustion in modified oil burners which place stringent limits on rheological and combustion characteristics of the fuels. These constraints can be substantially relaxed for combustion in fluidized beds. Accordingly, such strategies as coarser coal grinds and lower concentrations of fuel additives can be in-

vestigated as methods for improving the economics of liquid coal fuel. A bench-scale FBC facility has been constructed to evaluate these fuels, especially with regard to expanding the market for coal to small industrial and commercial users.

115. Abrasive wear of selected polymers

A. F. VETTER, A. D. BLANKENFELD

Department of Chemical and Materials Engineering, University of Iowa, 131 CB, Iowa City, IA 52242

The wear response of a group of materials in an abrasive environment was measured using a procedure based on ASTM G-65. The materials were selected from candidates for use in bearings, seals and gears as replacements for currently used metal components.

Two abrasives were used, AFS foundry sand which is a round grained silica and a commercial freshly crushed quartzite, both abrasives in the Taylor sieve 50-70 fraction.

Results are compared to 1018 steel. In at least one polymer the results showed a higher wear resistance than 1018 steel using the AFS abrasive but with the crushed quartzite abrasive the polymer was abraded a factor of 3-4 times faster than 1018 steel in the same test sequence.

This study demonstrates the need for designers and others to have good wear test data on candidate materials in a variety of wear environments.

116. Abrasive wear resistance of chromium plating

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

The behavior of chromium plated steel exposed to abrasive wear conditions is presented. A Dry Sand Rubber Wheel Abrasion Tester (ASTM G-65) is used to assess the low stress three body abrasion resistance of this material. Results are compared to several other materials including AISI 4340 steel and ultra-high molecular weight polyethylene. Also of interest in this study is the sensitivity of chromium plating to abrasive particle shape.

Results show that chromium plating is indeed resistant to abrasion conditions, especially in comparison with other commonly used materials. The mechanism of material removal appears to be a combination of microcutting and plowing.

117. Comparison of turbulence models in free shear flow

C. C. CHEN and C. J. CHEN
Department of Mechanical Engineering, The University of Iowa, Iowa city, Iowa 52242

Comparisons are given between the experimental data and the calculated results of several existing variants of the k-ε models in turbulent free shear flow. Included among these are new calculations based on full Reynolds-stress model and the two-scale model. The concept of two turbulence scale is based on the Kolmogorov, (ε,υ), scale, which characterizes the small, energy-dissipating eddies, and the (k,ε) scale which characterizes large, energy-containing eddies. Comparisons of the computed results from various turbulence models with measured values show that the two-scale turbulence model without modifying the tubulence moduli predicts satisfactory results.

REFERENCE : C. J. Chen, "Prediction of Turbulent Flows," Department of Mechanical Engineering, The University of Iowa, Iowa City, Iowa 52242.

118. Noise reduction device for the hearing impaired

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University of Iowa, Iowa City, IA 52242

A large part of the population, including many elderly, suffer from high frequency hearing loss. One telling consequence is the inability to effectively focus attention on one particular sound or voice in the presence of interfering noise. This is the so-called "cocktail party effect."

This presentation describes a family of algorithms which adaptively process signals from a microphone array to produce an output of high signal to noise ratio, thus making the mental "focusing" unnecessary. The user selects the desired signal by physically aiming the array at the desired signal source. Because the algorithms are adaptive, the system enables improvements in signal-to-noise ratio even when the "noise" consists of interfering speech, very similar in characteristics to the desired signal, originating from an unknown or even a time-varying direction.Improvements in signal to noise power ratios of 10 dB have been demonstrated in simulations involving real speech and simulated time delays.

119. Observation of the sea-land breeze and associated phenomena.

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The sea-land breeze is a mesoscale circulation driven by surface differential heating across a land-water boundary. Its spatial and temporal characteristics depend upon the prevailing large-scale velocity and pressure fields, the areas of the associated land and water masses, and the latitude.

Phenomena apparent in some sea breeze occurences include a sea breeze front, and the Coriolis deflection of the land-ward component to the right (in the northern hemisphere).

Observational studies of the sea-land breeze are reviewed. The typical sea breeze circulation for mid-latitude zones will have landward currents adjacent to the earth's surface reaching speeds of a few tens of m sec^{-1}. The seaward current above the inflow layer will be much deeper and weaker.

120. The water flow boundary layer over a round crested weir

Minliang Hu
Wuhan Institute of Hydraulic and Electric Engineering, Wuhan,Hubei, P.R.C.

In order to investigate the effects of curvature and gravity on the boundary layer in water flow, a series of experiments of round crested weirs were made. There were five models which radii were from 9.4cm to 35cm.The important instrument in the experiments was Laser Velocity Meter.
The main results are as follows:
(1) The region out of the boundary layer can be treated as a potential flow.
(2) In boundary layer, the velocity profiles are no longer similar along the flow direction. In the formula $u/u=(y/\delta)^{1/n}$, n is the function of H/R and X.(H:water head, R: radius, X: flow distance)
(3) The actual pressure on the wall surface is smaller than the value calculated with potential flow theory.
(4) At present case, the equation of Karman momentum integration should be deduced renewly.
(5) This investigation shows that the parameter H/R is essential to the flow over round crested weir. The large the value of H/R is, the thicker the boundary layer is at the corresponding position.

This test also shows that the boundary layer in water flow has some differences from that in air flow.

121. The coherent pattern of the fluctuation pressure

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In this paper the complete coherent pattern of the fluctuation pressure and computing method which are based on the coherent structure are suggested, the paper consists of three parts (1) the qualitative analysis of the coherent pattern (2) the pattern recognition and sampling for fluctuation pressure, and (3) experiment results in which show clearly there exists certain fluctuation pressure coherent pattern.

122. Use of a pressurized layer to limit convective solute transport across compacted clay liners

G. J. KLUITENBERG AND R. HORTON

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Compacted clay liners are often used in surface impoundments and hazardous waste disposal sites to provide a physical barrier to the flow of leachate. Clay liners are designed to have low permeability resulting in low water velocities, thus minimizing convective solute transport through the liner. If a liner develops cracks or regions where permeability exceeds design criteria, increased convective transport can lead to greatly increased chemical transport.

We propose the use of a pressurized layer of coarse material between two clay liners to eliminate or greatly reduce the hydraulic gradient across the upper liner. Such a system would limit convective transport through regions of undesireably high permeability.

To test the idea set forth, miscible displacement experiments were conducted using permeameters packed with layered soil materials. Experimental results are presented.

123. Feasibility of on-farm cogeneration

J.A. WALTER, J.A. HAACK, AND D.M. THORNTON

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University of Iowa, Iowa City, IA 52242

This study is designed as a feasibility analysis of on-farm cogeneration in Iowa. A multi-step process of formulation, optimization, and economic analysis is performed. The energy consumption and power requirements of a composite "model" farm are formulated. The optimum size cogeneration unit is determined simultaneously with the mode of operation which will produce the smallest value of annual energy expenditures, while meeting the modeled annual electric and thermal requirements. The optimization is performed for each of four energy sources: natural gas, LP gas, fuel oil, and biogas. These four solutions are then subjected to a life-cycle economic analysis to determine the economic feasibility of the concept.

The results obtained show that cogeneration is a viable means of meeting the energy needs of the model farm. The input parameters must be modified and the analysis repeated for any specific farmstead, but this study indicates that the potential for savings does exist. The methodology employed and the overall feasibility of the concept will be presented.

124. A new system for vacuum deposition using an atmospheric pressure inductively coupled plasma

B. D. MERKLE, R. N. KNISELEY AND F. A. SCHMIDT

Ames Laboratory USDOE, Iowa State University, 124 Metals Development, Ames, Iowa 50011

An atmospheric pressure inductively coupled plasma has been combined with a low pressure chamber for thin film deposition. The basic characteristics of the plasma system and details of the equipment are described. Refractory powders (Nb and Y_2O_3) were injected into the plasma and deposited as Nb and substoichiometric yttrium oxide, $YO_{1.49}$ onto Fe and Cu substrates.

This work was supported by the U. S. Department of Energy, Office of Basic Energy Sciences, Division of Materials Sciences under contract No. W-7405-Eng-82.

125. A comparison of the strength and microstructure of heavily cold worked Cu-Nb composites formed by different melting procedures

P. D. KROTZ and W. A. SPITZIG

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The strengths and microstructures have been evaluated for heavily cold worked wires of Cu-20% Nb made from castings using two different melting procedures which varied the initial Nb dendrite size. The strength of both these composites increased rapidly with increased deformation, but more dramatic increases in strength were observed in the composite made from the casting with the smaller Nb dendrite size. These differences in strength were due to the microstructural changes occurring during continued deformation by wire drawing. The Nb dendrites adopt a filamentary morphology during deformation and both the size and spacing of these filaments decrease. Decreasing the initial Nb dendrite size results in finer spacings at a given deformation and, therefore, increased strength.

This work was supported by the U. S. Department of Energy, Office of Basic Energy Sciences, Division of Materials Sciences under contract No. W-7405-Eng-82.

126. NDE Methods for determination of thermal history and mechanical properties of Al-Li alloys

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The relationship between process variables during fabrication and heat treatment of Al-Li alloys and their effects on the mechanical properties is investigated, applying a variety of NDE methods. Two Al-Li alloys were investigated, an Al-8at%Li binary alloy and a 2090 commercial alloy. Following solid-solutioning, the alloys were aged at various temperatures for various lengths of time to achieve different combinations of α, δ' (metastable), and δ phases, the latter one being extremely detrimental to the mechanical properties. Details of the thermal history of the alloys are obtained from a combination of conductivity, hardness and modulus measurements in conjunction with TEM studies. On the same alloys, the mechanical properties are determined in uniaxial tension. Using approximate relationships, the fracture toughness can be estimated from the uniaxial tension tests. The major results, obtained so far, will be discussed. Work supported by the Center for Nondestructive Evaluation, Energy and Mineral Resources Institute, Iowa State University, Ames, Iowa, 50011.

127. NDE characterization of metallic interfaces

D. D. PALMER, D. K. REHBEIN, J. F. SMITH AND O. BUCK

Ames Laboratory, Iowa State University, 206 Metals Development, Ames, IA 50011

Ultrasonic waves interact with an interface between similar and dissimilar materials. This interaction depends on the microscopic details of the interface itself. In the present study, model diffusion bonds, prepared under a variety of conditions, are being examined. Effects due to grain size gradients and texture in the vicinity of the bond will be determined. The theoretical basis for interpreting the interaction between longitudinal waves and an interface has been developed to such an extent that partial contact can be detected and analyzed using the combined frequency dependence of the transmitted, reflected or mode converted waves. Major results obtained so far will be discussed.

Work supported by the Center for NDE, Energy and Mineral Resources Research Institute, Iowa State University, Ames, IA 50011

128. Finite analytic method for elliptic partial differential equations with irregular boundary

Z. XU, and C. J. CHEN

Program in Applied Mathematical Science, University of Iowa, Iowa City, IA 52240

The finite analytic method is a numerical method that utilizes the local analytic solution of differential equation in formulating the approximate algebraic representation of differential equation. In this study, the finite analytic solution is developed for second order elliptic partial differential equations in non-rectangular domain. The finite analytic algebraic equation in a finite element of the computational domain is derived such that an interior nodal value is a function of the surrounding nodal values. Several examples are given to demonstrate the application of the finite analytic method in solving Navier-Stokes equation. The results obtained by finite analytic method are compared with that from finite difference method. It is shown that finite analytic solutions are stable and accurate.

129. A mesh generation program, for finite element analysis of two-dimensional domains

D. SPIRES, W. McCAULEY AND P. SCHWARZ

Department of Civil and Environmental Engineering, The University of Iowa, Iowa City, IA 52242

Many finite element analysis packages lack a convenient method for generating the required nodal coordinate and element connectivity data. Typically the user must prepare a lengthy input file, which can become quite tedious for complicated domains.

A program is presented which can quickly generate a triangular or quadrilateral mesh over a polygonal domain, with minimal user input. The user can try several different mesh densities in the course of a few minutes.

The program will then prepare a data file suitable for input to a general finite element analysis package.

130. Accurate computation of finite analytic coefficients for 2-D Navier-Stokes Equations

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The Finite Analytic Method (FA) is a numerical method which utilizes the local analytic solution in obtaining the approximate algebraic representation of a governing partial differential equation. The FA solution of Navier-Stokes equations were shown to be accurate and stable. However, because of the limitation in the present computer, a difficulty of large round off error is found in calculating the series solution obtained in the FA solution. This paper presents a special programming technique in making an accurate computation of the series solution. The main idea of the technique is to devise a special combination of registrar in the computer which has any number of significant digits specified by the user so that the summation of the alternating series can be obtained with high accuracy. Consequently the FA method can be applied to the laminar and turbulent flows with large Reynolds number.

131. Estimation of relative uncertainties of calculated quantities in science and engineering disciplines

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A shortcut method is presented for estimating relative uncertainties calculated from a wide variety of scientific or engineering formulas. The method exploits the mathematical properties of the natural logarithm function, particularly its differential calculus properties, which confers a significant simplification of the usual approach based on the mathematical properties of the exact differentials of multivariate functions.

Several applications of the method will be used to demonstrate (1) the efficiency of the method, (2) how to account for interactions among variables and (3) how to estimate relative uncertainties for values obtained from tables, laboratory experiments, field experience and so on.

132. Numerical grid generation on three dimensional configurations

Y. N. XU AND C. J. CHEN

Department of Mechanical Engineering, University of Iowa, Iowa City, Iowa 52240

The generation of curvilinear body-fitted coordinate systems on several three dimensional configurations is obtained numerically. The contours of the three dimensional body are transformed to a Cartesian coordinates by solving a set of Poisson equations. With such coordinate systems, the computation of fluid flows can be done on the simple transformed coordinates regardless of the complex shape of physical boundaries. The concentration of grid spacing is controlled by specifying the inhomogeneous source functions in Poisson equation. A desired smooth distribution of the grid spacing and the control function is obtained in present study.

The numerical grid generation is demonstrated by two examples, namely the high-speed ship model 5415-1 and a junction formed by a cylindrical body erected normal to a plate.

133. **Finite analytic numerical prediction of turbulent flow past an isolated airfoil**

K. M. OBASIH AND C. J. CHEN

Department of Mechanical Engineering, The University of Iowa, Iowa City, Iowa 52242

A numerical solution of the incompressible Navier-Stokes equations, including a laminar to turbulence transition model, is obtained for an isolated airfoil in a body fitted coordinate system. The Navier-Stokes equations, cast in primitive variable formulation, are discretized by the finite analytic method, in a staggered grid arrangement. The turbulence model used in evaluating the turbulence variables is the K - ε turbulence model, while the laminar to turbulence transition model is based on the momentum thickness Reynolds number.

A modified SIMPLER algorithm is employed in the solution method. Results are presented for both laminar and turbulent flow past an NACA 0012 airfoil at zero incidence. The results are compared with available experimental data.

134. A theoretical investigation of ionic pnenomena in combustion

A. N. ERASLAN, and R. C. BROWN

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The objective of this research is to model the appearance and behavior of combustion-generated ions in hydrocarbon flames. An understanding of ionic phenomena is important to the development of advanced combustion technology including electrical control of flame structure and suppression of soot formation. In addition, these simulations can provide a better understanding of the interaction of neutral and ionized species in combustion. Computer models have been developed to evaluate the formation and behavior of ions in acetylene flames. Acetylene flames have been chosen for this work because of the large quantity of experimental data on these flames. The model contains reactions for fuel oxidation, pyrolysis, chemiionization, ion-molecule reactions and charge recombination.

135. Nonlinear wave propagation in simple steps

ADRIAN KORPEL

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Waves in nonlinear media propagate in surprising ways. In many cases of beam propagation the wave may form its own wave guide if it carries the right amount of energy. For larger powers, the beam is periodically focused and de-focused; or it may break up in small filaments. If the medium is also dispersive, "waveguiding in the time domain" sometimes occurs in addition to waveguiding in the space domain, creating non-spreading packets of energy. Such self contained pulses are called solitons. They move freely through each other in spite of the nonlinearity that ought to destroy them upon collision.

In most cases, the relevant equations cannot be solved analytically, and computer simulation must be used. An intuitively appealing technique is to split up space in slices which are alternately dispersive and nonlinear. The wave evolution may then be traced by a simple iterative application of Fourier transforms, wave-space multiplications, inverse Fourier transforms, and real-space multiplications. We will discuss this technique and show simulation of typical nonlinear wave phenomena.

136. Digital photonic computing - part 1

Robert Cuykendall

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Integrated optics offers a particularly interesting candidate for implementing parallel, reversible computing structures operating in closer correspondence with the underlying microphysical laws which presume nondissipative interactions and global interconnections. Planar optical implementations of sequential and cascaded binary adders are discussed using a reversible nonlinear interface device as the single computing primitive. The device is bit-conserving and both optically and logically reversible.

137. Digital photonic computing - part 2

David R. Andersen

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Integrated optics offers a particularly interesting candidate for implementing parallel, reversible computing structures operating in closer correspondence with the underlying microphysical laws which presume nondissipative interactions and global interconnections. Planar optical implementations of sequential and cascaded binary adders are discussed using a reversible nonlinear interface device as the single computing primitive. The device is bit-conserving and both optically and logically reversible.

Geology

138. Lead and Sulfur isotopic ratios of galenas from the Fessler mine at the Mines of Spain, Dubuque, Iowa

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

The Fessler mine (ca. 1908-1911), developed in a gash-vein deposit in the Ordovician Wise Lake Fm, is located in the state-owned Mines of Spain area on the south edge of the Upper Mississippi Valley (UMV) Zn-Pb district. Five samples of PbS mineralization from Fessler No. 2 were analyzed to study covariation between Pb and S isotopic ratios--the first attempt using UMV ores. $^{206}Pb/^{204}Pb$ values range from 21.921 to 22.438, and $\delta^{34}S$ (CDT) values from 1 to 3 o/oo. Lead isotope ratios between ^{208}Pb, ^{207}Pb, ^{206}Pb, and ^{204}Pb at Fessler conform to linear trends known from UMV deposits, and fit regional patterns documented across the UMV. The $\delta^{34}S$ values, however, are lighter than those known from deposits in SW Wisconsin. Plots of $^{206}Pb/^{204}Pb$ (abcissa) vs. $\delta^{34}S$ show linear correlation, and a least-squares line through the data has negative slope with high correlation coefficient ($m = -0.75$, $r = -0.89$). These data can be integrated with a hypothesis suggesting that UMV ore-fluid migration resulted from tectonic/hydrologic processes operating along the Ouachita-Marathon collision in latest Paleozoic time.

139. Geochemical aspects of outlying Upper Mississippi Valley (UMV)-type mineralization in Iowa, Illinois, and Wisconsin

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Over 60 occurrences of minor UMV mineralization surround the main UMV district. Several of these minor occurrences are mineralogically and paragenetically similar to mineralization in the main UMV district. However, fluid inclusion and S, C, and O stable isotope data suggest major differences in the genetic history of the outlying occurrences. Values of $\delta^{34}S$ for pyrite from 3 outlying locations display wide variation within each occurrence. Overall values of $\delta^{34}S$ for sulfides from 17 locations range from -21 to +33 per mil. Fluid inclusion homogenization temperatures, for sphalerite and calcite, are generally lower than those reported for the main UMV deposits although some overlap does occur. Measured salinities from fluid inclusions in calcite are considerably greater than UMV calcites. Sulfur isotope data suggest that at least two stages of sulfide mineralization may have taken place in some outlying UMV occurrences. The possibility exists that some of the minor occurrences are diagenetic in origin and are unrelated to events that formed UMV mineralization in the main district.

140. CICSCO: A deep core drilling project to investigate Iowa's Precambrian crustal evolution

R.R. ANDERSON

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CICSCO (Continental Interior Crustal Studies Consortium) is an informal consortium of midcontinent geoscientists interested in advancing knowledge of the evolution of the continental interior. CICSCO operates under DOSEC, an organization of universities funded by NSF and created to manage a national scientific drilling program. One of the top priority CICSCO projects is the Archean-Proterozoic Transition Traverse, a series of 9 drill holes along a northwest-trending line across Iowa, from Van Buren to Sioux County. The drill holes are primarily targeted on particular Precambrian terranes or geophysical anomalies, however the need for Phanerozoic information in certain areas was also considered in selecting drill sites. In most holes the entire local Phanerozoic section will be cored, with coring continuing at least 500 m into the basement. The cores collected with be extensively studied including petrology, chemistry, geochronology, isotopes, physical properties, and diagenesis. Bore hole studies will include geophysical logging, heat flow, and stress measurement. The first CICSCO core hole was drilled in Cherokee County in January 1987.

141. Selection of carbonate rocks in Iowa for desulfurization during fluidized bed combustion

J. LEMISH AND W. BUTTERMORE

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Carbonate rocks have been proven to be an economical sorbent for sulfur pollutants in the fluidized bed combustion (FBC) of high sulfur coal. The sorbent efficiency of carbonate rock depends on chemical composition, particle size, texture, total porosity and pore size. The objective of this research has been to geographically and geologically identify those carbonate rocks in Iowa most suitable for use in fluidized bed combustion. Criteria for the evaluation of carbonate rock for FBC was developed from data gathered by the Iowa Department of Transportation and include chemical analysis by x-ray fluorescence, and physical analyses of specific gravity, water absorption and pore properties. Analysis of the pore index test procedure and results in terms of sorbent efficiency has provided a rapid and effective means for identifying those Iowa carbonate rocks most suitable for use as sorbents in FBC. These include rock from the Gower, Hopkinton, Spillville, Wapsipinicon, Cedar Valley, Hampton, Sperger and St. Louis formations. Laboratory-scale fluidized bed combustion tests are planned to verify the selection technique.

142. The Iowa Municipal Water-Supply Inventory

P.E. VANDORPE and C.L. SCHERER

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

The Municipal Water-Supply Inventory (MWSI) provides geohydrologic, well construction, water use, water quality, water treatment, and water system data for 814 communities and 30 rural water systems which supply drinking water to 75% of Iowa's populace. MWSI is operated on the Integrated Data Management System in Des Moines with cross-links between the GSB Geologic On-Line System (GEO), the U.S.G.S. Groundwater Site Inventory (GWSI), the U.S.G.S. water quality file (WQ), and the Environmental Protection Division's Model State Information System (MSIS). Users of MWSI can generate detailed reports for specific communities, counties, regions, or state-wide on any parameter or group of parameters. Aquifer characteristics, detailed geologic descriptions, well performance, detailed casing schedules, raw and finished water quality, water treatment, daily water use, storage, surfacewater sources, rural water-supply sources, buyers and sellers, and municipal authorities are all identified. Potential uses include well forecasting, analyzing water quality problems, water-withdrawal permitting, and geohydrologic research. MWSI is available to the public through the Department of Natural Resources.

143. Sedimentary Petrography of the Idlewild Member, Lithograph City Formation, Finchford, Iowa

E. D. Spande
Department of Earth Science, University of Northern Iowa, Cedar Falls, Iowa 50614

The Idlewild Member of the Lithograph City Formation (Devonian) displays a variety of interesting textural features at the Yokum Quarry, near Finchford, Iowa. Recognized as a regressive carbonate

sequence by Bunker, Witzke, and Day (1986), the Idlewild Member contains desiccation features such as birdseye structure. Intraclasts, bioclasts, and pellets are common constituents in the carbonates. Grains of quartz and feldspar and silt are relatively abundant in the Idlewild limestones. These occurrences suggest the proximity of a terrestrial source area. Representative textures will be described and illustrated.

144. A crossbedded grainstone unit in the upper Rapid Member, Cedar Valley Fm, Middle Devonian, of Johnson County, Iowa

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The upper 1 m of the Rapid Member, in a limited area of Johnson County, consists of a crossbedded crinoidal grainstone. This unit is exposed at the north end of Coralville Lake and is present in a core from northern Johnson County. Where the grainstone occurs there is a transition of lithologies from the more typical Rapid crinoidal wackestone to mixed skeletal packstones into a crinoidal grainstone. The top of the unit is marked in places by large horizontal and vertical burrows and is directly overlain by the Coralville Member, which is an organic coral-rich packstone. The grainstone is composed principally of echinoderm grains, but also contains other open-marine organisms. This unit is locally characterized by large-scale crossbedding. The grainstone represents a shallowing-upward sequence from an offshore position below effective wave base to a position within effective wave base. Cementation occurred in meteoric phreatic environments. Probable stratigraphic equivalents of the grainstone unit include tidal-flat facies to the northwest and offshore open-marine facies to the southeast.

145. Provenance of Pennsylvanian age sandstones in Iowa as determined by heavy mineral analysis

S. M. PAULY

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Samples of Pennsylvanian age sandstones were collected from Tower Rock Park at Steamboat Rock in Hardin County, Dolliver Memorial State Park in Webster County, and Ledges State Park in Boone County. The samples were mechanically disaggregated. Most grains were coated with iron oxide. These coatings were removed by immersing the grains in ammonium sulfide for twenty-four hours and then washed with hydrochloric acid. The cleaned grains were sized and heavy minerals were separated from the -0.250 +0.125 and the -0.125 +0.064 mm size fractions using bromoform (S.G. 2.88). The heavy minerals were further partitioned using a Frantz Isodynamic Magnetic Separator. Preliminary examination of the heavy mineral suite indicates a high-grade metamorphic source area.

146. Fauna and biostratigraphy of the Juniper Hill Member (Early Late Devonian) of the Lime Creek Formation, north central Iowa

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Recent subsurface and surface study of the Lime Creek Formation in it's type area reveals that the Juniper Hill Member contains a sparse but diverse invertebrate fossil assemblage consisting of 43 species of brachiopods, corals, molluscs, conodonts, conularids, scelecodonts, and tentaculites. Many species are known from the overlying Cerro Gordo Member, but some were previously known only from the Independence Shale. Discovery of this fauna confirms that the Independence Shale fuana is a stratigraphic admixture of Juniper Hill and Cerro Gordo Member species.

A detailed biostratigraphic zonation based on brachiopods is proposed, these are: (1) the basal multinervosa, (2) walcotti, and (3) uppermost arcuata Assemblage Zone. These zones are based on the first occurrences of Nervostrophia multinervosa, Devonoproductus walcotti, and Douvillina arcuata, and can be recognized in correlative sequences in the Sly Gap Formation of New Mexico, and eventually may be tied in with the central Great Basin sequence of eastern Nevada.

147. Early fossil amphibians from the upper St. Louis Fm. (Mississippian; Visean), Keokuk Co., IA

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Fossil amphibian bone was discovered near Delta, Keokuk Co., IA, in May 1985. Subsequent collecting, including a 3 month excavation during 1986, yielded hundreds of isolated bones, several skulls, vertebral columns, feet, and a partial skeleton. At least two early tetrapod groups, colosteids and anthracosaurs, are present. Associated fish remains include palaeoiniscoids, rhizodonts, xenacanths, and lungfish. Tetrapod fossils are concentrated in a 0-50 cm thick unit of interbedded limestone conglomerate and laminated shale within a paleodepression in the upper St. Louis Fm. Stratigraphic and environmental interpretations suggest that deposition of the bone-bed and associated strata occurred in several nonmarine settings developed following withdrawal of the St. Louis sea. The Delta site has yielded the oldest well-preserved amphibian fossils in North America. Because the fossil record of Tournaisian-Visean tetrapods is scant, previously known only from localities in Scotland, Nova Scotia, and W. Va., the Iowa discovery will provide significant insights into the evolution and paleoecology of early tetrapods.

148. Detrital mineralogy and microfabric characteristics of soil samples-Missouri River Bottomland, Western Iowa

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A detailed petrological study was conducted on alluvial-derived soils to characterize the nature and ultimate dispersal of parent material in this region. Quartz, chert, potassium feldspar, and micas were the main light mineral components in the samples; whereas garnet, zircon, amphibole, pyroxene, tourmaline, epidote, sphene, staurolite, rutile, apatite, anatase, and brookite formed the heavy mineral suite. Both the assemblages showed strong resemblance in terms of overall micro-textural attributes. It is suggested that a combination of both proximal and distal sources could be envisioned for the sediments in the area. Furthermore, influences from a cratonic upland source and polycyclic sedimentary packages have been amply exemplified from this study.

149. Source of beach sands of Araruama Lagoon, Brazil as deduced from heavy minerals

F.O. Vieira

The Araruama Lagoon is located 120 Km northeast of Rio de Janeiro,Brazil. The Lagoon is separated from the sea by a barrier beach. Two sand samples were collected in the area. One from Kacambaba Beach, on the seaside of the barrier beach, and the other from Coqueiral Beach,on the landward Lagoon shore.

The samples were sized and the heavy minerals separated through the use of Bromoform (S.G. 2.88). Primary analyses of both samples suggest that the sand from Macambaba Beach could have been derived from the same source as that of Coqueiral Beach.

150. Late Wisconsinan-Holocene stratigraphy of Buffalo Creek, Johnson County, Iowa

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Buffalo Creek is an anomalous SW-flowing tributary of the east-flowing Clear Creek in Johnson County. It traverses two distinct geomorphic regions, the Iowan Erosion Surface and the Southern Iowa Drift Plain. This location has lead to a complicated stratigraphic record. Eolian/fluvial sand originating from the Iowa River valley and Iowan Erosion Surface immediately to the north is abundant throughout the basin and has an immense impact on basin morphology. Two alluvial fills have been identified in the Buffalo Creek valley; a gleyed late Wisconsinan to Holocene silt loam with particle size identical to local upland loess and a dark late Holocene silt loam to sandy loam with a poorly-drained paleosol developed in it. This study of the Buffalo Creek drainage will document the complex interwoven alluvial and eolian units and relate them to the evolving late Wisconsinan and Holocene stratigraphy of Iowa.

151. Contrasting Late Wisconsinan and Holocene fluvial sequences in Iowa

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Iowa's river systems underwent significant changes in sediment supply, source, and flow events as a result of different Late Wisconsinan and Holocene environments. Studies conducted in several major river valleys have demonstrated that Late Wisconsinan and Holocene deposits are characterized by distinctly different texture and sedimentary structures. Late Wisconsinan alluvium is dominated by in-channel, sand, and gravel deposits characteristic of sediment-laden streams with widely fluctuating flow conditions. Holocene alluvium, in contrast, is dominated by fine-grained overbank deposits; coarse-grained channel and near-channel deposits are found only in the basal 1-2 m. Late Wisconsinan fluvial environments appear to have been very dynamic with abundant coarse sediment supply, while Holocene environments were low energy with significantly reduced sediment supply.

152. Evidences of Pleistocene laking of rivers in Warren County Iowa.

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The presence of eolian deposits and recently discovered shore lines (Cary ?) provide evidence of laked waters of Middle River and several other tributaries of the Des Moines River in Warren County Iowa.

Maps showing the extent of the laking have been produced. Patterns and locations of dune deposits in relation to the lake seem to indicate a relationship of the dunes to the laked waters.

Possible causes of the laking are proposed and evidence is presented.

Locations of terrace slopes in relation to the dunes and the lake levels is shown.

153. Sedimentary sequences of Wisconsinan-age outwash streams on the Des Moines Lobe in north-central Iowa

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Distinctive sedimentary sequences characterize valley-train outwash along different reaches of the Des Moines and Iowa Rivers. Proximal reaches, adjacent to former ice-marginal sediment sources (end moraines), are dominated by sedimentary sequences composed of channel fills and solitary, large-scale cross-beds deposited by in-channel migrating bedforms (dunes, sand waves, etc.). The sequences become crudely coarser upward and appear to have been deposited in rapidly aggrading braided streams. Sedimentary sequences in distal reaches are characterized by a thick, sandy and pebbly lower increment overlain by a 1-2 m thick middle increment of coarse, cobbly gravel that is capped by a thin upper increment of fine-grained overbank/waning flow deposits. The coarse middle increment appears to result from episodic glacial floods originating in proximal areas. These floods increased coarse sediment supply and caused subsequent valley incision.

154. Periglacial geomorphology of the Tangle Lakes area, central Alaska

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A variety of periglacial features characterizes the Tangle Lakes area on the south side of the central Alaska Range. This area is within the discontinuous permafrost zone and has a mean annual temperature of approximately $-4^{\circ}C$. Frost-sorted patterned ground forms, including polygons, circles, nets, and stripes, are common in the hummocky silty tills which blanket the valleys. Nonsorted circles and stripes also occur in these situations but are less common. Gelifluction lobes are found on slopes of the hills and ridges and adjacent low mountains. Cryoplanation terraces occur at higher elevations on crests of bedrock ridges, and rock glaciers and rubble sheets exist below the terraces.

Many of these features are stabilized and inactive at present, but several patterned ground sites appear to show some activity. Investigations are currently underway in regard to the dynamics of sorted and nonsorted patterned ground features.

155. Rare earth & trace element variations in ophiolites along the North Anatolian Fault

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Rare earth and trace element data of ophiolites along the North Anatolian Fault have been synthesized. X-ray fluorescence, flame analysis with HF and HNO_3 sample digestion, and scanning electron microscopy with energy dispersive and wavelength dispersive x-ray microanalysis form the basis of the analysis.

The data is used along with other geological evidence in determining the nature and geologic evolution of the upper mantle and paleotectonic setting of the ophiolite suites. The compositional diversity of the ophiolite series indicates the complexity of the geodynamic environment in which the North Anatolian Fault developed. Results and interpretations will be discussed.

Nursing

156. A descriptive study of the etiologies and defining characteristics of pressure sores

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Pressure sores are one type of skin breakdown. Contributory factors include mobility, activity, incontinence, level of consciousness, nutrition, diseases, body build, stress, infection, age and sex.

Medical records were reviewed on 20 subjects in a pressure sore group and 20 subjects in a non-pressure sore group.

The only statistically significant variable was incontinence of feces; the non-pressure group had more subjects incontinent of feces. The other variables were not statistically significant. The pressure sore group showed inadequate nutrition and below normal body build. The number of pressure sores was 24, primarily stage II sores.

Implications for nursing practice and areas of further study will be discussed.

157. Prospective data collection in a program for intrauterine insemination with washed sperm

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A system was developed for ongoing computer-banking of data related to an infertility treatment performed by nurses. Pooling of nursing and laboratory data and periodic analysis of the data contributes to quality assurance for the program and provides answers to a myriad of research questions.

What is the rate of pregnancy, overall and for different diagnostic groups? What factors correlate with the achievement of pregnancy or with the failure to achieve pregnancy? What complications are occurring and at what frequency? Is the outcome of pregnancy different than for the general population?

Answers to such questions allow the program to be plastic in ways to optimize the success rate and minimize complications and risks. The outcome of the first year of this prospective clinical study will be discussed.

158. Incidence of pulmonary aspiration: Comparison of two common tube feeding methods utilized in an ICU setting

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The purposes of this research proposal were: (1) to determine if there is a significant difference in the incidence of pulmonary aspiration in ICU clients with endotracheal tubes who are fed by the intermittent, bolus or continuous infusion tube feeding method; and (2) to determine if there is a significant increase in the incidence of pulmonary aspiration in these tube-fed clients when they also receive pulmonary postural drainage with percussion treatments.

A total of twelve clients from two intensive care units were selected by non-probability, convenience sampling to participate in the year long study. The primary instrument for data collection was a bedside, flow sheet on which the ICU nurses, on an every four hour basis, recorded pertinent data.

The data results will be examined and a discussion of their clinical application in the hospital setting will occur. Further areas of research will be suggested.

159. Exploring advanced placement of registered nurses

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Comparison of knowledge levels of senior level baccalaureate nursing students with that of registered nurses entering degree completion programs to determine if comparable levels exist which might assist in placement of registered nurses in baccalaureate programs were studied.

Ninety-one students were tested using the American College Testing Adult Nursing Proficiency Examination. All participants also completed a Demographic Data Sheet consisting of descriptive data, grade point average, years of work experience as a registered nurse and type of registered nurse program.

Analysis of variance indicated a significant difference between the knowledge levels of registered nurses and senior level baccalaureate students.

Implications regarding improved educational mobility and appropriate placement using ACT Proficiency Examinations were explored.

160. Administrator and faculty acceptance of the computer as a technological innovation in baccalaureate nursing programs in independent colleges in the midwest.

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The purpose of this study was to examine administrator and faculty acceptance of the computer in National League for Nursing accredited baccalaureate nursing programs in independent colleges in the midwest. Based on Roger's theory of diffusion and adoption, a nonexperimental descriptive research design was used to examine acceptance as it relates to the activities of diffusion and adoption. A random sample of 35 department heads and 70 faculty was selected from 61 programs. Data collection methods included the telephone interview and mailed questionnaires designed to measure computer literacy, attitudes and level of computer use. With an overall response rate of 89.5% the results indicated the current level of computer literacy and attitudes to be sufficiently positive to promote the diffusion process components of awareness, interest, and evaluation. However, the need to develop strategies to promote trial and adoption of computer technology in the areas of instructional and administrative applications was identified.

161. Clinical preceptorships in nursing education: a model for role transition in nursing

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For over ten years the nursing profession has been struggling with a problem now identified as role transition. Since then many potential solutions have been explored. One model, the clinical preceptorship, developed by the undergraduate program, was the focus of this study. Senior nursing students (N=241) from four NLN-accredited baccalaureate nursing programs in their last semester/quarter were studied. Two programs implemented the clinical preceptorship as a required course; two did not. Using a pretest/post test control group design, all students were surveyed before and after their last clinical course. Research questions studied related to the effect of the clinical preceptorship on the student's self-perception of preparation for the reality of professional nursing practice, and the degree of change in nursing performance related to nine scales and sixty-six nursing behaviors/activities. Significant results were documented by senior nursing students experiencing clinical preceptorships which will be discussed.

162. Korean children's reactions to painful experiences

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The purpose of this study was to investigate how Korean children perceive, describe, relate pain to color, and cope with painful experiences.

An exploratory descriptive design using semi-structured interview schedules with 33 Korean children from 5 to 12 years of age was used for the study.

The results of this study showed that Korean children can describe the experience of pain, identify the pain, represent pain with color, and identify a variety of responses as coping strategies of pain.

163. The effects of gay sobriety

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Alcoholism affects every aspect of one's life. Does sobriety do the same? Is the quality of life enhanced? Or does it become less exciting?

The purpose of this study was to learn how sobriety affects the lives of gay recovering alcoholic men.

Thirty gay American recovering alcoholic men with at least 1 year of sobriety were interviewed in depth in Iowa, Illinois, Michigan, Oklahoma, and Texas. Each man was asked to evaluate specific aspects of his life on a 1-10 scale three times: "Immediately before choosing sobriety," "6 months into sobriety," and "today." Life aspects included things such as mental, physical, and spiritual health, leisure, sexual enjoyment and performance, job satisfaction and performance, relationships, finances, nutritional status, and the like.

164. Nurses' knowledge of the menopause

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This study compared nurses' and non-nurses' test scores of menopausal knowledge. Data were collected from 426 women, aged 25 to 65, who resided in a six-state area, by means of a 15 item questionnaire.

The nurses' mean scores, compared by a t-test, were significantly higher at <.001 level than the mean scores achieved by the non-nurses. The practical significance of a mean score achieved by the nurses of 58% is not considered to be adequate for these nurses to be able to promote optimal health for menopausal clients.

Items on the questionnaire most frequently answered incorrectly were related to osteoporosis. Education was the background variable most strongly related to the knowledge scores. Nurses' scores were not related to their basic nursing education or previous Obstetrical/Gynecological employment.

165. A comparison of nurse and patient perceptions of nurse caring behaviors

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Nurse caring behaviors are the acts, conduct and mannerisms enacted by professional nurses that convey to the patient concern, safety, and attention (Larson, 1984). A social support framework provides understanding of the support provided within the nurse-patient relationship.

Cancer patients have special support needs. Nurses are often the health professionals with the most opportunity to meet patients' needs for support. To better meet these patient needs, the nurse needs to know which nursing behaviors are most important to patients.

Using Larson's CARE-Q instrument, the ten most important and ten least important nurse caring behaviors as perceived by cancer patients receiving chemotherapy and by their nurses were compared. Results of this comparison will be discussed.

166. Identifying nursing care costs in the acute care hospital: towards a standardized approach

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A generic method of determining nursing costs for 120 patients in one hospital's six most common DRG categories was identified and tested. The methodology used the single apportionment Medicare stepdown procedure to assign nursing costs to homogenous groups. The study found that the nursing department operating budget consumed 33% of the total hospital operating budget. Ninety-four percent of the nursing department provided direct nursing care. Direct nursing care was 20% of the total hospital cost for the average patient. The total hospital services and overhead were 36% of the bill and the remaining 44% was attributable to ancillary services. The direct nursing cost by DRG ranged from $350 to $591 which is 20-30% of the patient's total hospital bill. An analysis of costs by nursing intensity found level one and two intensity levels (least intense) were identical at 20% of the patient bill, level three was 19% and level four was 23%.

Physics

167. An easily constructed diode-laser driving circuit

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A laser-diode driving circuit has been constructed and tested. The circuit consists of a capacitor-like charge-storage device called a charge-line which is in series with a laser diode. When a transistor switch is triggered into a conducting mode, a one-nanosecond duration current pulse flows through the laser diode which then produces an infrared light pulse. The charge-line is constructed from copper foil and teflon plumber's tape. The length of the charge-line can be used to control the laser-pulse duration. The width of the charge-line affects the efficiency of charge transfer from the charge-line to the diode. Efforts to obtain the shortest duration light pulse possible while still retaining usable light intensity will be described.

168. A simple Piezo-electric drop-measuring instrument.

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The quantitative measurement of raindrops with respect to size and frequency was first undertaken by J. Wiesner, 1895, where he used a water soluble dye impregnated filter paper. Since that time very few changes have occurred in the methods of measuring raindrops. An electro-magnetic transducer developed in Switzerland has almost completely replaced dye paper measurements of raindrops in recent years (Joss and Waldvogel, 1967). The dye paper technique still retains several advantages. The electronic approach has an inherent uncertainty resulting in a broader sampling size and the potential for not recording two drops in rapid sequence, arriving less than 5 ms apart. The present instrument resembles the Swiss instrument in physical character, it uses the same 50 cm^2 interchangable aluminum covered polystyrene cone as its collecting surface, however, the electro-magnetic transducer has been replaced by the polymer Piezo-electric film cemented to a brass disk. The disk receives the inertial impulse through the polystyrene cone rigidly linked to the brass disk by a small rod. The potential advantage of this transducer is a shorter ringing time and a higher output voltage. Presently calibration tests are being carried out.

169. Measuring Density of Extremely Reactive Glasses

H.P. Lim, A. Karki, B.C. Liang, K.H. Chong, S.H. Choo, B. Teoh, and S.A. Feller

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Using rapid quenching techniques, such as a roller-quencher, extremely high alkali content borate glasses have been formed. To measure the density of such very reactive glasses a special sink-float technique has been developed. Results are reported for sodium, potassium, and rubidium borate glasses with up to 75 molar percent alkali oxide.

170. A Density Model for Rubidium Borate Glasses

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Recently, a model for glass density has been developed and used with lithium, sodium, and potassium borate glasses. This model has now been applied to data from rubidium borate glasses. The results of the analysis yielded the relative volumes of the structural units present over an extremely wide range of glass compositions. These are compared with earlier results from the other alkali borates and it will be shown that all of the alkali borates possess very similar glass structures.

171. Photometric observations of HDE 226868 (Cygnus X-1)

L.A. KELSEY

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About a decade ago, HDE 226868 was proposed as the first example of a star believed to be orbited by a black hole. The literature describes the star as an eclipsing binary with a period of 5.60125 days. Last year, the astronomy group at UNI began a program of carefully examining this star photometricly. Our observations verify that the object does vary in brightness by almost 0.1 magnitudes. However, the light curve looks quite different from a typical eclipsing variable light curve. The data does not easily fit a period of 5.6 days as well. We will present our data, and discuss possible implications for the discrepancies.

172. Photometry of Rho Cassiopeiae

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The University of Northern Iowa (UNI) is active in blue and visual photoelectric photometry of suspected variable stars. Work is done in conjunction with the International Amateur-Professional Photoelectric Photometry association as well as individual projects. UNI has been actively taking photometric data on Rho Cassiopeiae (Rho Cas, HD 224014), a supergiant (F8pIa) star. Rho Cas has been a known variable for approximately 85 years, much of the time being confined to a brightness between 4.1m to 5.1m, however, in the Fall of 1946 the star decreased in brightness to 6.2m, after which it recovered to 4.5m to 4.9m. More recent reports, (January to June 1986) show the magnitude of Rho Cas varying less than 0.1m. However, since June 1986 observations at UNI in both blue and visual colors have indicated that Rho Cas has increased in brightness approximately 0.70m in the visual and 0.94m in the blue.

173. Studies of semiregular variable stars at Grinnell's Grant O. Gale Observatory

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Semiregular variables are long-period pulsating stars, but it is unclear whether they are pulsating in their fundamental mode, an overtone, or both. We have been engaged in a program of photometric and spectroscopic monitoring of a selected group of such stars for several years in an effort to detect evidence of switching between modes. Such events would be rare, if they occur at all, but successful observations of them might allow the modes to be identified. No unambiguous mode switches have been observed, but we do see some possible hints of such behavior and find a variety of other interesting effects, including a striking correlation between brightness, color, and carbon abundance. The results of this observing program, as well as the techniques that are used in the observations and analysis, will be discussed. This work is supported by NSF and Research Corporation.

174. Photometric mapping of emission nebulae

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We have developed a technique for mapping the brightness distributions of emission nebulae (clouds of glowing gas) by raster-scanning the 0.61 m telescope at Grinnell College's Grant O. Gale Observatory. Computer control is used both to make the brightness measurements and to scan the telescope. The maps can be displayed either as gray-scale images on a video monitor or as displays of three-dimensional surfaces. The advantages of this method over direct photography are the ease with which quantitative results can be obtained and the ability to accomodate a variety of detectors, including a spectrograph for making maps showing the distributions of specific elements. Examples of results obtained with this technique will be presented.

175. The Cavendish Experiment Revisited

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Henry Cavendish did not make the measurement we know as The Cavendish Experiment to determine the universal gravitational constant, but to determine the density of the earth, and he did not use the constant in his analysis of the data. Nevertheless, very soon textbooks began explaining the experiment only as a measurement of the constant, and that is the way most of us think of it. Although he did not explain his reasoning, we can make reasonable guesses about the motives which caused Cavendish to interpret his work as he did.

176. The Grinnell College Historical Physics Museum

G. O. GALE

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This year is the tercentenary of Newton's Principia and it seems appropriate to recognize it. One of the main topics considered by Newton was central forces, coining the word "centripetal" as opposed to Huygen's term "centrifugal". The museum exhibits a lovely set of lecture-demonstration apparatus that was popular (purchased) about a hundred years ago illustrating circular motion and associated phenomena. The central piece is Watt's "fly-ball centrifugal governor" which brings up an interesting and often confusing pedagogical topic - so called "fictitious" forces. The textbook treatment of centrifugal force through the years will be reviewed. Inertial-reaction forces in accelerating frames of reference will be demonstrated, illustrating what Mach called "dynamic equilibrium".

177. Gravitational Instability and Newtonian Evolutionary Cosmology

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Isaac Newton envisioned a static, infinite and initially uniform, zero field universe which was gravitationally unstable to local condensations of matter. In 1902 James Jeans analyzed this instability and used it to explain galaxy and star formation. Unfortunately, the field equation employed by Jeans and subsequent investigators does not determine a unique gravitational field on an infinite domain and thus is not suitable for numerical integration.

By postulating the existence of a zero field, uniform, infinite universe as a boundary condition on Newtonian gravity I derive a new field equation which differs from the old by a time dependent cosmological term proportional to the average mass density of the universe. The new field equation not only makes Jeans' instability analysis consistent, it also gives rise to a family of Newtonian evolutionary models paramaterized by a time invariant expansion velocity. The present model contrasts both with 19th century Newtonian cosmologies and with post general relativity 'Newtonian' analogs.

178. Derivation of the Schroedinger equation from Hamilton-Jacobi theory in a complex space with extra dimensions

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An attempt is presented to establish the quantum-mechanical Hamilton-Jacobi equation (HJE) in the context of a complex Hamilton-Jacobi theory. The optical analogy is used with an orthogonal geometry of complex momentum and position vectors. The dynamics of a quantum-mechanical particle is assumed to take place in a complex cylindrical geometry; one dimension, of variable curvature, is compactified and orthogonal to the usual real spatial dimension. The angular momentum of the particle along the curled up dimension is quantized and as a result, the rotational momentum as well as the curvature radius are derived. If the Hamiltonian thus obtained is inserted into a complex Hamilton-Jacobi equation, the quantum-mechanical HJE is derived and leads naturally to the Schroedinger equation. The compactified dimension is shown to have a vanishing radius of curvature in the classical limit.

179. Superstring dark matter

B.A. CAMPBELL, J ELLIS, K. ENQVIST, D.B. NANOPOULOS, J.S. HAGELIN AND K.A. OLIVE

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We argue that the lightest supersymmetric particle (LSP) emerging from the superstring theory is a mixture of neutral gauginos and matter fermions. We present their mixing matrix calculated in a minimal low-energy model abstracted from the superstring and exhibit the composition of the LSP. We compute its relic cosmological density and find that it lies within a factor of two of the critical density required for closure, over a wide range of possible input parameters. We also compute the flux of neutrinos from LSP annihilations in the sun, and find that it straddles the upper bound from proton decay detectors.

180. Dimensional transmutation in broken supergravity

J.S. HAGELIN

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We discuss a class of supergravity models coupled to matter in which the scales of supersymmetry breaking and of weak gauge symmetry breaking are both fixed by dimensional transmutation, and not put in by hand. These models are consistent with all particle physics and cosmological constraints, possess vanishing cosmological constant (at least at the classical level), and may provide the missing link between an effective low-energy theory and the fundamental Theory of Everything (TOE) as it may be derived as the low-energy limit of the superstring.

181. Aspects of the superunification of the fundamental forces

R.J.D. PARKER

Physics Department, Maharishi International University, Fairfield, IA 52556

We present a strategy for extracting low-energy phenomenological four-dimensional physics from the superstring. We discuss supersymmetry and gauge symmetry breaking, emphasizing key ingredients in the construction of a realistic model based on Calabai-Yau compactification. The incorporation of a no-scale mechanism for the dynamical generation of the electro-weak gauge heirarchy imposes a unique choice of the gauge group $SU(3)xSU(2)xU(1)^2$ and an almost unique set of matter fields and Yukawa couplings.

182. Phenomenology from the superstring

L.C. CONNORS AND A.J. DEANS

Physics Department, Maharishi International University, Fairfield, IA 52556

Attempts to link the superstring with the reality of physics in four dimensions at energies less than one Tev are discussed. We present phenomenological constraints on the minimal low-energy effective theory which can be obtained from the superstring by Calabai-Yau compactification.

183. Generation and propagation of solitons in stimulated Raman scattering: A unified field based analysis of a coherent transient optical phenomenon

K.J. DRUHL

Physics Department, Maharishi International University, Fairfield, IA 52556

Solitons were observed in stimulated Raman scattering in 1983 and have received considerable experimental and theoretical attention since then. We discuss their generation and propagation in terms of two fundamental principles of the unified field of natural law, perfect balance and perfect symmetry. The perfect balance between emission and absorption of coherent radiation is violated in real systems by collisional line broadening. This leads to the possibility of soliton generation and to soliton narrowing. Analytical estimates of temporal soliton width based on this approach are in excellent agreement with numerical and experimental results.

184. Classical objects and elements of quantization

S. KELLEY

Physics Department, Maharishi International University, Fairfield, IA 52556

Classical string theory is reviewed. The possibility of a field theory of higher dimensional objects is discussed. Covariant and light-cone quantization of the string theory are then presented.

Physiology

185. Type A behavior and the Immune Response

K.S. Blasdell

Neuroscience Department, Maharishi International University, Fairfield IA 52556.

The close connection between behavioral states and the immune system has been evidenced in the association of depression, bereavemnet and exam stress with lowered immune functions. The present study assesses lymphcyte response to the mitogen phytohemagglutinen(PHA) during stress in individuals displaying Type A behavior(TAB), a well known psychophysiologic complex correlated with coronary heart disease.

The results of serial blood samples drawn before and after two-sessions of oral math on 23 male subjects indicated that those rated TAB on the standard Structured Interview by an independent rater had a significantly higher PHA proliferation rate under all conditions, although both groups showed a decreased response to the stressor. TAB also had a lower total WBC. The findings are surprising in light of previous research which suggests that TAB leads to chronic sympathetic activation, a condition usually correlated with decreased immune responsivity. Analysis of serum-borne hormones may be revealing.

186. The role of a circadian rhythm of sensitivity to a specific hormone- a model for classroom experimentation in undergraduate physiology courses

K.M. MARR

Divine Word College, Epworth, Iowa

Endocrine systems in undergraduate physiology courses typically involve only lectures and few if any,demonstrations of hormone action. Availability of suitable experiments is often the reason. Further, rhythms of those hormones are seldom addressed. Early pregnancy and pseudopregnancy in nocturnal rodents is maintained by prolactin secreted in two daily surges, one at lights on and the other at lights off. Pseudopreg nancy, induced easily by artificial stimulation has been used as a model to study the timing necessities of these surges. CB-154(Bromocriptine) was used as an endogenous prolactin blocker, followed by timed exogenous prolactin injections to mimic pseudopregnancy. Quantification of the effects is easily obtained by monitoring vaginal cycles and uterine decidual responses. These results are easily achieved by undergraduate students as part of their normal experimental physiology course and serve to further their knowledge of hormone action as well as the nature and importance of circadian rhythms.

187. Thyroid status modifies endothelium dependent relaxation in isolated rat aortic rings.

D. B. STRATTON AND S. SABHARWAL

Department of Biology, Drake University, Des Moines, Iowa 50311

Young male rats were treated for two weeks with daily 200 ug injections of L-thyroxine (TRX) or with 0.1% propylthiouracil (PTU) in their drinking water. Aortic ring segments were either left intact or had the endothemium removed. Rings were mounted in muscle baths and isometrically contracted by the addition of norepinephrine (NE) in half log increments from 10^{-12} to 10^{-4} M or were precontracted to 100% maximum with NE and subsequently relaxed by the addition of acetylcholine (ACH) in increments from 10^{-12} to 10^{-5} M. Control (CON) rats generated greater tension than PTU to NE but not significantly so. TRX rings generated significantly less tension than CON and then relaxed completely at the highest concentrations. Removal of the endothelium did not alter this response pattern but did cause rings to generate slightly less tension in response to NE. NE-precontracted TRX and PTU rings relaxed more than controls to ACh with the TRX difference being significant. Removal of the endothemium eliminated ACh-induced relaxation. These data suggest thyroid status modifies endothelium dependent relaxation in rat aorta.

188. Contractile Response In Rat Hepatic Portal Vein Is Altered by Thyroid Status.

D. B. STRATTON, M. J. BLACKETER, AND J. A. SMAGA

Department of Biology, Drake University, Des Moines, Iowa 50311

Young male Sprague-Dawley rats were treated daily for four 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 by adding KCL in increments from 10 to 60 mM then washed and recontracted by adding norepinephrine (NE) in half log increments from 10^{-12} to 10^{-4} M in the presence or absence of propranolol (PPR). In concentration/response experiments with KCl, the TRX curve shifted to the left of control while the PTU curve shifted to the right. No significant differences were seen in the concentration/response curves to NE between treatment groups. After PPR pretreatment, concentration/response curves shifted significantly to the right in each treatment group. Also following PPR pretreatment, differences in generated tension developed in the three groups with the tension development order being reversed when the NE concentration exceeded 10^{-6} M. These data suggest that thyroid status modifies beta receptor activity and voltage operated ion channel activity in rat hepatic portal vein.

189. Lymphocyte beta-adrenergic receptors (BAR) and cardiovascular responsivity in the TM program and Type A Behavior

P. J. MILLS

Department of Neuroscience, Maharishi International University, Fairfield, IA 52556

This study examined the hypotheses that meditation reduces sympathetic end-organ sensivity, and alters responsiveness to stress. A 20 min. TM or relaxation period separated two mental arithemetic tasks. Blood pressure (BP), heart rate (HR), norepinephrine (NE), epinephrine (E) and BAR were measured. Results indicated that the TM group had a lower % of the BAR in the high affinity state ($p<.05$), a higher Bmax ($p=.05$), lower resting E ($p<.03$), and a lower BP ($p<.01$) throughout. Following the meditation period the TM group had lower DBP response to MA2 ($p=.05$), the controls a lower HR response ($p<.03$) and TM Type A's had a lower SBP response than the control Type A's ($p<.001$). The results indicate that meditation may alter BAR function, as well as Type A associated responsiveness to stress. They also support previous research showing TM's long-term effect of lowered BP.

190. Characterization of a Growth-inhibitory Factor Extracted from Plasma Membranes of Malignant Mouse Mammary Epithelial Cells.

D. EASTMAN and B.A. VOYLES

Department of Biology, Grinnell College, Grinnell, Iowa 50112-0806

The growth of sparse cultures of MCF-8, a cell 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. The active component of this membrane fraction can be extracted by the nonionic detergent octylglucoside. The isolated active component is nondialyzable and shows the same pattern of heat stability as the plasma membrane fraction, being inactivated at 65°C. The isolated factor produces maximal inhibition of growth at 24 hours after addition to sparse cultures compared to 72 hours for the plasma mebrane fraction.

191. The mechanism of kainate excitotoxicity is analogous to ischemia-reperfusion tissue damage.

J.A. DYKENS

Department of Biology, Grinnell College, Grinnell, IA 50112

Kainate, a dicarboxylic neurotoxin that causes susceptible neurons to depolarize repeatedly, produces lesions in limbic regions of mammalian CNS closely resembling those seen in Huntington's and other neurodegenerative diseases. Neuronal death has been attributed previously to ATP depletion and consequent failure of transmembrane ion-dependent ATPases. However, free cytosolic calcium increases immediately upon excitotoxin exposure, suggesting that ATP depletion may play a secondary role. Recent work shows that kainate-induced death of mammalian cerebellar granule neurons in culture is prevented by allopurinol, a specific inhibitor of xanthine oxidase (XO) which is an enzymic source of cytotoxic superoxide radicals. Neurons also are protected by the addition of superoxide and hydroxyl radical scavengers, or serine protease inhibitor which forestalls formation of XO. These data indicate that kainate-induced neuronal death is mediated by superoxide radicals generated by XO, a mechanism partially analogous to that proposed for the necrosis seen upon reperfusion of previously ischemic tissues.

192. Zero erythrocyte sedimentation rate(ESR) and the identification of a population with lower than predicted values

D. E .Smith, M. Dillbeck

Department of Physiology and Psychology, Maharishi International University, Fairfield, Iowa, 52556

The finding of a ESR of zero is unusual. Normal values are 1-13 mm in men and 1-20 mm in women. ESR goes up with aging. We have examined 464 volunteer male and female subjects at their usual place of work and found that 12% had zero ESR.

The study consisted of 2 cohorts. 252 subjects were practitioners of Transcendental Meditation(TM). The control group consisted of 212 non-practitioners of TM and included Trappist monks and nuns, Seventh Day Adventists, college students, and employees of a machine tool shop. Using discriminate analysis we found that both youth ($F=11$, $P=.0006$) and maleness ($F=24$, $P<.0001$) significantly discriminated for zero ESR but that TM was the most powerful discriminator for zero ESR ($F=35$, $P<.0001$). Using multiple regression analysis we found that ESR increases with age and femaleness but decreases with TM and the TM group was 17.45 years younger with respect to ESR than controls($F=21.9$, $P<.0001$).

We conclude that zero ESR is a normal finding in healthy subjects and that TM is highly predictive of zero ESR and is associated with lower ESR levels at all ages in both sexes.

193. Analysis of the ras-rho oncogene family

A. M. MYERS and PASCAL MADAULE

Department of Biochemistry
Iowa State University, Ames, IA 50011

The ras oncogene family is one part of a superfamily that also contains the conserved rho gene family. rho genes have been isolated from yeast, mammals and molluscs; nucleotide sequence analysis of these genes reveals the interposition of conserved and variable domains that suggest specific biochemical properties. Two members of the rho gene family from the yeast Saccharomyces cerevisiae, RHO1 and RHO2, have been analyzed by construction of site-specifc mutations. RHO1 was found to be essential for viability of yeast cells, while inactivation of RHO2 did not cause an obvious phenotype. A mutant allele of RHO1 (RHO1-His68) was constructed with a mutation analogous to one that activates the oncogenic potential of the human H-RAS gene. Diploid strains containing RHO1-His68 fail to sporulate in response to nutrient limitation, suggesting that rho proteins may be involved in cellular response to the environment. Activation of the adenylate cyclase-cAMP dependent protein kinase cascade, which cirvumvents the requirement for ras function, does not overcome the lethality induced by inactivation of RHO1. Therefore, rho and ras genes must interact with distinct biochemical pathways.

194. Membrane filters for growth and scanning electron microscopy of Tetrahymena.

B. L. BERGQUIST

Biology Department, University of Northern Iowa, Cedar Falls, IA 50614

Using a combination of several techniques, a method was developed to use membrane filters for growth and/or fixation of the ciliate Tetrahymena for scanning electron microscopy. In one application, washed, 13mm membrane filters were sterilized and applied to the surface of an agar (2%), proteose peptone medium. Following time to allow filter moistening, cells were innoculated directly from a monoxenic culture onto each filter and incubated for growth. While still on the filter, the cells were fixed with gluteraldehyde, osmium tetroxide and dehydrated through ethanol. Filters were then placed in hexamethyldisilizane, air dried, mounted on specimen stubs, coated and observed by scanning electron microscopy. In a similar manner liquid media grown cells were prepared for observation. This combination of methods appears to have several merits for the fixation and processing of ciliated protozoans.

195. A protein synthesis accuracy mutant of E. coli defective in ribosome editing.

R. P. ANDERSON and J. R. MENNINGER

Biology Dept., Univ. of Iowa, Iowa City, IA 52242

Aging in humans and other organisms is characterized by progressive deterioration of function, leading finally to death. The error catastrophe theory provides a sufficient cause for the deterioration. Studies on the accuracy of protein synthesis in E. coli provide necessary information to formulate experiments which can test the error catastrophe theory. In normal cells, a process known as ribosome editing improves the accuracy of protein synthesis by preferentially dissociating incorrect peptidyl-tRNA (ptRNA) from the ribosome, thereby preventing the misincorporation of amino acids into completed proteins. We have isolated a mutant strain which dissociates ptRNA at up to 4X lower rate than its parent. The mutant is more error-prone when errors incorporated into completed proteins are measured by the thermolability of β-galactosidase. However, there is no difference in the poly(U)-stimulated misincorporation of leu for phe by mutant cell extracts, a measure of accuracy which does not include the contribution by ribosome editing. The data support the notion that a defect in ribosome editing is both necessary and sufficient to explain the reduction in the accuracy of protein synthesis.

Psychology

196. Compliance with prescription medication therapy, regimen complexity, and locus of control

T. L. GRIEBLING

Department of Social Sciences, Wartburg College, Waverly, IA 50677

A major problem in the treatment of most health disorders, particularly chronic diseases, is patient noncompliance. In order for a given treatment to be effective, it must be appropriate to the disorder, and it must be taken as prescribed.

Numerous social and psychological factors undoubtedly influence compliance patterns. It is postulated that the degree of patient compliance is inversely related to regimen complexity. Additionally, it is hypothesized that patients who exhibit an internal locus of control will tend to be less compliant than those who are more external.

The present study examines compliance behavior via a simulation experiment.

197. Gender differences in the performance of normal and mirror-reversed spatial tasks

E. J. HOFF and M. W. O'BOYLE

Department of Psychology, Iowa State University, Ames, Iowa 50011-3180

An experiment was designed to investigate gender differences in spatial abilities. In the present study, males and females were asked to recreate one of six WAIS-R block designs in normal or mirror-reversed perspective. It was anticipated that males would outperform females in this task which requires considerable spatial skill.

Results indicate that males were superior in copying block designs outside of the context of a mirror. Within the context of a mirror, however, no gender differences in block design performance were observed. These findings are interpreted in light of the prevailing literature on gender differences in spatial abilities. Also, methodological issues in the use of mirror image information in testing gender differences in spatial abilities are discussed.

198. Social learning analysis of smoking cessation clinics

DECKER-FORSMARK, P.

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W008 Lagomarcino Hall
Iowa State University
Ames, IA 50011

This study compares leading public service approaches to smoking cessation (American Cancer Society, American Lung Association) with an experimental procedure derived from a broad-based cognitive social learning perspective. Subjects are randomly assigned to each method. Key elements are hypothesized to include group support, target date for quitting, and specific preparation leading to the target date.

199. Determinants of relapse in ex-smokers

WESTRA, B.

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W026 Lagomarcino Hall
Iowa State University
Ames, IA 50011

While smoking cessation programs can be effective in helping people stop smoking, most people who quit smoking relapse. This study will investigate the circumstances in which relapse is most likely to occur. Attention will be given to situational antecedents, coping responses and lifestyle factors as precipitants of relapse in ex-smokers.

200. Public service application of an effective method of smoking cessation

MILLS, K. R.

Department of Psychology
W004 Lagomarcino Hall
Iowa State University
Ames, IA 50011

An 8 week, 16 session smoking cessation clinic design has been found effective in the laboratory setting. This study examines one year follow-up data for 25 clinics, now removed from the laborator to a field setting.

Selected demographic and baseline smoking history variables of the sample will be discussed along with outcome data to indicate success rates at specific times following the quit date. The relationship between outcome status and sex of subject will be examined.

201. Evaluation of feedback instrument in smoking cessation clinic

McGOVERN, P. G.

Department of Psychology
W024 Lagomarcino Hall
Iowa State University
Ames, IA 50011

A 20-item questionnaire was mailed to 428 participants drawn from 42 smoking cessation clinics four months after the date on which they attempted to quit. One hundred and ninety six replies were received. Rate of reply was highly correlated with current smoking status. Response rate in individual clinics varied significantly from 16.7% to 88.2%. Results of a factor analysis indicated that three factors explained over 80% of the common variance. The factors were interpreted as being: 1) a treatment factor (i.e., reactions to specific components of the treatment); 2) a facilitator effect (i.e., evaluations of the group leader); and 3) a group effect (i.e., reactions to the other group members and the group atmosphere). It appears that with increased response rate (possibly through telephone contact) reliable evaluations of clinics are possible. Such information is vital, for instance, in conducting quality control checks on facilitators who are separated by great distances.

202. Reporting sexual harassment: perceptions and experiences of college students.

G. L. MOINE

The University of Iowa College of Nursing,
Iowa City, IA 52242

The 1986 United States Supreme Court ruling that sexual harassment is illegal requires increased vigilance for academic institutions. This study conceptualized a feminist attitude important to perception of sexual harassment, and social isolation important to inclination to report to institutional representatives. Eight category definitions of harassing behavior were utilized to elicit perceptions of 86 female community college women about incidence of harassment. It is important to note that more women indicate other females experience sexual harassment than they report personally experiencing harassment. The data indicate that a profeminist attitude does not significantly differentiate perceiving that harassment occurs; the FEM attitude scale revealed statistically significant differences in only two belief statements regarding male faculty behavior. The women inclined to report to institutional representatives were more socially isolated from friends or relatives than the rest of the sample.

203. The application of microcomputers to laboratory exercises in operant conditioning

D. LOPATTO

Grinnell College, Grinnell, Iowa 50112

Inexpensive microcomputers serve to control events and record data in a variety of operant learning procedures. A single set of equipment may be utilized by both introductory and advanced students. The advantages and costs of this microcomputer application will be discussed. Sample programs from an introductory "rat lab" and from an advanced learning course will be presented.

204. Interfaces for microcomputer applications in experimental psychology

T. BROZOSKI

Department of Psychology, Grinnell College, Grinnell, Iowa 50112

The Psychology Department at Grinnell College acquired its first microcomputer in 1977. Over the past decade we have developed both hardware and software applications for teaching and research. One aspect of our hardware development has been the construction of relatively simple cost-effective interfaces. These general-purpose interfaces, now in their fourth generation, anable our microcomputers to receive inputs from a variety of sources, such as conditioning chambers and skin-conductance devices, and additionally to control external instruments such as feeders and stimulators. Features of our design program will be discussed, including costs and live demonstration of sample applications.

205. A demonstration of motion analysis in psychological research

F. GOODKIN and E. AMANN

Department of Psychology, Grinnell College, Grinnell, Iowa 50112

Motion analysis is currently being performed to evaluate stepping movements in cats. A demonstration of motion analysis of limb movement will be given together with analyses of other forms of movement, including general activity level of a single organism, and group movement.

206. A microcomputer system for evaluation, feedback and record-keeping in undergraduate psychology courses

J. GREEN

Department of Psychology, Grinnell College, Grinnell, Iowa 50112

The Psychology Department at Grinnell has developed an array of sophisticated software designed to simplify the management of courses with large enrollments. Two important applications will be discussed and demonstrated: an integrated micro-computer-based test scoring and course record-keeping system and an interactive exam review program.

Science Teaching

207. Nightly news and science class

R. L. Iverson

Miller Junior High School, South Eleventh Street, Marshalltown, Iowa 50158

In the past few years science teaching has come to include social impact as well as the body of knowledge and processes associated with science. Technical and economic changes in VCR's have opened the possibility of bringing in current events while they are still warm. The presentation will include a demonstration tape and the sharing of things that have worked as well as those that have not.

208. The use of STS materials as a motivational tool in Junior High Science classes.

J.A. ROGIS

Oxford Junction Consolidated School, 313-3rd Ave., Oxford Junction, Iowa 52323

STS-based curriculum is one way of making Science courses seem more relevant to the student. By using an STS approach the Science course is forced out of the classroom and into the community--where the students will be using Scientific principles for the rest of their lives. Using people from a community as resources helps to establish strong ties between the community and the school.

209. An invention model for teaching of energy ethics

Gary L. Jensen

Roland-Story Middle School, Roland, IA 50236

During an energy unit the students invent a process or invention that will help us out of our energy crisis. The project does not have to be a working model but should be feasible in the student's mind.

Students keep a scrap book of energy periodical articles and their summaries to increase energy awareness. Filling out teacher-made patent papers helps the students focus on the lesson.

The teacher issues a teacher-made patent. Afterwards, an imaginary energy company offers to purchase their invention. The offer states that their invention will not be considered for production now because the company has special interests in making a profit from the company's energy product and not from the energy saving invention developed by the student. The student must finally decide to take the money or help out with the energy crisis.

210. A three week unit for the eighth grade on nuclear weapons: a science, technology and society approach.

J. T. KUBICHEK

Graduate student, Instutute for Environmental Education, University of Northern Iowa, Cedar Falls, Iowa 50614

This unit has three major goals:
1. To inform students about nuclear weapons related topics and their threat to the ecosystem.
2. To examine the relationship between nuclear weapon technology and societal interaction.
3. For students to formulate informed opinions on nuclear weapons issues and take some action on those opinions.

A packet will be distributed and discussed that includes lesson plans, original activities and materials, student evaluations, and teacher evalutions for the unit.

This material was developed at the 1985-86 University of Iowa NSF/NSTA - Science, Technology,Society Chautauqua Short Course.

211. Energy Materials (Fossil Fuel Junction)

K. K. Newton

Jr. High Science Dept. Iowa School for the Deaf
1600 So. Highway 275 - Council Bluffs, Iowa 51501

Text: "Fossil Fuel Junction" was the workbook and basic information guide.

Type of Class: This unit was presented to a sixth grade class at Iowa School for the Deaf. Abilities; very low to below average in reading and below average to average in comprehension.

Teaching Strategies: ISD is a residential school and our field trips were designed to help students become acquainted with where the campus gets its power. We toured our power plant, the heating oil storage area, generators, transformers, and computer. We toured the school kitchen, laundry, and sewing room to find out what energy sources were used and how they were connected to the power plant. We went to other buildings on campus to see how they received power. The students mapped underground tunnel and wiring systems.

A speaker from Iowa Power came to our class and we toured their facility.

212. The student -- our best resource

S.L. JOHNSTON

Webster City Junior High,
740 Bank Street,
Webster City, IA 50595

Students possess many capabilities that can be effectively used in science classes. My eighth and ninth grade students produced a book on Halley's Comet. The 100 page book of student creations depicts the society and the technology in Halley's past, present, and future. The book, printed by our school press, sold over 150 copies.

Methods used to carry out this project, the application to other topics, and the positive effects of allowing students to express their ideas by the means in which they show the most talent and expertise, will be discussed.

213. STS-science, technology, & society: relevant thinking in your classroom, you can make a difference!

ED REZABEK

Glidden-Ralston Community Schools, Glidden, Iowa, 51443

OBJECTIVE. Clearly, children like and want activities in which they are involved in and which have meaning to them. STS uses relevant issues to build on science concepts and lends itself to values and decision making stragies. Each participant in an STS activity has the opportunity to think relevantly.

ACTIVITY EXAMPLE. "SEATBELT SCIENCE" is a STS activity that will allow the student to examine, study, and act on a current issue.

PROCEDURE. 1) Opinion and attitude test. 2) Introduction of science concepts. 3) Activities to stimulate thinking. 4) Verification of research. 5) Consideration of the consequences. 6) Test. 7) Opinions and attitudes "retest".

This activity, and many others like it, have been developed through the exposure of teachers to STS. An alternative to traditional science education. An alternative that can make a difference.

214. A unified field physics course for high schools

J.A. HANE, A.J. DEANS, K.W. KLEINSCHNITZ

Maharishi School of the Age of Enlightenment, Fairfield, IA 52556

The science faculty of the Maharishi School of the Age of Enlightenment have developed and taught a seven-week course on the physics of the unified field to its 1985-86 twelfth grade physics class. The aim of the course was to present the most recent advances in physics and thereby excite student interest in the subject. The course included an introduction to quantum field theory, electro-weak unification, grand unification, supersymmetry, superstrings and cosmology. The relationship between the unified field and the field of pure consciousness was a central theme of the unit, thereby allowing the students to relate the knowledge gained in class to their own experience of the unified field gained during their twice-daily practice of the Maharishi Technology of the Unified Field.

215. Quickie physical science demonstrations

E. A. PETERSON

East High School, 815 E. 13th St., Des Moines 50216

Thought-provoking demonstrations can add interest and enthusiasm to the classroom atmosphere. Several short physical science demonstrations will be performed illustrating concepts in sound transmission, inertia, relative motion, falling bodies, circular motion, reflection and refraction.

216. Hands-on activities with crystals

L. CLIFTON

Indianola Junior High, Indianola, IA 50125

Demonstrations of activities students can do to study crystalline formation will be presented. Crystal models and crystal growth activities will be shown.

217. What's the point of a bed of nails?

B. COX

Dowling High School, 1400 Buffalo Road, West Des Moines, IA 50265

A series of demonstrations including a bed of nails and lifting a person in a garbage bag will be presented. These will illustrate how we use equations to describe nature.

218. Gas solubility in water

M. F. FEDDERSEN

North High School
Sioux City, Ia. 51104

Gas solubility in water (fruit punch) is shown by adding dry ice to punch in a pressure cooker. Carbon dioxide dissolves during the class period producing carbonated punch which is served at the end. Solubilities of gases in liquids are then discussed.

219. Origins of color - transmission and reflection

R. P. STOUT

Department of Chemistry
Drake University
Des Moines, Ia. 50311

A simple method of producing a visible spectrum will be presented. This method will be used to demonstrate the creation of color by transmission and reflection of light, and the relationship between transmission and reflection.

220. Demonstrations: static electricity, convection and atomic structure

J. C. MEHLE

Physics Department, Drake University, Des Moines IA 50311

Three simple demonstrations on the above listed topics that can be done without scientific equipment.

221. The 240-watt hot dog

D. MCGRAIL

Carlisle High School, 417 School Street, Carlisle, IA 50046

Series and parallel circuits, voltage drop and simple circuit analysis will be investigated using hot dogs and easily constructed electrical "cheater" cord. This is not at all times a hands-on activity.

Zoology

222. Macroevolution in caves

K. A. CHRISTIANSEN

Grinnell College, Grinnell, Iowa 50112

Eight controversies are active in the study of macroevolution. These are: 1) the meaning of the term macroevolution, 2) the role of chance, 3) the role of stasis and gradualism, 4) whether significant change is limited to speciation events, 5) the environmental conditions where macroevolutionary change occurs, 6) whether neodarwinian mechanisms are adequate to explain change, 7) the existence and nature of hierarchical evolutionary processes, and 8) Darwin's views about this. We examine each of these and then use the extensive data available for 9 species of European and Nearctic cave Pseudosinella to examine the third, fourth and fifth of these controversies. Our conclusion is we have clear evidence that significant adaptive change is not limited to speciation. It does; however, appear that the amount of adaptive change is far greater during the process of speciation than in between. We show that there is no evidence for clear periods of stasis in the evolutionary process of these forms. This leads us to a new model of the macroevolutionary process combining features of gradualism and punctuated equilibrium. We also showed that evolutionary change is not associated with unstable environments but with more stable ones.

223. Some problems in estimating age of turtles by counts of plastral annulae

J. L. CHRISTIANSEN

Department of Biology, Drake University, Des Moines, Iowa 50311

Age of many temperate turtles is most easily estimated by counts of annular grooves in the scutes of the carapace or plastron. These indentations result from slow growth during winter dormancy. False annulae, presumably resulting from interruption of growth during non-hibernating periods, have been described for ornate box turtles but seem rare in painted turtles and many others. The difficulty of recognition of false annulae in turtles that estivate during summer may make estimates of age for these species unreliable.

224. Scanning by Harbor Seals for predators

L. M. Mehl

Department of Biology
Simpson College
Indianola, IA 50125

Harbor Seals (Phoca vitulina) spend most of their lives in the water but haul out onto beaches, shoals, and icebergs to give birth, suckle their young, and to rest. Their movements on land are extremely clumsy, making them vulnerable to attack by bears and bounty hunters. When out of the water, seals scan their surroundings frequently. Often groups will desert a site simultaneously, suggesting that seals respond to other seals. My research at Prince William Sound, Alaska, was designed to test the hypothesis that increasing the numbers of seals hauling out together allows a reduction in the time each individual must invest in surveillance.

Travelling unobtrusively by kayak to my observation site each day, I counted the number of seals on each iceberg. Using a behavior code, I recorded the scanning frequency of individual seals at 10 second intervals. Scanning frequency of individuals did decrease as group size increased. Statistical testing indicates the differences involved are significant.

225. Selected transects of Crustacea from Prince Edward Island, Canada.

R. W. COLEMAN

Department of Biology, Upper Iowa University, Fayette, IA 52142

Ampithoe longimana, A.rubricata, Calliopius laeviusculus, Cancer irroratus, Caprella septentrionalis, Corophium insidiosum, Crangon septemspinosa, Gammarus lawrencianus, G.mucronatus, G.oceanicus, G.setosus, G.tigrinus, Hyale nilssoni, Hyalella azteca, Orchestia grillus, Idotea sp., I. baltica, Jaera sp., J.forsmani, Porcellio scaber, Mysis stenolepis, and Neopanope texana sayi were found in 29 transects from Prince Edward Island, Canada. Physical and chemical factors were analyzed. Acknowledgements to Dr. Don Steele, Memorial University of Newfoundland, for determinations of crustaceans, and to Dr. E. L. Drake and the Department of Biology, The University of Prince Edward Island, Canada for logistic support are made.

226. Notes on reproduction in the differential grasshopper, Melanoplus differentialis (Thomas)

TRUMP, R. F.

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Melanoplus differentialis deposits egg pods in the soil in autumn. The eggs, 50 to 200 per pod, hatch the following summer. To determine the effect of temperature on the hatch, 80 pods were collected from screened cages in each of four autumns and stored under soil in glass vials. The percentage hatch from pods kept at 20° to 24°C was significantly lower than from pods kept at ambient winter temperatures, Ames, Iowa. For the pods kept outside, the hatching began 17 to 29 days after the pods were brought indoors (January 20, February 28, and April 6). For pods kept indoors, hatching began in December or January and continued significantly longer than for those kept outdoors. In making daily emergence counts, the nymphs were shaken into mild detergent water. When samples were transferred to tap water and confined beneath the surface, 58% survived six hours of submersion in water at 31°C. At 9°C, 96% survived six hours of submersion. Data on the number of matings for marked males and females will be presented.

227. Chance and the roots of sexual asymmetry

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Sexual selection theory states that ♀♀ tend to be choosier of their mates than ♂♂, and less variable in reproductive success. We analyze the role of chance in mate choice strategies and variances in lifetime mating success (LMS) in both sexes. Using Markovian mating models, we derive analytical expressions for the mean and variance of LMS as a function of the probabilities of survival and mate encounter per unit time, and of the duration of a postmating latency period, during which individuals do not search for mates. If ♂♂ have similar survival but shorter postmating latencies than ♀♀, then ♂♂ always have higher variances in LMS than do ♀♀, given equal LMS means in both sexes. Therefore, simply observing a higher LMS variance in ♂♂ is not sufficient proof of the existence or operation of sexual selection, as has been claimed. Mate choice is also favored by sexual asymmetry in postmating latency to remate; the sex with the longer latency should be choosier of mates at all levels of survivorship and availability of potential mates. Accordingly, we present a modified means of measuring the opportunity for sexual selection on ♂♂.

228. New information on wetland butterflies

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Approximately 15 of Iowa's 136 butterfly species are associated with wetlands. Data gathered in 1986 field work and from earlier surveys have given some insight into these species and wetland butterfly communities.

Some species are habitat generalists, found in wetlands and other habitats. Others are restricted to wetlands. Rare species found on wetlands include: Poanes massasoit; highly localized populations on three sites. Euphyes bimacula; known from eight sites but hard to identify. These species may be more common than currently thought. A few species probably will not be found at many additional sites: Polygonia faunus and Phycoides batesii; possibly near the edge of their ranges. Euphydryas phaeton; near the center of its range, rare due to habitat loss. The survey for this species demonstrates some of the problems of butterfly research.

Several of these species appear to be associated. Euphyes dion is present only on sites where Poanes viator and Euphyes conspicua are found.

229. Overview of recent and future butterfly projects in Iowa

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Even though Iowa has been collected for lepidoptera for over 100 years, it has received little attention until recently. In 1971, M. C. Christenson sampled the collections of the state, and after extensive field work, completed a masters thesis on Iowa butterflies. In 1980, Downey and Roosa executed a survey of the butterflies of the loess hills. Twenty lepidopterists found 76 species, with 69 county records. In 1984, a project was undertaken to compile basic data on selected loess hill sites to monitor long term changes in butterfly populations. Recent work has lead to a new species for the state and range extensions from the West to the East side of the state. Searches for specific habitats in 1986 have lead to important fauna including 127 county records. Future projects should involve a look at new habitats and certain rare species. Most importantly a study of the effects of management on populations, particularly in prairie sites should be undertaken.

230. Lepidopteran faunal composition for Iowa fen communities and their biogeographic significance.

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Since rediscovery in eastern Iowa in 1983 by the principal author, fen communities have proven to harbor not only a large number of rare plant and bryophyte species, but lepidopteran taxa as well. Since systematic collection of lepidoptera from these sites began in 1985, 11 rare Iowa species (after Nekola and Schlicht, 1986) have been observed in the fen environment, including two critically endangered taxa (Euphydryas phaeton and Poanes massasoit). In addition, Lethe eurydice fumosa (under review for federal listing) may reach its greatest abundance worldwide on these sites. The fauna differs from that found in typical tallgrass prairie, and shows affinities to the boreal and northeastern United States regions. It is likely that these species have invaded Iowa fen communities since Hipsothermal times. As with the vascular plant floras, eastern and western Iowa fens exhibit differing faunal compositions, with some species restricted to one region or the other.

231. Biogeographic implications of refugial communities in eastern Iowa.

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(See Botany Section)

232. Ecophysiology of Drosophila robusta and D. tripunctata

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In samples taken from a lowland forest community, the seasonal abundance of Drosophila robusta was significantly positively and that of D. tripunctata significantly negatively correlated with temperature. These data suggest that temperature may play an important role in determining the seasonal abundances of these species. Studies of the effects of high temperature stress on adult survival, egg hatchability, and behavior were undertaken in order to test the hypothesis that temperature could influence the seasonal abundances of D. robusta and D. tripunctata in a manner consistent with our ecological observations.

D. tripunctata does much worse in adult survival and egg hatchability at high temperature than does D. robusta. Moreover, behavioral studies indicate that adults of D. tripunctata actively avoid high temperatures, a behavior not seen with D. robusta. These results are consistent with the hypothesis that temperature plays a major role in regulating the seasonal abundances of these two species in nature.

233. Environmental and genetic effects on amylase activity in Drosophila pseudoobscura

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We studied the activity, in crude extracts, of the amylase enzyme in Drosophila pseudoobscura. Amylase hydrolyzes starch to maltose. There are two major alleles at this locus and thus three genotypes, the two homozygotes and the heterozygote.

We looked at the possible effects due to environment, genetic background, and the amylase locus itself on the activity of the amylase enzyme. We have done this by assaying flies from four cultures (for environment) of each of nine strains (for genetic background) of each of the three different genotypes.

The data were analyzed by analysis of variance. Preliminary results indicate that while all three aspects significantly affected amylase activity, more variation was due to the environment.

234. Effects of nitrate and alachlor on lethality, fecundity, and mutagenicity in Drosophila melanogaster

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We have studied the effects of nitrate (as sodium nitrate) and alachlor, two known groundwater contaminants, on lethality, fecundity, and mutagenicity in Drosophila melanogaster. After a six hour period of starvation, males were exposed to various concentrations of the two compounds by ingestion. Each individual male was then mated to three females and the number of offspring counted to determine fecundity. Mutagenicity of the coumpounds was determined by looking for sex-linked recessive mutations in the F2 offspring. Males were counted at all stages to determine lethality.

Neither compound was mutagenic at the concentrations tested. At low concentrations both compounds had a significant effect on fecundity (compared to controls). At higher concentrations both compounds significantly affected survival but fecundity differences disappeared.

235. Behavioral responses of Peromyscus leucopus to wet and dry subtrates

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White-footed mice, Peromyscus leucopus, alter their movement patterns with changes in ground litter dampness in ways that minimize the amount of noise their passage produces. Given a choice, mice will run from a threatening situation over wet leaves rather than dry, and this preference is especially strong in full moonlight as opposed to new moon conditions. When traversing dry ground areas, mice in the field or enclosure more often choose routes incorporating logs and trees. Mice required to cross dry leaves use a slower, more precise pace which minimizes the number of contact points with the leaves and which was much different from the gait used in crossing wet leaves.

236. Seasonal changes in maternal defense in a paper wasp

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Free-living queens of the paper wasp Polistes fuscatus were tested for tendencies to defend or desert their brood when threatened. Early in the season, queens tended to desert the brood. As the season progressed, they increasingly tended to defend the brood. A switch from desertion to defense is consistent with predictions based upon Trivers' concept of parental investment, since the replacement of brood lost to predation becomes less effective as the season progresses.

237. The environment and water exchange of painted turtle (Chrysemys picta) eggs during natural incubation.

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We measured environmental properties influencing water exchange of naturally-incubating painted turtle eggs for two consecutive nesting seasons in the Lakes Region of northwest Iowa. We found the water potential ranged from 0.0 kPa to -77.0 kPa. In 1985, the change in mass of eggs resulting in hatchlings varied from an increase of 63.3% to a loss of 15.1% of initial mass. In 1986, the change in mass of eggs resulting in hatchlings varied from an increase of 71.5% to a loss of 3.1% of initial mass. In 1985, the average increase in mass of viable eggs was 15.1% of initial mass for 21 eggs in 4 nests. In 1986, the average mass increase of viable eggs was 34.3% of initial mass for 107 eggs in 15 nests. Hatching success in 1985 and 1986 was 28.9% and 65.9% respectively. Maximum and minimum temperatures at the center of the clutch averaged 28.6° C and 19.8° C respectively for both field seasons.
These results provide additional evidence that painted turtles lay their eggs in wetter soils than was previously thought and thus increase in mass.