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PROGRAM ABSTRACTS

97 th Session

IOWA ACADEMY of SCIENCE

April 26-27, 1985
Central College

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GENERAL SESSIONS

I. Reform in science education: some immodest propositions

F. JAMES RUTHERFORD

American Association for the Advancement of Science, Washington, DC

Reform rhetoric has been at once frightening -- "a rising tide of mediocrity" -- and stratospheric -- "the best in the world by 1995." But reform itself is not what is happening. Instead, we are engaged in merely patching up the existing rickety system, and our tools for doing so are mostly bureaucratic. If we really want to reform science education, we must, I believe, do the following: reformulate the conceptual base for the learning of science; design and build a sophisticated support system for teaching and learning, one part of which would be an electronic resource infrastructure; learn how to aggregate and deploy educational investment capital; and establish the individual school as the focal point for reform.

II. Conservation With a Tramp: An Evening With John Muir

Performance by LEE STETSON

Yosemite National Park, California

III. Sex pheromone research in the Lepidoptera

WENDELL ROELOFS

New York State Agricultural Experiment Station, Geneva, New York

The mating communication system in moths has received a great deal of attention because of the potential of using these species specific chemicals for insect monitoring and control. It also has proved to be an excellent system for studying unique biosynthetic pathways, genetics of a system important in speciation, as well as olfactory perception and discrimination of chemical blends. Our research program is involved in basic and applied research on the emitter and receiver of this communication system.

SYMPOSIA

Mines of Spain

A. Unique Government and Private Cooperative Efforts Needed to Protect Mines-of-Spain

M. C. ACKELSON

Iowa Natural Heritage Foundation
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Des Moines, Iowa 50309

The story of the cooperative efforts involved in protecting this unique feature of Iowa's natural/cultural history can serve as a model for other similar efforts.

The Mines-of-Spain site had long been identified as a priority for acquisition/protection. The complexity of the site and its features, financial and legal needs of owners, requirements of local, state and federal agencies had to be melded to produce an initial acquisition/management plan.

The Iowa Natural Heritage Foundation served as the catalyst/facilitator for the project.

B. Julien Dubuque and The Mines of Spain

T. E. AUGÉ

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As early as 1690 The Mines of Spain area was a part of an Indian-French trading culture based upon the lead deposits of the region. In the mid-eighteenth century the Mesquakie Indians established a village on the northern edge of The Mines of Spain where they remained until 1833.

In 1786 Julien Dubuque received permission from the Indians to mine the lead. He resided at the mines until his death in 1810. In the course of his life at The Mines of Spain Dubuque became one of the most prominent personages in the Upper Mississippi River Valley. His life style was relatively elegant and sophisticated and his influence over both Whites and Indians was significant.

After the death of Dubuque the Indians continued to mine and trade lead but they refused to allow any white to take the place of Dubuque. With the opening of the Blackhawk Purchase in June of 1833, The Mines of Spain area became a part of the white American community of Dubuque, contributing to it both by mining and agriculture.

C. The Cattese Hollow Rockshelters of the Mines of Spain Area, Dubuque County, Iowa

L. R. ABBOTT

Office of the State Archaeologist,
The University of Iowa, Iowa City, IA 52242

Forty small rockshelters, distributed singly and in clusters of two to nine, were shovel tested in Cattese Hollow as part of the 1982 archaeological field work at the Mines of Spain Area, Dubuque County, Iowa. Twenty-seven of these rockshelters produced evidence of prehistoric occupation or utilization. The few diagnostic artifacts recovered, and the stratigraphic placement of all the materials, suggests Late Woodland stage occupation/utilization of the shelters. The paucity of cultural material and the diversity of faunal remains recovered suggests short term, warm season occupation/utilization of these small rockshelters as part of Late Woodland stage subsistence strategy.

D. Geologic features of the Mines of Spain

J. C. WRIGHT, G. A. LUDVIGSON

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The Mines of Spain preserve is located in the central region of the continental mass of North America, within the Upper Mississippi Valley Zinc-lead District, and on margin of what is now called the Paleozoic Plateau. Geologic features characteristic of this unique setting are well represented within the boundaries of the preserve. Exposures of Galena Dolomite provide insights to the paleozoic history of the region. The many mine pits, shafts, and adits penetrating the bedrock are visible indicators of the occurrence of concentrated mineral deposits. Incised and abandoned valleys, alluvial terrace features, and loess deposits provide physical evidence of the active processes that have influenced the development of existing landscape.

E. The vegetation of the Mines of Spain, Iowa.

J. W. LEHMANN and T. J. BLEWETT

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Ames, IA 50011

A three-year floristic and ecological study was conducted on the Mines of Spain property near Dubuque, Iowa. Over 480 vascular plant species representing 91 families and 281 genera were found on the 1200+ acre tract. Evidence from the modern soil survey and the 1837 witness tree survey suggests presettlement oak savannas on the uplands. A complex disturbance history of surface mining, farming, and lead smelting is reflected in the present vegetation patterns.

Previously open sites, hill prairies and oak savannas, were documented by community composition analyses and forest reproduction trends. Two-thirds of the property is predominantly oak-hickory forest with numerous minor communities: aspen-birch forest, maple-basswood forest, alluvial forest, juniper groves, and bur oak woodlands. A balanced plan for public usage and preservation is suggested for this historically rich yet ecologically vulnerable site.

F. The Mines of Spain: charting its future

J.C. PRIOR and D. C. ANDERSON

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

The Mines of Spain site, located near Dubuque, Iowa, is the most significant single natural and cultural resource in the state. It is the largest intact natural area in public ownership within the Upper Mississippi Valley in which are concentrated such rich associations of geological, ecological, and human history. The State Preserves Advisory Board, in cooperation with the Iowa Conservation Commission, Office of the State Archaeologist, and Iowa Geological Survey, is pursuing designation of the site as a National Natural Landmark; nomination papers have been filed with the National Park Service. This action represents the first step in an effort to achieve international recognition of the area through selection as a World Heritage Site, a listing sponsored by the United Nations Educational, Scientific, and Cultural Organization. The registry of this diverse Iowa property as a select example of the nation's natural and cultural history will enhance its value as an important public, educational, and scientific resource, and thereby encourage its future protection, study, and interpretation.

Iowa Science Foundation

A. Fossil mammals of a full-glacial tundra/tree-line biota from Conklin Quarry, Johnson Co., southeastern Iowa.

R. S. RHODES II

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

Basal Wisconsinan loess has buried a small upland swale in the bluffs adjacent to the Iowa River. Exploratory samples of unoxidized sediments from this swale yielded fossil beetles, snails, pollen, plant macrofossils, and rare microvertebrates. Wood fragments from it date $17,170 \pm 205$ RCYBP, the time when Wisconsinan glacial climate was at a maximum. The species composition of this rich biota strongly suggests that it accumulated in a tundra/tree-line environment. Grant ISF-84-3 supported excavation and processing for microvertebrate fossils of 15 short tons of swale matrix. Local development of true dry tundra environments is indicated by the presence of collared lemming (*Dicrostonyx* sp.) and singing vole (*Microtus miurus*) in the mammalian fauna. The fossils of yellow-cheeked vole (*Microtus xanthognathus*) signify that boreal forest niches also were present. The other three mammalian species so far identified are less restricted boreomontane taxa. The presence of mammalian ecotypes now restricted to either tundra or boreal forest best conforms to an ecotonal environment analogous to that near the modern tundra/boreal forest ecotone in arctic Canada and strongly supports the paleoenvironment interpreted from the associated non-mammalian biota.

B. Science reasoning ability in children.

D. R. PHILLIPS and D. G. PHILLIPS

Grant Wood A. E. A., 4401 6th St. SW,
Cedar Rapids, IA 52404

The purpose of this study was to trace the development of certain logical thinking structures in children over a period of four years, investigating possible effects of a developmentally-based, hands-on math/science program (DAP) as compared to traditional approaches. In the fall of 1983, 342 pre-kindergarteners (201 experimental; 141 control) were tested with 5 Piagetian-type tasks (conservation of liquid amount, order of placement, seriation, conservation of number, and collections) in individual interviews. Non-significant Chi Squares revealed the groups to be equivalent. In the fall of 1984 the remaining 288 subjects were given the same tasks. Following one year of DAP math/science, the distributions of scores of the experimental group were significantly different on the Chi Square analyses for every task. The percentage of DAP students scoring in the top categories on each task was greater. While it may be inferred that manipulative math/science increases logical thinking, the overall data indicate that beginning first graders still need hands-on experiences. In no case did more than 30% of the total sample pass a task. (Percentages passing were 22%, 26%, 20%, 22%, & 4% respectively.)

C. Technology as a focus for science teaching in middle/junior high schools

GLASS, L. W. and ELTINGE, B.

N156 Quadrangle
Iowa State University
Ames, Iowa 50011

Thirty two eastern Iowa middle/junior high school teachers have utilized technology as a focus for their science teaching. Data pertaining to science/technology lessons have been collected in three broad areas: curriculum content, method of presentation, and learning environment. These data will be presented and interpreted in light of current science education thinking.

D. Preliminary characterization of monoclonal antibodies directed against chicken lymphocyte and red blood cell surface molecules.

L.K. WATHEN, C.M. WARNER, S.J. LAMONT, and A.W. NORDSKOG

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Monoclonal antibodies (MAB) directed against class I and class II major histocompatibility molecules on the surface of white and red blood cells were produced. Using an enzyme-linked immunosorbent assay, the cellular specificity of each MAB has been determined. Several MAB recognize all white cell types of every chicken haplotype tested. One MAB recognizes T-lymphocytes of a single haplotype. Two MAB are able to hemagglutinate red blood cells in an indirect hemagglutination assay but their white cell specificities differ.

E. Intestinal flora of the domestic rabbit.

R.L. PENNEY, G.E. FOLK, R.P. GALASK, C.R. PETZOLD

Depts. of Physiology & Biophysics, and Obstetrics,
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We looked especially for *L. acidophilus* in the domestic rabbit (N=12 females; 1.9-2.1 kg) since this species like ruminants has a digestive tract with continuous fermentation; white rats were compared (N=4). Are there naturally occurring *L.* in the rabbit gut after cold acclimatization (CA) and does supplemental *L.* colonize in the stomach, the mid-duodenum, the caecum, or the large intestine? Samples were obtained by injecting and withdrawing 2ml of sterile saline; pH was measured in the lumen. pH differed in rats (stomach pH $4.1 \pm SE 0.42$) and rabbits (stomach pH $1.7 \pm SE 0.33$). Two rabbits were fed natural food (no pesticides or herbicides). During CA the minimum temperature varied from $-12^{\circ}C$ to $5^{\circ}C$. Thirteen groups of bacteria or species were identified, but *acidophilus* was only found in rats even when supplemented in rabbits; no experimental modification caused important changes in types of bacteria.

Supported by Iowa Science Foundation.

F. Plant-parasitic nematodes in noncultivated areas of Iowa

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The plant-parasitic nematode fauna around Iowa crops, especially corn, is reasonably well known. Relatively little collecting has been done in natural areas. Preliminary data from natural habitats indicate major qualitative and quantitative differences between cultivated and noncultivated habitats. The present project has allowed more extensive collecting from natural habitats in Iowa. The objectives are: 1) Document the species of plant-parasitic nematodes in natural habitats in Iowa, and 2) Classify the species by communities and habitats.

A total of 355 soil and root samples from 28 natural areas were collected between June and mid-October, 1984. Most samples were taken from state parks and preserves. Samples were taken to a depth of 15-20 cm.

One important finding was the discovery of the root-knot nematode, Meloidogyne ovalis, infecting maples and other trees over wide areas of the state.

G. Shape analysis of stylistic variation in projectile points: a Glenwood Culture example.

S. C. LENSINK

The University of Iowa
Office of the State Archaeologist
Iowa City, Iowa 52242

A numerical technique for recording and analyzing the morphology of projectile points demonstrates that the patterns of microstylistic variation in these artifacts can shed light on the social organization and dynamics of prehistoric groups. The morphology of arrow points recovered from dated Glenwood Culture housed in western Iowa were recorded by means of a video digitizer. Their shapes were then described in terms of a rotationally invariant Fourier series. A cluster analysis performed on the Fourier coefficients reveals significant correlations between the degree of morphological variations and the spatial and temporal distance between houses. Possible social correlates are suggested as well.

H. Amplification, integration, and curation of the Fungus Herbarium

R. W. POHL and D. A. QUALLS

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The Iowa State University Herbarium has acquired by transfer the entire mycological herbarium of the University of Iowa. This collection aggregated around thirty standard herbarium cases of fungus specimens from various parts of the world, with strong emphasis on Iowa fungi. To make the SUI collection useful, it must be integrated into our current fungus herbarium. This is being accomplished by: a) removing the specimens from the herbarium sheets on which they are mounted in variously shaped packets and repackaging them in uniformly sized packets which are boxed and can be stored more efficiently; b) examining the specimen labels for duplication with specimens in the current ISU collection; and c) filing the SUI specimens with the herbarium's current fungal specimens. Our 1984 ISF Grant has provided partial funding for equipment and supplies required for implementation of this project. When this project is completed, Iowa and the region will have one major fungal herbarium and research facility.

I. The Motor Mill 100-Acre Foray

D. R. MENKEN

Clayton County Conservation Board, Elkader 52043

In October 1983, the Clayton County Conservation Board, with the assistance of the Iowa Natural Heritage Foundation, acquired the 100-acre Motor Mill complex which includes a flour mill, the cooperage, an inn and stable, and the icehouse. Motor Mill was recognized in 1976 as a national historic site. In August 1984 a Foray was organized whose purpose was to survey the natural and cultural aspects of this 100-acre site. Preliminary investigations were conducted in archaeology, birds, botany, geology, invertebrates, vertebrates, soils and water, history and education. This survey will provide information to base future decisions regarding the development of the Motor Mill complex as a cultural, scientific, educational and recreational site.

J. Methods of reducing wildlife problems in suburban yards and homes.

R. A. PATTERSON

Indian Creek Nature Center
6665 Otis Road SE
Cedar Rapids, Iowa 52401

Houses and yards in urban and suburban neighborhoods sometimes suffer damage caused by vertebrate wildlife. Homeowners often do not understand why wild animals cause damage or what steps to take to prevent or reduce the problem. The booklet describes damage caused by twelve types of wildlife. It offers suggestions for preventing and solving this damage.

Archaeology

A. Introducing the F-518 project

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This paper reviews the history of the F-518 project from an archaeological standpoint. The processes of site survey and testing along the F-518 corridor are described, and the rationale for the selection of four sites for full-scale excavation is discussed.

B. Prehistoric settlement patterns on the Southern Drift Plain as revealed by the F-518 project

STEPHEN C. LENSINK

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Office of the State Archaeologist
Iowa City, Iowa 52242

Recent archaeological reconnaissance and testing along the proposed F-518 highway corridor has revealed a surprisingly high density of prehistoric sites located on interfluvial ridge tops and along small drainages of the Iowa River basin. A resource procurement model is proposed to account for the distribution and density of sites in these settings. Comparisons are made with prehistoric sites located in other areas of the Southern Drift Plain and on other land forms in Iowa.

C. Archaeological investigations at 13WS122: a multicomponent site in southeastern Iowa.

CRAIG A. CUNNINGHAM

The University of Iowa
Office of the State Archaeologist
Iowa City, Iowa 52242

In the late summer and fall of 1984, large scale excavations were undertaken at site 13WS122 located on Davis Creek, a tributary of the Iowa River. The prehistoric activities at 13WS122 can best be described as a series of short-term occupations that occurred between approximately 3000 B.C. and A.D. 1500. Of the three archaeological components represented, the Late Archaic is the best understood at this time. The Archaic materials, characterized by Table Rock projectile points (3000-1000 B.C.), yielded valuable information concerning lithic procurement and knapping technologies in the Southern Drift Plain of southeastern Iowa.

D. Archaeological investigations at 13WS61: a Late Woodland site in Washington County, Iowa.

MARK A. HILL

The University of Iowa
Office of the State Archaeologist
Iowa City, Iowa 52242

In response to the planned construction of Highway 518 in southeast Iowa, archaeological surveys were carried out in 1983 to identify cultural resources endangered by this construction. One of the sites found was 13WS61, located about three miles south of the town of Riverside in Washington County. Subsequent test excavations identified the presence of a Late Woodland occupation, and as a result the site was recommended for more intensive investigation. This paper will discuss this excavation which identified a buried occupation surface with several cultural features including shallow basin-shaped pits, cobble clusters, and possible postmolds. These are interpreted as representing two functional areas, a habitation area and a refuse dump.

Biotechnology

A. Enhancing plant productivity and utilization through plant biotechnology.

D. T. TOMES

Pioneer Hi-Bred International, Inc.,
Department of Biotechnology Research, P.O.
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Increased productivity is a central goal of plant biotechnology which encompasses several scientific disciplines, most at a cellular or molecular level. The addition of specific attributes such as disease resistance, herbicide resistance, improved stress resistance, or nutritional quality to commercially acceptable cultivars and hybrids is one strategy for increasing yield. The techniques of cellular selection and plant genetic transformation should allow an increased number of desired changes in the future. In addition, other allied technology such as more efficient propagation and/or increasing the efficiency of conventional plant breeding strategies can assist in increasing plant productivity. The scarcity of knowledge about plant biochemistry and higher plant gene structure at a molecular level is the greatest limiting factor for technical application of plant biotechnology.

B. Technical implications: impact of immunological and genetic advances on human and animal health.

R.G. LYNCH

Department of Pathology, University of Iowa College of Medicine, Iowa City, IA 52242.

Basic research in biology has expanded in an almost explosive fashion since the discovery of the chemical structure of DNA by Watson and Crick in 1953. The conceptual and technical advances that have occurred since that time have transformed biology from a descriptive to a quantitative science. Perhaps the most interesting area of new knowledge in biology is that which deals with so-called "informational macromolecules". A great deal is now known about the storage of genetic information in cells and of the process of information transfer from DNA through RNA to protein. A particularly well studied family of genes codes for the production of antibody molecules. Antibodies are proteins that have the remarkable property of recognizing and distinguishing an extraordinary number of specific chemical structures. The lecture will: 1) Review the developments in molecular genetics and immunology that have made it possible to produce large quantities of pure, homogeneous (monoclonal) antibody molecules, and 2) discuss how the availability of monoclonal antibodies is beginning to impact on human and animal health.

C. Economic implications of biotechnology in agriculture

J. BOEHLJE

Agriculture and Home Economics Experiment Station,
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Developments in agricultural biotechnology will result in major economic and institutional adjustments for farms, agribusiness firms and rural communities. Evaluating these adjustments with a focus on facilitating the transition from current technology to "new" technology is the focus of research activities of economists and sociologists.

Because of the rapidity of its development, the bovine growth hormone (bGH) will probably have market applicability within this decade. The adjustments required by the dairy farmer and dairy industry may be indicative of the kinds of adjustments that biotechnology will require for other agricultural products.

The paper will develop the impacts of biotechnology on economic and institutional change at the firm, sector and macro level using milk production and bGH as an illustration.

With a 20-30% increase in milk production per cow using bGH, current levels of total milk output can be produced with a substantially smaller herd. Alternatively, increases in milk output will result in dramatic declines in milk prices, putting pressure on the smaller, high cost producer. Changes in the input supply industry will also occur, with increased emphasis on packaging complementary inputs into a single input or service.

D. Social and ethical implications of research involving human subjects

L. J. Filer, Jr., M.D., Ph.D.

University of Iowa, Iowa City, IA 52242

Biotechnical advances that improve the quality of life involve human experimentation. Biomedical ethics, long championed by the Golden Rule, were formalized by the Congress under Public Law 93-348 in July 1974. Initially, many investigators considered these regulations as detrimental to research. Ten years of experience with the system has proven otherwise. The impact of these Federal Guidelines on research at the University of Iowa Colleges of Medicine, Nursing and Pharmacy will be reviewed with emphasis on selected biotechnical advances.

CONTRIBUTED PAPERS

AGRICULTURAL SCIENCES

1. Measured and predicted solute leaching in an Iowa soil.

J. F. MCBRIDE and R. HORTON

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A field experiment was conducted to obtain data required for the evaluation of a solute transport model. Control and non-control 0.30-m² plots were established in late May, 1984, on a 13 x 13 m plant-free area in central Iowa. Tillage on the site was fall-moldboard plow followed by a spring-disc plow. Known amounts of chloride-tracer and tracer-free solutions were applied with minimal ponding on the control plots which were subsequently covered with plastic and polystyrene insulation to exclude rainfall and minimize evaporation. Known amounts of chloride-tracer solution were applied to the non-control plots which were then left exposed to natural evaporation and rainfall conditions. The plots were sampled incrementally to a depth of 1.50 m at several times, the samples analyzed for chloride, and chloride-concentration profiles with depth determined. The experimental data from the control plots were used to calibrate the solute transport model. The model was then tested on the data from the non-control plots. Predicted chloride-concentration profiles for the non-control plots agree well with experimental profiles.

2. Evaluation of polyolefin-encased soil cores for measuring physical properties

W. R. EFFLAND and T. E. FENTON

Agronomy Lab, Iowa State Univ.
Ames, Iowa 50011

Measurements of many soil physical properties require minimally disturbed soil samples and thus these measurements are less frequently obtained in routine soil analysis. This paper evaluates the use of soil cores obtained by a Giddings hydraulic probe and encased in polyolefin tubing for routine measurement of physical properties. Routine measurements reported include bulk density, water desorption (0-100 KPa) and saturated hydraulic conductivity. These physical parameters provide additional information for various uses such as suitability for on-site sewage systems, tile drainage field requirements and plant-soil moisture relationships.

3. Classification of eroded Mollisols: A dilemma

A. MANU and T.E. FENTON

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Classification of Mollisols is based on the mollic epipedon which is highly susceptible to erosion. In Soil Taxonomy, two opposing viewpoints are presented in classifying eroded Mollisols: (1) precise classification to meet the mollic requirement; (2) classification by inferring their genetic pathway. Twelve pedons within the Otley (Typic Argiudolls), Ladoga (Mollic Hapludalfs), and Clinton (Typic Hapludalfs) mapping units were analyzed for organic carbon (OC), available P (AP), pH, and texture. The severely eroded Otley soils did not meet the color requirement to classify as Mollisols. Depth distribution and amounts of OC in the top 25 cm do meet the requirement for this property. Weighted means of AP have the following trend: Clinton>Ladoga>Otley which supports the classification of eroded Otleys as Mollisols. These and other factors indicate that the classification criteria for Mollisols should be reexamined especially in areas that have been subjected to accelerated erosion. The present emphasis placed on the dark-colored surface horizon neglects all other properties common to these prairie-derived soils. Presently, eroded Mollisols are generally correlated as taxadjuncts of the less eroded soils but eventual resolution of this problem is needed.

4. Corn yield expectations from reclaimed mine land in Mahaska County, Iowa

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State and federal laws require lands to be reclaimed after surface mining so that productivity is equal to or greater than that achieved before mining. Consequently, a crop productivity goal has to be determined for a mine site. This paper will present methodologies to assess corn productivity expectations from lands surface-mined and an example from Mahaska County, Iowa. The methodologies include use of (1) soil survey reports and (2) crop productivity records. Factors modifying yield expectations will be discussed, too.

5. Soybean chimeric plants: a source of nuclear and cytoplasmic mutants

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The occurrence of plant chimeras in nature is a common phenomenon. Chimeras are a direct result of the segregation of normal and mutant organelles into genotypically and phenotypically distinct vegetative sectors.

In soybeans we have found a number of chimeric plants of spontaneous origin. Progeny of such plants manifest a direct relationship between sector phenotypes and nuclear or cytoplasmic genotypes. We have obtained two nuclear mutants and five cytoplasmically inherited mutants. In six examples, progeny from chimeras were green plants and yellow lethal plants. Progeny of these green plants gave all green plants, precluding genetic studies. We could not determine whether the genetic conditions were dominant lethals or cytoplasmically inherited lethals. In soybeans, chimeras are a valuable source of nuclear and cytoplasmic mutants.

6. Effectiveness of S_2 recurrent selection in corn (Zea mays L.)

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S_2 recurrent selection was conducted in 4 populations of corn that included 0 (BSK), 25 (BSTL), 50 (BS2), and 100% (BS16) exotic germplasm. Objectives of the research were to determine effectiveness of S_2 recurrent selection for the genetic improvement of corn populations and response to selection in populations that included different proportions of exotic germplasm. Grain yield was the primary trait under selection. Gain per cycle of selection for yield was 5.0% for BS2, 4.2% for BSTL, and 1.3% for BSK, but a decrease of -7.2% per cycle of selection was realized for BS16. There was no change in maturity with selection in BS2, BSTL, and BSK, whereas the selected cycle of BS16 was 5 days earlier. Selection reduced the effects of inbreeding in all populations. Based on crosses with 4 testers, the indirect effects of selection were about 50% that of direct selection. Except for BS16 per se, S_2 recurrent selection was effective for developing improved sources of germplasm for applied breeding programs.

7. Moisture stress effects on nutritive value of alfalfa.

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Alfalfa grown in lysimeters was subjected to 5 moisture-stress treatments during a 7-week regrowth period. Yield of the highest stress treatment (HS) was 40% of the lowest stress treatment (LS). The ratio of leaf to stem increased with stress (0.5 for LS, 1.0 for HS). Cell-wall concentration of stems was inversely related to stress (66% for LS, 56% for HS). A similar relationship was observed for acid-detergent fiber of stems (52% for LS, 41% for HS). Crude-protein concentration in stems increased with moisture stress (10% for LS, 12% for HS). Concentration of *in-vitro* digestible dry matter in stems increased by 12% from LS to HS. The higher nutritive value with moisture stress can be attributed to slower phenological development and higher leaf to stem ratio with stress. In another set of treatments, stress occurring only during the flowering stage reduced forage quality by inducing about 50% leaf loss. Stress occurring only at the vegetative or bud stage did not significantly affect nutritive value.

8. Effect of infection level on selection for field resistance to crown rust

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In routine testing of oats (Avena sativa L.) for field resistance to crown rust (Puccinia coronata Cda.) inoculations are made early in the season to insure an ultimate high level of infection. "Heavy" and "light" infections were obtained on 140 lines by varying inoculum load.. Duplicate plantings were maintained rust free with a fungicide. Mean yield indexes (rusted/rust-free) were 0.416 and 0.735, and seed weight indexes were 0.600 and 0.727, under heavy and light infection, respectively. The numbers of lines significantly ($P = 0.05$) differentiated from the overall means did not differ greatly under heavy and light infection. Heritability values for yield index were 44 and 41%, and for seed weight index, 60 and 68%, under heavy and light infection, respectively. Thus, infection level had little effect on the efficiency of selection for field resistance to crown rust at the levels studied.

9. An economical laminar-flow microbe-free chamber for culturing small plants

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An economical plant growth chamber, 16 cm in dia and 50 cm high, was made from two 4-liter glass beakers. The bottom was removed from one beaker and a 1 cm hole cut in the bottom of the other. The bottomless beaker, when placed atop the other, telescoped slightly for firm support. Sand (10 cm depth) was placed in the bottom of the chamber as a growth substrate. The chamber was placed on four rubber stoppers in a crystallizing dish (17 cm dia) that received drainage. An aluminum foil skirt, taped to the base of the chamber, covered the edge of the dish. Filtered air (under pressure) was brought into the bottom of the chamber with rubber tubing and flow controlled with a screw-type clamp. After autoclaving, the unit was covered with a sterile polyethylene bag (45 x 20 cm dia). Six chambers, each with an open petri dish of nutrient agar in the bottom, were tested for 2 weeks and all dishes remained microbe-free. The chambers supported good growth of corn and soybean seedlings for 4 weeks when a sterile nutrient solution was added to the sand as needed.

10. A method of extracting and purifying bacterial starch

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Corynebacterium kutscheri is a bacterium that produces intracellular starch, but the molecules are too large to pass through the bacterial membrane. Cellular destruction was achieved by treating about 5 g of wet cells with 20 mg of lysozyme in 9 ml of water at 37C for 24 hrs, adding 2 ml of a 25% sodium lauryl sulfate solution, and heating to 60C for 10 min. Cellular debris was removed by centrifugation for 30 min at 400 x g. Butanol (300 ml) was added to the effluent and the starch was pelleted by centrifugation for 30 min at 7,800 x g. The starch was further purified by heating to 100C in 200 ml of water in an atmosphere of N₂, cooling to 60C, adding 0.1 g thymol, and allowing to stand for 3 days to precipitate amylose. The supernatant was removed. Mean yield (two replications) was 3 mg of amylose per g of cells. Purified starch (200 mg) served as controls and was subjected to all treatments. Mean yield was 65% of the initial starch.

11. Characterization of brown stem rot resistant and susceptible soybeans utilizing a computer database

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After the development of brown stem rot (BSR) resistant soybeans, we compared resistant and susceptible lines of comparable maturity and agronomic characteristics, particularly yield, in the presence and in the absence of BSR. Resistant soybeans included both germ plasms (A_) and cultivars (BSR__). Resistant and susceptible soybean pairs included A3 and Corsoy, A4 and Cumberland, A8 and Williams 82, BSR 101 and A 1937, BSR 201 and Pride B216, BSR 301 and Oakland, and BSR 302 and Williams 82. A graphic characterization of disease and yield data using a computerized database indicated a linear relationship between yield and apparent disease severity in susceptible soybeans. This relationship was non-linear for BSR resistant soybeans. R-square values, ranging from 0.40 to 0.96, were consistently high with susceptible soybeans, and were consistently low, ranging from 0.00 to 0.29, with resistant soybeans.

12. The use of soybean cyst nematode and brown stem rot resistant cultivars where both problems are concurrent.

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Soybean cyst nematode (SCN) and brown stem rot (BSR) are serious problems of soybean that may occur together in the same field. Possible interactions of SCN and BSR were studied at two locations. Three cultivars, BSR 201 (BSR resistant), CN290 (SCN resistant), Corsoy 79, and 50:50 blends of each combination were tested with and without aldicarb. BSR ratings averaged 84.4% plant and 44.7% stem at Thompson and 41.7% plant and 18.8% stem at Garner while June cyst counts averaged 23 and 145/250 cm³ soil, respectively. Each resistant cultivar yielded highest where its respective disease or infestation was highest, while blends were intermediate in yield and disease control. BSR ratings were not significantly lower in aldicarb treatments.

13. Pratylenchus scribneri increase in maize races from Colombia.

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Nineteen races of maize obtained from Colombia were compared for resistance to Pratylenchus scribneri. Mol7xB73 was used as a check. Seeds were planted in naturally infested sandy soil at the Hinds Research Farm, Ames. There were five replications in a randomized block design. Plots were one row, 2.4m long, with seven seeds per plot. Sampling was done at planting (May 9, 1984) and on July 2, and September 11. Nearly all of the Colombian races supported more P. scribneri in both roots and soil than did Mol7xB73. Races with the fewest nematodes /g dry root on July 2 were Amagaceño (7260), Común (8277), Mol7xB73 (9006), and Puya (9131), and on September 11 were Mol7xB73 (4131), Común (6438), and Puya (9439). Races with the highest nematode populations were Puya Grande (31,435), Yucatán (29,488), Clavo (28,003), and Montaña (25,746) in July, and Cacao (32,008), Harinoso Dentado (26,719), and Clavo (26,194) in September.

14. Development of suppressiveness to Rhizoctonia solani in Iowa soils

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Eight Iowa soils were investigated for their ability to become suppressive to Rhizoctonia solani during monocropping. The soils were artificially infested with large sclerotial propagules of R. solani (AG-4) and were successively monocropped with radishes every two weeks. Damping off was assessed and the population of R. solani in soil was determined by beet seed baiting and isolation. Two of the soils became highly suppressive and five were intermediate in suppressiveness. The R. solani population correlated directly with damping off percentage. The two highly suppressive soils were the only soils with a recent history of animal manure applications. Mycoparasitic Trichoderma spp were abundant in these soils.

15. Phloem/xylem relations in soybean vein endings as seen in cleared and stained leaflets.

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A century ago it was discovered that vein endings in leaves may be complete (sieve tubes and xylem end together) or incomplete (sieve tubes end short or are lacking). The few studies of vein endings have, however, been severely limited by the need to reconstruct from serial sections. I have found that cleared leaf samples can be stained selectively with chlorazol black E, so that the thick primary wall of the sieve tubes becomes visible in the smallest minor veins and vein endings. It is thereby possible to survey types of vein endings and their distribution quantitatively. Correlation with other leaf characteristics is then possible. Soybean leaflets have an interesting mixture of vein ending types, and a study of their distribution and relative proportions is underway. This talk, however, will emphasize what can be seen using the clearing method, and the diversity of phloem/xylem relations that occur in soybean vein endings.

16. Soybean (Glycine max L.) leaf response to varying sink demand

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To evaluate how a soybean leaf responds to differing sink demands two treatments were imposed at R3: 1) the stand was thinned from 26 to 6.5 plants per m²; and 2) plants were continuously partially depodded (leaving one pod to develop at each node). Thinning the stand induced greater plant pod set, as well as greater protein concentration and a higher photosynthetic rate per unit area in fully expanded leaves (node 7) and in leaves that were just beginning to expand (node 10) at the time of treatment. Partial depodding reduced final pod weight per plant, but did not change photosynthetic rate or leaf protein. Final pod weights for the thinned and partially depodded treatments were 155 and 43% of the control level. The fact that photosynthetic rate increase occurred in both a fully expanded (node 7) leaf, as well as an expanding one (node 10), suggests that photosynthetic potential is not necessarily determined by the time of full leaf expansion.

17. Alder - an agricultural alternative.

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Results from six years of genetic improvement research on European black alder (Alnus glutinosa) have been used to estimate the potential productivity of alder as a crop. Using the best currently available planting stock it should be possible to produce at least 16.9 metric tons of dry biomass fuels per hectare in the first 5 year seedling rotation. First year coppice results indicate much better production (5.3 metric tons per hectare the first year) in subsequent rotations. This compares favorably with other species suggested for biomass fuel production. Cultural and genetic improvements should result in substantial additional yield increases. At the same time, the nitrogen-fixing symbiosis of alder produces high levels of extra nitrogen in the soil that can help support the growth of other tree species planted in mixtures. The alder is well-suited to bottomland sites that frequently flood and where it can escape summer droughts by tapping into a water table with its deep roots. In addition to its use as a fuel, alder might be used for furniture lumber, windbreaks, and possibly animal feed.

18. Aquaculture of fish biomass and cellulose decomposition

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Different nutrient treatments in artificial ponds were used to determine the effects on fish growth and decomposition rate of cellulose. Cotton duck cloth strips were submerged in the ponds for different periods of time after which they were tested for tensile strength. Bacterial counts and nitrogen levels were measured for the different ponds and fish biomass was determined at the end of the project. With manure treatment the total nitrogen levels were greatest and fish production was maximal. With feed treatment bacterial counts were found to be maximal. The combined treatment of manure and feed result in the greatest rate of cellulose decomposition.

19. Epidemiology and seed transmission of Goss's wilt in corn.

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The bacterium Corynebacterium michiganense subsp. nebraskense (CMN) is the causal organism of Goss's wilt in corn. In greenhouse and field experiments it has been possible to generate infected seed in leaf inoculated plants which became systemically

colonized by the bacterium. Percentage seed infection was found to be no higher than 4%. Yield depression as high as 22% occurred in diseased plots. Periodic field sampling of corn leaf debris infested with CMN during winter months showed that although populations of the bacterium declined 14% from an initial level of 10.2 log cfu/gm leaf debris they were still substantial at planting time in the spring. Both infected seed and corn residues may potentially serve as sources of primary inoculum in the spring.

20. Production of cell wall-degrading enzymes by corn stalk rot strains of Erwinia chrysanthemi.

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Erwinia chrysanthemi is a bacterium which causes soft rot diseases in a wide range of plant hosts. Culture filtrates from corn stalk rot (CSR) strains have a much greater ability to macerate autoclaved corn tissues than do filtrates from non-CSR strains. CSR and non-CSR strains were analyzed for their ability to produce cell wall-degrading enzymes. Both groups produced similar levels of pectic enzymes, glucanases, and proteases. CSR strains, however, produced much higher levels of enzymes(s) capable of degrading xylan substrates than did non-CSR strains.

21. Acid rain: effect on early corn growth.

G. A. Bell.

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Corn plants were tested with sulfuric acid treatments to determine potential effects of acid rain on initial growth. Corn seed pretreated with fungicide exhibited signs of delayed germination, stunted growth, acute injury, and reduced water uptake at high levels of acidity. The adverse effects were much less apparent on untreated seed.

ANTHROPOLOGY

22. Preliminary report of the Early Woodland to Early Late Woodland Smith site, Louisa County, Iowa.

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Excavations at the Smith site, 13LA2, by the 1958 University of Iowa field school are detailed. Ceramics from approximately 40 features and a midden deposit suggest the presence of Early Woodland, Early Middle Woodland, and Early Late Woodland components. The Smith site is one of few excavated Iowa sites containing Marion Thick pottery, the earliest known ceramic type in the Midwest.

23. Changing patterns of stone procurement and utilization among the Pawnee

L HUDSON

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The protohistoric and historic Pawnee villages in central Nebraska offer a unique opportunity to study the changes in aboriginal economic organization that accompanied the advent of regular European trade and the introduction of the horse during the eighteenth and nineteenth centuries. This paper explores the consequences of factors on one aspect of Pawnee economic activity, the organization of stone tool procurement, manufacture, and utilization. Lithic assemblages from three Pawnee sites provide the basis of the present study: the Schuyler site (25CX1), the Barcal site (25BU4), and the Linwood site (25BU1).

24. Business connections from Buxton bottles: an archaeological perspective of the Buxton, Iowa, town site.

J. M. GIFFORD and D. M. GRADWOHL

Traditionally, archaeology has not been concerned with the events of the twentieth century. There is growing recognition, however, of the insights into human behavior which can be derived from an archaeological analysis of "modern" garbage. This situation obtained at the abandoned site of Buxton, Iowa (13M010), a company owned coal mining town occupied, primarily by Black people, between 1900 and 1926. The preponderance of material recovered there consisted of utilitarian items such as household glassware, ceramics and utensils. The analysis of

the bottles and glassware from this site reflects aspects of the community which supplement the archival and oral historical accounts of the town. The bottles from the Buxton town site reveal patterns of consumption not easily documented through other sources. Analysis of these bottles demonstrates some of the trade relationships important for sustaining the relative prosperity of Buxton, Iowa.

25. Curating the Charles R. Keyes Collection

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The Charles R. Keyes Collection is a nationally recognized permanent collection of the Iowa State Historical Department. The Keyes Collection is the result of a 30 year state-wide survey and contains over 108,000 artifacts representing all of Iowa's prehistoric cultures. This paper presents an overview of the past 5 year effort to curate the collection in order to make it accessible for research and exhibition. On-going curation needs of the Keyes Collection will be discussed as well as future curation projects under consideration. The presentation will be illustrated with slides derived from original photographs and glass slides in the Keyes Collection.

26. Mesquakie Chief Poweshiek's Feathered Cape

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An unusual feathered cape came to light recently while selecting objects for the IOWA HALL exhibit at the University of Iowa Museum of Natural History. According to handwritten documentation with the specimen the object was made for Mesquakie (Fox) Chief Poweshiek by his youngest daughter in the winter of 1839. The cape represents one of the few examples of featherwork from the period and is the only such specimen that can be attributed to the Mesquakie. The paper (1) discusses the history of the cape; (2) describes the methods of manufacture; and (3) presents a short sketch of Chief Poweshiek's life.

27. Language death in a Mayan community

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Language death in a Mayan community. In the last century, Mazapa de Madero was a traditional Mayan town in southern Chiapas, where Teco, a local Mayan language, was spoken. Today, no one under the age of thirty speaks Teco. This paper presents the preliminary results of a study on the process of language death, based on interviews with a number of Teco speakers. The language data are discussed in conjunction with data on marriage patterns and migration for Teco speakers and their families. Together, these data are examined within the context of a major transformation taking place in this area of Mexico, resulting in the loss of isolation for Mayan communities and their increasing affiliation with the larger Mexican society.

Biotechnology

28. Unusual genetic phenomena associated with Tn5 mutagenesis in Alcaligenes eutrophus

W. W. Chow and A. G. Atherly

Transposons have been very useful for genetic analysis and molecular cloning in bacteria because of their abilities to transpose into a variety of genes and create mutations. Usually, the site of mutation can be correlated with the site of insertion. Also, a gene can be easily cloned after transposon mutagenesis by cloning the DNA segment labelled with the transposon. Tn5, coding for kanamycin resistance, is one of the most useful and frequently used transposon for genetic cloning and mutagenesis. Our attempts to use Tn5 for mutagenesis and gene cloning in A. eutrophus have been unsuccessful. We observe a variety of genetic phenomena upon introducing Tn5 into A. eutrophus. These include plasmid loss and large spontaneous deletions. This is the first report of the inability to use Tn5 for mutagenesis in any Gram-negative bacteria.

29. Nuclear magnetic resonance spectroscopy of non-motile and motile spermatozoa of Limulus polyphemus L.

P.-M. L. Robitaille, P. A. Robitaille, G. G. Brown

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A model system, Limulus polyphemus L., was used to examine the metabolism of high energy compounds involved in sperm motility. These spermatozoa are easily collected and have the characteristic of being non-motile until stimulated by a sperm motility initiating peptide (SMI) obtained from the egg. Using ³¹P-NMR, we have demonstrated that under aerobic conditions, the relative concentrations of ATP, ADP, phosphoarginine (or phosphocreatine), phosphoglycerates, inorganic phosphate, and phosphosugars can be determined in both motile and non-motile spermatozoa. We have observed in the motile sperm, as compared to the non-motile sperm, that the relative concentration of phosphoarginine is greatly reduced while that of inorganic phosphate is increased. This indicates that phosphoarginine is being used as an energy source to drive the motile apparatus of the sperm flagellum. Also, the intracellular pH was proven to increase as a result of motility stimulation.

30. Production of Immune Reagents for Blood-Typing Goats.

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Eighteen alloimmunizations among saanen goats and two xenimmunizations into Holstein cattle were made by multiple intravenous injections with washed goat erythrocytes. Eleven failed to produce any detectable hemolytic or agglutinative antibodies. Seven resulted in the production of specific hemolytic antibodies. No two patterns of reaction were alike when tested against 42 different goat cell samples; however, asymmetrical, subtype-like patterns were evident among the allosera. Absorptions are needed to clarify whether these immune sera are true subtypes, or whether they can be fractionated into unrelated specificities. The two cattle antisera against goat cells were species-specific, since all of 30 goat cell samples were hemolyzed. Absorption with individual goat cell samples are expected to yield some reagents showing individual differences among goats.-- Population data, as well as family data, is being collected in order to characterize these reagents by frequency and type of inheritance of the antigens. After appropriate study, such reagents can be used to solve parentage disputes, including those resulting from artificial insemination, as in cattle and horses.

31. Identification of the Symbiotic Genes of Rhizobium japonicum

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One fast-growing strain of Rhizobium japonicum, USDA191, isolated from the People's Republic of China can nodulate and fix nitrogen on North American soybean cultivars. The genes responsible for nodulation and nitrogen fixation are located on a 220 megadalton plasmid (pSym) in strain USDA191. We have created a series of mutants containing various deletions of pSym and by complementing these mutants with cloned fragments of DNA containing nodulation genes, we have identified the DNA fragments that are necessary for nodule formation.

32. Transfer and expression of Rhizobium japonicum symbiotic genes

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The large molecular weight plasmid containing the symbiotic genes of Rhizobium japonicum strain USDA193, pSym193, has been transferred to other species of Rhizobium and related genera. The plasmid pSym193 was stably maintained but not expressed in most species of Rhizobium that contained indigenous symbiotic plasmids. Conversely, pSym193 was maintained and expressed in several species of Rhizobium cured of indigenous symbiotic plasmids and Agrobacterium tumefaciens cured of its tumor-inducing (Ti) plasmid. Cloned nodulation genes from pSym193 were also transferred into other species of Rhizobium and A. tumefaciens to test their expression and ability to extend the host range of other Rhizobium species.

33. Insecticidal properties of d-limonene, a monoterpenoid isolated from citrus peel.

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The insecticidal effects of the naturally-occurring monoterpenoid d-limonene were examined using the German cockroach (Blattella germanica), rice weevil (Sitophilus oryzae), and housefly (Musca domestica). Bioassays were performed to determine topical, residual, fumigant, and per os activity. Sublethal effects such as repellency and interference with development were also examined. The material was found to be slightly toxic topically and its vapors were toxic at high concentrations. No residual or oral toxicity was observed. Repellency occurred at high concentrations.

34. Isolation of active heparin fragments.

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Heparin is a family of polydisperse sulfated polysaccharides which are isolated from porcine mucosa and have an important clinical role as a parental anticoagulant. Heparin has additional activities which might permit its use in the treatment of atherosclerosis, immune-related disorders, and cancer. The polymer has a repeating 1,4 linked uronic acid-glucosamine backbone with variation in O-sulfate positions and N-substitution by sulfate or acetate. To locate specific biologically active regions we have depolymerized heparin with heparinase. This enzyme cleaves specific linkages to form fragments ranging from 2-20 sugar residues in size. We have been successful at sizing these fragments by gel-permeation-chromatography. The sized products are further separated by strong-anion-exchange HPLC. Finally, affinity chromatography is used to separate fragments which show in vitro anti-coagulant, anti-atherosclerotic, anti-tumor, and complement inhibition activities.

35. Careers in biotechnology: industry and national laboratories

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Research directors and senior scientists engaged in biotechnology research and development at national laboratories and in industry were interviewed concerning their opinions on employment needs and desirable preparation of potential employees at the B.S., M.S., Ph. D., and post-doctoral levels. They stress the importance of a strong foundation in the basic sciences, ability in written and verbal communication, and strength in quantitative skills. Laboratory experience (e.g., summer employment, independent study projects, internships) is strongly recommended to demonstrate proficiency in "real life" laboratory work and to gain an understanding of research in practice. Liberal arts breadth and the ability to use critical judgment are viewed as more important than technological knowledge, although the latter is a definite asset. Experience in the use and maintenance of modern instrumentation is highly desirable.

Trends in hiring as the field of biotechnology matures will be discussed.

BOTANY

36. Investigation of proton-sugar cotransport mechanisms in suspension cultures of Streptanthus tortuosus

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The uptake of sucrose, glucose, and fructose can be measured in suspension cultures of Streptanthus tortuosus. These sugars were used to determine if hexose uptake was due to a proton-cotransport mechanism. A pH-sensitive microelectrode was used to determine the changes in extracellular proton concentration and a signal-averaging program was developed for a microcomputer to reduce signal noise and increase the measurement sensitivity. The addition of either glucose or fructose to the suspension culture caused a rapid alkalization of the medium due to proton uptake by the cells. When sucrose was added to the medium, however, proton uptake was delayed. These results are consistent with a sucrose uptake mechanism which requires the hydrolysis of sucrose to hexoses by an extra-cellular invertase and subsequent hexose-proton cotransport by the cell membrane.

37. Induction of a sucrose uptake system in plant suspension cultures of Streptanthus.

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The rate of sucrose uptake by suspension cultures of Streptanthus tortuosus harvested after 10-14 days of growth is increased when they are incubated in a sugar-free medium. If the protein synthesis inhibitor cycloheximide is present during the incubation the rate of sugar uptake does not increase. Although many investigators have explained similar results as being due to the recovery from membrane damage caused by the harvesting or washing of the cells prior to the incubation, the higher uptake rate induced by the incubation period in the present study is not reduced by a subsequent harvesting and washing cycle. The increased rate of sucrose uptake can be induced in 7 to 9 hours after harvesting the cells by filtration, washing them with distilled water, and incubating them on a pH 6.0 phosphate buffer. The same increased rate of sucrose uptake can be obtained without filtration or washing if the culture medium is decanted and replaced with a sugar-free medium. In this case, however, the higher uptake rate is only obtained after 3 days due to the carryover of sugars.

38. An experimental system for study of the physiology of branch orientation in plants.

C.E. LAMOTTE

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P.F. Wareing and his coworkers in the United Kingdom have studied the physiological bases for apical dominance and branch morphogenesis (esp., stolon formation, tuber formation, and the transformation of stolons to upright leafy shoots) in the potato plant for 30 years. Recent experiments, some done in collaboration with this British group, suggest that the potato plant may also provide unique opportunities for exploring the physiological basis of branch orientation (i.e., of "branch angle") in higher plants. Abscissic acid (ABA), a plant hormone, supplied exogenously to leafy potato cuttings causes small axillary buds to become horizontal stolons and well-developed, leafy branches to become similarly reoriented. By varying dosage of exogenous ABA, branch angle can thus be determined by the experimenter. Under some experimental conditions, this can be done without altering other facets of branch morphology. This tractable system for the study of branch orientation and its possible hormonal basis will be described in some detail.

39. Response of soybean leaf respiration to respiratory inhibitors

A. SESAY, R. SHIBLES and C. R. STEWART

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Respiration rates by leaf discs from glasshouse-grown soybean [Glycine max (L.) Merr. cv. Corsoy] plants was measured polarographically at 25°C in the presence and absence of respiratory inhibitors. O_2 uptake by mature leaves was stimulated by 1 mM KCN (63%) and 5 mM NaN_3 (79%), whereas SHAM increased the rate by about 36%. KCN and SHAM together inhibited O_2 uptake substantially but not completely, the residual component varying from 42 to 44% of the control rates. One μ M FCCP uncoupled respiration and stimulated the rate about 70%. SHAM repressed the uncoupled rate and inhibited it an additional 64% as compared with the control rate, whereas KCN decreased the uncoupled rate by 26%. O_2 uptake of young (2 day-old) leaves was not stimulated but was inhibited by both KCN and SHAM individually to rates that were 40% of the control. These results strongly suggest the presence of a large and potentially significantly active cyanide-insensitive respiratory capacity in soybean leaf tissue.

40. Two easily recognizable diatoms from the Cedar River: Their distribution and abundance.

S.P. MAIN

Wartburg College, Waverly, Iowa 50677

Cyclotella meneghiniana Kutz and Diatoma vulgare Bory are among the most abundant diatoms found throughout the year in the Cedar River. Both are heavily silicified and of moderate size and so can be readily recognized without oil immersion in the living condition, if necessary. Comparing 190 samples collected in October 1975, February, May, August, and October 1976, C. meneghiniana was observed in 186 accounting for greater than 20% of 33 samples while D. vulgare was observed in 120 samples, in 14 of which it was over 20%. C. meneghiniana was most abundant in August (5973 of 21,434 diatoms counted) and lowest in February and May when it was seldom over 10% of any sample. D. vulgare reached its maximum in October, was widespread but in small numbers during February, dominated some samples in May, and was almost absent in August. D. vulgare forms extensive filamentous colonies on rocks or on green algae while C. meneghiniana is associated with the surface layer of silt found on substrate surfaces in protected calmer waters along the margins of the river. Both are also considered normal components of the plankton in rivers in general.

41. Phloem sieve element differentiation in suspension cultures of Streptanthus

R. D. Sjolund and K. G. Jensen

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Iowa City, Iowa 52242

Suspension cultures of Streptanthus tortuosus, the California shield leaf, can be maintained as an undifferentiated population of parenchyma cells when grown in a liquid White's medium with 2,4-D (2 mg/L). When the cells are transferred to a liquid medium containing NAA and kinetin phloem sieve element development is seen after 7 to 10 days. The formation of phloem in liquid cultures is not dependent on the presence of sucrose, as sieve elements are also formed in media containing glucose or fructose. The development of the phloem sieve elements has been studied by means of transmission electron microscopy.

42. The occurrence of parenchymatous projection in kohlrabi tissue cultures.

T. M. GLENDENING and R.D. SJOLUND

Department of Botany, University of Iowa,
Iowa City, Iowa 52242

Many different species of the genus Brassica have been successfully grown in tissue culture. Reports of in vitro growth of kohlrabi (Brassica oleracea L. var. gongylodes), however, have been very limited. In our studies, cotyledon explants

of kohlrabi were cultured on a Murashige and Skoog agar medium containing 1 mg/l kinetin and 5 mg/l 2,4-D. After 4 weeks, callus tissue developed which was then transferred to a liquid medium. Both the original callus and the resulting cell suspension cultures exhibited numerous projections of parenchymatous tissue. These protuberances grew to a length of 1 cm. and a width of 1 mm. in 14 days. Anatomical studies with light, scanning and transmission electron microscopy showed these projections to be neither roots, shoots, embryos, nor organoids. The abnormal structures consist entirely of proliferating parenchyma cells.

43. Biology of Elsinoë panici Tiffany & Mathre on Panicum virgatum L.

A. Wachua and L. H. Tiffany

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Iowa 50011.

In 1961, a new species of Elsinoë was described as a pathogen on P. virgatum, a native prairie grass (Tiffany & Mathre). A specimen collected in 1882 near Ames, Iowa, by C. A. Bessey was examined and determined to be E. panici, indicating the disease has been in Iowa for a long time. Elsinoë sacchari Lo is the only other species of Elsinoë described from a member of the Gramineae. Very few studies on the biology or development of Elsinoë, or any member of the order Myriangiales have been reported.

In the present study, distribution and persistence of E. panici in Iowa are being investigated. Information on biology of the pathogen from field and inoculation studies, with reference to overwintering, dispersal mechanisms, infective propagules, and disease progression during the growing season is included. The role that asexual and sexual portions of the life cycle play in each of the above is considered.

44. In vitro production of ascocarps of Mycosphaerella populorum.

C.J. Luley

Plant Pathology Seed and Weed Sciences, Iowa State Univ., Ames, IA 50011.

Pseudothecia of Mycosphaerella populorum Thom., the casual agent of Septoria leaf spot and canker of poplars, were produced in vitro on a poplar leaf decoction agar (PLDA). Ascocarps with mature asci and ascospores had developed at 8°C two to three months after cultures were spermatized with spermatia from different isolates. Spermatia were rod shaped, 4-5 X 1 um and were produced in globose to flask-shaped spermatogonia from two to four week old cultures on PLDA. Ascospores were 11.8-15.4 X 2.4-4.7 um (average 13.8 X 3.6 um) and were slightly

smaller than ascospores from naturally infected leaves which were 12.5-16.1 X 3.4-4.8 um (average 14.5 X 4.2 um). Pseudothecia were produced from crosses between single ascospore isolates from leaves and from a cross between an ascospore isolate and a single conidium isolate from a canker. This is the first report of spermagonia and ascocarps of this fungus being produced in culture. Basic studies on the genetics of sexual compatibility and inheritance of pathogenicity in this species should now be possible.

45. Ultrastructure of ascospore, ascus, and ascocarp of Mycosphaerella populorum.

K. A. Niyo, H. S. McNabb, Jr. and L. H. Tiffany

Depts. of Plant Pathology, Forestry and Botany, Iowa State University, Ames, Iowa 50011.

Mycosphaerella populorum G. E. Thompson is the telomorph (Septoria musiva Peck = anamorph) of a North American fungal pathogen that causes leaf spots and stem and branch cankers of Populus species and their hybrids. This fungus exhibited the typical characteristics of the Dothideales of the Loculoascomycetidae. Ascocarps were immersed to erumpent in the leaf blade. The outer wall cells were heavily melanized. The mature pseudothecium developed an ostiole without periphyses. The locule contained a fascicle of bitunicate asci arising asynchronously from basal ascogenous cells. Ascospore delimiting membranes seemed to arise from the plasmalemma and to assist in spore wall formation. The mature ascospores were one-septate with a septal pore connection, and contained many organelles. The ascospores usually germinated by a germ tube from each cell. The germ tubes penetrated the leaf only through stomata.

46. Genesis of calcium oxalate bipyramidal crystals associated with the basidiocarps of Geastrum minus (Lycoperdals).

H. T. HORNER, L. H. TIFFANY, A. M. CODY, and G. KNAPHUS.

Department of Botany, Iowa State University, Ames, IA 50011.

Bipyramidal crystals of calcium oxalate dihydrate that occur on inner peridial surfaces of mature Geastrum minus basidiocarps, originate at the hyphal interface of the peridial primordia before they separate. Initially spherical complexes of small, elongate crystals appear as the two peridial surfaces begin to separate from each other prior to the opening of each basidiocarp. Just-opened basidiocarps display a range of crystals from spherical complexes, to intermediate forms, to bipyramids. Completely opened basidiocarps predominately have tetragonal prisms and bipyramids. The crystals seem to be a unique

characteristic of G. minus as compared to other Geastrum species. They are probably involved with the separation of the peridial layers during basidiocarp development and expansion. During their genesis, the crystals display forms similar to those found in urinary tracts of humans and other animals prone to urinary stone formation.

47. The mimosoid pleurogram - an overlooked taxonomic character?

BRAGG, L. H.

The University of Texas at Arlington, Biology Department, Arlington, TX 76019

The pleurogram, a groove in the testa of mimosoid seeds, has previously been inadequately described in the literature. In this SEM study, mimosoid seeds representing 8 genera and 20 species were examined for their pleurogram shapes, the length/width ratio of the pleurogram as well as other features. The varied results obtained in this initial study provides a basis for a more extensive investigation of pleurogram features of the remaining mimosoid members.

48. Surface waxes of Berberis aquifolium: Structure, reflectance and chemical composition

V. S. BERG

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Wax crystals on the surface of leaves cause diffuse (dull) rather than specular (shiny) reflection from leaf surfaces. In this study, leaf surfaces of two varieties of Oregon grape (Berberis aquifolium) have been compared. One has glossy leaves while the other has leaves with a dull surface. Scanning electron microscopy revealed that the diffuse reflection was due to tubular crystals of wax 250 nm in diameter. These structures were present only on dull-surfaced leaves. Thin layer chromatography showed that the tubes were associated with large quantities of a 29-carbon secondary alcohol, identified as 19-nonacosanol using gas chromatography-mass spectrometry. Other chemical constituents of the leaf surface waxes were the same for the two varieties of leaves. Two n-alkanes (29-C and 31-C) plus a 29-carbon primary alcohol were characterized. The presence of tubes did not change the reflectance spectra of the leaves.

49. Notes from the UNI Herbarium, II.

L. J. EILERS

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Cedar Falls, IA 50614.

Because of several recent gifts, indefinite loans, and the collections of students and staff, the UNI Herbarium now houses 27,000 plus specimens. The following gift collections are gratefully acknowledged: 1) The Iowa-Illinois Gas and Electric company has given a set of 508 B. Haglan specimens from The Big Sand Mound in Louisa and Muscatine Counties. This collection is of significance because of the many threatened and endangered species that occur in that unique habitat. 2) Maharishi International University has loaned on an indefinite basis their herbarium of S.W. Iowa specimens collected by C. Gilly and others. 3) Jean N. Bates has given UNI a set of her Loess Hills specimens. This valuable collection documents the large number of unique species that occur in that very different area. 4) Lastly, many other occurrences of important Iowa plants are documented by the gift collections of J. Peck and D. Roosa. Spring foray biologists have added others. Large collections have been added to the UNI herbarium recently from Des Moines, Dubuque, and Black Hawk Counties by Tom Lammers, James Lehmann, and Karen VanNorman, respectively, former or current graduate students at UNI.

50. Preliminary study of the aquatic hyphomycetes (Deuteromycotina) from the Dominican Republic

C. BETANCOURT

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Twenty-six species of aquatic hyphomycetes were identified from submerged leaves and foam samples from the Rio Yaque del Sur, Rio Yaque del Norte, Rio Cuatro Alas, Rio Serafin and Rio Guanos in the high mountains (2,300m) in the Cordillera Central of Dominican Republic at Parque Nacional Armando Bermudez. The species identified have not been previously reported from this country.

51. Sordariaceous fungi in prairie soils

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Iowa 50011

In a study of fungi in Iowa prairie soils underway at the present time, a surprising diversity of Ascomycetes has been recorded. Among these fungi, a very interesting and unique group are the Sordariaceae. Although they are known usually as dung inhabiting organisms, they are also not uncommon on herbicolous, lignicolous, and terricolous substrates.

The distribution of Sordariaceous fungi is poorly documented except in parts of Europe and of Canada. In the midwest, their presence and importance in prairie soils has been largely overlooked, yet they represent a major component of the Ascomycetous flora recovered from this ecosystem.

52. Distribution of morels and false morels in Iowa

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Dept. of Biology, Central College, Pella, IA 50219

A survey of the distribution of morels, Morchella spp., and of false morels, Verpa spp. and Gyromitra spp., was begun in 1984. Cooperators were encouraged to bring specimens to their county extension office or to send them directly to identification centers at Iowa State and at Central. Significant contributions were made by the members of the Prairie States Mushroom Club through individual efforts and three forays. This report summarizes information from the 1984 season and published records. We have five species of Morchella, two of Verpa and two of Gyromitra. In 1985, efforts will be concentrated on areas of the state not represented at the present time.

53. The effect of spring fire on shooting star, Dodecatheon meadia, in Iowa tallgrass prairie

M.J. Leoschke and D.C. Glenn-Lewin

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Ames, Iowa 50011

The effect of spring fire on shooting star, Dodecatheon meadia, growth, flowering, and phenology in Iowa tallgrass prairie was studied at Hayden Prairie and Clay Prairie state preserves. Fire tended to produce an increase in flower number. Total flowering plant weight, scape weight, and total leaf weight increased with an early burn, but decreased with a late burn. Flowering plant leaf number decreased with burning. The total leaf weight and number of leaves on non-flowering plants tended to increase with burning. In some cases, the timing of the fire relative to the extent of leaf expansion affected the response.

54. Hill prairie vegetation on the Paleozoic Plateau

E. UGARTE and D. GLENN-LEWIN

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Hill prairie communities are a characteristic element in the vegetation of the Paleozoic Plateau, northeast Iowa and adjacent regions. Following European settlement, a reduction in the area or number of prairies due to encroachment by woody species has occurred. Changes in the disturbance regime (fire and grazing, primarily) are proposed as explanatory factors.

204 stands covering a broad range of ecological conditions were sampled on 31 prairies. A restricted random sampling design was used with the objective of evaluating community organization in relation to environmental factors and grazing regimes.

Initial ordination and classification schemes and the environmental variables related to them indicate a surprising degree of variation in hill prairie vegetation.

55. Natural forest recovery of 150-year old surface mining sites in the Upper Mississippi Valley

T. J. BLEWETT, J. LEHMANN, and C. WRIGHT

Clarke College, Biology Department, Dubuque 52001

Pit mines were used by Indians to remove superficial lead deposits in the Upper Mississippi Valley as early as 1600. The practice was replaced in the 1830's with shaft mining that was introduced by white settlers. Eastern Iowa and adjacent Illinois and Wisconsin were searched for remnants of pit mines, but most sites have been lost to farming and urban development. Three sites in Iowa and Wisconsin, including the Mines of Spain at Dubuque, were found to have well established forest cover in spite of severe surface disturbance and available lead as high as 240 micrograms Pb per gram of soil. Two sites have mature oak-hickory forest composition while a third site is dominated by large redcedars and bur oak. The natural reforestation of these sites has notable implications for reclamation of mined surfaces.

56. Methods for long-term study of vegetation communities

C. L. Johnson-Groh

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The establishment of permanent study plots is imperative for the long-term study of vegetation communities. Few studies of vegetation in Iowa have used permanent plots. Methods used in an ecological study of the Ledges State Park are advocated for long-term studies in Iowa. These include a survey of vegetation according to basal area, cover of understory and herbaceous plants, and sapling counts in plots mapped and marked by permanent markers (tree anchors and tagged trees). Black and white photographs were taken from fixed stations in each plot in the spring prior to leafing of the canopy.

57. MBIOBANK, a system for handling biological field data with a microcomputer.

L. J. EILERS

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

The MBIOBANK programs are written in Microsoft Basic for a Radio Shack TRS-80, Model III Microcomputer with two disk drives. All data pertaining to one specimen are arranged in a given format into a variable-length data record. Each data record begins with a 12-character taxon code which is used in filing, sorting, and retrieving of data. The data records are stored sequentially when filed. The "user-friendly" program, DATAIN, is a combined input and editing program which automatically controls the format of the data record and is designed to eliminate many input errors. A completed data record can be edited before filing, or DATAIN can also be used to edit records that were filed previously. When entering specimen data with repeated information (same locality, habitat, etc.), a new data record can be created by simply modifying portions of the previous record. The SEARCH program recalls selectively stored records in a variety of ways, depending on the wishes of the operator. The stored data can be formatted as desired for printout. Specimen labels can easily be produced.

Chemical Education

58. Individualized computer aided instruction using the Smart Alex authoring system.

D. D. Vogel

Oskaloosa Senior High School, Oskaloosa, Iowa 52577

Trials of a computer driven interactive textbook for students who lack prerequisite skills for chemistry and physics during the 1984-85 school year indicate that truly individualized, interactive materials can easily be prepared which are well received by students and produce long term improvement in skills relevant to decimal arithmetic, word problems, the metric system, etc. 90% of students responding to a free-form questionnaire volunteered the view that the interactive text is superior because it will not allow the student to read past material that is not understood and provides useful assistance with material that is not understood.

59. The First Eight Years of General Chemistry I-II at UNI

J. C. CHANG, E. W. RICHTER, AND R. A. WILEY

University of Northern Iowa, Cedar Falls 50614

In 1977 an accelerated first-year chemistry course for science majors, General Chemistry I-II, was instituted at UNI. This course is offered only in the fall semester, primarily for the well-prepared entering freshmen; and it covers the entire year of general chemistry in one semester. From 1977 to 1984, 123 students had taken this course. Those taken this course from 1977 to 1980 have graduated, and 16 out of the 52 students in these five years are chemistry majors. Among these 16 graduates, 8 have gone on to graduate studies in chemistry, 5 entered professional schools, 2 are working in industries, and 1 is deceased. In the more recent four years, 29 out of 71 students are chemistry majors or are leaning toward majoring in chemistry. We feel that this course is serving our purpose of accelerating our good students through the ACS accredited program so that they are well-prepared to take advanced courses and to do research in their senior year.

60. String statistics: an elementary exercise for students of analytical chemistry.

L.E. ERICKSON

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For the past several years we have used a simple exercise to introduce students to basic concepts of statistics and the use of the terms precision and accuracy to describe the results of experimental measurements. Each student in a class is asked

first to cut off (without measuring) a specified length of string, then to measure the actual length (in cm) and finally to record the data on a data sheet which is subsequently duplicated and distributed to the class. The assignment is to determine minimum, maximum, mean, median, standard and average deviations (both absolute and relative) and to compare precision and accuracy of the class data. Typical class results will be presented and compared to the perceptions of the people who come to this presentation.

61. The meaning of minus - the use of negative signs in science

R. P. STOUT and J. D. WOODS

Department of Chemistry
Drake University
Des Moines, Ia. 50311

No less than eight distinctly different uses, and even more subtle variations, of "negative" exist in science. Individual context clearly indicates the intended usage in most circumstances. Even when usage is unclear, or not clearly perceived, the observer usually suffers negligible or nil consequences. At times a negative sign carries a meaning whose identity is critical. In the unusual circumstance, up to three negative signs, each with a specific interpretation, appear in a single equation, leading to considerable confusion. Several examples of these situations will be presented, supplying strategies for avoiding deceptive pitfalls.

62. Teaching SPICE: Structured Pacing in Chemistry Education

J. M. Hines, J. L. Kelly

Dept. of Teaching
Price Laboratory School
University of Northern Iowa
Cedar Falls, IA 50613

SPICE (Structured Pacing in Chemistry Education) is a laboratory oriented program which establishes an alternative to the traditional textbook approach for high school chemistry instruction. The philosophy, rationale, and characteristics of the program will be discussed. Samples of materials will also be provided.

63. Chemical safety and emergency response in small schools.

R. C. PFAFF

Department of Chemistry, University of Nebraska at Omaha, Omaha, Nebraska, 68182-0109.

The maintenance of laboratory safety is necessary for many reasons. Most discussions of the topic focus on large research labs or on specific hazards. All laboratory operations can benefit from a clear and concise safety program. Such a program must include a comprehensive document covering the issues of authority, responsibility, rules, and emergencies. It is also essential that faculty and staff promote safety and that students receive safety training. Emergency response is often underemphasized. All personnel must be made aware of the location and use of emergency equipment and of the policies to be followed in the event of an accident. School administration officials usually will need to participate in the development and implementation of a good safety program.

64. A Chemistry Character Set for Microcomputers

L. A. MCGREW

University of Northern Iowa, Dept. of Chemistry, Cedar Falls, IA 50614.

The successful application of microcomputers in chemical education depends upon a quality graphics display. Some of the low-cost micros now on the market are reported to have excellent graphics capability. However, very little chemistry will appear on the CRT's of these machines without an abundance of programming. The most serious shortcoming is the lack of a character set suitable for displaying chemical formulas, structures, and reactions. This report will include discussion of the design and use of a successful chemistry character set for one of the most popular low-cost microcomputers. Bring a blank 5.25-in. floppy diskette and share some free chemistry graphics software.

65. Humor as a teaching tool

R. P. STOUT

Department of Chemistry
Drake University
Des Moines, Ia. 50311

Humor has long been used as a handle to help us remember things. It can be used as an effective teaching tool, helping students remember some of the definitions, facts and concepts found in science. Several of the "daffy-nitions" and other humorous tools which I have found helpful in teaching chemistry will be presented.

66. This Is The Cover Of Your Science Book - a computer interactive textbook of topics that underlie physical science.

D. D. Vogel

Oskaloosa Senior High School, Oskaloosa, Iowa 52577

The first ten chapters of a computer interactive textbook of unusual versatility have been in use during the 1984-85 school year. Examination of the actual materials is needed to appreciate the differences between these and other computer materials aimed primarily at drill, graphic illustration, or superficial explanation. The fill-in-the-blanks format is completely individualized in response to students' free-form answers (no multiple choice). Topics include a review of decimal arithmetic, fractions, word problems, and the metric system. Pretests, posttests, drill adjusted to student performance, answers based on previous student input, timed drill, calls for teacher intervention, etc. are all implemented thanks to the Smart Alex authoring system.

CHEMISTRY C

67. Determination of calcium, magnesium, and zinc in goat milk and cow milk

F. E. NETTLETON and R. P. STOUT

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Drake University
Des Moines, Iowa 50311

A significant portion of the human population shows allergic responses to cow milk, warranting studies of goat milk to determine its value as a replacement. Atomic absorption spectroscopy is used to determine calcium, magnesium, and zinc concentrations in goat milk and cow milk for comparison. Results show values for calcium, magnesium, and zinc concentrations in goat milk similar to both measured and known values for cow milk.

68. Phenol-formaldehyde chemistry: The initial reactions

C. C. Rila

Department of Chemistry, Iowa Wesleyan College, Mt. Pleasant IA 52641

The reaction was followed by HPLC and the initial sequence of reactions was clearly established. The first three levels of reaction were determined. The identity of the initial reaction products was determined by synthesis.

69. Reactions of some pentaammine (o-substituted benzoato)chromium(III) cations in perchloric acid and in water

R. L. WILLIAMSON and J. C. CHANG

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

The reactions of three pentaammine(o-substituted benzoato)chromium(III) cations in 0.01 M perchloric acid and in water were investigated. In perchloric acid the reaction was the release of ammonia, and the rate constants estimated for the three complexes were similar to the rate constant for the ammonia release of tetraammine(oxalato)chromium(III) cation. In water the reaction was aquation to pentaammine-aquachromium(III) cation, and the rate constants of aquation decreased as the substituent was changed from fluoro- to bromo- to nitro-. The difference in the aquation rate constants for these three complexes was attributed to the difference in the size of the three substituents.

70. Non-aqueous Titration of Some β -Diketones

C. S. WOO

University of Northern Iowa, Dept. of Chemistry, Cedar Falls, IA 50614.

The β -diketones, acetylacetone, dibenzoylmethane and thenoyltrifluoroacetone have been used extensively as chelating and extraction reagents. These compounds behave as weak acids in water but are too weakly acidic to be determined by titration in aqueous solutions. Tetrabutylammonium hydroxide in a solvent of 1:9 benzene-methanol was found to be a suitable titrant for these ketones in pyridine medium. The stoichiometric end-point is very sharp potentiometrically, if the aqueous KCl solution in the calomel electrode is replaced by a modified methanol saturated KCl solution. The end-point can also be detected visually by using thymol blue as an indicator. The results of using this titration technique to the characterization of solvates of some metal chelates will be discussed.

71. Characterization of a Column Mediated Bio-Affinity Assay for Lactate Dehydrogenase.

K. S. Kline and M. A. Arnold

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

A new competitive binding assay, combining the selectivity of affinity chromatography with the low limit of detection of fluorescent measurements, is being developed. A mixture of free lactate dehydrogenase (LDH) and fluorescently labeled LDH actively compete

for a limited number of adenosine 5'-mono-phosphate (AMP) binding sites on an affinity column. The degree of labeled species binding is dependent upon the relative concentrations of free and labeled species in the sample.

Optimization of this technique requires complete characterization of parameters such as pH, temperature, conjugate preparation and stability, and the timing scheme of sample elution through the column. The results of our optimization studies will be detailed in this presentation.

72. Homogeneous enzyme immunoassays based on the reversible inactivation of lactate dehydrogenase

J. WANGSA and M.A. ARNOLD

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

We are developing a novel homogeneous enzyme immunoassay using lactate dehydrogenase as an enzyme label. This enzyme can be inactivated by mixing it in a low pH buffer which drastically alters its conformation. Reactivation is possible in high yields upon neutralization. Our enzyme immunoassay procedure starts with the formation of an enzyme-antigen complex using conventional conjugation techniques. An enzyme inactivation reagent is then mixed with a fixed amount of the enzyme-antigen conjugate and a known volume of sample which contains free antigen is then added. Next, an enzyme activation reagent is added which is followed by a fixed amount of antibody specific for this antigen. Once the antibody binds an inactive enzyme-antigen complex, enzyme reactivation through conformational changes will be prohibited. Hence, only unbound enzyme-antigen complex will be activated. The amount of activated enzyme will be directly proportional to free antigen concentration. Results of our initial studies will be presented.

73. Sensitivity and precision improvements in direct ion-selective electrode techniques

S. A. GLAZIER and M. A. ARNOLD

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

One fault often cited of potentiometric techniques is their lack of acceptable precision. We are currently investigating possible methods of increasing the sensitivity and thus, hopefully, the precision of these techniques. This research involves the summing of the potentials of several electrochemical cells (potentials of indicator/reference electrode pairs) generated in the same solution. Theoretical considerations predict a square root relationship between the increase in precision and the number of cell potentials summed. Statistical analysis of replicated measurements and anal-

ysis of the linear region of analytical curves are two of the means of comparing the sensitivity and precision of the methods studied. The ammonium responsive, nonactin based polymer membrane electrode is the electrode system receiving the greatest attention at the present time. Details concerning the methods studied, procedures for comparing sensitivities and precisions of the methods, and results will be given.

74. Equilibrium and kinetic studies of hydrolysis behavior of some chloro complexes of platinum.

M.R. GODFREY, L.E. ERICKSON

Department of Chemistry, Grinnell College, P.O. Box 805, Grinnell, Iowa 50112-0806

The aqueous solution behavior of four closely related four coordinate platinum(II) complexes, $\text{cis}(\text{N,S})\text{-Pt}(\text{DMSO})(\text{glycine})\text{Cl}$, $\text{cis-Pt}(\text{DMSO})(\text{sarcosine})\text{Cl}$ and both cis and $\text{trans-Pt}(\text{DMSO})(\text{dimethylglycine})\text{Cl}$ was investigated by nmr and electrochemical methods. Equilibrium constants (K_h) for hydrolysis of the chlorides to form the corresponding aquo complexes and rate constants (k_2) for displacement of coordinated water by Cl^- were determined by titration of the aquo species with KCl using a chloride ion specific electrode to monitor chloride concentration. Promotion of the hydrolysis reaction by silver ion was also investigated and the relative importance of first-order hydrolysis ($k_1 = k_2K_h$) and silver ion dependent second-order hydrolysis (with rate constant K_{Ag}) was established. Rates of parallel chloride substitution reactions of these complexes by OH^- were also investigated. Comparative data for the series will be presented.

CHEMISTRY D

75. The use of ^{13}C NMR in assigning structures to isomeric diols

R. J. WARNET, B. P. MUNDY and D. BRUSS

Simpson College, Indianola, IA 50125

The ^{13}C NMR spectra of diols made from metal mediated coupling of 3 and 4 methyl cyclohexanones are reported and correlated. The chemical shifts of the carbons are used to assign structures to new diols. X-ray crystallography data confirms the assignments.

76. Novel multifunctional epoxides.

V. NAIR* and T. S. JAHNKE

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

Fatty acid hydroperoxides arise by lipid peroxidation and by the action of lipoxygenases on unsaturated fatty acids. These fatty acid hydroperoxides are known to thermally, chemically, and enzymatically decompose to prostaglandins, leukotrienes, thromboxanes, and a variety of epoxy compounds. Secondary lipid peroxidation products are known to react with amino acid residues of proteins and are postulated to be reactive towards DNA and RNA. The study of the chemistry of secondary lipid peroxidation products is important to understanding the biological activity of these molecules. Little attention has been focused on the chemistry of the natural multifunctional epoxides derived from lipid hydroperoxides. This paper will present the synthesis, stereochemistry, and reactivity of model multifunctional epoxides related to the complex natural epoxides of lipid origin.

77. Interesting ring extended products from the reaction of epoxycarbonyl compounds with nucleic acid bases.

V. NAIR* and R. J. OFFERMAN

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Numerous naturally occurring epoxides have been isolated from a variety of biological sources. These compounds exhibit a wide range of biological effects ranging from toxicity and carcinogenicity to anti-tumor, antileukemic, and fungistatic activity. While certain of these compounds are produced from microorganisms, others are formed *in vivo* as the result of metabolic activation of procarcinogens. To gain further insight into the nature of modification of nucleic acid bases by functionalized epoxides, we have investigated the reactivity of such epoxides with some representative alkylated bases and the corresponding nucleosides. Both five- and six- membered ring extended products are produced in these reactions. Details of these conversions as well as the systematic deduction of the structures of the products by UV and high-field NMR data will be discussed.

78. Photoinduced hydrations in purine chemistry:
A new synthesis of isoguanosine.

V. NAIR* and D. A. YOUNG

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Iowa City, Iowa 52242

Isoguanosine (crotonoside or 2-hydroxyadenosine) is one of only a few naturally occurring nucleoside analogs of guanosine. Isoguanosine is incorporated in mammalian nucleic acids. It has been synthesized previously, but in very low yields. We have discovered a new, reproducible, and highly efficient synthesis of isoguanosine starting from guanosine. The key step in the synthesis is a photoinduced hydration of 2-iodoadenosine through transient purinyl radicals or the corresponding ion pairs. Purinyl radicals have been cleanly produced from the photolysis of halopurines in our laboratory and have been used previously by us to transform halopurines into the corresponding arylated and heteroarylated compounds. Applications of the photoinduced hydrations and the mechanistic details of these reactions will be presented.

79. B-Z transitions of poly(dG-dC) and poly(dG-m5dC)

E. D. Glendening and M. L. Bleam

Department of Chemistry, Central College
Pella, IA 50219

The B-Z transitions of poly(dG-dC) and poly(dG-m5dC) DNA have been studied by ultraviolet absorption of NaCl solutions at 25, 35, and 55°C. The transition was found to be both salt and temperature dependent for both unmethylated and methylated polymers. An increase in solution temperature increased the NaCl concentration required to induce the transition in poly(dG-dC) but decreased the NaCl concentration required to induce the transition in poly(dG-m5dC). A thermodynamic quantity, Δi , has been determined which includes the number of ions and water molecules released or bound during the transition. Per 130 basepair cooperative unit, $\Delta i = 81$ ions for poly(dG-dC) and $\Delta i = 21$ ions for poly(dG-m5dC). For the Z to B transition at 25°C, H° and S° per cooperative unit have been estimated to be 19.2 kcal and 193 cal/K for poly(dG-dC), and -8.6 kcal and -46 cal/K for poly(dG-m5dC).

80. Interaction of mammalian topoisomerase II with DNA and intercalating antineoplastic drugs.

E.L. UHLENHOPP and K.W. KOHN

Department of Chemistry, Grinnell College, P.O. Box 805, Grinnell, Iowa 50112-0806

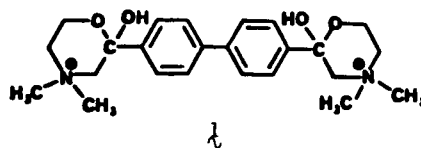
Treatment of mammalian cells with DNA intercalating agents results in protein-associated DNA strand breaks presumably through the action of a nuclear topoisomerase. Studies using either intact cells or isolated nuclei have revealed that different intercalating agents such as 4'-(9-acridinylamino)-methanesulfon-m-anisidine, 2-methyl-9-hydroxy-ellipticine, adriamycin, & 5-iminodaunorubicin have a variety of effects on the formation of breaks and DNA-protein crosslinking *in vivo*. In order to examine the effect of these drugs on purified reactants *in vitro*, we have used a filter binding technique to isolate different reaction intermediates. Nocovalent DNA-topoisomerase II-drug, ternary complexes were assayed by vacuum filtration through PVC filters under physiological conditions; covalent, DNA-topoisomerase complexes were detected by denaturation with ionic detergent followed by filtration and washing with a high-salt, detergent solution. The dose response curves for the 5 different intercalating drugs revealed a variety of effects on the ability of topoisomerase II to form noncovalent and covalent complexes with DNA.

81. Hemicholinium congeners as inhibitors of choline uptake

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Division of Medicinal Chemistry and Natural Products
College of Pharmacy, University of Iowa, Iowa City, Iowa 52242

In a definitive structure-activity study of hemicholinium 1, an inhibitor of choline uptake into nerve terminals, the central biphenyl portion of the molecule has been replaced by 2,2'-dimethylbiphenyl, 2,7-disubstituted phenanthrene, 1,7-disubstituted phenanthrene, 2,6-disubstituted naphthalene, and trans/trans-4,4'-bicyclohexyl systems.



Synthesis of these congeners will be described. Biological data will be reported, and correlations of biological effects with chemical structure will be presented.

82. Thermal reactions of diethyl phosphite ion with halobenzenes, triad of mechanism.

J.H. HUGHES and J.E. SWARTZ

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The reactions of a variety of halobenzenes with diethyl phosphite ion in Me_2SO proceed via three different mechanisms. The identity of the dominant mechanism depends upon the nature of the aryl halide. 4-Bromobenzonitrile reacts via an $\text{S}_{\text{N}}2$ -like mechanism involving nucleophilic attack on bromine. 2- and 3-Bromobenzonitrile react in a similar fashion, the order of reactivity being $2 > 3 > 4$. 4-Iodobenzonitrile reacts by the $\text{S}_{\text{N}}2$ mechanism, but also gives some nucleophilic substitution product, diethyl 4-cyanophenylphosphonate, which appears to form by an $\text{S}_{\text{RN}}1$ mechanism. 4-Chlorobenzonitrile is unreactive by the $\text{S}_{\text{N}}2$ mechanism and slowly gives the arylphosphonate product via an $\text{S}_{\text{N}}\text{Ar}$ mechanism. Reactions of diethylphosphite ion with other electron withdrawing group substituted halobenzenes have been studied. For instance 4-bromobenzotrifluoride reacts via the $\text{S}_{\text{N}}2$ mechanism, albeit much more slowly than 4-bromobenzonitrile.

83. Hydrogen abstraction by phenyl radicals.

E.D. APEL, J.E. SWARTZ, and P.S. KOSEK

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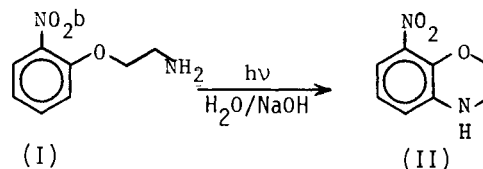
We have generated phenyl radicals by the thermal decomposition of phenylazotriphenylmethane for studies of the reaction of phenyl radicals with various hydrogen atom sources. We find that the relative rates of hydrogen atom abstraction from deuterated dimethylsulfoxide and tetra-N-butyl ammonium perchlorate are identical regardless of the source of phenyl radicals. We have also determined that tetra-N-methyl ammonium and tetra-N-ethyl ammonium perchlorates are not a source for hydrogen atoms in our system, thus an indication that hydrogens furthest from the nitrogen in tetra-N-butyl ammonium ion are being removed by phenyl radicals. Furthermore, a hydrocarbon, decane, has been found to have the same relative reactivities as tetra-N-butyl ammonium perchlorate toward the phenyl radicals. Polar effects of substituent groups on phenyl radicals have been studied under similar conditions in deuterated dimethylsulfoxide with hydrogen atom sources of tetra-N-alkyl ammonium salts. Also somewhat related, polar effects of substituent groups on the hydrogen atom source were investigated.

84. Mechanism of an intramolecular hydrogen photo-displacement of β -(2-nitrophenoxy)-ethylamine.

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In our exploration of photo-Smiles rearrangements of β -nitrophenoxyethylamines, we found that I readily undergoes thermal Smiles rearrangement, but does not do so on irradiation. Instead an intramolecular hydrogen displacement occurs forming II in low yields. We have examined the



influence of pH and alternative acceptors for the hydride equivalent on the yield of II and conclude that the mechanism involves an intermediate dihydro adduct.

85. Synthesis of o-mercaptobenzyl alcohol and ,2-dimercaptotoluene

J. A. THYNE and D. C. SPECKARD

Loras College, Dubuque, IA 52001

Synthesis of o-mercaptobenzyl alcohol from thiosalicylic acid in a four step process is outlined in *J. Org. Chem.*, 30,4074 (1965). The product's purity was verified by melting point and Infrared Spectroscopy. Following suggestions in *J. Am. Chem. Soc.*, 3034 May (1978), the methodology for the synthesis of ,2-dimercaptotoluene is being developed. The results from this synthesis will be verified by boiling point and N.M.R.. The ,2-dimercaptotoluene will be oxidized to form an analog of Lipoic Acid. The properties of this acid are to be studied further.

86. 3-Fluoropyruvate is a substrate for an unusual reaction catalysed by mammalian pyruvate dehydrogenase.

D. C. SPECKHARD

Loras College Dubuque Iowa 52001

3-Fluoropyruvate inhibits the action of beef pyruvate dehydrogenase complex with an apparent K_i of .1 mM. The inhibition is relieved by pyruvate and stimulated by thiamine. The inhibition decreases with time indicating fluoropyruvate is being consumed.

Fluoropyruvate will not substitute for pyruvate in the pyruvate dehydrogenase complex activity, but may be decarboxylated to fluoride, carbon dioxide and acetate. This is the first report of this activity for a mammalian enzyme.

CONSERVATION

87. Survival and root system morphology of tree seedlings planted in newly reclaimed strip mine land in south central Iowa.

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Containerized and bare-root seedlings of green ash (*Fraxinus penn.*) and hybrid poplar (*Populus x eur-america*) were planted in newly reclaimed strip mine land in south central Iowa in 1983. Survival of bare-root stock is slightly greater than containerized stock for both species. Survival of ash and poplar bare-root stock is equal, while containerized ash survival is twice that of containerized poplar. Addition of mycorrhizal inoculum to half the seedlings had little effect on survival. Seedlings were excavated in 1984. Ash roots generally grew downwards. Poplar roots exhibited similar tendencies, but some roots also grew parallel to the surface. These shallow roots extended out almost two meters—three times the height of the seedlings. The exceptionally hot, dry summers of 1983–84, combined with the lack of established site cover, produced a very hot, dry, and hard zone at the soil surface. Root growth was inhibited within this 15 cm thick zone. Many, deep cracks facilitated deep penetration by the roots, overcoming root growth resistance due to the soil's high bulk density.

88. Growth and rooting characteristics of hybrid aspen and alder on a reclaimed mine site.

R. C. Shultz and R. B. Hall

Dept. of Forestry, I. S. U., Ames, Iowa 50011.

Pure and mixed plots of hybrid aspen (*Populus alba* X *P. grandidentata*) and alder (*Alnus glutinosa*) were planted on the I. S. U. Mine Site in 1978. After 7 growing seasons the aspen survival was 82% while the alder survival was only 31%. For both tree types the best growth was for trees growing near the middle of the terrace. Dry matter production averaged 5 metric tons per hectare per year for the hybrid aspen. Hybrid aspen height growth was 49–76% of that observed on an undisturbed upland site near Amana, however, over the last two growing seasons the rate of height growth has exceeded the growth on the Amana site (1.7 vs 1.6 m per year). No growth promoting effects of the alder's nitrogen-fixing abilities could be demonstrated. Thirteen trees of

each type were excavated. Alder roots grew primarily downward with roots extending beyond 1.5 m deep. Few horizontal roots were found. Hybrid aspen produced primarily horizontal roots with some sinkers. Aspen roots invaded the rooting cylinders of alder instead of the reverse. Horizontal aspen roots produced sprouts up to 1 tree height (8.5 m) away from the parent trees.

89. Some effects of lifting date and storage temperature on forest nursery seedlings.

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

Seedlings of 3 hardwood and 2 pine species were lifted from the Iowa State Forest Nursery in the fall of 1983 and spring of 1984. Pines were stored at -2°C; hardwoods at -2°C and +1°C.

Plant moisture stress (PMS) levels during storage generally ranged from 0 to -10 bars. Seedlings stored at -2°C maintained comparable or less negative PMS levels than stock stored at +1°C.

Seedlings stored at -2°C maintained the level of frost hardiness present in roots at lifting or became more frost hardy during storage. Those stored at +1°C maintained the level of hardiness present at lifting or became less hardy.

Spring lifted pines had survival rates two times those for any fall lifted pines. Hardwood seedlings lifted in late fall and spring had the highest survival rates. Seedlings stored at +1°C had comparable or better survival than stock stored at -2°C. There is no correlation between lifting date or storage temperature and height or diameter growth.

90. Status of short-tailed weasel in Iowa

R. P. LAMPE

Department of Biology, Buena Vista College,
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During July and August, 1984, 48 sites in 11 northern Iowa counties were sampled for the occurrence of short-tailed weasels (*Mustela erminea*). Large Sherman traps were baited with a mixture of peanut butter-suet-raisins-oatmeal-paraffin and set in upland habitat adjacent to wetlands. In 4755 trap nights, 34 *M. erminea* and 1 *M. frenata* were captured in eight counties (Clay, Dickinson, Kossuth, Winnebago, Mitchell, Howard, Worth and Cerro Gordo). Eleven *M. erminea* and 1 *M. frenata* were immobilized with ketamine hydrochloride, measured and released. Other specimens were prepared as study skins. The greatest number of captures occurred at Union Slough National Wildlife Refuge, Kossuth Co., where 13 individuals were captured during 600 trap nights.

91. Possible use of nestboxes to increase the population of eastern screech owls

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Department of Biology, Central College
Pella, Iowa 50219

The eastern screech owl (Otis asio) has declined in recent years and is now blue-listed by the American Ornithologists' Union. Few studies have been conducted on habitat preferences or population ecology. A three-year study was initiated in 1983 to determine the status of screech owls in Summit Township, Marion County, Iowa and the feasibility of increasing the population, especially in intensively farmed areas, by installing nestboxes in selected sites. To date 19 screech owls have been located in both woodlands and farmsteads. Seventy nestboxes have been installed throughout the township.

92. A comparative study of species diversity: Iowa's winter bird counts (1966,1971,1976-1983).

M.J. SARLAT

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50125

Preston's log-normal distribution is known to approximate patterns of relative abundance in bird species. Results from Iowa's 1966, 1971, 1976-1983 winter bird counts were fitted to Preston's log-normal distribution using a computer model fit by Gauch and Chase (1974), called CURVEFIT. The observed and expected data was then compared in a Chi-square goodness of-fit-test. The total number of species present was estimated for those years having data that fit the model.

Having the total number of species, the Shannon Index of Species Diversity and the computer program DIVERSE allow statistical comparisons, by t-tests, for overall diversity between successive years. It was then concluded that neither species diversity nor the number of individual species has been declining, but fluctuating yearly, for an overall stabilizing trend.

93. Ontogenetic changes in predatory behavior and selectivity of larval tiger salamanders (Ambystoma tigrinum)

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

Tiger salamander larvae (Ambystoma tigrinum) were collected and divided into three size class (small, medium, and large) based on their snout-vent length. The behavior of the salamanders when preying on five types of invertebrate prey was documented. Electivity indices for each prey type were calculated based on larval responses when presented with all types of prey at the same time. Predatory behavior patterns, handling times, and selectivity varied between larval size classes. Small larvae behaved differently compared to medium and large larvae. The differences between medium and large larvae were not as pronounced. It is hypothesized that differences in behavior between size classes results from ontogenetic changes in limb development.

94. In situ determination of limiting nutrients in streams.

BUSHONG, S. J. and R. W. BACHMANN.

Dept. of Animal Ecology, Iowa State University,
Ames, Iowa. 50011

We adapted a technique of Fairchild and Lowe to determine limiting nutrients for attached algae in Iowa streams. Porous clay containers (flower pots) filled with agar gel were used as artificial substrates for the colonization of periphyton. Nutrients including phosphates, nitrates and ammonia that were added to the agar in different containers, leached through the clay and increased the concentrations of these nutrients at the water-substrate interface. The containers were placed at three sites in four streams for each of the experiments. At each site there were representatives of each nutrient treatment and a control without added nutrients. Conditions of water depth, current velocity, and exposure to solar radiation were kept uniform. Experiments lasted from 7-14 days and final algal biomass was determined by chlorophyll measurements on attached periphyton. In several of the experiments the addition of ammonia and ammonia plus phosphorus significantly enhanced growth compared to the controls.

95. Seasonal changes in the transport of seston and dissolved organic carbon in an agriculturally impacted stream ecosystem.

T. E. ROBERTSON AND R. W. BACHMANN

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

Seston (suspended organic matter) and DOC (dissolved organic carbon) were studied along a 2.0 km section of an agriculturally impacted Iowa stream from June 1982 - November 1983. Samples were collected at three sites, from the headwaters and following a gradient downstream at evenly spaced intervals. DOC concentrations ranged from 4 mg/l to 22 mg/l during the study with a mean value of 9.26 mg/l over the study period. FPOM (fine part. organic matter) concentrations ranged from 0.66-9.90 mg/l over the study period with a mean value of 2.00 mg/l. CPOM (course part. organic matter) values showed major fluctuations over the seasons, with the timing of some major inputs differing from streams with woody riparian vegetation. One major pulse occurred in the early summer and was composed predominantly of seed and other related material shed by the riparian grasses.

96. Analysis of the IDOT Environmental Impact Statement for the 30th Street woods, Linn County, Iowa

J. C. NEKOLA

Coe College, Cedar Rapids, IA 52402

The Environmental Impact statement prepared by the Iowa Department of Transportation for the Marion Bypass project (#F 151-3) mentions no organism, plant or animal, by name, even though the proposed roadway passes by the 30th Street woods, an area which has been known to harbor protected lifeforms for over 30 years. A new study of the area's flora was conducted in the summer of 1984. 344 plant species were observed in 7 plant communities within the study area, including 11 species which are considered threatened or endangered by the Iowa Natural Areas Inventory. One of these species, Carex conoidea, exists here at its only extant Iowa site. In addition, 49 plant species considered rare within the Iowan Area were located. Also of interest was the discovery of a sandy woodland community within the 30th Street woods. Comparisons will be drawn between this site and the previously documented sandy woodland area at the Indian Creek Nature Center in Linn County. The community seems to further indicate the importance of the sandy woodland community as a vital habitat for endangered Iowa species.

ENGINEERING

97. Desulfurization and deashing of Midwestern coal.

C.-W. FAN, R. MARKUSZEWSKI, AND T. D. WHEELOCK

Iowa State University, 231 Sweeney Hall, Ames, Iowa 50011.

The removal of sulfur and ash-forming mineral matter from Iowa and Illinois coals has been achieved by leaching the finely ground coals with hot alkaline solutions. When leaching is conducted at 250°C with 1 M sodium carbonate, silica is dissolved and clays are converted to hydrous sodium aluminum silicates. Also part of the iron pyrite is converted to hematite and soluble sulfur species. Subsequent extraction with a hot mineral acid removes the hydrous sodium aluminum silicates and hematite. The conversion of iron pyrite to hematite is facilitated by dissolving oxygen under pressure in the alkaline solution. By employing a combination of physical and chemical cleaning steps, very low ash and sulfur contents can be achieved.

98. Effect of Vanadium on Internal Friction Properties of Oxygen in Niobium

H. INDRAWIRAWAN AND O. N. CARLSON

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

In BCC metals, interstitial solutes exhibit the well known Snoek relaxation process. The addition of a substitutional solute to these metals results in changing the characteristic of Snoek relaxation due to the interactions between the two types of solute. The effect of vanadium on the oxygen Snoek peak in niobium was determined as a function of vanadium concentration. The addition of up to 10 at.% vanadium shifts the oxygen peak temperature upward about 80 K. The activation energy for relaxation of oxygen also increases significantly with increasing vanadium concentration. This indicates that there is a strong interaction between vanadium and oxygen in the niobium matrix. A discussion of the nature of the interaction will be included.

99. CHEMICAL COAL CLEANING USING MOLTEN NaOH-KOH MIXTURES

D. R. MROCH, R. Markuszewski, and P. Chiotti

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

Several coal cleaning methods are being investigated at Ames Laboratory as a way to produce a low-sulfur, low-ash coal which meets Federal emission standards. The overall objectives of our own DOE-sponsored work at Ames Laboratory are to propose, test and develop methods for regenerating the spent caustic and other reagents used in the TRW Gravimelt Process in order to make this chemical cleaning method economical. As a preliminary step to our investigations, procedures similar to the Gravimelt Process were used to produce samples of cleaned coal and spent caustic. Several bituminous coals have been treated with molten mixture of NaOH plus KOH at 350-370°C in a 1:10 coal/caustic ratio for 1 hour and then washed with water, dilute acid, and finally with water again. By this procedure, 80-90% of the ash and 70-80% of the total sulfur have been removed with a recovery of 80-90% of the coal on a moisture and ash-free basis.

100. Fast Diffusion of Co in Th

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Ames, Iowa 50011

In previous work the activation energy for diffusion of Co in Th was found to be considerably less than the activation energy of relaxation, as determined from internal friction experiments. This was inconsistent with that found for the similar solutes, Fe and Ni, where the two activation energies were nearly equal. It was suspected that the Co diffusion data were in error, therefore this study was undertaken to determine that data more precisely. The value obtained for the activation energy for diffusion from this study was 83.7 ± 6 KJ/mol which is in excellent agreement with the reported value of 83.7 ± 6 KJ/mol for the activation energy of relaxation. The importance of this result in the identification of the diffusion mechanism is discussed. In addition, the initial results of a transmission electron microscopy investigation of a Th-0.4 at.% Co alloy quenched from 1150°C are presented. These results indicate the presence of plate precipitates on {130} planes as well as a "tweed" microstructure identified as a pretransformation effect observed in other alloys. The possible association of fast diffusion with the observed microstructure is discussed.

101. Chlorination of coal fly ash-coke granules for metals recovery

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

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

Metals can be extracted from power plant fly ash by carbochlorination in which a mixture of the ash and carbon are reacted with chlorine at high temperature. The volatile metal chlorides formed are condensed and separated to yield the purified products.

The finely divided fly ash/carbon mixtures could be processed more effectively in the form of small granules. The use of fluidized bed reactors or readily permeable fixed bed reactors would then be possible.

This work has dealt with the use of a rotary pan agglomerator to prepare granules with sufficient strength, porosity and homogeneity for use in the carbochlorination process, and with the chlorination of these granules at 850°C. The major variables considered have been chlorination time, carbon content and the sodium and potassium present in the granules.

102. A status report on nuclear power

B. I. SPINRAD and R. A. DANOFSKY

Department of Nuclear Engineering, Iowa State University, 261 Sweeney Hall, Ames, Iowa 50011

Nuclear power produces over 20% of Europe's electricity (50% in France), over 15% in the U.S., and is growing rapidly elsewhere as well. In ten years over 20% of U.S. electricity is scheduled to be nuclear. Further growth depends on controlling construction costs. Improved designs based on system simplification and reduced field construction could permit this. New design directions also include: offering plants composed of modules of modest capacity (100-400 MWe); increasing fuel burnup to reduce shutdown time for refueling and decrease the amount of spent fuel; and lowering power density to reduce stresses on primary components. High temperature helium cooled reactors and fast breeder reactors continue to receive attention.

Nuclear power avoids significant air and water pollution and has relatively cheap fuel. Recent results indicate it is also much safer than has been believed; even in large accidents most of the radioactivity is retained in the plant and consequences to the public are commensurately reduced.

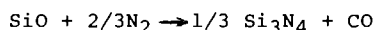
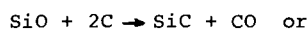
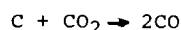
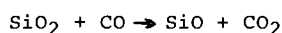
103. The carbothermal reduction of silica to silicon nitride

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

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Physical properties inherent to certain ceramics make them attractive materials in a wide range of engineering applications. Silicon nitride is one of a group of high-tech ceramics that may find its greatest use in the automotive industry.

The carbothermal reduction of silica followed by nitridation is a viable procedure for the production of high purity silicon nitride. The reaction mechanism for this process is thought to be:



Practical applications for silicon nitride powder along with an examination of the proposed reaction mechanism will be discussed.

104. Lower enrichment fuel for the ISU reactor

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Iowa State University operates a small nuclear reactor for research and to train students in nuclear engineering. The reactor typically runs an hour a day at a few hundred watts of thermal power, but is licensed to run continuously at 10 kW. It is managed by the Nuclear Engineering Department. It is fueled with about 3 kg of highly enriched U-235, supplied by the USDOE. It has recently been publicized that the reactor will have to be converted to run with lower enriched fuel.

This paper discusses the background and status of the conversion requirement. At the time this abstract was prepared, the U.S. Nuclear Regulatory Commission had issued a proposed rule for public comment, but no final rule had been issued. The need for conversion is still being debated, since the purpose of the rule -- preventing theft of weapons-usable nuclear material -- can be achieved at less cost and trouble by appropriate security measures. If conversion is mandated, USDOE has also agreed to supply replacement fuel that would permit the reactor to run without significant modification.

105. Pore water pressures in the Borehole Shear Test

JOHN HOLM and R. L. HANDY

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The Borehole Shear Test (BST) is a soil direct-shear test conducted in-situ in the sides of a borehole. The test is unique in that it provides shear strength data that are discretionary for soil friction angle () and cohesion (c). The recent addition of a pore-water pressure transducer enables evaluation of influences from transitory drainage states during the test. These data confirm that the soil is consolidating during the initial compression stage of the test, and also following relaxation of the shearing stress. A time effect was noted and may relate to soil permeability.

106. Quality science and engineering practices in Japanese industry

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Certain of the quality science and engineering strategies advocated by renowned Japanese authority Genichi Taguchi will be briefly summarized. A few simplified numerical examples will be used to illustrate the contrast between Japanese and U.S. approaches to improving quality, productivity and competitive position in the manufacturing industries.

107. Importance of free radicals and organics in cloud chemistry

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The role that cloud chemistry plays in the overall tropospheric chemistry is currently uncertain. However, the results of current laboratory, field, and model studies indicate that in-cloud chemistry is important and can lead to the acidification of cloud water. Furthermore, the cloud chemistry can influence the gas phase chemistry by preferentially removing soluble species from the gas phase and by injecting in-cloud produced species during cloud evaporation.

The gas phase removal and liquid phase chemistry processes are treated simultaneously, and the predicted species profiles are presented and discussed. Special attention is paid to the role of RO₂ in the production of ROOH in solution, the role of ROOH in in-cloud sulfate production, the effect of aldehydes on in-cloud OH concentrations, and the importance of in-generated organic acids.

108. An investigation of the formation of ambient NH_4NO_3 aerosol

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Aerosol nitrates are important contributors to not only human health but also visibility reduction in cities with photochemical air pollution problems. For example, White and Roberts estimate that during the ACHEX study, aerosol nitrates were responsible for about 40% of the light scattering observed at Riverside in the eastern Los Angeles basin. Groblicki et al. report that 17% of the visibility problem in Denver is attributable to aerosol nitrates. Control strategies for urban visibility improvement in such cities will need to address aerosol nitrate abatement alternatives.

In this study a detailed transport/chemistry model is utilized to investigate the behavior of nitrogen compounds, especially nitrate formation and to evaluate the aerosol equilibrium assumption. Model results are evaluated against NH_3 , HNO_3 , NH_4^+ , and NO_3^- concentrations measured at Nagano Prefecture, Japan on 29 and 30 July, 1983. These results indicate that the aerosol equilibrium assumption is useful in analyzing field data.

109. Morphological analysis review

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The paper presents recent developments in the theory, instrumentation and applications of morphological analysis of particulate materials. Topics include: size analysis, texture analysis and analysis of selected microstructural

110. Particle Size and Shape Analysis in Abrasive Wear

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A procedure for particle size and shape analysis is reviewed. Abrasive wear data of carbon steel abraded by silica particles are examined in relation to the test conditions and the abrasive particle size and shape. It is shown that highly angular particles produce from four to seven times the weight removal in a dry sand abrasion tester, as compared to relatively smooth round particles of the same size. An empirical relationship of wear rate versus metallurgical parameters and abrasive particle characteristics is presented.

111. Iowa Lovilia Coal and its Gasification Reactivity Towards Steam

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A fundamental investigation into the steam gasification for one type of Iowa coal was examined. The coal was collected from the Lovilia No. 4 deep mine in Monroe County, Iowa. Two samples were gasified: a raw sample and a sample which had been oxydesulfurized in an alkaline (Na_2CO_3) solution. Reaction temperatures ranged from 500 to 1050° C at 1 atm. The specific method of treating the coal markedly affected gasification and produced a major increase in the reactivity of the oxydesulfurized coal towards steam. The apparent activation energy increased from 8.21 to 11.96 kcal/mole. The statistical frequency factor increased from 0.0857 to 1.608 min^{-1} . Combined energy dispersive x-ray analysis (EDAX) and scanning electron microscopy (SEM) allowed coal characterization; elemental sodium mapping and its relation to the coal matrix. Porosimetry was used to describe porous structure. The Iowa coal was significantly different in both the character of the raw sample and the desulfurized sample, contributing towards higher gasification rates with oxydesulfurized Lovilia coal.

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112. On the Interaction of Ultrasound with Cracks

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Partial contact of two rough fatigue crack surfaces leads to transmission and diffraction of an acoustic signal at those contacts. This paper deals with recent experimental and theoretical efforts to understand and quantify such contact in greater detail. The final objective is two-fold: 1. To develop an understanding of the closure phenomenon and its application to the interpretation of fatigue data, in particular the R-ratio, spike overload/underload and threshold effects on crack propagation. 2. To obtain an understanding of the effects of closure on the detection probability of fatigue cracks, which reflects strongly on the capability for accurate life prediction. In the present paper only the first objective will be discussed.

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

113. Computer aided design of prestressed concrete members.

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The design of prestressed concrete members usually requires several iterations in order to satisfy strength and serviceability requirements presented by the design code. At each iteration the designer changes one or more parameters of the design and repeats a part or all of the procedure. The computer program presented in this paper allows designers to review the important design parameters in the form of computer generated graphs and charts. One quick glance at these figures tells the designer much more than long columns of numbers.

The program has commands for plotting shear and bending moment diagrams for simple beams, tendon profiles, limiting zone and stresses. Any task can be performed for various load cases and for various cross sections. The program is menu driven. It is protected against wrong input and has friendly and easy to understand messages. With slight modifications, the program can also be used for the analysis of reinforced concrete beams, both simple and continuous

114. Computer graphics in stress analysis using Mohr's Circle.

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The Mohr's Circle analysis provides a very effective means of determining the maximum and minimum shear stresses, the maximum and minimum normal stresses and the angle of tilt of the principal stresses in mechanical elements. It is also important to relate these stresses to the strength of the material being used. The maximum shear stress theory is commonly used for this purpose.

The paper describes a computer program that integrates the Mohr's Circle analysis and the maximum shear stress theory into a computer aided stress analysis package. In the program the Mohr's Circle diagram is graphically displayed for the given stress case. The principal stresses are found and displayed on the stress element tilted to the principal axis. The maximum shear stress theory plot is then displayed and a point is plotted corresponding to the given loading case. A point outside the maximum shear stress theory plot would predict failure, while a point within the plot is predicted to be safe. The program is an effective learning tool as well as a good design aid.

115. Computer aided surface generation using B-splines

K.E. JOHNSON

Computer graphics can be used as a powerful tool to model and display three-dimensional surfaces and objects. One method of displaying an object or surface is to connect points on a given surface, thus producing a wireframe model of the surface.

Since the x, y, and z coordinates of these points often can not be represented by a function of these three variables, parametric cubic equations for each x, y, and z coordinate in space are used to produce points on a smooth surface.

By specifying control points that define a surface, smooth curves can be obtained by a procedure known as the B-spline method. This method, which results in the calculation of points on surface patches, is employed in an interactive computer graphics program.

The user is able to define objects and surfaces by several means, which include locating points directly on a terminal screen, selecting a primitive object, or entering data from a file. The program allows the user to select options from its menus, such as changing the viewing direction of the object.

116. AGRAPH: a versatile graphics program for science and engineering data.

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This paper describes AGRAPH, a versatile graphing program written by the author that inputs user generated data, performs all necessary scaling and orientation, and presents the completed "drawing" on any of a variety of display devices. These include units that utilize a Tektronix 4010 emulation, a GiGi/Regis emulation, certain bit-image dot matrix printers and, with a suitable modem program, home computer screens. AGRAPH can produce ordinary $y(x)$ vs x plots, contour/stream-line maps, 3D hidden line drawings, drawings of 3D wire figures, and volume density 3D figures. With AGRAPH, the user's problem is "what to plot", not "how to plot."

GEOLOGY

117. Hunter's Cave and other Tertiary caves in former artesian aquifers in Iowa

J. HEDGES

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Several relatively large caves with distinctive ground plans and internal sediments occur in massive Hopkinton dolomite in Jackson, Jones, and Delaware counties, Iowa. These caves occur beneath ridgetops far from modern streams. Their passages form 3-dimensional mazes, their floors are not graded, and they contain no erosional or depositional evidence of flowing water.

Their soils are reddish, indicating temperatures warmer than the region has experienced since the close of the Miocene. A sedimentary section in Hunters Cave includes, above the reddish soil, two gray/brown laminated silts with an interbedded travertine, suggesting ponded water during the Nebraskan and Kansan glaciations, with an air-filled interval during the Aftonian. Worden's Cave ends at a sinkhole deposit which contains no glacial erratics, suggesting that it was emplaced before the Pleistocene.

Hunters and similar caves in east-central Iowa probably were developed by artesian waters within especially soluble zones during the Dodgeville cycle of erosion, when their localities still were covered by impermeable Pennsylvanian sediments.

118. Mine map restoration project

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Coal mining in Iowa grew from the 1840's until 1917 when it began to decline. Abandoned mines have created subsidence problems threatening both life and property. To address these problems, the Iowa Geological Survey along with the Department of Soil Conservation sought to gather, restore and preserve documentation on Iowa mining and geology. Toward these ends, the Conservation Lab of the Iowa State Historical Department has begun restoring 1,000 coal mine maps which currently reside, at IGS' Oakdale facility. These blueprints and original maps represent a primary source of information concerning early Iowa coal mines. Sizes range from 10"x20" - 48"x108". Problems include brittleness, dirt, adhesives, acidity and damage due to careless handling. Each map is examined, inventoried, dry-cleaned and tested for ink solubility. After washing, tape is removed and maps are mended with long-fibered Japanese tissue. Fragile maps are backed using an "English" lining technique. After final humidification

and pressing, the maps are encapsulated in polyester. Further preservation will be provided at IGS Oakdale in the form of flat storage in a controlled environment. These efforts will combine to provide long-lasting work copies of vitally important maps.

LINGUISTICS

119. Grammaticality and meaningfulness

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The consensus position regarding grammaticality and meaningfulness is that they are distinct notions; it is commonly believed both that ungrammatical strings can be meaningful and that grammatical ones can be meaningless. I shall argue that this view is mistaken in at least the first respect, and perhaps both. I shall discuss the significance of this issue for the theory of natural language processing insofar as cognitive modelling of the understanding process is concerned. In particular, I shall show that the meaninglessness of ungrammatical sentences spells doom for an asyntactic model of understanding.

120. Reason, expression, and the common equation

R. E. BYERS

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This paper argues that mathematics has important linguistic character which is at the heart of explanation in mathematical physics and attempts to develop strategies to enable the beginning student to read these expressions as they are encountered in their texts. By comparing the characteristics of mathematical expressions with those of natural language it is seen that paraphrasing may be a possible bridge in comprehension. Four categories of expression types are developed to aid in translation and use is made of the ontology and causal presuppositions behind expressions to provide meaningful translations. The primary focus is on a nontrivial translation of the equal sign.

121. The grammatical structures for place and motion in English and Russian compared.

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While the complex, but archaic, English system for distributing location and directed motion:

wh-ere	wh-ither	wh-ence
h-ere	h-ither	h-ence
th-ere	th-ither	th-ence

is similar,
but of different construction from the series which
is valid for modern Russian:

g-de	ku-da	ot-ku-da
z-de-s'	sju-da	ot-sju-da
tam	tu-da	ot-tu-da

English has reduced its ^{modern} system to a triple one:
where here there.

Russian has maintained its complex system by force of analogy with case usage, while English seems to be trying to reestablish needed distinctions it lost earlier, through innovations such as "where to", "where from", and "where at", by force of analogy with non-place-motion standards as "whereupon", and "there-for". Russian stands firm, while English rebuilds. And that's where it's at in English.

122. Sign Language Facilitates Reading with Moderately Mentally-Handicapped Students

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Sign language to facilitate reading in mentally/ language-handicapped individuals was studied. Fifteen students were taught to read in two counterbalanced groups (Sign and Nonsign). Results revealed that signing significantly increased reading; however, post-testing indicated the gain was not maintained. Results also demonstrated that mentally/language-handicapped individuals recognize signs with less difficulty than writing.

123. Emphasis and vowel rounding in Lebanese loanwords

G. F. HADDAD

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IA 50011

In Haddad (1984) I present various pieces of evidence to show that the underlying inventory of Lebanese vowels contains five vowels (a, aa, i, ii, uu) rather than the traditionally accepted six vowels (+u) of Classical Arabic. I specifically show that all instances of short u can be derived from an underlying /i/ by means of two rules: the first

takes place if /i/ exists in a non-word initial emphatic domain, and the second takes place if /i/ exists in the context CiCC_C.

In my presentation, I will attempt to show that this type of distribution also governs the process of loanword nativization. Data from various languages, ancient and modern, will be presented to support this analysis.

124. Adjective as a polemical weapon

MICHEL THELIA

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The power of the adjective, and its placement vis-à-vis the noun, to aid the polemicist in passing off value judgments, opinions, and prejudices as facts. Also discusses impact of nominalization of verbs in creating an impression of "universal truth" for untested opinions and sentiments. Proposes a statistical analysis of the frequency of preposed adjectives in polemic versus non-polemic texts (possibly of the same author), with the object of ultimately serving as an identifying mark of polemic.

125. TV weather report: discourse and text

B. G. CAMPBELL

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The national weather map segment of an evening TV weather report is selected as a text for analysis. Foregrounded aspects of textual cohesion are noted: orientation and linkage devices and topicalization devices. Text addresses the actual, physical level of message transmission; discourse focuses upon the interpersonal, interactional level. Especially prevalent in TV weather reporting are deictic markers, which anchor the discourse situationally and contextually. These elements are relevant in examining the TV weather report as discourse and text.

126. Tense in French Newspaper Narratives

C. O. THOGMARTIN

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Based on a corpus of 40 recent French newspaper stories containing 1733 tensed verbs in 16 different tenses and tense paraphrases, this study uses statistical and textual analysis to show how journalists exploit the tense resources of French to organize complex sequences of events in written narrative.

Nursing

127. Age differences in the blood-brain barrier (BBB):
Implications for gerontological nursing.

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Age differences in BBB morphology were investigated in 4-, 10-, and 20-year-old Macaque monkeys and in 1-, 14-, 35-, 180-, and 800-day-old Sprague-Dawley rats. This study revealed the following alterations with increasing age: a significant decrease in cerebral capillary wall thickness in frontal cortex in monkeys but not in rats; a significant increase in thickness in basal lamina of cerebral capillaries in rats but not in monkeys, however there was a marked increase in this parameter in the monkey between 4 and 10 years of age; a significant decline in cerebral capillary endothelial mitochondrial content in monkeys whereas a significant decline in this parameter in rats was found only when the peak content at 35 days was contrasted with that at 800 days of age; and, aberrant tight junction and thickened basal lamina in one of five 20-year-old monkeys. These findings suggest impairment of the BBB with increasing age in both the rat and the monkey. Similar changes have recently been noted in aged humans (Cervos-Navarro, *Aging* 23:231-258, 1985). Implications of these findings for gerontological nursing will be discussed.

128. A study of skin dryness and sebum secretion
in the elderly

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The purpose of the study was to determine whether sebum secretion and other external variables were associated with the occurrence of dry skin in the elderly. The sample consisted of 76 white elderly ranging in age from 65 to 97 years. Dry skin was measured through verbal report and observation. Sebum was collected on Dacron mesh disks and measured by quantitative thin layer chromatography. Other variables pertinent to the occurrence of dry skin were measured through structured interview. Dry skin was found in 59% of the subjects. Mean sebum secretion rate was .534 mg./10 sq. cm./3 hr. While sebum secretion rate was significantly lower in females than in males ($p < .001$), sebum levels did not differ significantly as a function of dry skin for either sex. A significant association was found between severity of skin dryness and age ($p < .02$) with more severe dryness occurring with greater frequency in older subjects. This refutes the previously untested belief that the decreased sebaceous gland activity that accompanies aging is responsible for skin dryness in the elderly.

129. Utilization of health care practitioners among
four ethnic groups of European descent.

T. TRIPP-REIMER

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This paper reports Phase III of a larger investigation of Iowa ethnic groups of European descent: Norwegian, Old Order Amish, Czech and Greek. Data were collected during semi-structured interviews with 160 individuals (40/community). While the majority of all groups ($> 95\%$) used services of physicians, the groups differed significantly in utilization of other practitioners including: chiropractors, public health nurses, osteopaths, psychologists, and folk healers. This pattern was most evident when preferred practitioners were elicited for seven illness conditions. Implications of these findings for social scientists and health care providers are discussed.

130. Attitudes toward self and the aged among
three age groups

M.E. MARTIN

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This paper describes a study which explored the relationship of a number of variables to attitude toward self and attitude toward the aged among three discrete age groups: young adults, middle-aged, and 'almost old.'

The findings point to several inter-related components which appear to be significant in relation to attitudes toward the aged. First, attitude toward self correlated significantly with attitude toward the aged. Second, frequent interaction with elderly persons related to more positive attitudes toward the aged. Third, socially and physically active subjects had more positive attitudes toward the aged than did less active subjects.

131. A study of retired persons' life satisfaction
and perceptions of retirement as related to prior
work experience, health status, and certain demo-
graphic characteristics

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Subjects were 90 retired persons age 65 and older in two Iowa counties whose prior occupations had largely been professional or administrative. Statistical analysis of the interviews included: frequency distributions, t-tests, analysis of variance, and chi-square tests.

A majority of the subjects viewed their last pre-retirement job positively; two statistically significant demographic variables suggest that greater job satisfaction is associated with living in towns having a population of 2,500 or more and having a clerical-unskilled occupation. One measure of life satisfaction revealed two statistically significant differences suggesting greater life satisfaction is associated with living in towns of 2,500 population or greater at the time of retirement and with being married. Any implications derived from this study are made recognizing the special nature of the sample.

132. The learning needs of nursing home nurses in eastern Iowa.

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"Safe practice" depends upon using up-to-date knowledge. Few nursing home nurses have had academic preparation for practice; therefore, a needs assessment was conducted in six Iowa counties in the fall of 1983. In addition to the identification of general learning needs, specific emphasis was placed on four common health problems of the elderly. Data analysis revealed that these nurses had similar learning needs which were identified from problems occurring frequently in the practice setting. Respondents were divided into two groups on the basis of study or nonstudy of the specified health problems. Nurses who had studied a topic rated their learning need greater than nurses who did not study a topic. Nurses who studied a topic also obtained a higher score on a test of knowledge. The implications of the study findings are also discussed.

PHYSICS

133. Measuring glass density using the sink-float method

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The "sink-float" method of measuring glass density will be discussed. This method is able to make use of extremely small (~0.05 grams) samples and is accurate to $\pm 2\%$. The method has been applied to glasses in the lithium and sodium borate families and the resulting data will be presented.

134. Random and systematic shift in Iowa precipitation

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Each year in which a portion of the state experiences an atypical precipitation pattern, it is suggested we are undergoing a climatic shift. With only slightly more than 100 years of climatic records at a limited number of sites, it is questionable whether anything short of a major climatic excursion could be identified. Ninety-five years of precipitation and temperature records from four Iowa sites - Cedar Rapids, Des Moines, Dubuque, and Storm Lake - were analyzed in an attempt to identify any coherent parameter shift. If any discernible climatic shift were present during this period, it should be identified as a coherent departure from the parameters long-term mean. The major results of the study show a complex situation with limited coupling between adjacent sites. Neither phase nor sense of either parameter remained coherent through an appreciable fraction of the period. As might be expected, the results suggest the inherent noisiness of the climatic system masks any discernible change. In general, the fluctuations exceed any possible systematic pattern shift.

135. Plasma loss in a magnetic spindle cusp

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The desirability of producing high-density plasmas for nuclear fusion has led to renewed interest in confinement schemes using magnetic cusps. However, many of the properties of cusp-confined plasmas, including the loss aperture, are not satisfactorily understood. We have constructed a steady-state spindle cusp argon discharge device in which an argon plasma is produced by energetic electrons from a hot filament. Measurements of the loss aperture as the magnetic field and argon pressure are varied suggest that the size of the aperture is controlled by collisions between plasma electrons and neutral atoms.

136. Imaging properties of holograms

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We describe an elementary but quantitative method for predicting the imaging properties of thin transmission holograms. The essential simplification compared to more complete imaging theories comes from emphasizing the directions of the two images and de-emphasizing their distances from the hologram. The directions of the images can be easily calculated for a general direction of the incident readout beam. To achieve this only the spatial frequency at one point on the hologram needs to be given. This is readily calculated from the geometry of the set-up used to form the hologram. Using this method a complete description of the movement of the two images formed by the hologram as a result of rotating the hologram about an axis perpendicular to the plane of the table is obtained. (Equivalently the effect of rotating the readout beam can be predicted.) The method has proved very useful in an introductory optics course for physics students.

137. The facilities and observing programs of the Grant O. Gale Observatory

R. R. Cadmus, Jr.

Grinnell College's Grant O. Gale Observatory began operations late in 1983. The facility was designed for a wide range of uses including undergraduate education, public observing, and faculty research. The primary instrument is a 24-inch computer-controlled Cassegrain reflector. The control system handles the pointing of the telescope as well as a number of other tasks. Auxiliary instrumentation includes a UBV photometer, a spectrograph, and an intensified CCD TV system, all of which are interfaced to the data acquisition computer.

A variety of student projects are in progress. The primary faculty research program involves a photometric and spectroscopic study of a group of peculiar semi-regular variable stars. Observations of occultations of stars by the moon and asteroids are also made occasionally.

138. On computer-aided symbolic analysis

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Applications of large-scale digital computation to numerical analysis are now well-known. It is rather less well-known that it is also possible to apply digital machine computation to problems involving difficult algebraic and analytical manipulations which would be manually intractable. In this paper, we apply a symbolic computing language (FORMAC with PL/1) to the solution of 1) a problem in 2-dimensional potential theory, and 2) explicit calculation of the Picard sequence for a non-linear ordinary differential equation.

PHYSIOLOGY

139. Use of an equivalent black-body temperature to estimate the resistance to heat loss in a small homeotherm

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The mathematical model developed by Robinson et al., 1976, treats heat flux from an animal as a diffusion process and segregates dry from evaporative heat fluxes. This allows an analysis of an animal's active control of heat exchange as opposed to heat flux at an obligatory rate. White-crowned sparrows were used to examine the mathematical relationships in the model of ambient temperature, body temperature, metabolic rate (determined from O₂ consumption), evaporative water loss (determined with a dewpoint hygrometer), and resistances to heat loss via radiation, convection, and conduction. The data show a curvilinear change in body resistance (tissue + plumage) to dry heat loss that peaks just below the thermoneutral zone; this indicates the effect of vasomotor control and ptiloerection. The resistance to evaporative heat loss shows a steady increase as ambient temperatures decline; this indicates a change in respiratory evaporation.

140. A computer simulation of human heat loss in heat, cold, and wind.

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Advances in technology have made possible the widespread use of the microcomputer as an educational tool. The power of this medium is its motivational qualities, safety, and time efficiency. In addition, using computer simulations to teach scientific concepts has been shown to be an effective aid to learning. The present paper describes a computer simulation concerned with the concept of temperature regulation in mammals. Two somewhat neglected components are included: 1) the contribution of wind chill to heat loss in cold weather, and 2) a new calculation in tabular form to include the more complicated effect of breeze or wind on heat loss during hot weather. This new material has been condensed to form the Driscoll Breeze-Factor Chart. Also to be included is a discussion of what is currently believed to be the best use of the microcomputer as an educational tool.

(Supported in part by the Iowa Environmental Physiology Fund).

141. Hyperhidrosis: A Case Study

M.J. Kenney, P.T. Wall, M.D. Owen, K.C. Kregel and C.V. Gisolfi

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This study was designed to characterize the sweating response of a hyperhidrotic patient. Forearm (FSR) and palm (PSR) sweat rates, rectal (Tre) and mean skin temperatures, and heart rate were monitored in response to neutral and cold ambient temperatures, emotional stimuli, and to cycle ergometer exercise. To elicit graded emotional responses, the subject listened to music, wrote responses to questionnaires and word puzzles, and viewed a nasoesophageal intubation under the pretense that he would perform the same procedure. Following instrumentation and during the intubation demonstration, FSR's were 0.69 and 0.64 $\text{mg}\cdot\text{cm}^{-2}\cdot\text{min}^{-1}$, respectively. Corresponding Tre's were 37.1 and 36.9°C. Following 12 min of cooling, FSR declined to 0.20 $\text{mg}\cdot\text{cm}^{-2}\cdot\text{min}^{-1}$ while Tre was maintained at 36.9°C. During the 15 min bout of graded exercise, FSR increased to a peak value of 0.60 $\text{mg}\cdot\text{cm}^{-2}\cdot\text{min}^{-1}$ while Tre was maintained at 36.8°C. FSR was elevated throughout the experiment despite Tre's below threshold for evoking sweating in an untrained, unacclimated individual. The emotional interventions failed to increase PSR, which is atypical for a hyperhidrotic condition.

142. Is increased bone material strength S during growth due only to increased calcium content C?

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University of Iowa, Iowa City, IA 52242 (1), Coe College, Cedar Rapids, IA 52402 (2), and Winthrop College, Rock Hills, SC 29733 (3)

The answer is "No" for bending tests upon femurs from 53 male, Sprague-Dawley rats for age t (days) of from 28 to 92. Simple regressions show S (10^8 dyne/cm²) increased as functions of either C (% by mass of fresh material) or t and C as a function of t:

$\log S = -1.59 \pm 0.02 (\text{SEE}) + 1.8 - 0.3 (\text{SE}) \log C$,

$\log S = 1.31 \pm 0.01 - 19 \pm 1/t$, and

$\log C = 1.45 \pm 0.01 - 6 \pm 1/t$.

Multiple regression, however, shows significant dependence of S upon age alone:

$\log S = 1.34 \pm 0.01 + 0.67 \pm 0.09 \log C - 5.6 \pm 2.1/t$.

Moreover, when development occurs in simulated increases of gravitational intensity, growth of S is enhanced even when growth of C may be unchanged or slightly discouraged. Although part of greater S of older material appears related to C, there must be significant involvement of other factors related to better support from existing calcium.

143. The effect of intragastric prostaglandin E₂ derivative administration on gastrointestinal growth

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The intragastric administration of certain prostaglandins has been reported to increase gastrointestinal growth. This report examines the effect of two new prostaglandin derivatives on gastrointestinal growth and blood flow to the G.I. tract in male Sprague-Dawley rats. Oral doses of 5 mg/kg were administered to groups of 10 rats for 14 consecutive days. Growth was indicated by 1) increased wet weight of the tissue, 2) increased mucosal thickness of the stomach and colon; increased villus height and crypt depth in the small intestine, 3) increased surface area of the stomach; increased length of the intestines, 4) increased DNA content. Organ blood flows were determined by injection of microspheres labelled with ⁴⁶Sc. The two derivatives, designated A and B, had different effects on growth and blood flow. For all assessed parameters of growth, prostaglandin B was a more potent trophic agent than A. The mechanism for growth stimulation appeared to be direct. Prostaglandin A appeared to be a powerful vasoconstrictor while B had no significant effect on blood flow.

144. Erythrocyte changes, serum iron concentration and performance following iron injection in neonatal beef calves

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The injection of iron-dextran into beef calves at an early age immediately increased values for erythrocyte (RBC) numbers, hemoglobin (Hb) concentration, packed cell volume (PCV), mean corpuscular hemoglobin (MCH), and mean corpuscular volume (MCV) even though the calves were not anemic. There were no significant differences in average daily gain (ADG) from birth through 15 weeks between those that were injected and those that were not injected. Hereford calves had lesser values for PCV, Hb, MCH, and MCV than Angus and crossbred calves, and both Hereford and Angus calves had lesser body weight than crossbred calves. Serum iron (Fe) concentrations were greater in calves born in the spring and pastured in the summer than in calves born in late summer and fall and pastured in the fall.

145. Survival of Irradiated Plateau Phase CHO Cells

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Do cells in various stages of the cell cycle respond differently to radiation? Does such radiation exposure stimulate cells to re-enter the cycle? Chinese Hamster Ovary cells in plateau-phase (no net increase in number) were populated for dose-rate, split-dose, and delayed-plating radiation response studies. Because plateau-phase cells do not progress through the replicative cycle, their radiation sensitivity is relatively constant and allowed for better comprehensiveness in data analysis than if exponentially growing cells were used. A given population of plateau-phase CHO cells then was irradiated with X-rays and was separated aseptically by an elutriating rotor. The subpopulations collected were fractions of specific cell diameter, which correspond to cycle stage. Such diameter size was pre-determined by the Beckman Company's Rotor Speed and Flow Rate Nomogram and was confirmed throughout the experiments by the Multichannel Analyzer. These individual fractions were then assayed for survival (return to a less damaged state). To date, results show the subpopulations to have a greater resistance to radiation than the full samples or unsorted populations.

PSYCHOLOGY

146. Earliest visual processing in left and right hemispheres.

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A duration judgment paradigm (Avant & Lyman, 1975) was used to test earliest visual processing of upright, inverted, and vertically arrayed words and nonwords. Pre- and postmasked presentations prevented recognition of inputs to right and left hemispheres. Lexical status of the inputs (words vs. nonwords), dominant vs. nondominant eye presentation, and hemisphere of registration all influenced prerecognition processing of these inputs.

147. The influence of unattended word primes on lexical decisions

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In recent years, the priming task has been used extensively as a means to further explicate the structure and retrieval processes operating in semantic and episodic memory. Evidence suggests that factors such as allocation of attention, the duration of the interval between prime and target, and the associative relationship of the prime and target may influence the direction and the strength of the priming effect. This study looked at the differential priming effects between four types of prime/target conditions: superordinate/exemplar, exemplar/exemplar, noncategorical associates, and nonword primes. The time between prime and target was varied, and prime words were presented under conditions that prevented subjects from attending to the prime. The influence of these manipulations on subjects' word/nonword decisions for target stimuli will be discussed.

148. Prerecognition visual processing of road signs.

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Experiment 1 determined the exposure duration for chance-level presence/absence detection of pre- and postmasked presentations of traffic signs. Experiment 2 used a duration judgment paradigm (Avant & Lyman, 1975) to test for prerecognition processing of sign meaning with exposures briefer than the duration for presence/absence detection. Sign meaning was analyzed when sign presentations were at presence/absence detection duration as well as when presentations were one and two standard deviations below that duration.

149. Conscious and unconscious perception in bilingual subjects.

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Twelve bilingual subjects (German, French, and Spanish speaking) and six monolingual subjects (English speaking) were given a priming and masking task. The primes were randomly in English or in their native language, though the subjects expected only English or only native language primes. It was hypothesized that telling bilinguals that stimulus words would be presented in a specific language, would be sufficient to create the language set to process all incoming information as belonging to that set. Therefore subjects would exhibit a greater positive priming effect for words in the expected language, as compared to those in the unexpected language. The data did not support this hypothesis. All groups showed a greater positive priming effect when the prime words were in English, regardless of their expectations ($F(1,34)=7.2990$, $p=.01$). This suggests that unconscious, data-driven processes are 'set' by a more global contextual awareness.

150. Effects of target cueing and removal of the memory set on automatic responding in a memory search paradigm

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In Experiment 1, subjects were trained to respond automatically to either visual or auditory targets using a high-speed memory search paradigm. In Phase 2 of Experiment 2, a verbal cue indicating the spatial position of a possible target was given prior to each trial. Reaction time increased significantly under cueing conditions, while error rate was unaffected. In Phase 2 of Experiment 2, the memory set was removed on each trial. Automatic responding was not affected by this manipulation, suggesting that attention to the memory set was not necessary.

151. Additive effects of multiple targets in automatic visual search performance

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Subjects developed automatic detection under typical single-target test conditions with a test display mask onset asynchrony (test SOA) of 250ms. The highly practiced single-target condition was then compared to an all-target condition in which the same target stimulus appeared in all positions of the test display at 50, 30 and 20 ms test SOAs. The all-target condition aided performance. Results suggest conscious attentional resources are required in automatic search.

152. Interest in computer applications associated with college major.

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One hundred twenty undergraduates completed a questionnaire assessing their major, experience with computers, and general attitudes toward computers. They also rated their interest in 7 computer applications areas. An Analysis of Variance on total interest scores was significant, $F(4,107) = 2.58$, $p<.05$; a Duncan's Multiple Range Test indicated that Business majors expressed more interest than did Education or Humanities & Fine Arts majors ($p<.05$). However, an equivalent Analysis of Covariance controlling computer experience and attitudes failed to reach significance ($p=.05$), suggesting that these variables mediate the effect. Separate analyses of the areas revealed significant ($p<.05$) differences among majors in interest in spreadsheet and database management applications, but not in word processing, communications, graphics, project management, or appointment scheduling.

153. The effects of a closed economy depend on weight fluctuations.

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Pigeons were trained to key peck in an operant chamber and subsequently were exposed to a procedure in which food was contingent upon waiting (delay of gratification). In one condition, the pigeons ate only the food they obtained in the operant chamber (closed economy). In a second condition, the pigeons were given supplemental food (open economy). The closed economy produced more pecking and less waiting than the open economy, but only if the pigeon's weight was allowed to fluctuate. Holding weight constant eliminated the effect of economy type.

154. Tactics of humane research

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The recent controversy about the suffering of laboratory animals reveals that the public often fails to understand, and researchers often fail to articulate, the reasons for standard scientific practices, e.g., the use of the experimental method. This paper addresses animal research in psychology. It is suggested that students of psychology be challenged to defend scientific practices and find alternatives to animal suffering. Brief defenses of some scientific practices are given, and some suggestions are made concerning tactics to reduce animal suffering.

155. Transcendental Meditation, mindfulness and relaxation: Comparative effects on the elderly.

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This study assesses whether different mental techniques produce positive psychological and physiological effects independent of expectation and simple relaxation. Seventy-three residents of homes for elderly (60 females, 13 males; mean age 80.7 years) were randomly assigned among no-treatment and three treatments identical in external structure and expectation fostering features: Transcendental Meditation (TM), mindfulness training, or a relaxation program. Despite similarity among groups on pretest

measures and expectation, TM subjects improved in comparison to no-treatment and/or relaxation on three measures of cognitive flexibility, word fluency, systolic blood pressure and mental health; and on self-ratings of behavioral flexibility, aging and treatment efficacy. The mindfulness group improved on a self-report measure of internal locus of control, and like the TM group, on word fluency, blood pressure and mental health. After three years, survival rate (longevity) for TM was 100% in contrast to lower rates for other conditions. These predicted findings contradict simple relaxation or expectancy explanations.

156. Sex role specialization in college students' socialization for childrearing.

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Forty-three male and eighty-six female college students completed a questionnaire assessing various demographic characteristics, sex role orientation, and self-rated experience on a variety of childrearing activities previously judged to involve either playing or physical caregiving. A number of correlational analyses were performed, but the chief analysis was a 2 (Sex) x 2 (Domain: play vs. care) ANOVA with repeated measures on the second factor. There were significant ($p < .01$) effects for both factors and the interaction: while both sexes reported more experience at play than at care, the difference was greater among males. This finding lends support to the theory that males are socialized primarily for an instrumental (rather than an expressive) role in childrearing.

157. Longitudinal effects of the Maharishi Technology of the Unified Field on intelligence and field independence

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To assess the hypothesis that the Maharishi Technology of the Unified Field can increase intelligence and field independence, students practicing the technique at Maharishi International University were tested on measures of field independence and intelligence in their first and fourth years. Significant increases were found in intelligence ($p < .0001$) and field independence ($p < .005$).

SCIENCE TEACHING

158. Muffin tins and memory: A model

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Piagetian concepts of learning provide a rationale for the use of physical models in teaching computer science. A muffin tin is a good physical model to use for teaching some concepts: addressable computer memory, variable names, storage and retrieval of data, etc.

159. The effect of word processing/text editing on the quality of scientific abstracts of high ability h.s. students.

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The study was conducted to determine whether science abstracts that were composed with a word processor and/or text editor were superior to those composed without a computer. Specifically, do science abstracts written with the aid of a word processor and/or text editor rate higher in the areas of spelling and punctuation, sentence structure, organization and design, clarity, and overall quality than abstracts composed without a computer? The sample was composed of sixty-eight students who were participants in the 1984 SST Research Program at The University of Iowa. A Mann-Whitney Test was utilized to assess differences between groups of abstracts. This study demonstrated that abstracts composed with the aid of a computer rated higher than those composed without computer.

160. Components of science anxiety in secondary school science and non-science teachers.

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Science anxiety of secondary school teachers of both science and non-science subjects was assessed by administering a science anxiety inventory developed by R.

Alvaro of Loyola University to 76 secondary level instructors from Scott County, Iowa. Five multivariate factors summarizing the variation in this data set were obtained by principal component analysis. With respect to these factors, subjects significantly differed across subject areas taught and teacher's sex in their level of science anxiety. The components of science anxiety in the respondent group and general implications for secondary level instruction will be discussed.

161. Unbalanced concentration of power corrupts scientists' paradigm.

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Science education is in crisis because of the corruption resulting from the concentration of unbalanced power in the objective paradigm of research oriented graduate programs. Needed checks and balances are blocked by the paradigm: criticism being respected only if the critics operate within the paradigm. The paradigm was not designed to promote personal and communal integrity in healthy appreciative learning, so it does not. The paradigm diverts attention away from the personal responses of the victims of injustice in academic value-conflicts. Efforts to resolve the conflicts and crisis in science education will fail if they are directed by the paradigm which created them. For resolution we must seek the wisdom of non-paradigm people qualified to offer constructive insights into the limitations of scientists and their paradigm. There is no technical solution to the crisis in science education or the arms race. They are synergistically related and must be transcended together in non-technical ways. See: Hardin, The Tragedy of the Commons, SCIENCE, Vol. 162, pp 1243-1248, 13 Dec. 1968; and Crowe, The Tragedy of the Commons Revisited, SCIENCE, Vol. 166, pp 1103-1107, 28 Nov. 1969. PEACE!

162. Variety is the spice: Tips on maintaining student interest.

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A variety of approaches, activities, and aids can help maintain high student interest and achievement. Learning activity packets can provide flexibility within a known structure for both the student and instructor. Discrepant events can be used as a motivator as well as supporting objectives. The film projector, overhead, video, and computer can all be used to spark interest and yet provide teacher control. Daily or weekly classroom changes, student support teams, student recognition, and the "Columbo Charisma" provide additional support. Teacher time control is a key factor and demands attention.

163. Videotapes for classroom use in comparative vertebrate anatomy

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Videotapes demonstrating important concepts and structures of the shark circulatory system and the brains of representative vertebrates have been prepared at Drake University for classroom use in comparative vertebrate anatomy. These videotapes have been presented in a variety of ways. On some occasions the students have been given supportive materials such as diagrams, vocabulary lists, and actual specimens to accompany the viewing of the tapes. It has been found that the use of these videotapes has contributed to more rapid learning, markedly better performance on dissections, and higher test scores. The instructor's time is freed for more individual assistance to students because the need for repeated demonstrations is eliminated. Students' enjoyment of their laboratory work and their understanding of the concepts involved are noteworthy. Future plans include preparation of videotapes that would complement those already developed on the shark and, in addition, presentations on cat anatomy that would parallel existing tapes that are used in medical schools in teaching human anatomy.

164. The development, use, and success of an effective inservice model.

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An effective inservice model has been developed to use with OUTLOOK Environmental Education Enrichment materials. Like some science curricular projects of the 1960's and 1970's, OUTLOOK's approach to teaching is nontraditional. To ensure use and success and avoid the pitfalls encountered by curriculum reforms in the decades mentioned, it was felt that inservicing was an absolute necessity.

A two-phase model was conceived, consisting of a Philosophy and Approach Module (PA) and a Use and Infusion Module (UI). Each module became a course offered for five days, three hours per day, providing a one week workshop for two graduate credit hours. PA covered Piagetian theory on which the learning cycle teaching approach is based as well as Kohlbergian moral development and experience in writing learning cycles. UI covered familiarization with and use of learning cycle activities from OUTLOOK as well as infusion into teachers' curricula. Immediate as well as six month post-workshop evaluations showed very positive feedback on the value and effectiveness of this inservice approach.

165. Collection and analysis of data related to high school science preparation for Iowa State University pre-service students.

DOWNS, G. E.

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This study was done to collect baseline data related to the high school science and mathematics courses taken by the students who major in elementary education at Iowa State University. Over 450 different student records were used for the data base.

The data was analyzed for types and numbers of high school science and mathematics courses taken. Differences found between the four classes at ISU will be discussed. Conclusions and recommendations gained from the study will be shared.

ZOOLOGY

166. Normal antibodies in blood typing goat, sheep and cattle

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One hundred forty-three cattle normal sera were tested with goat erythrocytes for the presence of naturally occurring antibodies. Hemolytic reactions requiring rabbit complement were frequently observed, some to a titer of 1/64 with 10-30 goats as a source of test cells. Twenty four percent of the cattle sera failed to show any reaction with goat cells. The remaining reactive cattle sera were approximately equally divided into those reactive with all goats (36%) and those reactive with some but not all goats (40%). These 2 classes can be representative of species-specific reagents and of those showing individual differences, i.e., polymorphism, in goats. —Rabbit complement invariably had weak to strong naturally occurring antibodies against sheep and goat cells, and some against cattle cells. Therefore, it was necessary to absorb such complement at 0°C with sheep or goat cells. Sheep cells removed reaction for other sheep cells and for cattle cells, but not for goat cells. Goat cells removed reactions only for other goats and not for cattle nor sheep cells, although the titer for sheep cells was significantly reduced.—Normal sera of 10 other species often reacted with cattle and sheep cells, but not with goat cells. Two of 20 normal sera samples from pigeons showed individual differences with goat cells.

167. Amylase activities in *Drosophila pseudoobscura*: Genetic relationships and fitness consequences.

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We are studying catalytic activities of different forms of the amylase enzyme in crude extracts in nine strains of *Drosophila pseudoobscura*. Amylase hydrolyzes starch to maltose. There are two major alleles, Amy^{0.84}, and Amy^{1.00}, at the amylase locus in this species and thus three different genotypes.

We are interested in whether the genotypes differ in their amylase activities. If so we will determine the relationship between the activities of the heterozygote and the homozygotes, i.e. is the heterozygote activity intermediate between that of the homozygotes or is some form of dominance present, and does increased amylase activity allow an individual to survive better in a starch environment.

168. Ecology of Iowa *Drosophila*: Temperature stress

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We are studying ecological and genetic factors which determine a species' distribution by studying the spatial distributions and seasonal abundances of a group of closely related fly (*Drosophila*) species native to northeastern Iowa. We have found that the seasonal abundance of one common species, *D. robusta*, is significantly positively correlated with temperature while that of another common species, *D. tripunctata*, is significantly negatively correlated with temperature. We are testing under controlled conditions in the laboratory the hypothesis that there is differential survival of these two species at high temperatures in a way consistent with the ecological observations. Results obtained so far support this hypothesis--temperature plays a major role in limiting the seasonal abundances of these species.

169. The herpetofauna of Belize Central America

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An introduction to the reptiles and amphibians of the rain forests, coastal lowlands, and barrier reef cayes of Belize Central America. Color slides of animals encountered during a nine day trip in August 1984 include new country records and significant range extensions. Nearly fifty species will be pictured and/or discussed.

170. Survey of bird egg collections in Iowa with an inventory of the Luther College egg collection.

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Stimulated by work with the Luther College egg collection, a long-overdue comprehensive survey of state egg collections was undertaken. Surveys requesting complete information on bird egg holdings were sent to all institutions in the state potentially housing such collections. An effort was also made to locate private collections. Compilation of the data revealed eight collections in Iowa, with one additional large, uncured collection. The collection at Luther College grew out of two large donations, one in the early 1970's and the second in 1980. Over the past two years the assemblage has been completely curated in accordance with the A.O.U. Check-list of North American Birds. Two hundred seventy-five egg sets represent 181 species from North America and Scandinavia.

171. Certain mollusks of Queens County, Prince Edward Island, Canada.

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Deroceras sp. and *Retinella* sp. were collected under rotting logs near the edge of North River from the West Royalty area. *Fossaria* sp., *Gyraulus* sp., *G.circumstriatus*, *G.deflectus*, *G.parvus*, *Helisoma anceps*, *H.trivolvis*, *Lymnaea* sp., *Physa* cf.*heterostropha*, *Pisidium* sp., *P.nitidum*, *Sphaerium* sp., *S.(Musculium) securis*, and *Stagnicola elodes* were collected from freshwater habitats. Transects were photographed and aquatic habitats were analyzed for pH, salinity, phenolphthalein and total alkalinity, total hardness, dissolved oxygen, hydrogen sulfide, silica, phosphate, nitrate nitrogen, turbidity, color, and substrate. For the majority of aquatic habitats we see a basic pH with hardness primarily due to calcium. Dr. D.S.Davis, Nova Scotia Museums, Halifax, Nova Scotia, Canada determined these mollusks.

172. Uniform dispersion and territoriality in tellin clams.

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Sabbatical research at Dalhousie University in Nova Scotia, Canada, demonstrated uniform dispersion patterns within a population of small, deposit-feeding clams which are prey upon by a variety of commercially important flatfish and waterfowl. To reveal movements of the 100 clams buried within the sediment

of a large sediment tray, individuals were distinctively marked with lead foil, so that their positions showed up clearly on serial X-ray negatives taken at intervals of 3-4 days. Individuals maintain a personal space much larger than their body size, and most remained in the same general area, relative to their neighbors, despite considerable moving around within the sediment (i.e. "philopatry"). Quadrat analyses of the X-rays were computer simulated by a positive binomial model in which the exponent (k) represents the maximum number of personal spaces that could fit in the quadrat area used. Although neighbors often approach each other, they maintain their distance (at least a siphon's length) by what appears to be mutual avoidance. Active defense of areas was not observed but may have occurred.

173. Survey of echinoderm commensals

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Echinoderms often participate in commensal relationships and these relationships vary greatly in frequency, associate number and type. Seven shoreline areas (including coral reefs, grass beds and sandy shores) from three islands within the Visayan Region of the Philippine Archipelago were sampled by use of SCUBA. Collections were made during an 18-day study trip in June of 1984. Samples included representatives of at least 23 genera and all five echinoderm classes. Commensal relationships were observed in representatives of all classes, however, three classes never served as hosts. Eight of the sixteen phyla reported by other workers to be represented among echinoderm commensals, were found in this survey. Host specificity was apparent and a definite relationship between host size and number of commensals was found in asteroids. Aggregations, water temp., surrounding flora and fauna and other characteristics possibly relating to commensal frequency were also observed and recorded. A unique discovery was finding a single echinoid that hosted representatives from six phyla.