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ABSTRACTS OF CONTRIBUTED PAPERS 94TH SESSION IOWA ACADEMY OF SCIENCE FORT DODGE APRIL 16-17, 1982

Iowa Central Community College

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Agricultural Sciences

1. Changes in nematode numbers associated with corn and soybeans planted in soybean cyst nematode infested land.

D. C. NORTON, R. F. NYVALL, and M. E. ZIRAKPARVAR

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Corn, A619Ht x A632Ht, and soybeans, cv Corsoy, were planted continuously and in a corn-soybean rotation during a two-year experiment on soybean cyst nematode infested silt loam soil in Winnebago County in 1980-81. Under continuous corn, numbers of cysts and juveniles of the soybean cyst nematode (*Heterodera glycines*) declined markedly; but populations of the spiral nematode, *Helicotylenchus pseudorobustus*, and the lesion nematodes, *Pratylenchus* sp., increased both years. Under continuous soybeans, numbers of *H. glycines* increased, *H. pseudorobustus* declined slightly, and *Pratylenchus* sp. decreased and remained low. In a corn-soybean rotation, numbers of *H. glycines* increased under soybeans after one year in corn, *H. pseudorobustus* increased both years regardless of the crop, while *Pratylenchus* sp. remained low around soybeans but increased significantly in corn following soybeans. Numbers of *H. glycines* and *Pratylenchus* sp. were higher in 1981 than in 1980, presumably due to the excessively wet growing season in 1981. Numbers of *H. pseudorobustus* also increased in 1981 compared to 1980.

2. Yield losses in soybean cyst nematode infested land.

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Twenty four treatments to control the soybean cyst nematode, *Heterodera glycines*, were tested in Winnebago County, Iowa in 1981. Treatments consisted of four-row plots replicated five times. Each row was 9.1 m long and 97 cm wide. Resistant soybean lines L-76-129 and L-76-141 (U. of Illinois) yielded 85 and 56% more, respectively, than the susceptible variety Corsoy. Corn planted in 1980 reduced numbers of nematodes resulting in significant increased soybean yields in 1981. However, nematodes increased in 1981 resulting in inoculum for soybeans planted in 1982.

Nine nematicide treatments of 19 applied increased yields significantly with the best one increasing yield 48%. These treatments (percent active ingredient, method of application, and percentage yield increase) were: Vydate 10G, 1 lb band, 48%; Temik 15G, 1 lb furrow, 47%; Nemacur 15G, 1.5 lb band, 44%; Temik 15G, 1.5 lb band, 43%; Vydate 10G, 2 lb band, 39%; Counter 15G, 2 lb band, 35%; Advantage 15G, 2 lb furrow, 35%; Counter 20G, 2 lb band, 35%; and Furadan 10G, 2 lb furrow, 33%. Yield increases generally correlated with nematode control.

3. Evaluation of sources of resistance in oats to *Puccinia coronata* by use of a large number of fungus cultures.

L. J. MICHEL and M. D. SIMONS

ARS, U.S. Dept. of Agriculture, and Dept. of Plant Pathology, ISU, Ames, IA 50011

We have accumulated many lines of oats (*Avena sativa*) potentially useful as sources of resistance to crown rust (*Puccinia coronata*) in breeding improved oat cultivars. We needed to determine those lines with the same resistance genes, and the relative breadth of resistance of those that differed. 70 lines, most with resistance genes from the wild *Avena sterilis*, were chosen for intensive study. Field testing older plants showed that most lines were resistant to common cultures. 34 single sorus cultures of *P. coronata* were used separately to inoculate seedlings of the 70 oat lines in the greenhouse. These showed a range of infection types from immune to fully susceptible. When infection types were arbitrarily divided into "resistant" or "susceptible" categories, the 70 lines comprised over 40 patterns of host reaction, which ranged from resistance to all cultures to susceptibility to all cultures. All the lines that were highly susceptible as seedlings had good field resistance as older plants.

4. Epidemiology of *Melampsora* spp. and evidence of leaf rust resistance in poplar half-sib progeny trials.

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Two-year old poplar seedlings, representing seventeen controlled crosses of *Populus deltoides*, *P. nigra* and *P. trichocarpa* clones, were evaluated for severity of *Melampsora* spp. leaf rust. Results obtained at four stages of host and pathogen development were used to graphically represent pathogen spread and disease development in the seedling plantation. Average disease severity ratings of seedling families and family groups, based on like species of either parent, were compared and used to identify high rust resistance levels in specific clonal or species combinations. Seedlings with *P. deltoides* parentage exhibited lower average disease ratings than those without. Performance of selected clones with *P. nigra* and *P. trichocarpa* parentage, however suggest improvements can be made in disease resistance of these species through selection.

5. Verticillium Wilt in Soybeans

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Verticillium dahliae, a soil inhabiting fungus of broad geographic distribution and causing a vascular wilt (Verticillium wilt) in a large and diverse number of plant genera, including many woody plants, has been found to cause rapid and severe wilting following inoculation of soybean plants growing in the greenhouse. The inoculum used was derived from isolations made from severely wilting and dying plants of Abutilon theophrasti (Velvet Leaf) in soybean fields in the Ames areas during August and September of 1981. Studies to determine whether this fungus constitutes a potential threat to Iowa's soybean crop are being initiated.

6. A study on the interaction of brown stem rot, nodulation, and cropping history of soybeans.

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The interactions and relative significance of brown stem rot (BSR), caused by Phialophora gregata, and nodulation produced by Rhizobium japonicum, in BSR problem fields following soybeans and corn were studied. Nine soybean cultivars with specific genetic differences were used. Cultivars included Clark 63, Wayne, Calland, Oakland, Cumberland, BSR 301, BSR 302, and non-nodulating and nodulating Clark. On land after soybeans, non-nodulating Clark became chlorotic at the beginning of flowering and yielded 22% less than on corn land. All cultivars, including BSR resistant BSR 301 and BSR 302, yielded less on soybean than on corn land with a mean yield reduction of 9.2%. BSR incidence after corn averaged 68% of that after soybeans. Late season rains precluded any significant yield differences between BSR resistant and susceptible soybeans.

No significant difference was detected in nodulation of soybeans of the two fields. Based on these results, it is hypothesized that significant yield differences between BSR and non-BSR fields involve nitrogen deficiency as well as BSR.

7. Improving germination of skunkbush sumac and serviceberry seed.

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Skunkbush sumac (Rhus trilobata Nutt.) and serviceberry (Amelanchier alnifolia Nutt.) are native shrubs extensively distributed in the western United States, and have achieved importance for their use in revegetation of disturbed lands. Standard germination tests were performed on each species according to methods outlined in the literature. Seed viability was determined with triphenyl tetrazolium chloride (TZ). Results indicated special techniques

would be required to affect the rapid germination which is needed in current seed testing programs. Both species have hard or impermeable seed coats and embryo dormancy normally overcome by cold stratification or fall sowing. Results confirm that skunkbush sumac germination is promoted by 75 minutes acid scarification and that KNO₃ or GA produce no additional response. Acid scarification for 30 minutes and a mixture of thiourea (TU) and benzyladenine (BA) as a moistening agent for the media was beneficial to serviceberry germination. Analysis predicted maximum germination to occur at 100 ppm BA and 100 mM TU. An interaction of BA and TU on germination was observed at the lower concentrations tested.

8. Sediment production from range land under alternative livestock grazing managements in the North Central Region

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A National Interregional linear Programming model is used to analyze the impact of livestock grazing on soil erosion under alternative livestock management practices.

The least-cost criteria is used as a decision-making tool to determine the efficiency of range-resource allocation. This study analyzes the impact and interactions among the crop, livestock and range sectors when attempts are made to manage livestock production under several levels of soil erosion occurring from the range-ecosystems.

9. Drop spectra measurements as a possible tool in estimating soil erosion

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The single most serious long term factor affecting the world agricultural community is a continuing decrease in top soil quality and amount. Quite by accident during an investigation of the probable upper limit in continental Iowa precipitation rates from convective clouds the authors found what seems to be a simple technique for estimating potential soil erosion, given quantified radar rain rate mapping. Using a modification of an empirical relationship originally developed by Marshall-Palmer (1948) to describe a drop spectra for a single rain type, the modified equation provides a spectral distribution of convective rain drop sizes having a correlation value, $r = 0.89$, compared with field observations of a large dynamic range of storms. The major damage to newly turned soil results from the breaking down of the clods by energy release resulting from drops falling on soil. By computing drop spectra, from radar rain rate estimates, it is a simple task to assign an energy dissipation factor to the previously constructed area maps. Integrating with respect to time a potential runoff factor may be assigned. This gives a general rainfall potential erosion factor which needs then to be corrected to specific soil types.

10. Inheritance of bitterness, spine color, and degree of female expression in the interspecific cross Cucumis sativa L. x C. hardwickii R.

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The P_1 , P_2 , F_1 , and F_2 generations of the interspecific cross Cucumis sativa x C. hardwickii were grown in a randomized complete block design, with generations replicated within blocks. Data were collected on spine color, bitterness, and % gynocious nodes, for nodes 1-20. Using the parental and F_1 ranges to define classes, % gynocious nodes segregated in a 1:2:1 ratio, and is explained by segregation of alleles at the Acr locus. Bitterness segregated in a 3:1 ratio of bitter:non-bitter. Spine color, contrary to all previous reports, segregated in a 9:7 ratio of black:white spine. The gene controlling bitterness is unlinked to the genes controlling spine color, or the Acr locus. Finally the genes controlling spine color are linked to the Acr locus.

11. Inheritance of a male sterile apetalous inflorescence in Zinnia elegans.

R. K. DUFFY, L. C. EWART.

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A study was conducted to determine the inheritance of a male sterile apetalous inflorescence in Zinnia elegans. Four male sterile apetalous lines, M_1 - M_4 , were selected and 3 fertile petaled lines, P_1 - P_3 , were developed and selected. The 12 M x P cross combinations and their F_2 and BC M_i : P segregation ratios were evaluated by χ^2 . M : P ratios of 1:63, 1:15 and 1:3 ($P_{2.10}$) were observed in the F_2 generations with corresponding ratios of 1:7, 1:3 and 1:1 ($P_{2.10}$) occurring in the BC-M (back-cross to the male sterile). A 3 gene recessive model has been proposed. In this model the male sterile genotype = $ms_1ms_1ms_2ms_2ms_3ms_3$, with a variable number of recessive alleles present in the P lines. The possibility that the male sterile and apetalous characters may be pleiotropic was suggested.

12. Feasibility of oats as an oilseed crop.

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Oats are well adapted to midwestern soil conservation practices and provide needed crop diversity. If high oil cultivars can be developed, the profitability and acreage of oats might increase. Genetic effects for groat oil, its major fatty acids, and lipase activity were studied using generation means analysis of nine generations of each of four matings

grown in replicated experiments in two locations. Genetic variances for total oil were estimated in a factorial mating design with twelve matings grown in two replications in one location. Fatty acid heritability was studied using progeny of six matings grown as F_2 plants and F_2 -derived lines in F_3 in one location and as F_2 -derived lines in F_4 in three locations. Heritability was calculated using both standard-unit regression and variance components, and as realized heritability. Additive effects and additive x additive interactions were the most important forms of gene action for all traits. Dominance variance for groat oil content was not significant. High and low transgressive segregates for groat oil were found. Fatty acid heritability estimates indicated that fatty acid composition of groat oil should respond to selection using replicated tests in more than one environment.

13. Root and shoot growth for genotypes of cultivated and wild oats.

B. C. ABEL and K. J. FREY.

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Seedling root-growth rate of five oat cultivars (Avena sativa) and five wild oat lines (A. sterilis) was determined at three temperature regimes, using a randomized block design with three replications. Length of the central root was measured at 48-hr intervals for the 10°C temperature and 24-hr intervals for the 15-25°C and 20-30°C temperature regimes. At twenty, ten, and seven days, respectively, for these temperature regimes, shoot and total root length were measured. Cultivars Lang, O'Brien, and Cherokee showed consistently high values for both root and shoot length and weight. A. sterilis lines PI 324741 and PI 324810 showed high central root lengths and shoot dry weights. PI 328253, PI 324748, and PI 411569 were consistently low in root and shoot growth.

14. Genetics and agronomic characteristics of a chromosome translocation in soybeans.

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Plants heterozygous for a chromosome translocation were identified in crosses between Glycine max L. Merr. and Plant Introduction 101.404B (G. soja Sieb. & Zucc., the wild soybean). This translocation was backcrossed into the cultivar 'Clark' and homozygous translocation genotypes (T/T) identified. The T/T genotype had significantly smaller seeds than did the homozygous normal chromosome genotype (N/N) and progeny of the heterozygous chromosome genotype (N/T). Plants of the N/T genotype had 50% pollen sterility and 50% ovule sterility. In 3-ovule pods of all three genotypes, embryo abortion was most frequent in the basal position, and

occurred with about equal frequency in middle and apical positions. Ovule abortions were rare in the N/N and T/T genotypes. In the N/T genotypes, ovule abortions are numerous and equal in number, with respect to position of abortion within the pod. Across all three genotypes, the middle and apical seeds were significantly heavier than the basal seed.

15. Linkage studies in soybeans, utilizing available trisomics and translocations.

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Cytogenetic studies in soybeans (*Glycine max* (L.) Merr.) to date have been limited, with respect to the relative importance of the crop species. A study to increase information known concerning basic linkage and chromosomal relationships was done, by using available trisomic and translocation stocks in combination with other available genetic stocks. Hybrids were made between the translocation stocks used in the study, to examine their relationships through examination of pollen abortion in the F_1 . F_2 progenies from F_1 hybrids of the trisomic or translocation stocks and other genetic stocks were classified to determine linkage relationships. Translocation intercrossovers identified that four different translocation stocks were used in the study. Cytological observations indicated at least two of these have one chromosome involved in common. Linkage tests presented evidence for linkage of marker loci to translocation breakpoints and association of Linkage group 2 of soybeans with the extra chromosome of a primary trisomic stock used.

16. Meiotic studies of callus-culture-derived Indiangrass (*Sorghastrum nutans* L. Nash)

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Although chromosomal and genetic instabilities have been reported in many plant cell and tissue cultures, meiotic studies on two populations of Indiangrass ($2n=40$) derived from callus cultures were stable in chromosome number. Callus cultures were initiated from segments of young inflorescences and subcultured on Linsmaier and Skoog medium, supplemented with 5 mg 2,4-dichlorophenoxyacetic acid/liter. Plantlets were induced by culturing in the same medium without 2,4-D. All plants studied had 40 chromosomes. In 29 out of 74 plants, however, a small percentage (1.7-3.4%) of pollen mother cells showed one open bivalent or two univalents at diakinesis or metaphase I, which led to lagging chromosomes and micronuclei in later meiotic stages. The high incidence of abnormal meiotic behavior within populations, but low frequency of abnormalities in each plant, would suggest that these abnormalities might have been induced by some adverse environmental factors, instead of culture conditions. Thus, the application of tissue culture techniques for rapid cloning of Indiangrass is feasible.

17. Cytogenetics of the interspecific cross, *Hordeum procerum* (6x) X *H. vulgare* (2x)

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Hordeum procerum Nevski ($2n=6x=42$) was crossed with three cultivars of barley, *H. vulgare* L. ($2n=2x=14$). Based on morphological and cytological evidence, two classes of plants resulted. Crosses made with *H. vulgare* cv. 'Larker' resulted in polyhaploids ($2n=3x=21$), while crosses made with other cultivars resulted in hybrids with variable chromosome numbers, $2n=23-29$. The presence of genetic factors in the *H. vulgare* genome for resistance to chromosome elimination is proposed. Microsporogenesis was studied in the polyhaploids and hybrids, as well as in both parental species. *H. procerum* is considered a segmental autoallohexaploid. In addition, a mechanism for the genetic control of meiotic pairing was inferred, which causes *H. procerum* to behave cytologically like a diploid. It is suggested that there is no appreciable homology between the genomes of *H. procerum* and *H. vulgare*.

18. Genetic variation in Himalayan rice

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Considerable intra- and inter-genotypic variability exists in various metric traits of rice grown in Himalayan regions of India. Grain number and seed yield exhibit high heritability, genotypic coefficient of variation, and genetic advance. These traits are strongly intercorrelated with each other, but negatively with seed protein content. The protein content trait shows partial dominance, and very low heritability. Positive and negative alleles controlling protein production are distributed nearly equally in the rice genome, but unequally at the additive loci. Therefore, it is feasible to select and breed for rice with higher seed-protein yield, rather than for higher seed-protein content, as is being practiced generally in most cereals, including rice.

19. Comparison of mutants for feather structure in pigeons

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Of seven known structural mutants in pigeon feathers four were available for this study. Along with their proposed genetic symbols they are silky (L), fray (F), frizzy (fz), and fringe (fg). The latter two are newly discovered, and presumed recessives. Silky, fray, and fringe are phenotypically similar. Frizzy, while more visible in juveniles, appears as a midshaft effect in adults.

Microscopic comparisons of secondary feathers at 100x revealed structural differences, within genotypes and between mutants.--In the two genotypes of fray, barbules appeared thicker and more crowded than normal. Barbules exhibited terminal breaks, especially in the homozygous specimen.--The two silky genotypes featured barbules that were thinner and less crowded than in fray, but with similar terminal breaks. Twisting of barbules and terminal breaks were particularly visible on the homozygous silky.--Barbules on frizzy genotypes were more slender still and were lacy in appearance; this being more pronounced in the homozygous frizzy.--In the fringe feathers, barbules were also thin, with terminal breaks and a fragile, translucent appearance.

20. Symbiotic mutants of Rhizobium japonicum
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Rhizobium japonicum are of great agronomic importance in Iowa because of their ability to fix atmospheric nitrogen symbiotically in the root nodules of soybeans. Symbiotic mutants of R. japonicum have been obtained with ethidium bromide, acridine orange, sodium dodecyl sulfate, and growth at high temperature; techniques known to eliminate small plasmids (extrachromosomal DNA elements) in other types of bacteria. For some treatments the yield of symbiotic mutants was greater than 50%. The majority of mutants obtained were Nod⁻ (no nodulation), although several were either Nif⁻ (no nitrogen fixation, determined by acetylene reduction assays), or Nod⁻Nif⁻. Agarose gel electrophoresis was used to screen the mutants for plasmid elimination or deletions. Using a conventional isolation procedure no change was observed in the molecular weight of the large endogenous plasmid. Because this procedure exposes plasmids to large shear forces, a new plasmid isolation technique has been developed which uses high concentrations of lysozyme, proteinase K, and sodium dodecyl sulfate to lyse bacteria within agarose wells, and to release plasmids during electrophoresis. With this new technique, "megaplasmids" have been found in R. japonicum which are being characterized using molecular weight standards and by DNA hybridizations.

Anthropology/Archeol.

21. The frustrations of a volunteer organization

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There are problems associated with a volunteer organization working with refugees in Thailand, both within the organization itself, and between the other volunteer groups. The areas to be covered within the organization are maintaining the "volunteerism philosophy", involvement of the Board of Directors, fundraising, structure, rationale of spending funds for advertising and public relations and authority in the field. The areas of problems between groups will address the difference between the church-oriented, the governmental and our group, the American Refugee Committee (non-church, non-governmental), and how the different groups' potentially friction raising activities and policies affect people's work in the field. My information is obtained from participant-observation and personal correspondence.

22. Healers, Danish Women, and Change

D. R. FINK

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Rural women as traditional healers have become increasingly marginal as professional medical practice has been supported and licensed by the Danish state. Women's healing practices, the social position of healers, and the ambivalent feelings toward them are discussed as a means of opening avenues of inquiry into the anthropological study of Western women healers.

23. Ethnicity and climacteric in South Dakota

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During August, 1981, a standardized interview, designed to gather data on the effects of ethnicity and aging on women's experience of symptoms commonly associated with the climacteric, was administered to a sample of 150 rural South Dakota women between the ages of 45 and 70. It was hypothesized that ethnicity and age would effect climacteric symptomatology. Preliminary findings indicate that significant differences in symptom reports may be related to ethnic affiliation. Women from different ethnic communities; German, Czechoslovakian, and Native American report different experiences of the

climacteric. In addition, symptoms commonly held to be specific to the climacteric in middle-aged women were also found to be characteristic of women in the older, post-climacteric age groups regardless of ethnic affiliation. Special emphasis is given to methodological problems involved in correlating particularistic, folk cognitions of health and illness to relevant quantitative, medical symptom categories.

In this study over 300 basidiocarp specimens were collected from various sites in Iowa and preserved (by freezing) for starch gel electrophoresis. Crude extractions of water soluble enzymes were made with a 0.2 M KH_2PO_4 pH 7 buffer. Various gel and tray buffer combinations were used to maximize the activity and resolution of a dozen enzymes. Each individual basidiocarp was scored on a presence or absence basis of each allele compared to the overall allelic variation observed for each enzyme.

The banding patterns for all individuals and all 12 enzymes assayed were evaluated by means of a computerized cluster analysis. Selected portions of the resulting dendrograph will be discussed with respect to modern generic classifications.

Botany

24. _____ Lichens from islands of the Gulf of St. Lawrence, Canada.

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Lichens were collected in certain transects from Prince Edward Island and from Île Du Cap Aux Meules. Baeomyces rufus, Bryoria furcellata, Cetraria pinastri, Cladonia cf. chlorophaea, C. cristatella, C. cylindrica, C. rangiferina, Cladonia sp., Evernia mesomorpha, Hypogymnia physodes, Lecanora cadubriae, Lecanora sp., Parmelia sulcata, Ramalina farinacea, Toninia sp., Usnea angulata, U. subfloridana, Usnea sp., and Xanthoria polycarpa were collected from these transects. B. furcellata, C. pinastri, C. cristatella, E. mesomorpha, H. physodes, Lecanora sp., R. farinacea, U. angulata, U. subfloridana, Usnea sp., and Xanthoria polycarpa were primarily associated with tree wood. B. rufus, C. cf. chlorophaea, C. rangiferina, and Toninia sp. were especially seen from soil transects that were acidic with a pH from 4.4-5.0 in loamy soils. In the soil analysis tests for active aluminum, ammonia nitrogen, available phosphorus, chlorides, iron, magnesium, manganese, nitrate nitrogen, nitrite nitrogen, organic content, potassium, replaceable calcium, and sulfate were also made.

25. Isozyme variation and generic classification of the Polyporaceae

R. J. PINETTE

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Modern monographers of the Polyporaceae have been describing an increasing number of small or monotypic genera in their treatments of this family. Based almost entirely on morphological data, over 80 genera are presently recognized in the north temperate zone.

26. A preliminary report of some Tuberales of Iowa.

L. H. Tiffany and J. F. Shearer

The Tuberales, or truffles, are a group of hypogeous Ascomycetes, many of which are mycorrhizal. In Europe, where certain species are prized for their culinary properties, the existence of truffles has been known for centuries, whereas in North America, significant collection data have been accumulated only since the turn of the century.

The Tuberales are known to occur in greatest abundance in the Pacific Northwest, with limited field information from other regions of the United States. Reports of this group in Iowa are few, beginning in 1927 with a collection of Elaphomyces ascocarps parasitized by Cordyceps capitata. Gilkey (1939) in a monograph of the Tuberales of North America, reported Tuber Gardneri from Iowa Falls, Iowa.

During the past two summers, collecting forays in central Iowa have yielded additional specimens of Tuber, and ascocarps of Hydnobolites and Pachyphloeus. These recent collections have prompted our interest in this fascinating and unusual group of fungi.

27. The rusts of Iowa

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As we have attempted the past several years to monitor Iowa fungi, we have realized that available information concerned with Iowa rusts and their hosts is out of date and incomplete. The first account of Iowa Uredinales and their hosts was compiled by Arthur in 1884. Later summary listings were completed in 1924 by Arthur and in 1929 by Gilman and Archer as a part of their report on parasitic fungi of Iowa. Supplementary information was compiled by Gilman in 1932 and in 1949. These accounts all involved nomenclatorial interpretations of the rusts based on the American Code. All valid fungal taxa now are interpreted under the International Code of Botanical Nomenclature.

A corrected and updated treatment of the Iowa rusts and their hosts is now being completed. In

recent field work, we have found two previously unreported aecial stages of heteraecious rusts and one previously unobserved telial stage for Iowa. In addition, eleven new Iowa host species have been collected. A number of rust species reported from Iowa on the basis of a single field collection in the 1880's have been again collected and the continued presence of these species in Iowa validated

28. Plant diversity in tropical cloud forest light gaps.

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Light gaps, a disturbance in canopy cover, are the location of regeneration for 75 percent of Costa Rican tree species, and therefore, the location of competition for regenerative space among tropical plants. Microclimate can limit the ability of seedlings to propagate within a light gap of small, medium or large size. The Shannon/Weiner diversity index showed medium gaps, primary forest and the edge of a large light gap to have high diversity, while small gaps and the center of the large light gap have low diversity. Microclimatic fluctuations are greatest in the large light gap, followed by medium gaps, and then small gaps. The primary forest has the most constant environment. Plants of the primary forest are found in the small and medium gaps, indicating that these plants were once understory primary forest. The large light gap has a unique population of plants possibly because of the microclimate differences. These findings support the theory of resource partitioning as a factor involved in creating tropical diversity.

29. Aquatic hyphomycetes from Los Chorros, Utuado, Puerto Rico.

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Fifteen species of aquatic hyphomycetes were collected at Los Chorros, Utuado, Puerto Rico. Actinospora megalospora Ingold, Anquillospora crassa Ingold, Anquillospora longissima (Sacc. & Sydow) Ingold, Anquillospora pseudolongissima Ranzoni, Clavariopsis aquatica De Wildeman, Campylospora chaetocladia Ranzoni, Flagellospora penicilloides Ingold, Lemonniera terrestris Tubaki, Lunulospora curvula Ingold, Pyramidospora casuarina Nilsson, Scorpiosporium anrulatatum (Ingold) Iqbal, Tetracladium marchalianum De Wildeman, Tetracladium setigerum (Grove) Ingold, Tetrachaetum elegans Ingold and Triscelophorus monosporus Ingold. The species found during this study have not previously been recorded for the northern part of Puerto Rico. Tetrachaetum elegans Ingold, represent a new record for Puerto Rico.

30. An electrophoretic survey of the golden saxifrage, Chrysosplenium iowense

SCHWARTZ, O. A.

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The golden saxifrage is known from six sites in the driftless region of Iowa. These sites are on north facing slopes, and this species is only found where ice caves, cold air vents or cold water seeps maintain temperatures well below the ambient. Leaves from 210 plants from five of the Iowa sites were analyzed electrophoretically. Eight enzyme systems were resolved but showed no allozyme variation. An additional nine enzymes were either not present or unresolvable. The lack of variation in this species may be due to its pattern of reproduction, genetic drift, or natural selection, although no hypothesis has clear explanatory power.

31. Data transformation for polar ordinations with high levels of beta diversity.

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As ecological sample gradients increase in length, the gradient extremes will reach a point of zero degree of similarity with some ecological distance measure. Further increases in gradient length cannot be distinguished by similarity measures and contribute to ordination distortions where the techniques require linear, monotonic data for ideal results. If original species incidence data is premultiplied by a transposition matrix, a square matrix with values of species joint occurrences results. Species at gradient extremes which have no joint occurrences, but which have a common intermediate associate species, will not have a zero degree of similarity as would have been obtained with untransformed data. With this transformation higher levels of beta diversity, or a larger number of zero entries, can be tolerated in data that are to be ordinated.

32. Causes and consequences of population variation in plant nectar production rates.

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Plant species visited by the same pollinator may differ markedly in the amounts of nectar they produce. In an effort to understand the adaptive significance of interspecific differences in nectar production rate (npr) I first undertook a study on the causes and consequences of differences in npr within a population of a single species. For 2 species examined to date, Ipomopsis aggregata and Asclepias quadrifolia, npr is positively correlated with the plant's energy budget and negatively correlated with its inflorescence size. These results are consistent with a cost/benefit model predicting optimal nprs. If a plant's npr is an evolved trait then differences in npr should be correlated with differences in reproductive fitness. This was the case; for both species individuals with higher npr had higher seed set. In addition, for A. quadrifolia, the male contribution to fitness (pollen donation) was also positively correlated with npr.

33. Effect of Roundup in prairie reconstruction

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The herbicide, Roundup [N-(phosphonomethyl)glycine] was applied in May 1980 to a 7-year-old prairie reconstruction plot of two acres as a management tool in aiding establishment of native prairie grasses. Other plots were treated with more conventional management techniques, burning and mowing. Comparisons of treatments involved sampling, during the Fall of 1980 and 1981, of prairie grasses and non-native species in terms of presence, frequency, percent cover, biomass and height.

34. Some aspects of the life history of Dodecatheon meadia in Iowa prairies

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Shooting star, Dodecatheon meadia, is a spring forb found in the forests and prairies of eastern Iowa. A study of shooting star is occurring at three Iowa prairies-- Rochester Cemetery Prairie near Rochester, Clay Prairie near Allison, and Hayden Prairie near Lime Springs. Rochester is the furthest south of these prairies, Hayden the furthest north. Shooting star appeared and flowered first at Rochester. Shooting star appeared and flowered first at Clay and Hayden where the prairie had been mowed or burned.

Some shooting stars at Clay were attacked by a striped insect larva, causing the inflorescence to wilt. A light green insect larva attacked immature fruits, boring into them and devouring the ovules. Shooting star reproduces by means of seeds and buds. Rochester and Clay capsules contained large numbers of healthy, light brown seeds. In contrast, Hayden shooting star capsules primarily contained black masses of aborted seeds. Vegetative reproduction occurs by means of tiny buds on the roots. The buds may produce young plants 10x larger than seedlings.

35. Soil fungi in a native tall-grass prairie and an adjacent cultivated field in central Iowa

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Twenty soil samples were taken from a virgin tall-grass Iowa prairie, an adjacent field planted to corn and soybeans, and the interface area of these two sites. A total of 1989 fungal isolates was recovered using the dilution plate method. One-hundred and thirty-one species were identified in 70 genera. The Moniliales comprised 74.4% of the identified isolates. The principal genera in all study sites were Aspergillus, Chrysosporium, Cladosporium, Cylindrocarpum, Fusarium, Gliocladium, Myrothecium, Penicillium, Phoma, and Trichoderma. The principal species were Chrysosporium pannorum, Fusarium oxysporum, F. solani, Penicillium restrictum, and Trichoderma lignorum.

The cropland soils yielded the greatest number of isolates and species. The prairie had a lower number of species, with an even less diverse population in the prairie potholes.

The Jaccard index of similarity in plant communities did not indicate any extreme similarities or differences in the microfungal soil populations of the three study sites.

36. Changes in the vascular flora of a central Iowa wetland.

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Early collections at Goose Lake, Hamilton County, Iowa, provided a baseline for assessing changes in species composition in a Class IV marsh. Collections made in the late 1970's document the loss of sensitive species and addition of more tolerant, widespread species.

37. Old field succession on Floyd River floodplain.

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In 1969 a five acre tract of flood plain was set aside for a wildlife area. That spring a small portion was seeded with locally collected prairie seeds. Periodically some woody seedlings have been planted to expedite the diversity of berry-like vegetation. Preliminary checklists in 1972 include 21 species attributed to natural succession and 35 prairie species in the seeded lot. By 1975 a total of 104 species had been found and by 1979 a total of 145 species. Progressive dominants in the unseeded area in the early stages were smartweeds, giant ragweeds, thistles, goldenrods, and asters. Boxelders and reed canary grass were evident increasers in the mid-1970's. Silvermaples are beginning to dominate certain portions of the area once dominated by boxelders and the reed canary grass populations are becoming stabilized. The area is sectioned into a permanent grid of 20 meter square quadrats. Line transects of the vegetation were taken in 1975 and 1979.

38. Biological and geological investigations of a prairie remnant

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Mark Sand Prairie is a unique natural area located in northwestern Black Hawk County consisting of marshes, moist to dry sandy prairie and a wet to moist swale. A varied topography has resulted in considerable diversity in soil types and plant communities. Recent biological and geological investigations culminated in the preparation of a series of maps and a cross section. A vegetation map, topographic map, soils map and subsurface cross-section were prepared at the same scale. Overlays were utilized to determine the relationships among the different factors. The display will include maps, subsurface cross-section along with color and infrared photographs.

39. Distribution and morphology of secretory glands of tarweed, *Grindelia squarrosa* (Compositae).

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A preliminary investigation of the distribution and morphology of secretory glands of tarweed, *Grindelia squarrosa* was carried out at the light and scanning electron microscope level. Glands are located on the involucre bracts of the inflorescence and leaf surfaces. A high concentration of glands are located in a groove on the adaxial surface of the bract.

The concentration, size and vasculature of glands were analyzed at three different stages of leaf development. In younger stages of leaf development, glands were more concentrated, more uniform in size and were less sunken into the leaf surface. In later stages of leaf development, glands were more scattered, less uniform in size and clusters of glands were found sunken into the tips of the leaf teeth. The gland itself is composed of 25-60 individual cells and ranges from 25-121 microns in size. These secretory structures produce an extremely resinous substance which gives rise to the common name of the plant.

40. The Occurrence and Variation of Secretory Structures in the Betulaceae.

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Leaves of the five genera of the Betulaceae of North America were collected in Central Wisconsin and prepared for scanning electron and light microscopy. The secretory structures present are of two types: 1) sessile-capitate and 2) stalked-capitate. The sessile-capitate glands are specific to the genus *Betula*; although, among the compliment of other genera occasional sessile glands are present. Stalked-capitate glands occur in *Alnus*, *Carpinus*, *Corylus* and *Ostrya*. On all species sampled, glandular trichomes occur on both leaf surfaces with greater numbers on the abaxial surface. In most species occur predominately on major and secondary veins, however, in other species they occur predominately between the veins. Gland initiation and development begins during bud formation. By the time leaves are fully expanded glands are mature. By late spring the glands are nonfunctional or have fallen off.

41. Callus differentiation and root initiation in *Pinus banksiana* seedling cuttings

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20 day old and 97 day old *Pinus banksiana* seedling cuttings were used to study the anatomical development of callus differentiation and root initiation. In both age groups callus originates from the cortex. In 97 day old cuttings a complex callus develops around the base of the cutting. Within the callus, tracheid nests, numerous vascular cambia and cork cambia, resin canals, and several roots may differentiate. In 20 day old cuttings callus is less complex and in most cases only a single root is produced.

42. A comparison of crystal isolates from callus cultures and their explant sources.

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Callus cultures were derived from explant tissues of nineteen various angiosperm and gymnosperm species known to contain calcium oxalate crystals of different habits. Eight of these species produced crystals in culture including: Ginkgo biloba, Canavalia ensiformis, Glycine max, Phaseolus vulgaris, Cissus quadrangularis, Malus domestica, Capsicum annuum, and Psychotria punctata.

Comparison of crystal isolates from explant sources and calluses generally show maintenance of crystal habit in culture. Several calluses which produced crystals were cultured under media conditions which were sub-optimal for callus growth. Three species produced callus crystals which were abnormal compared to their intact plant counterparts. We believe crystal production and habit are generally species specific, under genetic control, and influenced by the metabolic condition of the cells.

43. Ultrastructural identification of nucleation sites for calcium oxalate crystallization in two plant species.

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Paracrystalline bodies associated with membrane complexes have been observed within the vacuoles of crystal idioblasts in two species. These bodies appear prior to calcium oxalate crystal formation in both species. In Capsicum annuum idioblasts numerous paracrystalline bodies are contained within a membrane complex. Each crystal forms in contact with a paracrystalline body. When the druse crystals reach maturity the paracrystalline bodies are no longer observed. The paracrystalline bodies in Psychotria punctata form a center of a membrane complex and each complex expands to form at least one raphide crystal chamber. Some paracrystalline bodies remain visible until late in crystal formation. Even though the chemical nature and origin of these bodies are not presently known, our information strongly suggests that they are nucleation sites involved with initiation of single or multiple crystals and may control crystal growth and shape.

44. Formation of calcium oxalate crystals by the discomycete Dasyscypha capitata.

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Dasyscypha capitata found growing on oak leaf litter in Iowa, produces calcium oxalate crystals on the tips of peripheral, sterile seta of fruiting bodies.

The crystals form on the outer surface of the seta and can be mechanically dislodged. Initially, there are a few small crystals formed, however, as the fruiting body continues to develop, the crystals increase in number into large aggregate masses on each tip giving the appearance of druses, a common crystal aggregation found in higher plant cells. The crystals have been shown to be calcium oxalate monohydrate by x-ray diffraction analysis. The development of these crystals was observed by light and scanning electron microscopy as a means of comparing them to oxalate crystals formed in higher plants. The functional significance of the Dasyscypha crystals is speculative and will be reviewed with respect to similar crystals associated with other plant and animal systems.

45. Culture and fine structural studies of Chlamydomyxa montana (Lankester).

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Various investigators have assigned the genus Chlamydomyxa to the ameboid protozoa, the Xanthophyceae, or the Chlorophycophyta primarily on the basis of light microscope interpretations of cellular inclusions which resemble plastids. Some believe these particles are algal food remnants; others consider them true functioning plastids. We have collected, isolated, and cultured the cyst-like stage of Chlamydomyxa montana from a lake bottom in Michigan. Our preliminary culture work with C. montana has verified that the ameboid stage will ingest diatoms. Low light intensity and an extended dark period enhance this heterotrophic behavior. Light and electron microscope observations of the cysts indicate that the cells are surrounded by a thick cell wall at least partially comprised of cellulose and intact plastids characteristic of the division Chrysophyta are distributed throughout the cytoplasm. Remnant diatom cell walls were also observed. The taxonomic significance of these inclusions and other ultrastructural features will be discussed.

46. Succinic dehydrogenase activity of Brassica campestris L. during transition to flowering.

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Succinic dehydrogenase (SDH) activities were investigated in shoot apical meristems during floral evocation by histochemical procedures. SDH activity was found in the vegetative meristem only in the central zone. There was an increase in reaction intensity in the central zone within the first 24 hr after the beginning of the long day. SDH activity was observed in the central, peripheral and pith-rib meristem zones of the meristem at the transition stage. Staining in the peripheral zone

at the late transition stage was localized in spots where floral bud primordia would be formed. The distribution and staining intensity of enzyme activity in the floral meristem was similar to the pattern found in the vegetative meristem. These observations support an interpretation of floral evocation in a transforming meristem of Brassica as consisting, at least partially, of a higher respiratory rate than the vegetative meristem of Brassica. Results are discussed in relation to other cytological events which are known to occur in the meristem of Brassica.

47. Scanning electron microscopic study of spore germination in the fern Anemia mexicana Klotzsch.

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Spore morphology, germination and early gametophyte development were studied in the fern Anemia mexicana Klotzsch using the scanning electron microscope. Spores and gametophytes were fixed with glutaraldehyde while on agar solidified mineral medium or Millipore filters. Spores are tetrahedral with smooth, narrow ridges and occasional knob-like projections of the ridges. Spore germination was evident three to four days after sowing with spores cracking open along the triradiate ridge followed by protrusion of the young gametophyte. This is typical of spore germination in most ferns. The rhizoid was usually the most prominent cell outside the spore coat early in germination, with later protrusion and growth of the prothallial cells. Subsequent growth of the gametophyte resulted in a two-dimensional prothallus.

48. Antheridial initiation and development in the fern Onoclea sensibilis.

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Antheridia of Onoclea sensibilis consist of three uniquely-shaped jacket cells, which include a funnel-shaped basal cell, a doughnut-shaped ring cell, and a round cap cell covering the "hole" of the ring cell. These cells surround an internal spermatogenous cell. The initiation and development of the jacket cells were studied. Four days after sowing sterilized spores onto agar media, some were treated with an antheridia-inducing substance. Treated and untreated gametophytes were then collected daily, cleared, and stained to document the following antheridial characteristics: stage of development; position on gametophyte; and specific cellular location. Other gametophytes were fixed at different developmental stages and processed for viewing with Nomarski optics, transmission electron microscopy, or scanning electron micro-

scopy. External and internal changes that occurred during antheridial initiation and subsequent development were observed.

49. Spermatogenesis in the fern Onoclea sensibilis.

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Spermatogenesis in Onoclea begins with the inception of a central spermatogenous cell surrounded by two antheridial jacket cells. Five successive mitotic divisions of the central cell give rise to 32 spermatocytes, which then differentiate into spermatozooids. A study of the cellular changes which occurred during spermatogenesis was conducted. Cultured gametophytes were collected and fixed at different stages of antheridial development. Some gametophytes were stained with RNA- and DNA-specific stains. Others were processed for observations with Phase-contrast optics, Nomarski optics, transmission electron microscopy, or scanning electron microscopy.

50. Some speculations and questions about the developing angiosperm embryo and endosperm.

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Propagules germinating outside all need a basal anchoring and absorbing organ before the distal portion can develop. Germinating angiosperm zygotes need only the latter. The suspensor is really a rhizoid; its variety of sizes and shapes reflect lack of selection pressure for an anchoring function. It ceases to absorb when isolated by the intercalated radicle-hypocotyl, which probably absorbs the endosperm. Endosperm is usually free-nuclear at first; this allows fast accumulation of nutrients in a membrane-bound sac, the former central cell. Later, wall formation allows individual endosperm cells to be digested without disrupting membrane integrity. Ab initio cellular endosperm provides a digestible form quickly, perhaps allowing earlier absorption by the embryo. True free-nuclear endosperm is an advanced state in which nutrients can move across the central cell membrane without disrupting it. Where and how is endosperm taken up by the embryo? When and where does a cuticle form on the embryo? These are among several important questions ignored in the literature.

51. Microsporogenesis in normal and ms_3 mutant soybean (Glycine max).

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Male sterility is an interesting phenomenon which may have a cytoplasmic or genetic factor as its cause. This factor disrupts normal development within the ms_3 microsporangia yielding the male sterility. The sterility in our system resides in a recessively inherited allele. The purpose of this study was to microscopically observe the difference between the heterozygous normal and homozygous (male sterile) mutant during microsporogenesis. The use of light, scanning and transmission electron microscopy has been employed to demonstrate these differences. Preliminary results show that the tapetal layer surrounding the sporogenous cells becomes abnormal during the time of meiosis by the buildup of large amounts of refractive material. The tapetum then degenerates prematurely leading to sporogenous cell abortion. These results will be compared with the events in other male sterile systems.

52. Initiation and development of the male inflorescence of Zea diploperennis L.

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Greenhouse grown plants were sampled during the short day growing season. Plant parts containing terminal shoot apices were killed and fixed in FAA, embedded in Fisher "Tissuemat", and sectioned at 6 μ m. Sectioned shoot apices were stained with safranin and fast green. In this study, staminate inflorescences were shown to develop by a definite sequence of morphological stages. Initiation of branch primordia follows transition of a shoot apex from vegetative to reproductive stage. Branch primordia divide to form two spikelet primordia. Each spikelet primordia develops glumes, lemmas and paleas. A floret arises in the axil of each lemma. Lodicules and stamens are initiated from floral primordia.

53. Preliminary observations on sieve-element ultrastructure in Drimys granadensis L.f. var. mexicana (DC.) A.C. Smith

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As part of a continuing study of sieve-element ontogeny in primitive angiosperms, sieve elements of Drimys granadensis var. mexicana were investigated. As in all other primitive angiosperms so far studied, sieve elements of Drimys possess phloem-protein (P-protein). This substance is found to take the form of striated fibrils in

mature elements. Measurements place the average fibrillar diameter at 105 Å. Additionally, one instance was observed of a paracrystalline form of protein referred to in the older literature as an extruded nucleolus.

Sieve elements communicate via pores in their walls. Mature pores in Drimys typically are associated with callose and are filled with P-protein. Preliminary data indicate that the diameters of mature pores range from 0.13-0.2 μ m. This small size may be indicative of the primitive nature of these sieve elements.

54. Observations concerning sieve-element development in Ginkgo biloba L.

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Development of sieve elements in petioles of Ginkgo biloba was followed with the use of a transmission electron microscope. As ontogeny proceeds, the ER increases in amount, often forming concentric sheets and isolating portions of the cytoplasm. This is followed by dissolution of common cellular components such as: ribosomes, microtubules, and dictyosomes. With time, the nucleus although still present, takes on a necrotic appearance. After maturity is reached, the amount of ER present is reduced, leaving the lumen largely free of obstructions. The pores, which at maturity connect adjacent sieve elements, develop from branched plasmodesmata having median nodules. Pore development is associated with ER, and in its later stages, with callose. At maturity, pore diameter was unusually large, being in the range of 2-5 μ m. At no stage is P-protein (phloem-protein) associated with these sieve elements. The developmental stages noted closely resemble those observed in other gymnosperms, such as Pinus resinosa and Welwitschia mirabilis.

Chemistry: Anal. & Phys.

55. Observations of excited neutral species using the neutral fragment mass spectrometer.

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The atmospheric gases N_2 , O_2 , and Ar were examined using a neutral fragment mass spectrometer. N^+ , O^+ , and Ar^+ are formed from autoionizing species whose excitation energies are in excess of the ionization energies of the original species, and whose lifetimes are greater than 15 μs . Other ions are observed to be products of collisions between excited and ground state species. Pure gases and varying compositions of binary and ternary mixtures of the title gases were studied at various pressures and electron energies to characterize the excited species observed.

56. Ambient air quality in Iowa.

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National ambient air quality standards established by the U.S. Environmental Protection Agency as guidelines for the protection of human health and welfare were exceeded at 50 sites in Iowa during 1980. Violations of the Primary (health related) Standard for particulate matter were reported at fifteen sites. The Secondary (welfare related) Standard for particulate matter was exceeded at 44 sites. The standards for carbon monoxide were exceeded at three locations. The standards for ozone were exceeded at two locations and the standards for non-methane hydrocarbons at one location. Standards for sulfur dioxide, nitrogen dioxide and lead were not exceeded at any Iowa monitoring locations. Results of monitoring conducted by the University of Iowa Hygienic Laboratory, Polk County Health Center and Linn County Health Department are summarized.

57. Airborne lead levels in the vicinity of a point source.

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Three months of ambient lead data and wind data were collected in the vicinity of a lead-acid battery plant located in Manchester, Iowa. Particulate matter was collected on glass-fiber filters and analyzed for lead by the University of Iowa Hygienic Laboratory, using atomic absorption spectrometry. A maximum quarterly contribution of 0.9 micrograms of lead per cubic meter of air was

determined to be the result of emissions from the plant. That is approximately one half the National Ambient Air Quality Standards established by EPA to protect the public's health and welfare. Influencing factors, such as reentrainment of contaminated soils and sampling frequency are also discussed.

58. The Application of Non-Steady State Kinetics to Acceleratory Reactions.

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Poly(vinylchloride) degrades by the loss of HCl in an acceleratory reaction. Based on the assumptions of the zipper mechanism a kinetic model that represents PVC degradations has been developed. The fraction of zip chains initiated per second, k_1 , and the fraction of initiated chains that unzip per second (k_2) are the parameters needed to characterize the degradation. Chains that start unzipping are joined by later starting chains during the acceleratory period. When first started chains go to completion and are no longer producing HCl, the deceleratory period begins. The active intermediate, the fraction of chains unzipping, does not reach a steady state but instead, changes in a regular pattern from the beginning to the end of a degradation. The explosive azides and a number of other inorganic solids degrade by acceleratory reactions and the kinetics developed for PVC appear to represent the data for these substances. The characteristics of our non-steady state equation will be compared with some of the kinetic equations that have been developed to represent inorganic acceleratory reactions.

59. Thermal decomposition kinetics of silver oxalate.

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A kinetic equation developed on the basis of the zipper mechanism characterized the acceleratory degradation of poly(vinylchloride) in terms of two parameters, k_1 , the fraction of a chain starting per second, and k_2 , the fraction of a started chain unzipping per second. Many inorganic compounds degrade thermally in acceleratory reactions analogous to PVC. Degradation data for one of these compounds, silver oxalate, follows the kinetic pattern of zipper kinetics; however, some ambiguities exist in assigning significance to the parameters for the degradation of an inorganic solid.

60. Formation constants for dithiomalonate complexes.

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The formation constants have been determined for the dithiomalonate complexes of nickel (II) and copper (II) at a constant ionic strength of 0.2 M (sodium perchlorate). The method used was a spectrophotometric study in basic solution of the competitive reaction of dithiomalonate ion and ethylenediamine for the metal ion. The following values are reported:

for the $\text{Ni}(\text{dtm})_2^{2-}$ complex, $\log \beta_2 = 13.5 \pm 0.4$;

for the $\text{Cu}(\text{dtm})_2^{2-}$ complex, $\log \beta_2 = 23.9 \pm 0.3$.

61. Kinetics of ligand exchange and isomerism of $[\text{Pt}(\text{amino acid})(\text{DMSO})\text{Cl}]$

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Both *cis*(N,S) and *trans*(N,S) isomers of $[\text{Pt}(\text{amino acid})(\text{DMSO})\text{Cl}]$ can be synthesized. We have previously reported equilibrium and kinetic data for isomerization reactions for several different amino acids. Rates of Cl^- and DMSO ligand exchange have been determined by radioisotope and nmr techniques, which will be described. These rates will be compared to rates of isomerization and ligand substitution. A general mechanism has been developed to account for the data. The mechanism postulates several $\text{CN} = 5$ intermediates which can serve as routes for isomerization, substitution, and exchange. The data suggest that a pseudo-rotation (turnstile) mechanism is an important isomerization pathway.

62. Reduction Characteristics of Methotrexate

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The electrochemical reduction characteristics of Methotrexate (MTX) were studied by polarographic techniques including differential pulse, cyclic voltammetry and controlled potential electrolysis, UV spectroscopy and HPLC methods. MTX exhibited three $2e^-/2$ proton reduction waves in the 2-7.5 pH range and a single wave in the alkaline medium. The first wave involves the reduction of MTX to a 5,8 dihydro derivative which subsequently undergoes a proton catalyzed tautomerization process to a 7,8 dihydro species. Part of the 5,8 derivative concomitantly undergoes a proton catalyzed non reductive cleavage involving the C(9) - N(10) bond. The rate constants for the tautomeri-

zation process were determined and found to vary from 0.41 sec^{-1} to 0.019 sec^{-1} in the pH range between 3.5 and 7.6 respectively. The second and third waves involved respectively, the reductive cleavage of 7,8 dihydro MTX to 5,6,7,8 tetrahydro MTX and the reduction of one of the cleaved products, 2,4-diamino-6-methyl-7,8 dihydropteridine to its corresponding 5,6,7,8 tetrahydro analog. The pH dependence of both the non reductive cleavage and the rearrangement processes will be discussed.

Chemistry: Org. & Biol.

63. Intermediates in the electrochemical reduction of carbon disulfide in acetonitrile.

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The electrochemical reduction of carbon disulfide in acetonitrile alone or in the presence of carbon dioxide or of phenol followed by methylation gave 4,5-bis(methylthio)-1,3-dithiole-2-thione and dimethyl trithiocarbonate as the main products. By-products formed in smaller amounts and either isolated or identified by gc-mass spectrometry were 4-methylthio-1,3-dithiole-2-thione, dimethyl dithiocarbonate, methyl dithioformate, 4,5-bis(methylthio)-2,2-dithiole-1,3-dithiole, 2,2,4-tris(methylthio)-5-thiol-1,3-dithiole, 4,4',5-tris(methylthio)-5'-acetylthio-2-spiro[5.5]1,1'3,3'-dithiole, dimethyl tetrathiooxalate, tris(methylthio)acetyl-dithioethylene, 2,4,5-tris(methylthio)-1,3-dithiole-2-acetylthiocarbonyl, methyl acetyl trithiocarbonate, methyl α -azirinedithioacetate, methyl α -azirinedithioacetate, methyl α -azirine-methyl trithiocarbonate, dimethyl trisulfide, dimethyl disulfide, 5-thio dimethyl disulfide, 5,5-dithio dimethyl disulfide and 4,5-bis(methylthio)-1,3-dithiole-2-one. Mechanisms are presented for the formation of these compounds from cyclic voltammetric studies of carbon disulfide.

64. A viscoelastic examination of mouse 3T3 DNA and its response to x-irradiation.

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When DNA from mouse 3T3 cells grown in minimal essential medium supplemented with fetal calf serum was analyzed by viscoelastometry, several observations were made regarding chromatin structure and the sensitivity of mouse DNA to damage by x-rays. Cells lysed and analyzed at temperatures from 10 to 80°C revealed that 10° lysis released a compact

nucleoid structure, 20° lysis produced a more unfolded structure and higher temperature lysis resulted in greater and greater flexibility until no viscoelasticity was observed for 80° lysates. Small doses of x-rays (down to 50 rads) produced large increases in viscoelastic properties when cells were lysed at 10°C. This ability to detect the effects of small doses of x-rays could serve as a useful molecular dosimeter for future radiation studies. DNA repair experiments in which cells were irradiated with 50 or 1000 rad, then allowed to incubate for up to 24 hrs. revealed dose-dependent repair kinetics and illustrated the ability of mouse 3T3 cells to counteract the effects of x-irradiation.

65. Synthesis of novel inhibitors of cAMP-PDE.

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The biological effects of the regulatory cyclic nucleotide, adenosine 3',5'-cyclic monophosphate (cyclic AMP or cAMP) are modulated by hydrolysis of the 3'-ester group catalyzed by 3',5'-cyclic nucleotide phosphodiesterases (cAMP-PDE). Conversely, intracellular processes such as protein phosphorylation by cyclic AMP dependent protein kinases are augmented by inhibitors of the phosphodiesterases. Results of the synthesis and inhibition studies of the phosphodiesterases by a new class of cyclic nucleotides will be presented. In these synthetic cyclic nucleotides, the purine ring is in the 5'-position of the carbohydrate moiety and the cyclic phosphate group is in the 1',2'-position. Details of the synthetic steps, stabilities of the final products, and correlation of multinuclear NMR data with structural characteristics will be presented. Inhibition enzyme kinetics and implications of the inhibition data with respect to the development of biologically useful cyclic nucleotides will be discussed.

66. Organic electrochemical studies of redox catalyzed $S_{RN}1$ reactions of bromobenzene

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Cathodically stimulated $S_{RN}1$ reactions typically result in good yields when the initial radical anion is relatively stable towards dissociation. Such reactions of bromobenzene, whose radical anion is relatively unstable, result in very low yields of the desired substitution product due to the two electron reduction of the substrate molecule. Due to its low stability the bromobenzene radical anion dissociates near the cathode thus allowing the aryl radical to be further reduced. We demonstrate here a promising and interesting solution to this problem using certain reversible reducible aromatic molecules which we call redox catalysts. The redox catalyst, is reduced to its radical anion, which is stable, and moves away from the electrode surface prior to transferring an electron to the substrate molecule

and initiating the $S_{RN}1$ reaction. With initiation occurring away from the electrode surface the two electron reduction of the substrate molecule is prevented. We have achieved yields of 56% diphenylsulfide in the $S_{RN}1$ reaction of bromobenzene with tetra-n-butylammonium thiophenoxide in dimethyl sulfoxide using benzonitrite as the redox catalyst.

67. Ant-repellent triterpenoids from Cordia alliodora.

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The leafcutter ants are classed as agricultural pests throughout the tropical Americas, both because of the massive amount of leaf material that they harvest and their special fondness for agriculturally important plant species. Colonies whose foraging is restricted to areas of native forest encounter a great variety of potential host plants, but, while the leafcutter ants are considered polyphagous, they are quite specific in their preference for some plant species and dislike of others. We postulated that some native plants might have evolved chemical defenses against this predation. Using a bioassay which measures ant feeding preferences, we have isolated a series of ant-repellent multiflorane triterpenoids from Cordia alliodora. The details of our isolation, structure determination, and bioassays of these compounds will be presented.

68. Methylene blue reductase indicator test for Escherichia coli infant formula contamination

J.S. McKINNEY

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I am modifying the American Public Health Association's Reductase test into a tropical field test indicating Escherichia coli contamination in prepared infant formula. As an exchange student in Kuantan, Malaysia, I demonstrated the bacterial contamination of powdered infant formula prepared in Malaysian conditions. The APHA test identifies Streptococcus lactis in raw dairy milk at 35°C. I adapted the test to identify Escherichia coli in prepared infant formula at Malaysian field temperatures (27°C). If Escherichia coli is present, it reduces blue Methylene blue to colorless Leuco methylene blue. Comparative 35°C and 27°C reductase tests and standard plate counts' results show my adaptations do not impair the tests' accuracy. The simplicity, low cost and speed of my adapted Reductase test could be useful to field workers, clinics and mothers working in Malaysian conditions.

Conservation

69. The role of floating and air gulping in the feeding ecology of larval tiger salamanders (*Ambystoma tigrinum*).

M. J. Lannoo and M. D. Bachmann

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Ames, Iowa 50011

The hypothesis that air gulping has a physical function of buoying tiger salamander larvae and allowing them to float was tested 1) by showing that physiological requirements alone could not explain air gulping, 2) by defining and quantifying proximal stimuli for air gulping and floating and using these data to correlate the two behaviors and 3) by showing that lungs act as air bladders. The proximal stimuli used by larvae to initiate floating and air gulping in the lab were darkness and the presence of pelagic prey. Lowered oxygen conditions also increased air gulping rates. An empirical model is presented predicting when larvae should float and air gulp under field conditions.

70. Agricultural watershed impacts on detrital processing in small Iowa streams

J. B. BARNUM and R. W. BACHMANN

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Eight sites from seven central Iowa streams were monitored throughout the spring and summer (1981) to determine the effects of agricultural watershed practices on organic matter decomposition rates of sugar maple (*Acer saccharum*) and field corn (*Zea mays*) leaves. Maple leaves are processed much faster at shaded sites compared to open sites (75% complete in 69 versus 102 days). Corn leaf decomposition follows the same trend but occurs approximately twice as fast at a given site. Within each canopy category the smaller watershed sites (ca. 10 km²) process experimental maple leaf substrates faster (62 days shaded versus 96 days open) than the larger (ca. 40 km²) drainage area sites (76 days shaded versus 108 days open). However, a water quality index, based on the relationship: $\ln[(TP)(TN)(SS)]$; where TP = mean total phosphorus, TN = mean total nitrogen and SS = mean total suspended solids is also correlated with decomposition rates.

71. Southern Iowa River Basin, Part I

C. L. Christensen, and J. C. Eichman

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The Southern Iowa River Basin samples were gathered by myself and Dr. Christensen in 1976 through 1978. This will be a status report, and the initial findings. Nine waterways of this water basin were selected for extensive study, but all waterways were sampled on the first collection trip. The nine waterways were the Grand River, Chariton River, Thompson River, Platte River, Nodaway River, Tarkio River, Fox River, Locust Creek, and the Nisabotna River. All samples taken from the waterways were as close to the Iowa-Missouri border as possible. Diatoms, photographs, and water chemistries were gathered at each site. Perhaps this study could be used as a baseline to mark the ecological changes as progress moves into the area.

72. Limnological Characteristics of Iowa Lakes.

S. G. BECK and R. W. BACHMANN

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The 107 major natural lakes and reservoirs of Iowa are all eutrophic and generally characterized by shallow depths, high chlorophyll *a* concentrations, and low secchi disc depths. These factors, along with nutrient data are analyzed to assess their relationships with lake water quality. The analysis includes investigations of the variability of limnological data on a yearly and a seasonal basis, comparisons of Iowa lake data with national studies, and evaluations of existing water quality or trophic state models. Emphasis is placed on relationships which aid in the development of methods to predict water quality in lake restoration.

73. Primary productivity and nutrient relationships in selected Iowa lakes.

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Traditionally primary productivity has been reported on an integral basis, the productivity below a unit of surface area. This has allowed comparison with other trophic levels in that system and with other systems. However, in some situations integral productivity may not be the best expression of productivity. In highly eutrophic or turbid waters the transparency decreases, the euphotic zone becomes compressed and integral rates may no longer accurately reflect changes in nutrient concentration, biomass or general trophic state of the lake. Comparisons with other systems may be misleading. Expressing productivity per unit volume of the euphotic zone

appears to reflect more accurately the relationship between productivity, nutrient concentrations and biomass. The results of work on five Iowa lakes are presented to determine if integral or volumetric productivity best reflects nutrient concentrations and biomass. The data are compared with reported productivity patterns of other north temperate lakes.

74. Limnological characteristics of selected gravel pit lakes in central Iowa

L. M. ANTOSCH and K. M. MANCL

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Scattered throughout the State of Iowa are 1,215 active surface mines, half of which have water withdrawal permits from the Iowa Natural Resources Council. The number of permits indicates the importance of surface mines as a water resource for the State of Iowa. The limnological characteristics of three central Iowa gravel pit lake systems were investigated in this study. The results of this investigation indicates that while these gravel pit lakes can be classified as eutrophic, they are not as productive as other Iowa water bodies. The reason for this seems to be the dominating influence of groundwater rather than surface water inflow into these systems.

75. Potential effects of a coal storage facility on Lake Superior algal communities

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The objective of this research was to analyze the effects of inputs, to the aquatic environment, of materials from a coal storage facility. Coal distillates and leachates were prepared from the low sulfur western coal stored in the Duluth-Superior Harbor storage facility. Three types of bioassays were used: laboratory stream, in situ and static bioassays. High concentrations of distillate generally showed some inhibitions of community growth while lower concentrations had little effect on the periphytic communities. Periphytic community responses to leachates were both stimulatory and toxic. The reasons for the varying responses to leachates are not known. Static bioassays showed similar results. In situ experiments were conducted with 3 concentrations of distillates. Bacterial populations increased at all concentrations. At higher distillate concentrations the zooplankton were killed.

76. Forest legislation and the development of federal forest control: 1691-1905.

A. L. STRAUSS

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This paper explores the formative years in the development of federal forest control and the politicization of forest conservation. Examining legislation, bureaucratic action, scientific input and social factors, the paper seeks to draw a composite picture of changing attitudes and views toward timber, timber resources and the forest. The central question asked is, what of federal forest policy and the development of federal forest control; was the policy process consistent, rational and end-oriented, or was it something less? Research demonstrates that the process--though incremental--was highly disjointed, fractured and misdirected. The developing realm of federal forest control opened itself to input and influence across a broad socio-scientific and political spectrum.

Topics reviewed and integrated include: the Broad Arrow Policy, the "legend of inexhaustibility," timber theft and depredation, the U.S. Naval Timber Reserves, Congressional forest-land disposal policy, the Timber Culture Act, the role of the scientific groups and early state action as culminating in the doctrine of federal forest control, forest set-asides, and management policy.

77. New tree growth resulting from elm mortality in the Dubuque area.

J.E. KAPLER and M.J. RICHTER

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Dutch elm disease destroyed most of the American elms and many other elms in the Dubuque area, beginning about 20-25 years ago. Random samples taken in three selected woodland areas indicated what species of trees are replacing the destroyed elms. The trees with the highest importance values in these areas are Acer negundo L., boxelder, Morus rubra L., mulberry, and Celtis occidentalis L., hackberry. Three streets in Dubuque were also studied to determine what species of trees were planted to replace the elms. Before Dutch elm disease, the trees along these streets were almost exclusively American elms. Acer sp., maples, and Fraxinus pennsylvanica Marsh., green ash, are the most common of the planted trees.

78. Status of endangered small mammals in the Iowa Loess Hills.

R. P. LAMPE and J. B. BOWLES

Department of Biology, Buena Vista College, Storm Lake, Iowa 50588

Three endangered species of small mammals (western pocket mouse, northern grasshopper mouse, and woodland vole) are present in the Loess Hills of western Iowa. Records of these species will be discussed with regard to faunal associations and microhabitat preferences.

79. Characteristics of small mammal communities in grassland and forest of the Iowa Loess Hills.

R. P. LAMPE and D. L. GEORGEFF

Department of Biology, Buena Vista College,
Storm Lake, Iowa 50588

Small mammal populations at seven sites in the Loess Hills of western Iowa were sampled during summer, 1981. Transects of Museum Special traps were set in grassland and forest communities at each site. Eleven species of small mammals were collected; sign of an additional 16 mammalian species was observed. New locations for two endangered species (plains pocket mouse and woodland vole) were discovered. Density estimates, obtained by use of assessment lines across transects to measure effective trapping area, varied between sites as well as between grassland and forest communities at each site. Western harvest mouse was the most abundant species at five grassland sites. At all forest sites, white-footed mouse was the most abundant species. The Loess Hills Wildlife Management Area, Monona Co., had the highest density in both grassland (257.8 individuals/ha) and forest (66.9 individuals/ha) of any site. Species diversity, community dominance, and faunal resemblance factors will be discussed.

80. Conflicts between Indian cultural-environmental values and mineral development.

T. J. BLEWETT

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Iowa 52001

As Iowa faces the prospect of mining and mineral development in the northwest, this case study raises some important questions about the value of existing resources and land use, the rights of local populations that could be affected, and the need for careful development of mineral resources with adequate environmental precautions. A small Chippewa community in northern Wisconsin now faces probable development of a major copper-zinc deposit adjacent to their land. They resist development of mineral resources under their own reservation to preserve the social, cultural and environmental integrity of their life. The development of a mine on adjacent land could adversely affect their wild rice, garden crops, fish and wild game in terms of production and safety for human consumption. Substantial social and economic disruptions could also result from the influx of miners and tribe members seeking employment.

Engineering

81. Agricultural solar energy system: central receiver.

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This paper reports on the design and development of a central receiver or Solar Tower concentrator system. After reviewing the thermal performance and costs of the various competitive collector systems, the conclusions reached are that the central receiver system has a competitive advantage down to $\frac{1}{2}$ MW thermal if canted or segmented heliostats are used. Heliostat field layouts were developed for 37, 148, and 592 heliostat models. The applications of the Power Tower energy production from these arrays will be presented and the emphasis will be on total energy systems, feedlot and feed mill operations, grain processing, and irrigation pumping. With respect to energy and power applications in agriculture, Carnot efficiencies and shaft work requirements are best satisfied by a concentrating system which can output a working fluid efficiently at 300°C or better. Under these conditions, the central receiver system is economically advantageous and cost effective. Preliminary net energy studies find that the system can pay back the total capital energy costs in less than one year of operation.

82. Comparisons of the Thermal-Optical Properties of Interior Window Treatments

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Thirty-four commercial available treatments were tested for their ability to both provide thermal insulation and to facilitate interior lighting. In all cases, the thermal resistance (R-value) for a single pane of glass (R=1.0) was improved by the addition of window treatments (R=1.5 to 2.0). By layering different treatments a maximum R of 2.5 was achieved. However, the tests revealed that installation was just as important in the determination of the R value as was the type of treatment. In most cases, proximity of the treatment to the window surface was the controlling variable.

All the window treatments tested reduced visible light transmission by 30% to 100%. Light transmission was observed to be a direct function of fabric openness and inversely related to fullness. In general, thermal resistance and transparency follow and inverse relationship. The results imply that provision for more effective window management is needed if window areas are to be properly utilized.

83. The technology and economics of using a lime-sinter process to recover alumina from retorted oil shale

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Ames Laboratory--USDOE and Department of Chemical Engineering, Iowa State University, Ames, IA 50011

The high cost of crude oil and the uncertainty of its availability have led to renewed interest in the production of a synthetic crude oil by retorting raw oil shale. A modified in-situ process, which involves a combination of underground and above ground retorting of raw shale, is expected to be used in commercial operation. Although there is no waste disposal in underground retorting, surface retorting produces a large amount of spent shale for disposal. Almost one ton of spent shale is produced for every ton of raw shale processed. Surface disposal of the spent shale would require large tracts of land and could have harmful environmental effects. An alternative to disposal would be to process this waste material to recover contained mineral values. Alumina can be extracted from the spent shale by a high-temperature sintering process and that process residue can then be used in the production of portland cement. An economic evaluation for a plant that would use this process to convert 15,000 tons of spent shale per day into useable products is presented.

84. Kinetics of rotational wall toppling

R. L. HANDY

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Toppling of a high masonry wall is a rare, albeit dramatic and potentially catastrophic phenomenon. Because most of the forces and restraints are readily identified and evaluated, it also affords an opportunity for mathematical treatment based on elementary principles of dynamics.

By ignoring soil forces one may predict that for a 30-foot-high stone masonry wall of uniform thickness: (1) After initial rotation as a unit, and beginning at a tilt angle of 48.2° , the uppermost masonry units will start to separate off and fall in parabolic arcs; (2) as a consequence the wall-laid-flat will be about 38% longer than the original wall height, and (3) the final resting angle of overturning is about 136° , and (4) the uppermost stones will strike at an angle from vertical of 23° and will tend to bounce a horizontal distance of perhaps 15 to 20 ft, depending on hardness of the impacted surface. (5) The maximum velocity at impact will be 44 fps (30 mph) for the uppermost stones, which will hit the ground first. (6) The total collapse time after initial disequilibrium is 1.6 seconds. Conclusions (3) and (4) were confirmed from observation of a collapsed wall.

85. In Vitro Digestibility of Ozone Treated Mesquite

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Ozone enriched oxygen was used to chemically treat mesquite biomass. The objective was to modify the lignin-cellulose structure to the degree that the cellulosic portion can be used in ruminant rations. In vitro dry matter digestibility was used as the measure of success. Untreated mesquite biomass, harvested from the entire above ground structure, pulverized in a hammer mill, and screened to an average particle size of 0.8 mm has an average in vitro digestibility of 32%. This same material, when combined with 60% water on a dry basis and treated with ozone has a digestibility of 60%. This suggests that the cellulosic portion of mesquite biomass can be utilized in ruminant rations, since alfalfa has a digestibility of 60%. Economic estimates show the cost of mesquite, to be supplied as a substitute for hay, to be \$90/ton for a capacity of 30 ton/day. This would be sufficient capacity for a 30,000 head cattle feedlot.

86. Some controversial issues worthy of attention in engineering

J. W. PATTERSON

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The author will focus on three controversial areas of engineering activity. Selected case histories will be used to demonstrate how the image and professional integrity of engineers is being seriously damaged. The need for professional groups and educators in engineering to consider responsible corrective measures will be emphasized. The focus will be on (1) questionable professional activities of non-qualified self proclaimed engineers who embarrass the profession with their conduct and the image of engineering they present to the public and to other professionals; (2) non-professional but ludicrous activities of bonafide engineers who, by flaunting their credentials, make engineers as a group appear ludicrous in the eyes of various scientists and non-engineering educators; (3) consulting and/or litigation activities wherein present protocol requires that engineers either compromise their professional judgments or suppress their opinions on controversial issues because of constraints and tactics employed by the legal profession.

Geology

87. A hydrothermal mineral deposit in southern Linn County, Iowa

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Epigenetic sulfide mineralization occurs at the Martin-Marietta Cedar Rapids Quarry in southern Linn County, Iowa. Minerals were emplaced in vertical to steeply inclined joint-controlled fissures in carbonate rocks of the Silurian Gower and Scotch Grove formations. Local solution enlargement of fractures accounts for widely varying fissure widths over short vertical and horizontal distances. The primary minerals in the deposit are (in paragenetic sequence): pyrite, marcasite, sphalerite and calcite. Sphalerite, which occurs in crusts up to a centimeter or two thick, appears to be confined to the southwest part of the quarry. Wall rock alteration consists of dissolution and pervasive pyritization of host carbonate rock. Fluid inclusion analysis of calcite gives filling temperatures of about 80°C. The form and structure of the deposit, the mineralogy and paragenesis, and the fluid inclusion data identify this deposit as Mississippi Valley type. The nearness of the mineralization to the Plum River fault suggests a genetic relationship.

88. Dye tracing and karst development in Fayette County, Iowa.

M. J. BOUNK

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During the spring and summer of 1981, a series of three fluorescein dye traces was conducted in the West Union area of Fayette County, Iowa. In these traces, the dye, which was introduced in a cave in Silurian strata and a nearby sink in the Devonian Wapsipinicon Fm., reappeared at Duttons Cave. Hydrologic connection between these features is thereby demonstrated. These features are developed along a locally prominent N60°-70°E joint trend, and the dye tracing confirms the hydrologic significance of this jointing pattern. Based on an analysis of joint trends, a third dye trace was expected to reappear at Sowards Cave, but instead flowed to the Duttons Cave. This, and the similarities in passage size of these caves, suggests that a portion of the Sowards Cave drainage and passage system was pirated to the Duttons Cave System.

89. An assessment of hazards and environmental effects of abandoned coal mine lands in Iowa

M. R. Howes

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Four hundred twenty-six abandoned coal mine sites were inspected in thirty-eight Iowa counties which have a history of past coal mining. Sufficient hazards to nearby residents or conditions with adverse effects on the environment were found on 181 of the sites inspected to merit designation as problem areas. Priorities were assigned to the

problem areas based on the degree of impact with priority I for extreme danger situations and II and III for lesser impacts. Criteria used to evaluate mine sites included presence of dangerous high walls or slopes, use of polluted water by local residents or livestock, evidence of serious erosion or sedimentation associated with barren mine spoil, and off-site discharge of sufficient quantities of polluted water to adversely effect local water quality.

Physics

90. A computer simulation of the spatial variability of summer showers

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Using a Monte Carlo simulation technique, contoured rain swaths were superimposed on a portion of the Iowa climatological rain-gauge network. Each shower cell (an ellipse with a major axis 26 km, a minor axis 6.5 km, the major axis being equal to the simulated rain swath path length) was contoured with three concentric rain-totals, 4, 8, and 12 mm, along with the shaping factor derived from upper air data and radar echo observations. The shaping was corrected for each summer month. The resulting simulated area rainfall charts seem very realistic when compared with real data.

Results show the National Weather Service, Iowa, climatological network had a resolution of 18.6, 13.6, and 11.0%, respectively, for the months of June, July and August for the simulated rains. Resolution is defined as the percent of the stations receiving detectable rainfall. In addition, the simulation reveals dry areas and areas with excessive precipitation. Further conclusions are that the natural showers are randomly distributed, and that with a random network of rain gauges, we may never have a true appraisal for the summer precipitation pattern.

91. The Hodges residence: thermal performance of a passive solar home in Iowa

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The Hodges residence, built in 1978-79, was Iowa's first scientifically-designed earth-sheltered and superinsulated passive solar home. It has been occupied since September 1979 by a family of four and has been serving as Iowa State University's de facto passive solar energy research home. Indoor and outdoor temperatures, solar radiation, natural gas consumption (furnace, water heater, and total usage) and electricity consumption (fans and total usage) have been monitored for over two years, including one heating season using night insulation

on the south glazing and one season using none. Experiments have been carried out to determine if the home's long time constant would permit using auxiliary heat only during off-peak energy consumption periods. A two-projector slide show will be used to illustrate the design, construction and operation of the home and present quantitative data from the monitoring program.

92. An application of intervention analysis to temperature data at Fairfield, IA

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Intervention analysis is a fairly recent development in the field of time-series analysis which allows one to both model a stochastic time series and assess the effects of an exogenous variable by means of a transfer function. This procedure is briefly described, as is its application to temperature data at Fairfield during a 92 day period from November 1, 1979 through January 31, 1980. In this case the exogenous variable of interest is the collective practice of the TM-Sidhi program, and the effect described is a warming of the weather on certain chosen days.

93. Entropy Generating Function

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A general entropy generating function is defined. It is calculated for a few probability density functions. The entropy generating function is used as a method to calculate the entropy of a few systems at thermal equilibrium and in non-equilibrium states.

94. Nonlinear effects in a simple electrical system.

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A nonlinear harmonic oscillator is constructed from an air core solenoid and a voltage dependent capacitor. The capacitor consists of two varactor diodes connected "head to head" in series. A normal capacitor is placed in parallel with this so that one may vary the relative strengths of the linear and nonlinear terms. The system is driven by a second coil and an oscillator. The dependence of C^{-1} (C = capacitance) on the charge is determined experimentally and approximated with a power series. This leads to Duffing's Equation which is solved for the fundamental frequency component.* Experimentally we observe the response curve, the "jump phenomenon" and super and sub harmonic generation. The response curve and the locations of the "jumps"

are calculated and found to be in reasonable agreement with experiment.

*T.W. Arnold and W. Case, Nonlinear Effects in a Simple Mechanical System, to be published in the Am. J. Phys. (March 1982).

Physiology

95. Investigations on Myocardial Depressant Factor

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Myocardial depressant factor (MDF) is an endogenous cardiodepressant substance produced by the ischemic hypoperfused pancreas. We have examined the effects of MDF on cardiac muscle function. The MDF was generated from canine, ovine, and porcine pancreases by methods which include pancreatic blood vessel ligation, *in vitro* pancreatic perfusion, and pancreatic homogenation. Ultrafiltrates and partially purified MDF were bioassayed on isolated isotonic canine (pup) papillary muscle preparations. Our results are in agreement with others in which depression of velocity (V_{max}), maximum load (P_0), and latency was demonstrated. We have not observed the magnitude of depression on young canine papillary muscles reported in the literature. Ultrafiltrates of a pancreatic perfusate have produced a $42.2\% \pm 4.2$ (SE) ($N = 8$) depression of P_0 relative to a modified Krebs-Henseleit (KH) solution. Partially purified MDF, to date, has typically depressed V_{max} 25% and P_0 32% and 26% relative to KH and a control isolate, respectively. Demonstration of MDF activity in the porcine and ovine has not been previously reported.

96. Influence of sympathectomy and demedullation on the training responses of SHR groups

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Changes in the activity of the sympathetic nervous system (SNS) are associated with hypertension and adaptations to chronic exercise. To obtain more information on these relationships, chemically sympathectomized (ANGF and Guanethidine sulfate) hypertensive rats were assigned to nontrained (NT) and trained (T) groups after demedullation of the adrenal gland at 9 weeks of age. Resting caudal artery systolic blood pressure (RBP-mmHg) taken in all animals before ($\bar{X}, SE: 121 \pm 8$) and after (127 ± 4) surgery revealed no significant differences; however, after 8 weeks, RBP was significantly lower (112 ± 3). During this period, endurance training had no significant effect on RBP. To determine the influence of an alpha blocker, phentolamine (0.5 mg/kg) was injected i.p. Interestingly, the NT exhibited a greater reduction in RBP (112 ± 2 to 104 ± 3) than the T (116 ± 4 to 111 ± 7). Subsequent measurements of urine and plasma catecholamine levels, as well as muscle aerobic enzyme activity are planned to determine the combined effect of sympathectomy and training. The inability of chronic exercise to lower RBP suggests the importance of the SNS in certain adaptations to training.

97. The Rube Goldberg Model of Higher Thinking

D. D. Vogel

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Memory may be conventionally modeled as a positive feed-back loop in which repeated activation increases the amount of synaptic transmitter released per action potential. If an array of n primary neurons is randomly associated through feed-back with approximately n secondary neurons, any collection of active primary neurons large enough to fire a secondary neuron will tend to initiate reciprocal firing between a subset of secondary neurons and the primary neurons which fired initially.

Such a model has numerous properties of real brains. It associates, generalizes and has a logical property analogous to the slash which Russell and Whitehead used to define "and," "or" and "if... then" connectives. It is also subject to errors as the amount of information stored increases.

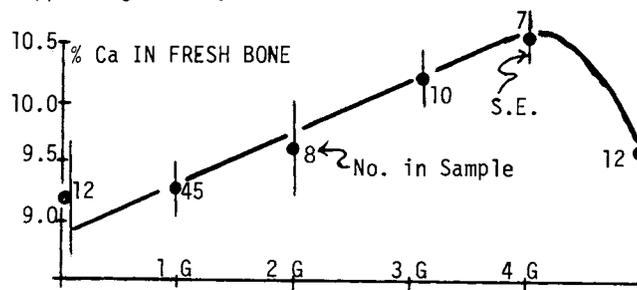
When used to associate motor output and sensory input with an internal standard of success, such as the limbic system presumably represents, the model also accommodates "consciousness" defined as the ability to 1) use information about how information is being processed (self-awareness) and 2) generate imaginary information. Conscious processing which is repeated tends to become "unconscious" in this model.

98. Calcium content of 35-day rat femurs after a week's growth in extraterrestrial gravity.

K.M. COOK, S.R. WATKINS, AND C.C. WUNDER

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For male, Sprague-Dawley rats, % Ca increases with gravitational intensity up to 4 G. High G was simulated by chronic centrifugation and weightlessness by harness suspension. Results are shown for samples selected to possess an average femur-length of 2.4 cm. As reviewed in the accompanying poster-paper (Wunder and Cook), high gravity animals show adjustments consistent with enhanced weight-supporting ability.



99. The EKG of Small Hibernators and Bears.

G. EDGAR FOLK, JR., JILL M. HUNT AND MARY A FOLK

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The EKG was recorded on 3 species of bears, of arctic marmots, and woodchucks, by implanted radiocapsule. We reported earlier that black bears, grizzly bears, and polar bears have a sleeping summer heart rate of 40 to 50 bpm, but in winter dormancy reduce the rate to 8 to 10 bpm. Their body temperature is reduced only 7 or 8 C. With newer capsules we were able to record the electrocardiogram in summer and in winter sleep. Such records are a clue to the identification of hibernator species. The classic hibernators such as woodchucks and hamsters are known to have a very short non-hibernating QT interval, which means that repolarization of the ventricle occurs rapidly after contraction. For comparison, QT intervals of marmots, woodchucks, polar bears, black bears, grizzly bears, and man, using the same telemetry equipment, showed (expressed as mean, in seconds, with S.E.): marmot $.15 \pm 0.3$; woodchuck $.09 \pm .01$; polar bears $.11 \pm .01$; grizzly bear $.23 \pm .06$; man $.45$. Summer sleep and winter hibernation (except for man) were compared: there was little difference. Because this study shows that hearts of bears are physiologically similar to those of other hibernators, and because of other physiological evidence, it seems justified to use the designation of "hibernator" for polar bears, grizzly bears, and black bears.

100. Life in high gravity environments.

C.C. WUNDER AND K.M. COOK

Department of Physiology and Biophysics, University of Iowa, Iowa City, IA 52242 and Biology Department, Coe College, Cedar Rapids, IA 52402

Adjustments made during life and growth at multiples (G's) of the Earth's gravity will be summarized as an introduction to the accompanying presentation (Cook et al.). We established the chronic animal centrifugation procedure in order to study, from exaggerated effect, normal gravity's poorly appreciated biological role. This approach is supplemented by and has predicted many of the opposite effects of weightlessness. Although sufficient intensity can reduce growth rates and fat depots by diverting greater proportions of food materials for work against gravity, high fields are necessary before small animals can experience the effect that man experiences in his day-to-day, one-G existence. Examples of hyper-gravitational responses in growing animals include: generally improved metabolic efficiency and appetite, 25% faster growth of 500-G fruit fly larvae (*Drosophila melanogaster*), 100% faster growth of 5-G turtles (*Pseudemys scripta elegans*), and 50% greater strength of femur-bone material from 3-G rats.

102. Skin conductance as an index of comprehension for attended and unattended auditory messages.

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A previous report showed that, when subjects repeat one auditory message and ignore a second message, skin conductance (SC) increases if the second message becomes interesting, an indication that the message is comprehended even though subjectively unheard. This report examines the possibility that unconscious comprehension of standard syntactic constructions can occur because comprehension is a highly practiced skill. The interesting message was couched in syntax that was awkward (nonstandard) but still comprehensible if attended. Under these conditions, no effect on SC was observed when the message was unattended. A second experiment examined the possibility that, in spite of subjective reports to the contrary, the original effect of the unattended interesting message was due to allocation of some attention to that message. When subjects repeated (thus fully attended) the interesting message, no global increase in SC occurred; instead, localized SC responses occurred. These two experiments help to refine the notion that a message can be unconsciously comprehended.

103. Behavioral correlates of EEG phase coherence

D. ORME-JOHNSON

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EEG coherence has been used to study the functional organization of the brain and event-related-coupling patterns within the brain. The test-retest reliabilities for EEG coherence among frontal, central and occipital derivations over a 3-4 month period for 45 college students were found to be quite high, on the order of .8 for all frequency bands, indicating that coherence patterns are a relatively stable trait. An exception was intra-hemispheric (F3C3 and F4C4) delta coherence (reliabilities were .28 and .39 respectively). In another study of 22 subjects, several of the alpha coherence variables were positively correlated with verbal creativity as measured by the Torrance Test: bilateral frontal (F3C4), $r = .65$, $p = .001$; homolateral right (F4C4) $r = .66$, $p = .001$; dominant alpha (area of the high-alpha coherence for each subject $r = .64$, $p = .001$). Other results showed that principled moral reasoning, WICS IQ and GPA were positively correlated with homolateral left and right alpha coherence and negatively correlated with occipital alpha coherence. Neuroticism was strongly negatively correlated with frontal left, right and occipital (r 's = $-.5$, $p = .005$).

Psychology

101. Adventitious taste aversion conditioning.

Richard W. Pohl

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Theories on a range of subjects (e.g., alcoholism, specific hungers) are based, in part, on experiments involving drug-induced changes in eating or drinking. In many cases, however, these changes appear to be confounded by taste aversion conditioning. The occurrence of unplanned taste aversions is suggested by long term selective decreases in alcohol drinking produced by the drug pCPA; at present all existing evidence suggests that pCPA induced reductions in alcohol consumption were caused by taste aversion. The demonstration of unplanned taste aversion forces a revision of a theory of alcoholism based on pCPA-alcohol studies and supports suggestions that other areas of research are similarly confounded. Implications are discussed.

104. The effect of motion on binocular rivalry

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52242

A mirror stereoscope was constructed that allowed a subject to view a sectored disc with the right eye and another sectored disc with the left eye. The images of the two discs fell upon corresponding retinal areas, so as to appear fused as a single disc. Six subjects viewed the discs in a stationary condition and a moving condition in which the discs were rotated in opposite directions at a rate of 45 rpm. The subject's task was to report the relative contribution of each eye to the perception of the image by pushing a lever to the left or right. It was found that the introduction of motion had a marked effect on the course of binocular rivalry. The stationary condition was characterized by the image remaining fused for a large part of the viewing time with infrequent changes in the perception of the image. The moving condition was characterized by pronounced binocular rivalry with a rapid changing of the perceived image occurring. In the moving condition, the two rotating discs would alternately mask each other. A "full field" binocular rivalry was attained in which all the elements of a particular disc would either be completely dominant or be suppressed.

105. Effects of sex-role stereotype and likableness of trait combinations on impression formation.

R. SIMMONS and D. ARKKELIN

Psychology Department, Wartburg College, Waverly,
IA 50677

Previous research indicated that masculine and androgynous trait combinations were seen as more desirable in a manager than feminine traits. The present study factorially combined trait sex-role, likableness, and target person ("manager" vs. "dating partner"). Subjects rated the desirability of either likable or unlikable masculine, feminine, and androgynous trait combinations. Unlikable masculine traits were rated as more desirable than unlikable feminine traits, but the reverse occurred for likable traits. Ratings of androgynous combinations fell in between those of masculine and feminine combinations for both likable and unlikable traits. However, the interaction of sex-role, likableness, and target person indicated that this pattern occurred only for the manager target person. Ratings of masculine, feminine, and androgynous combinations ascribed to a dating partner were all equal for both likable and unlikable traits, and all likable combinations were rated as more desirable than all unlikable combinations.

106. Perception of Situation Specificity of Behavior as a Personality Trait.

F. X. BARRIOS, A. R. GILPIN*, M. S. RICKE, AND
R. D. BROWNDepartment of Psychology, University of Northern
Iowa, Cedar Falls, Iowa 50614.

Due to the efforts of Mischel and others, psychologists have become disenchanted with personality traits as predictors of behavior in particular situations. Price has argued that it would be more fruitful to classify situations with respect to appropriate behaviors. In the present study we present evidence suggesting that the extent to which college students perceive behavior as constrained by situations is itself a personality trait, negatively correlated ($r(102) = -.16$, $p < .05$) with anxiety as measured by scores on the Spielberger State-Trait Anxiety Inventory. This finding is consistent with the hypothesis that it is functional to perceive situational cues for appropriate behavior.

107. Effects of Mood State and Competence on Altruism.

K. ARNOLD and D. ARKKELIN

Wartburg College, Psychology Department, Wartburg
College, Waverly, IA 50677

The relative effects of mood state and competence on altruism were the focus of this study. Forty subjects (20 males and 20 females) were randomly assigned to one of the following four conditions: good or bad mood state, and success or failure feedback on an anagram task. Two types of measurements of altruism were examined: 1) a task irrelevant to the competence manipulation (donations to charities) and 2) a task relevant to one's perceived competence (the number of anagrams sorted to help the experimenter after the experiment was over). All manipulations were effective in producing the desired level of competence or mood state. Similar amounts of altruism were observed among all four conditions on the irrelevant task. On the relevant task, good mood subjects helped significantly more than bad mood subjects, while no differences were observed between high and low competence subjects. These results indicate that mood state may play a more important role in mediating altruism than does competence.

Science Teaching

108. Pre-service science teacher preparation and challenges from the pseudosciences.

D. V. McCALLEY

University of Northern Iowa, Cedar Falls, IA 50614

Pre-service science teachers assessed by the Nature of Science Scale over a period of six years, have consistently shown significant deficiencies in understanding the nature of the scientific process and the limitations of science. Recent activity from pseudoscience groups, such as the Creationists, have had their impact upon society and upon teachers because of a similar lack of understanding of the nature of science. If the public is to be able to deal with science, we who are science educators and science teachers have a special responsibility to both understand science and to help our students to clearly differentiate between science and nonscience.

109. The development of the notions of chance and probability in adolescents.

L. A. KELSEY

Department of Earth Science, University of Northern Iowa, Cedar Falls, IA 50614.

Piaget and Inhelder employed a number of imaginative tasks to investigate the question of how children come to understand the notions of chance and probability. Their research has implied that the subjects acquire the combinatoric operations prior to the development of the ideas of chance and probability, and that these operations themselves are understood in a sequential manner. In an attempt to study these results in more detail, this researcher examined 130 junior high and senior high school age students on similar tasks. The investigation found evidence that the combinatoric operations are not necessarily prerequisite to the development of the notions of chance and probability. Also, although there is evidence for Piaget and Inhelder's hypothesis that combinations are mastered before permutations, the study disputes the claim that arrangements are understood after combinations.

110. Aerospace Education in Iowa Schools: The Application of Science Concepts

J. GERLOVICH, D. FAGLE, J. COOK, J. HARRIS, and R. MITCHEM

Iowa Department of Public Instruction, Grimes State Office Building, Des Moines, IA 50319

This session will discuss the applicability and appeal of Aerospace Education to secondary students. The role of the DPI, AEA and local school will be analyzed by persons currently in those positions. A pilot program in the Marshalltown schools will be outlined. Resource package, teacher inservice programs, and student career opportunities will be addressed.

111. Computer based homework in physical geology

K. J. DE NAULT

Department of Earth Science, University of Northern Iowa, Cedar Falls, Iowa 50614

Computer based homework assignments were introduced for the first time in the Physical Geology course at the University of Northern Iowa. Topics covered in these assignments include the earth's internal structure, structure of silicate minerals, elevations on topographic maps, calculation of exaggerated vertical scales, properties of common minerals igneous rock names, Bowen's reaction series, ore minerals, metamorphic rock names, crystal fractionation, types of volcanic eruptions, magma generation, chemical bonding, volcanic landforms, sedimentary environments, and determination of the precise orientation of σ_1 , σ_2 , and σ_3 , for normal, thrust, and strike-slip faults. The advantage of the computer based assignments are: 1) The instructor's time is spent assisting students who need help rather than grading papers, 2) Long delay time between submission of an assignment and return is eliminated, 3) Students may repeat an exercise until they have a perfect score and hopefully mastered the material, and 4) Students are introduced to computers. The disadvantages are: 1) The programs take a long time to write and de-bug and 2) Some students neglect to log-off the system when they are finished and thus waste allocated funds.

112. Techniques utilized in creative problem solving to facilitate independent research for high school science.

E.L. PIZZINI and G.E. O'BRIEN

Science Education Center, The University of Iowa, Iowa City, Iowa 52242

This session will highlight creative problem solving techniques that facilitate divergent thinking resulting in a greater pool of ideas. The techniques are beneficial in problem identification and selection, idea finding and solution finding. Participants will be exposed and experience the techniques during the session. The techniques can be utilized to stimulate and/or accelerate student research as well as be adapted to problem solving in general.

113. Does Physics have a future in Iowa Schools?

J. GERLOVICH and R. UNRUH

Iowa Department of Public Instruction, Grimes State Office Building, Des Moines, Iowa 50319

This session will analyze problems affiliated with physics teaching in Iowa High Schools; legislation which may compromise its teaching; and a proposed statewide plan to facilitate applicable physics teaching, especially in rural schools.

114. A status report concerning the development of an elementary classroom science safety manual (K-6)

G. E. DOWNS
J. A. GERLOVICH

Iowa State University, N126 Quadrangle, Ames, Iowa 50011

Presentation of the development, and a brief discussion of the components, of an elementary classroom science safety manual (K-6). The major components of the manual include: introduction and statistical background; legal liability; eye protection and eye care; physical sciences; chemicals and handling; life sciences; outdoor activities; student projects; science safety for handicapped learners; physical plant facilities; fire protection and control; and first aid. Information concerning a one day inservice workshop that was held late in 1981 will be presented.

115. A systems approach to curriculum development for solar science, engineering and technician training.

ARTHUR C. MEYERS III

Institute of Basic & Applied Research, PO Box 1671, Ames, IA 50010.

This paper reports on a systematic approach to meeting the national energy needs by providing methods whereby training in solar energy can be provided. The study on background information had the following results: (1)there exists an immediate need for individuals with both skills and educational background in solar energy for both industry and educational requirements. (2)current employment related company and union programs do not provide proper and long term complete training beyond the immediate system specific need. (3)market surveys have shown employment opportunities for the next 10-20 years that are very good. (4)task analysis determined the skills and knowledge levels required. From these results, a set of solar energy programs were and are being developed to provide the training and skills needed to meet demands of various occupations and disciplines. These programs are being used in a number of schools in the U.S. and Canada. The data from these programs will be discussed with respect to how parts and activities can be added to existing science programs.

116. Using volcanoes to illustrate physical principles in science classes

K. J. DE NAULT and T. L. DICKINSON

Department of Earth Science, University of Northern Iowa, Cedar Falls, IA 50614

Volcanoes are spectacular geologic features which can be used as exciting examples to illustrate physical principles to high school and college students. Last spring (1981) a volcanology course was taught by De Nault and problem sets were pre-

pared by Dickinson. The exercises employed basic physical principles to examine volcanic phenomena. Exercises included calculations on the effect of solubility on eruptive style, energy required to generate a magma, energy released by crystallization of a magma, depth to magma chamber based on the height of the volcano, density of country rock and density of lava, muzzle velocity of pyroclastic fragments, total energy released during a volcanic event (heat, mechanical energy, and work), and viscosity based on flow form. These exercises or modifications thereof can provide new and stimulating examples for application of physical principles.

117. The nuclear arms race and the science curriculum.

JAMES P. COTTINGHAM

Scattergood School, West Branch, Iowa 52358

Studies show an alarming ignorance on the part of our young people regarding nuclear weapons: their history, their destructive capacity, and the extent of their current deployment. Science teachers have a special responsibility in the area of accurate information about nuclear weapons. Ways in which the topic has been included in science courses at the high school level are described. Interdisciplinary courses that have been taught in this area are also discussed. Techniques for introducing a topic such as nuclear weapons in a way that strengthens rather than dilutes the "hard" science content of a course are described.

Zoology

118. Badgers, black widows and prairie rattlesnakes, an ecological association in Iowa's loess hills

J. L. Christiansen

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Des Moines, Iowa 50311

Prairie rattlesnakes (Crotalus viridis) and black widow spiders (Latrodectus mectans) were found in close association with badger (Taxidea taxus) dens in the loess hills of Plymouth Co., Iowa. It appears that the longevity of the numerous badger dens may benefit from the excellent digging quality of the loess. These dens provide diurnal cover and probably hibernaculae for the prairie rattlesnake surviving only here in Iowa. Eight of the abandoned badger dens examined in May 1981 had webs believed to be made by black widow spiders and three of these housed living black widows. The presence of the large number of abandoned badger dens may be essential for the survival of rare and endangered prairie rattlesnakes in Iowa and may be of significance in the success of black widows, a species uncommon in Iowa.

119. The freshwater mussel fauna of the Upper Mississippi River near Locks and Dam 19 at Keokuk, Iowa

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Academy of Natural Sciences of Philadelphia
19th & Parkway, Phila., Penna. 18901

Twenty-four freshwater mussel species (Bivalvia:Unionidae) representing 17 genera were collected during October, 1978, on the Upper Mississippi River above and below Locks and Dam 19 at Keokuk, Iowa. The most abundant taxa were Amblema plicata (Say), Quadrula pustulosa (Lea), Obliquaria reflexa (Rafinesque), and Ellipsaria lineolata (Rafinesque). Three distinct benthic habitats and their associated mussel communities were observed. A viscous silt-clay streambed was noted at Station A immediately upstream of Locks and Dam 19. Seven mussels comprising six taxa were collected at this site. The greatest variety of mussels was found at Station B, below the Locks and Dam, and at the portion of Station C located upstream from the Des Moines River confluence. The substrate throughout these areas was dominated by a more stable sand-cobble-silt composition. The number of mussels decreased throughout the downstream portion of Station C, which was directly affected by the shifting bedload deposited by the Des Moines River.

120. A study of the taxonomic validity of Orconectes iowaensis Fitzpatrick.

G. S. PHILLIPS

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50554.

While studying the Propinquus Group, Fitzpatrick examined specimens collected in Iowa which he

believed were closely related to but different from Orconectes propinquus Girard. A new species, Orconectes iowaensis Fitzpatrick, was described in 1968. Species designation was made on the basis of differences noted in the first pleopod of first form males and the annulus ventralis of females. In 1978, a two year survey of the decapod crustaceans of Iowa was completed by Phillips which described the distribution and ecology of O. iowaensis. During this study, taxonomic problems were encountered which suggested the need for a taxonomic analysis of this species. On the suggestion of Dr. Horton H. Hobbs, Jr., a study of the taxonomic validity of O. iowaensis was begun in 1979 at the University of Northern Iowa. Evaluation was made on the basis of 465 specimens of O. iowaensis and 776 specimens of O. propinquus. Measurements of 16 key taxonomic characters were made of each specimen. Statistical analysis of the data collected suggests that O. iowaensis is not a valid species but rather a variant of O. propinquus.

121. Effects of Zooplankton
On Algal Growth

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The relationship between distributions of different zooplankton species and the extent of clumping by blue-green algae was studied at a small eutrophic lake, and also under laboratory conditions. During an algal bloom, the concentration of Daphnia pulex was closely correlated with the amount of clump formation by Aphanizomenon, with a Pearson's Product Moment Correlation of 0.89. On the other hand, Daphnia rosea, and both calanoid and cyclopoid copepods did not exhibit this relationship with algal colonization at all. Different hypotheses concerning trophic relationships, chemical nutrients, and other factors are offered to explain the results.

122. The influence of habitats on population densities of Hemileuca oliviae Cockerell

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50011

Population response to environmental factors within a single favorable habitat has constituted most studies by animal ecologists in the past. Recently, Whittaker (1971), suggested that more information could be obtained by quantifying population responses to both favorable and unfavorable habitats. Such a study was undertaken with populations of Hemileuca oliviae Cockerell. Within the geographic range of this insect species are adjacent stands of blue grama and feathergrass plant communities. In 1979 these two communities provided very different habi-

tats to populations of H. oliviae. Egg densities were not significantly different between these potential habitats at seven study sites located in east-central New Mexico. However, population densities at all sites decreased more in feathergrass than in blue grama habitats. Important environmental characteristics which are different between the habitats included vegetative composition, ground cover, and topographic position. Perhaps the influence of habitats on population densities may explain the highly aggregated and discontinuous nature of populations of H. oliviae.

123. Selection involving the amylase locus in Drosophila pseudoobscura

R. D. SEAGER

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Amylase is a digestive enzyme which hydrolyzes starch to maltose. There are two common forms (alleles) of the amylase gene in natural populations of Drosophila pseudoobscura. We are studying mechanisms potentially involved in maintaining this genetic variability.

We have looked for conditions under which selection is and is not acting on amylase. We wish to know when during the life cycle and under which environmental conditions and conditions of intraspecific competition selection is occurring.

We have varied the food and temperature, looked at populations polymorphic or monomorphic for inversions, breeding under discrete or continuous time, and at various life cycle stages. Although selection is clearly involved under some conditions, no clear pattern has yet emerged.

124. Post-insemination mortality as a barrier to hybridization in mosquitoes of the Aedes scutellaris complex

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Interspecific crosses between the mosquitoes Aedes polynesiensis Marks and Aedes malayensis Colless have shown a unidirectional pattern of compatibility. Aedes polynesiensis females inseminated by Aedes malayensis males fail to produce viable offspring while the reciprocal cross is viable. Preliminary comparisons show a higher rate of mortality in Aedes polynesiensis females following insemination by Aedes malayensis males when compared with controls. Such mortality may provide an effective barrier to hybridization.

125. Notes on the food habits, the competitors and the breeding cycle of Melanerpes formicivorus on Irazú, Costa Rica.

WELLER, S. J.

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The foraging strategy of the acorn woodpecker (Melanerpes formicivorus) in the tropical habitat and climate of Irazú is a modification of the strategy of temperate populations observed in the southwestern United States. The temperate populations are noted for their communal defense of centralized acorn stores. On Irazú, however, acorn stores were decentralized although group members defended major caches. During the two-month study, insect consumption replaced acorn consumption as the major constituent of Melanerpes' diet. The change in foraging strategy was correlated with the intensity, the frequency and the nature of heterospecific competition. As in the U. S. populations, the breeding cycle began with nest hole excavation in late February, followed by copulatory behavior in April and nesting behavior (incubation) on April 25th.

126. Incidence of canine helminths in northwestern Illinois, with a discussion of public health implications

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Necropsy of 160 dogs between March and December 1978 revealed the presence of a number of species of parasitic helminths. Dogs of various ages and sizes were obtained from the Winnebago County Animal Shelter in Rockford, Illinois just subsequent to euthanasia; these ranged in age from approximately six weeks to four years, with the majority being one year or less of age. Thirty-eight (23.8%) were negative for helminths. Percent of dogs infected with specific helminths were as follows: Ancylostoma caninum and/or Uncinaria stenocephala (36.3%), Trichuris vulpis (21.9%), Toxocara canis and/or Toxascaris leonina (52.5%), Dipylidium caninum (17.5%), Taenia pisiformis (4.4%). Dirofilaria immitis was not detected. An attempt was made to correlate incidence of parasitism with host age and sex. The veterinary and public health implications of these findings will be presented.

127. Cinematographic Study of Attachment by Miracidia of Cyclocoelum oculum to Snails and Subsequent Redial Penetration

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Cyclocoelum oculum miracidia are unusual in that they contain a fully-formed redia. Upon contact with a snail, a miracidium immediately inserts its apical papilla through the snail's epithelial layer to or just beyond the basement membrane. After penetration by the apical papilla, the first tier of miracidial epidermal plates is shed. The region previously covered by these plates is drawn into the epithelial layer of the snail. Following this, vigorous contractions by the anterior third of the miracidium occur. These movements aid in pumping apical gland contents into the snail. Concomitantly the redial stage is actively moving and enlarging the cavity it occupies by destroying miracidial tissue; its anterior end is particularly active, constantly probing in the region near the base of the apical papilla. Eventually this probing action produces a hole in the miracidial membranes. As the redial stage starts to move through this opening, the apical papilla retracts. The emerging redia enters a snail hemolymph vessel, propelled forward by its large posterior appendages.

129. Use of the plankton centrifuge in studies of population dynamics of myxozoan infections in fish.

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The plankton centrifuge technique (PCT), widely used for diagnosis of salmonid whirling disease -- Myxobolus (Myxosoma) cerebralis -- is adaptable for diagnosing and monitoring intensity and prevalence of other myxozoan infections in feral fishes. The PCT was used in a survey of species of myxozoans inhabiting fathead minnows (Pimephales promelas) in Pillsbury Creek, Dickinson County, northwest Iowa. A plankton centrifuge harvest of 25 minnows yielded spores of 3 types of Myxobolus and 1 Unicauda species. Spores, cysts and separate sites of infection (brain, gills and musculature) indicated the 3 Myxobolus forms are distinct species. Determination of infection prevalence of the four myxozoans in separate minnow tissue samples was made by routine examination of microscopic smears followed by the PCT. The muscle-inhabiting Myxobolus was found in all of 10 muscle samples processed by both methods. Prevalence estimates of the brain and gill-inhabiting myxobolids made by the PCT were markedly higher than estimates made by routine microscopic examination.

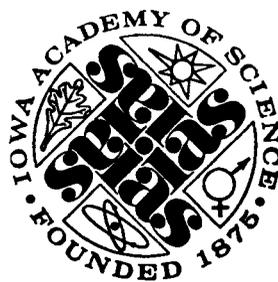
128. Myxobolus (Myxozoa: Myxosporea) infections on the brain of fathead minnows (Pimephales promelas) in northwest Iowa

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Myxobolus cysts occurred in the meninx primitiva and brain tissue in 20 of 25 (80%) adult fathead minnows examined from Pillsbury Creek in Dickinson County, northwest Iowa during summer and fall 1981. Cysts were globose or amorphous and often visible to the naked eye as white opacities on exposed brain surfaces. Microscopic cysts occurred within brain tissue, most commonly in the optic tecta; spore clusters were common within brain ventricles. Host response consisted of thin connective tissue encapsulation. None of the infected minnows showed external signs of disease. Spore morphology, infection site and host species indicate this is an undescribed species of Myxobolus. Scanning electron microscopy of freeze-fractured infected brain tissue showed masses of intact spores in noncellular ground substance. Spores were formed of two smooth-surfaced convex valves, and showed a distinct suture line. Each sutural ridge was enlarged at the position of the cnidocyst-filament discharge pores. Freeze-fracturing of spores exposed the granular sporoplasm, cnidocyst discharge canals, and internally thickened sutural zones.

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