

Proceedings of the Iowa Academy of Science

Volume 88 | Number

Article 9

1981

Abstracts of Papers, 93rd Session, Iowa Academy of Science, April 24-25, 1981, Coe College, Cedar Rapids, Iowa

Let us know how access to this document benefits you

Copyright ©1981 Iowa Academy of Science, Inc.

Follow this and additional works at: <https://scholarworks.uni.edu/pias>

Recommended Citation

(1981) "Abstracts of Papers, 93rd Session, Iowa Academy of Science, April 24-25, 1981, Coe College, Cedar Rapids, Iowa," *Proceedings of the Iowa Academy of Science*, 88(1),.

Available at: <https://scholarworks.uni.edu/pias/vol88/iss1/9>

This Research is brought to you for free and open access by the IAS Journals & Newsletters at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

Offensive Materials Statement: Materials located in UNI ScholarWorks come from a broad range of sources and time periods. Some of these materials may contain offensive stereotypes, ideas, visuals, or language.

ABSTRACTS of PAPERS

93rd Session

Iowa Academy of Science

APRIL 24-25, 1981

Coe College

CEDAR RAPIDS, IOWA

Author	Abstract	Page	Author	Abstract	Page
Albertson, M.C.	10	3	Edwards, C.	65	16
Ales, D. C.	79	19	Espenson, J. H.	B	15
Anderson, W. I.	104	24	Farmer, J. N.	159	37
Anellis, I. H.	121	24	Fay, L. P.	109	25
Baker, R. G.	A	8	Ferrell, J. L.	51	12
Bakken, C. K.	28	6	Ferrett, T. A.	71	17
Bergquist, B. L.	A	15	Fisher, A. K.	29	6
Black, A.C., Jr.	60	14	Ford, J. E.	68	16
Bovbjerg, R.	85	20	Frest, T. J.	F	9
Bovee, E. C.	61,119,131,164	14,27,30,38	Friis, J. M.	40	9
Bower, J.R.F.	27	6	Galloway, K. E.	116	27
Bowles, J. B.	89	21	Gerk, A. J.	105	24
Buchheim, M.A.	47	11	Gerlovich, J.	151	35
Burggraf, D.R., Jr.	113	26	Gilpin, A. R.	137	32
Burkhart, C. P.	100	23	Godfrey, L. R.	36	8
Celander, D. W.	80	19	Goeppinger, W. W.	13	3
Chatterjee, R.	75	18	Goff, H. M.	C	15
Christiansen, J.L.	G	8	Graeff, R. W.	114	26
Christiansen, P. A.	82	19	Greenwood, J. C.	138	32
Cloud, T. A.	110	25	Gurira, R. C.	66	16
Cole, J. R.	33	7	Hallauer, A. R.	5	1
Coleman, R. W.	56	13	Hanson, R. J.	127	29
Cooper, Curt S.	74	18	Hartman, K. A.	153	36
Crawford, R. P.	9	2	Haustein, C. A.	64	15
Critchlow, S. C.	67	16	Henthorn, S.	31	7
Crossett, J. M.	120	28	Hightshoe, G. L.	83	19
Curry, T. M.	12	3	Hill, K. R.	90	21
Delannay, X.	11	3	Hodges, C. A.	58	13
Dobbins, M. S.	102	23	Hogben, C. A. M.	135	31
Downs, G. E.	146	34	Holden, M. L.	99	23
Dumkrieger, B.J.	53	12	Horner, H. T., Jr.	43,44	10
			Hull, B. L.	139	32

(Continued on back page.)

Agricultural Science

1. Cereal leaf beetle resistance of pubescent Avena sativa-A. sterilis hybrids.

C. YOUNG

Iowa State University Agronomy Department, Room 1
Agronomy Building, Ames, Iowa 50011.

The objectives of this study were to discover the inheritance of leaf pubescence in oats and to assess the effect of pubescence on oviposition preference and larval antibiosis of the cereal leaf beetle (Oulema melanopus). Avena sterilis PI 311677 was selected for introgression of pubescence genes into six glabrous A. sativa lines. Several F₂ segregates exhibited greater trichome density than the pubescent parent indicating transgressive segregation for trichome expression. These pubescent progenies were used in subsequent tests. Glabrous 'Mariner,' included as a susceptible check, was preferred as an oviposition site when tested with the hybrid progenies and A. sterilis. However, the beetles distinguished between A. sterilis and the pubescent test material, indicating that wild type resistance had not been completely recovered. Larval feeding damage was significantly more severe on glabrous than pubescent plants. The results of this study indicate that progress toward cereal leaf beetle resistance may be made by selection for increased leaf pubescence.

2. Inheritance of tertiary seed development in oats.

B. D. McBRATNEY and K. J. FREY

Iowa State University Agronomy Department, Room 3
Agronomy Building, Ames, Iowa 50011.

Most cultivated oats (Avena sativa L. and A. byzantina L.) set one primary and one secondary floret in each spikelet, but Avena nuda sets as many as six florets per spikelet. Lines of A. sativa with low, intermediate, and high proportions of tertiary seeds were intercrossed for this study.

These crosses showed that inheritance of the tertiary floret set in oats was due to alleles at two loci. As tertiary floret percentage increased, grain weight, heading date, plant height, and spikelets per panicle remained constant, and bundle and straw weights decreased. Since grain weight remained constant while bundle and straw weights decreased, it must be assumed harvest index increased. Even though the study showed sink size of oats can be increased by greater tertiary seed set, there was no increase in grain weight due to this factor. Probably, the photosynthetic capacity of the plant was not efficient enough to take advantage of the increased sink size.

3. Direct and indirect selection for grain yield in oats (Avena sativa L.).

S. K. JOHNSON and K. J. FREY

Iowa State University Agronomy Department, Room 3
Agronomy Building, Ames, Iowa 50011.

Direct selection has been used by plant breeders for the improvement of grain yield. Microplots are valuable for preliminary studies in small grains, but selections for grain yield based upon measuring this trait in such small plots usually leads to little if any genetic gain. Indirect selection provides a possible alternative method for choosing lines which have improved grain yield. Using component traits of grain yield, which generally have higher heritability than yield itself, has been suggested.

Four selection criteria were used to test the degree to which predicted gains in grain yield would be realized. The component criteria were: 1) grain yield (GYD), 2) harvest index (HI=grain wt/total plant wt), 3) growth rate (GR=straw wt/growth duration), and 4) HI + GR (assigned equal weight). All data were coded into standardized units before applying selection. In the evaluation experiment, the realized gain in grain yield were a) 6.7% when GYD was the selection criterion, b) 3.0% when HI was selected, c) 7.8% when GR was selected, and d) 6.3% when HI + GR was the index criterion.

4. The impact of sixty years of plant breeding on the genetic variability of oats.

D. M. RODGERS, J. P. MURPHY, and K. J. FREY

Iowa State University Agronomy Department, Room 3
Agronomy Building, Ames, Iowa 50011.

An investigation of the genetic relationships within the North Central gene pool of cultivated oats was conducted using the coefficient of parentage (r), an inbreeding parameter developed by Malcot. The pedigrees of cultivars and breeding stocks developed during the period between 1920 and 1980 were used to obtain estimates of r . The change in inbreeding (r) over time and the level of inbreeding among contemporary cultivars were examined.

A positive relationship between varietal yields and r was observed over time. A plateau in varietal yields due to a loss of genetic variability among breeding stocks is highly probable unless the current genetic base is broadened through the use of unadapted or unimproved germplasm. The results of our study should be helpful to plant breeders both in identifying parental combinations having optimum r -values and also in designing comprehensive breeding schemes for germplasm utilization.

5. Response to reciprocal full-sib selection in two corn populations

Arnel R. Hallauer

USDA-SEA, AR
Department of Agronomy
Iowa State University
Ames, IA 50011

Reciprocal full-sib selection is a method of interpopulation recurrent selection that includes the

evaluation of full-sibs produced between two populations. Five cycles of reciprocal full-sib have been completed for Iowa Two-ear Synthethic (BS10) and Pioneer Two-ear Composite (BS11). Yield was the primary trait emphasized in selection, but indirect selection also was practiced among plants used to produce full-sib progenies and among full-sib progenies for other agronomic traits. One cycle of selection can be completed in 2 years. Response to selection for yield has been positive in each population and the population cross; 14.2% for BS10, 11.9% BS11, and 18.7% in the population cross. Correlated response for other agronomic traits were in the desired direction except for BS11 for root lodging, which showed an increase. There was no evidence that the genetic variability was reduced after four cycles of selection. Reciprocal full-sib selection seems to have potential for integrating germplasm improvement with line and hybrid development.

6. Possible pathogenic seed-borne fungi of sunflowers

L. E. Sweets and H. L. Bissonnette

Iowa State University, 109 Bessey, Ames, IA 50011

Several sunflower seed lots with low germination values in laboratory tests were examined to determine if seed-borne fungi might be affecting germination. Preliminary isolations on APDA and in blotter tests indicated that 93% of the sunflower seeds were infected by Alternaria alternata and 17% by a Phomopsis sp. Seeds from four sunflower seed lots were plated directly on APDA, washed in running water and plated, and washed in running water, surface disinfected in 2% NaOH and plated. Rhizopus stolonifer and A. alternata were isolated from 90-100% of the seed directly plated. Alternaria alternata was isolated from more than 50% of the seed which was washed or washed and surface disinfected before plating. Phomopsis sp., Sclerotinia sclerotiorum, Botrytis cinerea, Aspergillus nigrans, and a Penicillium sp. were isolated at low frequencies from the treated seeds. In petri plate and blotter tests, the Alternaria alternata covered the seed coat and spread out on developing seedlings, but it did not injure or kill the hypocotyl or radicle. The Phomopsis sp. and Sclerotinia sclerotiorum covered the seed coat and spread out on the developing seedling causing damping-off of seedling.

7. Integrated control of Phytophthora rot of soybeans.

H. Tachibana, R. A. Thompson, and J. D. Hatfield.

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

Ridomil (N-[2,6-dimethylphenyl]-N[methoxyacetyl] alanine methyl ester), a systemic fungicide specific for Phycomycetes, effectively controlled Phytophthora rot of soybeans in Iowa in 1979 and 1980. Soybean cultivars with different levels of resistance were tested. The susceptible variety 'Marshall' yielded as well as the highest yielding specific-resistant cultivar 'Harcor' when both seed and soil treatments were used. No significant benefit resulted from treatment of resistant soybeans. Ridomil provides

another method for managing Phytophthora megasperma var. sojae that has repeatedly overcome specific genetic resistance alone. Also problems of new pathogenic races have been only accentuated through genetic remedies. When susceptible, high yielding soybeans are grown with the protection of Ridomil, a degree of genetic diversity can be retained in the crop that has been made more uniform with emphasis on incorporation of resistance into the majority of the commercial varieties. Integrating the use of Ridomil along with the principles of the "prescribed resistant variety" concept for BSR of soybean would provide diversity in method, genetics, and geography for control of Phytophthora rot of soybeans in Iowa.

8. Conservation tillage and eyespot disease of maize.

C. A. Martinson

425 Bessey Hall, Iowa State University, Ames, IA 50011

Conservation tillage utilizes crop residues on the soil surface for soil erosion control and less water runoff. Eyespot caused by Kabatella zeae Narita & Hiratsuka has become prevalent in many Iowa maize (Zea mays L.) fields where conservation tillage is practiced, especially in Northern Iowa. In 0.4 hectare plots, eyespot severity was 5 to 20 times greater in no-till maize than in maize planted in plowed soil. Partial burial of maize debris by disking, chisel plowing, and till planting reduced the disease proportionately. A maize-soybean-maize rotation effectively controlled eyespot in the maize crop. Yield losses due to eyespot varied from 3 to 20% with different hybrid varieties. Eyespot has emerged as a problem in conservation tillage of maize but eyespot can be controlled economically by crop rotation, partial tillage, and resistant varieties without sacrificing the benefits of conservation tillage.

9. Pythium ultimum resistance and cold tolerance in maize.

R. P. Crawford and C. A. Martinson

Dept. Plant Pathology, Seed & Weed Sciences, 353 Bessey Hall, Iowa State University, Ames, IA 50011

Three maize (Zea mays L.) populations (BS13 [SCT]C₂ improved for cold tolerance and BSSS2[FP]C₃ and BS7[FP]C₃ both improved for resistance to Pythium ultimum Trow) and the respective unimproved C₀ populations were evaluated by S₁ testing of 105 families per population for cold tolerance and resistance to P. ultimum. Relationships between the traits were studied. Data on germination, survival, and root weight were recorded for environments with and without P. ultimum. Cold tolerance was assayed under controlled temperature and moisture conditions in natural soil and was based on criteria of final stand and daily rate of seedling emergence. Good progress had been made for cold tolerance but not resistance to P. ultimum. Apparently, cold tolerance was mistaken for P. ultimum resistance. The traits were inherited independently, with occasional fortuitous co-inheritance. Cross-products analyses

of phenotypic and genotypic correlations support the feasibility of simultaneous screening for both traits.

10. Zea mays/Z. diploperennis interspecific hybrids

M.C. Albertsen and R.W. Pohl

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

Interspecific hybrids were produced from intercrossing Zea mays with Z. diploperennis, using Z. diploperennis as the female parent. Hybrid plants produced multiple culms but did not produce the rhizomes that are characteristic of Z. diploperennis. Major culm tassels on hybrid plants resembled those of Z. mays but lacked the prominent central spike. Additionally, simple terminal staminate inflorescences were produced by many of the ear shoots. Culms produced by hybrid plants developed three to eight major leafy branches. Because all the middle and upper nodes produced ear shoots, the total number of ears per plant was numerous, with 10-82 ears occurring on various culms. Hybrid plants produced paired pistillate spikelets, forming four-rowed ear shoots. Hybrid plants were backcrossed both to Z. diploperennis and to Z. mays. Using Z. mays as female parent yielded both yellow and darkly colored caryopses. This color segregation may help to determine the constitution of the aleurone color alleles in Z. diploperennis.

11. Genetics of root fluorescence in soybeans.

X. Delannay and R. G. Palmer

Department of Genetics, Iowa State University Ames, Iowa 50011

Most soybean cultivars and plant introductions express a bright blue fluorescence when exposed to ultra-violet light. Some lines have been found that do not show this trait. Negative-root-fluorescent genotypes are uncommon in cultivated soybean (Glycine max (L.) Merr.), but are found frequently in the wild progenitor (G. soja Sieb. & Zucc.). Genetic studies of negative root fluorescent plants indicate that three independent recessive genes, and one dominant gene, are involved in the inheritance of root fluorescence in the cultivated species. Only the dominant gene has been found in the wild species so far. Root fluorescence in soybeans, therefore, seems to be a good trait to use in the study of the relationships between the wild and the cultivated species. These studies should contribute to our understanding of the domestication of the soybean.

12. Genetic and growth comparisons between normal and fasciated soybeans.

T. M. Curry, M. C. Albertsen and R. G. Palmer

Departments of Botany and Genetics
Iowa State University, Ames, Iowa 50011

Fasciation in soybeans (Glycine max (L.) Merr.)

results in abnormal stem morphology. The fasciated trait (f) is inherited as a single-gene recessive. In soybeans, three different plant introductions show fasciation. Allelism tests indicate that the gene for fasciation is at the same locus in all three plant introductions. Linkage studies show that f is not linked to pubescence color, flower color, seed coat peroxidase level, or to a synaptic mutant (st₂). Additionally, f is not located on primary trisomics A, B, or C, and no linkage was found between the mutant and the chromosome interchange from PI 101,404B. Results from single wedge, double scion wedge, and approach grafts showed that plant phenotype was that of the scion and not the rootstock. Different growth parameters were analyzed during the growing season. Significant differences between fasciated and normal plants were observed with shoot dry weight, stem circumference, and petiole number.

13. Zea Diploperennis opens new horizons for corn agriculture

W.W. Goepfinger

Goepfinger Farms, P.O. Box 358
Boone, Iowa 50036

The discovery of the long sought after diploid perennial teosinte by Mexican botanist Rafael Guzman in the Sierra Manatlan mountains of Jalisco in 1978 was the break through basic corn breeding scientists had been hoping for for decades. Hitchcock had found a perennial teosinte in Mexico early this century in tetraploid form but it was of no great value to corn improvement because it was a tetraploid and corn a diploid. Guzman's find was corroborated a diploid by Dr. Hugh Iltis, Director Herbarium, University of Wisconsin. This led Iltis and other scientists including the author to promptly visit the site of the find to make further research. Subsequent studies and plantings of seed, stalk, leaf and root materials from the plants of the diploid teosinte were made. Extensive laboratory tests of resistance of the diploid to air, insect and soil borne corn diseases already indicate high values of possible corn improvement. The author's chief interest lies in searching for and stimulating other corn researchers to find a plant containing a cold resistant gene in one of the plants capable of over-wintering and growing again the next season, thus opening the possibility of perenniality to corn agriculture.

14. Germination of Convolvulus arvensis L. seed

J. L. Jordan and L. S. Jordan

Plant Pathology, Seed and Weed Science, Iowa State Univ., Ames, IA 50011; Botany and Plant Sciences, Univ. of Calif., Riverside, CA 92521

Initial germination of Convolvulus arvensis L. seeds was less than 10%. Exposure to microorganisms in the soil did not increase germination. Continuous chilling at 11 C increased germination, but alternation between 11 C and 16.6 C did not increase germination. The chilling response occurred with both moist and dry seeds. Dry and wet heating also increased germination. Scanning electron microscopy analysis of the seed coat revealed an open, porous structure of coats on

seeds that will germinate tight, nonporous structure for seeds which will not germinate.

15. Competition of Avena fatua L. with Triticum turgidum L. durum group cv. Mexicali and Triticum aestivum L. cv. Anza for nitrate

L. S. Jordan, J. F. Henson and J. L. Jordan

Botany and Plant Sciences, Univ. of Calif., Riverside, CA 92521; Plant Pathology, Seed and Weed Science, Iowa State Univ., Ames, IA 50011

Growth and nitrogen of wheat and wild oats alone were the same with a 1.5 mM nitrate Hoaglands solution. When nitrate content was increased to 15 mM, growth and nitrogen of Anza and wild oats increased threefold, with a twofold increase for Mexicali. Wheat with the 15 mM nitrate solution, and in a 1:1 wheat to wild oat ratio, had greater growth and nitrogen than expected from growth and nitrogen of pure stands. With wild oat populations of 5 oats to 1 wheat, both topgrowth and total nitrogen for each wheat type were reduced. When the nitrate content was 15 mM, the ratio of Anza to Mexicali for grain yield was 1.8, 1.5, and 1.0 with no wild oats, 1:1 and 1:5 wild oat to wheat ratios.

16. Chenopodium album L. seed coat characteristics

J. L. Jordan and L. S. Jordan

Plant Pathology, Seed and Weed Science, Iowa State Univ., Ames, IA 50011; Botany and Plant Sciences, Univ. of Calif., Riverside, CA 92521

The seed coat of Chenopodium album L. was investigated using scanning electron microscope techniques. Black and brown lambsquarters seeds do not show any differences in exterior surface details. However, the cryofractured black seeds had seed coats approximately twice as thick as the brown seeds. Also, differences in structure are revealed; the seed coat of black seeds appears to be more condensed than the seed coat of brown seeds.

17. Temperature-dependent interaction of auxin and ethylene in anomalous cultivars

Nader Seyedin, J. S. Burris, C. E. LaMotte, and I. C. Anderson

Seedlings of certain soybean cultivars fail to exhibit normal hypocotyl elongation at 25° C. Samimy and LaMotte (Plant Physiol. 58:786, 1976) have implicated ethylene in this phenomenon. Neither methionine (125 μM) nor auxin (10 μM IAA) alone stimulate ethylene production in isolated apical 2-cm section of hypocotyls. When combined they stimulated ethylene production, both at 25 and 30° C. In the presence of methionine, 1 μM IAA stimulated ethylene production at 30° C but not at 25° C. The immediate precursor of ethylene, ACC, at 125 μM significantly stimulated ethylene production by isolated hypocotyls at both temperatures. We propose that the temperature-dependent inhibition of hypocotyl elongation involves an abnormally

high level of both methionine and auxin at 25 than at 30° C.

18. Role of cotyledons in temperature-dependent inhibition of hypocotyl elongation

Nader Seyedin, J. S. Burris, C. E. LaMotte and I. C. Anderson

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

Seedlings of certain cultivars of soybean (Glycine max L) exhibit breakage and reduced elongation of hypocotyl at 25° C. Samimy and LaMotte (Plant Physiol. 58:786, 1976) have implicated ethylene in this phenomenon. Burris and Knittle (Crop Sci. 15:461, 1975) have demonstrated that partial removal of cotyledon tissue from seeds of 'Amsoy 71' results in normal hypocotyl elongation at 25° C. Removal of 50% of the cotyledon significantly decreased ethylene evolution. Intact seedlings of 'Amsoy 71' evolve twice as much ethylene at 25 as at 30° C. Apical 2-cm sections excised from hypocotyls of 'Amsoy 71' and 'Cutler 71' show a similar temperature dependence. Hypocotyl sections from the normal cultivar 'Corsoy' evolved significantly less ethylene compared with those of 'Amsoy 71' and 'Cutler 71'. These findings suggest that the cotyledon controls ethylene production in the hypocotyl.

19. The ecology component of weed science.

David W. Staniforth

Iowa State Univ. 457 Bessey Hall, Ames IA 50011

Weed control methods are based on exploiting known differences in the ecological characteristics of crops and weeds. These special attributes which fit plants for the role of weeds include life history, survival mechanisms, germination requirements, and competitive efficiency. Weeds are the vegetational common denominator of arable land. The reservoir of seeds and vegetative propagules buried in the soil in various conditions of dormancy, comprises the habitat into which the crop is planted. Effective weed control subjects this crop-weed association to habitat manipulation with tillage and herbicides which minimizes the competitive effects of weeds. Annual weeds are major in Iowa agriculture. Modern control methods are based on the creation of the even-start seedbed habitat for crop and weeds at planting time. Seedbed tillage promotes rapid weed germination and enhances the efficacy of soil applied selective herbicides. A major challenge facing the adoption of conservation tillage is to maintain weed control efficacy in a soil habitat where the dominant effects of tillage are minimized.

20. Soybean seed disease tests

D. C. McGee and A. G. Wacha

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

Concerns about the effects of seed-borne fungi on soybean seed quality have led to the development

of a soybean seed health testing service at Iowa State University. Seeds are incubated on damp blotters for 10 days at 25° C in the dark and then examined for the presence of fungal colonies. Quantitative estimates can be made of the incidence of about 10 fungal genera in the seedlot. The seedsman receives a report indicating the significance of the various fungi found with respect to seed quality. A test also has been developed to estimate pod-borne inoculum of *Phomopsis* spp. (the cause of pod and stem blight) on soybeans. Pods, detached in the field when still green, are surface sterilized in sodium hypochlorite, immersed momentarily in a herbicide and incubated for 7 days on a damp blotter. Infected pods are then identified by the presence of *Phomopsis* spp. pycnidia on the pod surface. The amount of pod-borne inoculum is used to determine whether a fungicide application is needed on the seed crop to control *Phomopsis* seed infection. This predictive scheme is presently experimental, but hopefully, will be made available to growers in 1982.

21. Monte Carlo simulation of spring and summertime precipitation patterns

H. C. Vaughan, G. R. White and P. H. Carr
304 Curtiss Hall, Iowa State University, Ames, Iowa 50011

An understanding of the natural distribution of precipitation is of prime importance to the agricultural community. Because of economic and geographic constraints it is often necessary to limit the number and restrict the location of rain gauges within a region.

The present model permits simulation of any geographic region and the symmetrical or random positioning of any number of rain gauges. The operator has the option of entering precipitation parameters; diameter, duration, rain swath length, vector angle and precipitation amount for any number of discrete showers. In a series of computations the model generates a random "first echo" location and resulting rain swath which is superimposed on a specific grid of rain gauges. The resulting series of computations provides an estimate of the number of rain gauges receiving a hit and the number of undetected rain events within an area.

Using a portion of the Iowa climatological rain gauge network and parameters derived from radar and rain gauge observations in central Iowa, a series of computations have been made which suggest only 8% of single cell showers and thunderstorms are detected by the existing sampling grid. This is not to suggest that the observed rainfall in error, only that the size of summertime showers and the political grid spacing of rain gauges is such that 92% of the showers are never detected.

22. Parental stress and seed dormancy of Pennsylvania smartweed (*Polygonum pennsylvanicum* L.)

JORDAN, J. L.

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

Pennsylvania smartweed (*Polygonum pennsylvanicum* L.) seeds were harvested from plants growing without competition stress and with maize competition stress. When the seeds were prechilled, more seeds from the plants without competition germinated than seeds from plants with maize competition. When the seed coat was nicked, similar results occurred. By using scanning electron and transmission electron microscopic techniques, differences were noted. Seeds from plants growing without

maize competition are more prone to be seed-coat induced dormant. Whereas, seeds from plants growing with maize competition tend to have an embryo induced dormancy.

23. The effect of ultrafreezing (-196 C) on barnyardgrass seeds: I. seed dormancy and ultrastructure.

JORDAN, J. L.

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

Barnyardgrass (*Echinochloa crus-gali* (L.) Beauv.) seeds were ultrafrozen in liquid nitrogen and slowly thawed. The number of seeds that would germinate increased. No increase in water imbibition of ultrafrozen seeds was noted. Scanning electron, light, and transmission electron microscopy reveal no changes in the seed coat. Changes in the lipid bodies were noted to occur in the embryo. Also, differences in the breakdown of the protein bodies during germination (of ultrafrozen vs. nonultrafrozen seeds) were noted. How these findings relate to barnyardgrass dormancy and germination will be discussed.

24. The effect of ultrafreezing (-196 C) on barnyardgrass seeds: II. physiology during germination.

JORDAN, J. L.

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

Barnyardgrass (*Echinochloa crus-gali* (L.) Beauv.) seeds were ultrafrozen in liquid nitrogen and slowly thawed. Seeds were germinated in 10⁻⁴ M concentrations of intermediates from glycolysis, the TCA cycle, the pentose phosphate pathway, the glyoxylic acid cycle, and other pathways. Utilization of substrates was most enhanced for substrates from glycolysis and the TCA cycle. How this relates to barnyardgrass dormancy and germination will be discussed.

25. The effect of maize competition on weed growth habit.

JORDAN, J. L.

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

Plants of four weed species--yellow foxtail (*Setaria lutescens* (Weigel) Hubb), green foxtail (*Setaria viridis* (L.) Beauv.), Pennsylvania smartweed (*Polygonum pennsylvanicum* L.), and velvet-leaf (*Abutilon theophrasti* Medic.)--were grown without competition from plants of other species or with maize competition. Vegetative and reproductive parameters were measured. The effect of maize competition on the growth habit of plants of each weed species was determined and compared with plants of other weed species. Also, minimum, average, and maximum ratios of weed seed production for maize versus no-maize competition were calculated.

26. Fuel alcohol yield varies with corn variety

T. L. FUNK, K. L. ROWLEY, D. G. ODOM

Biology Dept., Cornell College, Mt Vernon, IA 52314

Because of the interest in using corn as a fuel alcohol source, we determined the alcohol yields of 5 corn varieties under similar conditions of mashing and distillation. Chemically untreated corn samples were digested with α -amylase and glucohydrolase to break starches down to sugars. The digested corn was then fermented by yeast. The liquid supernatant of the fermentation mixture was distilled and the volume and alcohol content of the distillate determined. The results in ml alcohol \pm standard deviation per 250 grams corn were: Pioneer Waxy, 66.8 \pm 4.0, IFA Lysine, 54.8 \pm 5.8, IFA Waxy, 54.0 \pm 5.5, Elevator sample (variety unknown) 52.5 \pm 4.3, popcorn 36.3 \pm 1.1. The wide variation in alcohol yield with corn variety used should be considered when designing a farm or industrial fuel alcohol plant.

28. Global education: Needs and methods of implementation

Corene K. Bakken

Iowa State University, East Hall, Ames, IA 50011

This presentation investigates the need and methods for implementation of global awareness and global education in Iowa schools. A U.S. Department of Education grant, awarded to Iowa State University, supports a research project titled, IOWA IN GLOBAL PERSPECTIVE: A PROGRAM FOR CROSS-CULTURAL UNDERSTANDING. This research program seeks to develop ways of increasing Iowa's awareness, knowledge, understanding and appreciation of the cultural, economic and political relationships between Iowans and citizens of other countries in the world. Current linkages between Iowa and other countries are utilized in curricula. The needs of two Iowa school systems are being determined by analysis of a questionnaire, selective interviews, and the evaluation of existing and proposed curriculum materials. Preliminary findings of intercorrelations of collected data are presented and suggestions for implementation of global curricula.

Anthropology

27. Archaeological Investigation of a Middle Paleolithic Site, Serengeti Park, Tanzania

J. R. F. Bower and K. Kang'wezi

Iowa State University, Ames, IA 50011

Little is known about the Middle Paleolithic of East Africa, locally called the Middle Stone Age (MSA). This is unfortunate in view of the abundant data that exist concerning earlier and later stages in the evolution of East African cultures. Thus, when the authors of this paper located an MSA site with good bone preservation in 1977, they assigned it a high priority for excavation. Extensive test trenches were dug during July and August, 1979, and preliminary results of the excavations are reported here. The principal MSA occurrence at the site was recovered from pond deposits believed to represent a hydrological regime markedly different (wetter?) than the modern one. The material recovered consisted of numerous stone tools, exhibiting a high incidence of prepared core technology and heterogeneous scrapers, plus abundant bone debris in excellent condition. The latter contains some aquatic species (catfish), but is dominated by a varied array of mammalian species whose general configuration does not appear to differ much from the modern mammalian community of the area.

29. A case of possible treponemal infection from prehistoric Iowa

ALTON K. FISHER

University of Iowa, P.O. Box 69, North Liberty, Iowa 52317

An adult human femur and two tibiae were recovered in 1977 from site 13PW18 located in the loess hills of Pottawattamie County, Iowa. The surfaces of these bones had been altered during life by well-formed extra bone similar to that produced by low grade chronic inflammation. This abnormal process had caused an irregular, fusiform enlargement of the distal two-thirds of both tibiae with anterior bowing and increased breadth of the anterior border in the middle third of the shafts. Radiographic examination revealed increased thickness of cortical bone and conspicuous reduction of the medullary canals. These changes are consistent with those of syphilis, yaws and trepanarid which are very closely related treponemal infections. Radiocarbon analysis of this material provided an age of 1810 \pm 80 years B.P. Therefore, it is quite possible that treponemal disease existed in Iowa between 90 A.D. and 250 A.D. Many more discoveries and studies of this sort are needed to resolve the numerous questions regarding the presence of syphilis and related infections among prehistoric Americans.

30. THE epidemiology of nutritional status: observations from two Costa Rican communities.

Michael B. Whiteford

Department of Sociology and Anthropology, Iowa State University, Ames, Iowa 50011

This paper is concerned with the identification of specific social and economic factors which influence the nutritional well-being of pre-school children in two rural communities. Based on seven months of nutritional anthropological research in Costa Rica, Central America, this paper deals with how an interdisciplinary approach can collect data needed for nutritional status assessment while simultaneously gathering essential epidemiological information on the underlying causes of malnutrition.

31. Field studies in historical archaeology: documenting the physical landscape of a 19th c. mill village.

Sydney Henthorn

Grinnell College, Grinnell, IA 50112

In the past ten years the importance of historical archaeology as a social science has grown and expanded, creating a holistic bridge between social history, social anthropology, and cultural geography. Through the interpretations of archaeological and documentary evidence, more can be learned about the stages of development of a community and the structure of its physical landscape. In America, the industrial expansion during the 19th c. fostered extensive modifications to the physical landscape of many rural New England communities. A comprehensive archaeological survey was conducted in Phoenixville, Connecticut where the community was investigated to document the physical relics of past settlement which remain in situ. The historical and archaeological interpretation of Phoenixville's physical landscape is a record of settlement succession, tracing the changes within the community setting.

32. The Development Advisory Team Training Program: A Model for Cross-Cultural and Cross-Disciplinary Communications

D. M. Warren

Iowa State University, Department of Sociology & Anthropology, Ames, Iowa 50011

The Development Advisory Team Training Program at Iowa State University, a USAID Title XII program designed to provide intensive six-day training workshops for cross-disciplinary international development project design and evaluation teams, is discussed. The program, involving faculty and staff from 40 departments representing all univer-

sity colleges, focuses on cross-cultural and cross-disciplinary communications techniques, team building exercises, management and planning concepts, and USAID development project design and evaluation techniques and formats.

33. Anti-evolutionism in American thought

J R Cole

University of Northern Iowa
Cedar Falls, Iowa 50614

Anti-evolutionism has not been consistently associated with political or social conservatism, nor did the fundamentalist movement originally reject evolution. Today, it is strongly entwined with conservative politics via organizations such as Moral Majority and Christian Voice. "Equal time" arguments for scientific creationism and efforts to ban or censor evolutionist textbooks have been financed by the Heritage Foundation and other doctrinaire conservative groups with authoritarian views of education potentially inimical to populist tradition. The Scopes trial resulted in a massive retreat from evolution by publishers and school boards. In the 1960's this was reversed, but in the 1970's and 1980's anti-evolutionism regained lost momentum. Politics, not religion or science, guides the anti-evolutionist crusade.

34. Did the Devil make Darwin do it? Historical perspectives on the creation-evolution controversy

D. B. Wilson

History Department
Iowa State University
Ames, IA 50011

The nineteenth century witnessed a conceptual revolution of the first magnitude, not only in biology but also in physics, geology, philosophy, and theology. Primarily, this paper sketches these intellectual developments in Britain as they shaped and were shaped by the ideas of Charles Darwin. Finally, from this perspective, the paper comments on aspects of the current creation-evolution controversy, including the creationist suggestion that scientists accepted the theory of evolution because Satan persuaded them to do so.

35. An engineer looks at the creationist movement

J. W. Patterson

Materials Science and Engineering
110 Engineering Annex
Iowa State University
Ames, Iowa 50011

The author will share his views as to why creationism has regained such public support in recent years, despite the already overwhelming scientific refutations which eliminated

creationism from science long ago. The success parallels that experienced by many other quasi religious forms of pseudo science, crank science, and cults. When viewed in this context, creationism is not particularly special nor are the counterfeit methods of persuasion employed by its promoters. Like so many other movements, it is a religious ideology motivated by emotional needs and employs the polemic/apologetic approach of evangelists to convert laymen and the gullible to its cause.

Brief revealing comments will be directed to the very significant role which professional engineers and engineering educators have played in the creationist movement and especially in its leadership.

36. Misconstruing evolutionary theory

L.R. Godfrey

University of Massachusetts
Amherst, Massachusetts 01003

Evolutionary mechanisms, rates, and processes are fertile grounds for scientific debate. The scientific process of questioning and revising is misconstrued by "scientific creationists" to be signs of weakness rather than strength. Particularistic, anti-theoretical argumentation, quotes out of context, misunderstandings and misuses of scientific data, and the rejection of scientific standards of research, logic, and philosophy characterize the scientific creationist movement. Their major research organizations require members to swear an oath of a priori belief in the Bible's scientific accuracy, while science in general rejects such logic. The probably unwitting use as anti-evolutionist proof of documented hoaxes such as faked human footprints carved in Texas Cretaceous sediments, misuses of statistics, and appeals to authority rather than evidence or theory constitute the unscientific, non-predictive core of creation "science." Human footprints allegedly associated with dinosaur tracks and the misuse of punctationalist arguments are discussed in detail.

B. Biogeography of Iowa: 30,000 years from the pollen record

Baker, R. G.

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

Biogeography usually deals with the present distribution of taxa or biota. From a geological perspective, this picture is but a moment in a long period of changing environments. The fossil record provides the basis for understanding how present biographic patterns came to be. The paleobotanical record shows that mixed conifer forests of 30,000 to about 20,000 gave way to open spruce parkland with subarctic elements during the advance of Des Moines Lobe glaciers 17,000 years ago. During retreatal phases of the glacier, deciduous trees grew within a closed spruce forest. In post-glacial time, deciduous forests gave way to savanna by 9000 B.P. Prairie dominated western and central Iowa throughout the last 7700 years.

D. Holocene climatic changes in Iowa: the mammalian record

Semken, H. A.

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

Twenty-five paleontological and archaeological sites in Iowa contain at least 11 associated species of mammals. These faunas range in age from the Atlantic (8400 RCYBP) through the Neo-Boreal (AD 1850) climatic episodes and provide evidence for climatic change over the last 8500 years. Data from water-screened sites indicate that Atlantic time was characterized by progressive desiccation around Cherokee which culminated circa 6350 RCYBP. At that time the Mud Creek fauna of eastern Iowa reflected greater effective precipitation than at present. This resulted in a stronger climatic gradient than presently exists. The Sub-Boreal Garrett Farm fauna of southwestern Iowa shows a reduction in this gradient because forest species reappeared in the Missouri valley circa 3400 RCYBP. Variations of the modern "theme" are characteristic of both eastern and western Iowa after that time.

G. Comments on the biogeography of Iowa's amphibians and reptiles.

J. L. Christiansen

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

Since the withdrawal of the last glacier, Iowa's fauna has been subjected to three succeeding environmental conditions affecting species distribution. The first was a cold, wet climate allowing invasion of mesic forms from the east and south, the second hot and dry allowing invasion of xeric forms from the southwest, and the third a return to more

Botany

NOTE: Abstracts for presentations A, C, and E in the Symposium, "Biogeography of Iowa", were not available.

mesic conditions with reestablishment and expansion of some mesic species and decline of more aridity-adapted forms. The Wisconsin drift appears to be a partial barrier to many species.

F. Iowa land snail biogeography: modern and Pleistocene

T.J. Frest & L.P. Fay

Dept. of Geology, University of Iowa, Iowa City, 52242

Although Iowa is not well studied malacologically (last state list published in 1890) a tentative outline of its land snail biogeography for the last 12,000 years can be suggested. Recent work indicates a fauna of at least 70 species: about 20 are new state records. Iowa is now entirely within the Interior Province, East American Realm. Highest diversity is in the oak-hickory forests (deciduous biome) of the eastern third of the state.

In the Late Pleistocene (Wisconsinan) portions of Iowa may have had climates analogous to modern tundra & taiga biomes, and a biome with no precise modern analogue (Midwest biome of Frest & Fay, 1980) was also represented. The sparse fauna (ca. 30 species) consists mostly of species now restricted to the Northern & Rocky Mountain Provinces, plus some Midwest endemics.

Relict colonies of Northern and Midwest species (long believed extinct) survive on algal talus slopes, a specialized environment unique to the Driftless Area of northeastern Iowa and southeastern Minnesota.

37. Seed characters supporting elevation of Cicer to tribe Cicereae (Fabaceae).

¹N. R. Lersten, ²C. R. Gunn, and ¹S. R. Rugenstein

¹Department of Botany, Iowa State Univ., Ames, 50011

²U.S. National Seed Herbarium, Beltsville, MD 20705

Cicer (40 species) is usually placed in tribe Viciaeae. Kupicha recently elevated it to the monotypic tribe Cicereae, based mostly on vegetative and floral characters. She said its seeds also differed from those of Viciaeae, but she looked at only two species at low magnification. To compare with our earlier survey of Viciaeae seeds, we examined seeds of 12 Cicer species by scanning electron microscopy. Cicer seeds have a terminal 'beak' on which occurs a circular hilum with a conspicuous hilar rim. A beak and such a hilum are lacking in Viciaeae. The seed coat surface is also strikingly unlike the minutely papillose surface characteristic of Viciaeae seeds. Large irregular plates, separated by grooves, occur in all species examined. These plates are raised into conical projections of various heights among the species, and in some they become conspicuous spines, which are often uncinat. In one species the spines in turn bear small spinose secondary projections. Gross features and microscopic surface characters of Cicer seeds both support Kupicha's segregation of this genus from the Viciaeae.

38. Unusual foliar nectaries in pomagranate (Punica granatum: Punicaceae).

G. W. Turner and N. R. Lersten

Department of Botany, Iowa State Univ., Ames 50011

This is the first report of extrafloral nectaries from this small family of two species. Conspicuous nectar secretion was seen (and tasted) at the leaf tip in greenhouse plants. The nectariferous tissue is a mass of small cells 10 or so layers thick which extends from the hypodermis to the flared midvein ending, which consists mostly of phloem. Accompanying the terminus of the midvein, and smaller veins in the vicinity, are masses of large sclereid-like cells. There are no stomata in the epidermis overlying the nectary, and the epidermis does not seem secretory, as in other nectaries. Invariably, at the tip of the nectary the epidermis is raised to form a subepidermal cavity, and the epidermis and cuticle is ruptured to varying degrees. This irregular porelike area seems to be the only exit for nectar. This nectary is unusual because it is at the leaf apex, a position known in only two other dicot genera. Anatomically it resembles a hydathode but differs in lacking stomata and an extended bundle sheath, and in having phloem instead of xylem dominating the flared vein ending.

39. Foliar nectaries in mahogany (Swietenia: Meliaceae).

N. R. Lersten and S. R. Rugenstein

Department of Botany, Iowa State Univ., Ames, 50011

We have found foliar nectaries in all three species of Swietenia. Nectaries are circular to elongate, and occur on the petiole, rachis, petiolule, and on both lamina surfaces, either on or near the midrib. They occur from leaflet base to apex. This is an unusual, perhaps unique, distribution for extrafloral nectaries. Nectary anatomy was studied in cleared leaflets and paraffin sections, and by scanning electron microscopy (SEM). The nectaries are flush, slightly sunken, or slightly convex. The surface is featureless even at high SEM magnification. There are three shortly elongate cell layers (epidermis and two subtending layers) with rather dense cytoplasm. These rest on a biseriate sheath of cells with comparatively sparse cytoplasm. No crystals occur in the leaf, even adjacent to the nectaries. There is no uniform relation to vascular tissue; bundles occur near or under some but not others. Nectar secretion was often observed in greenhouse plants. There is one brief mention of meliaceae extrafloral nectaries in the literature; the family is omitted from all recent lists.

40. Phloem-protein ontogeny in Magnolia soulangeana, Soul.

J. M. FRIIS and R. R. DUTE

Department of Biology, St. Ambrose College, Davenport, Iowa 52803

An ontogenetic study of phloem-protein development in sieve elements of species of the primitive dicotyledon order Magnoliales is being conducted

using electron microscopy. The stages of P-protein differentiation in Magnolia soulangeana, Soul. have been found to parallel those reported by Cronshaw (1975) for Nicotiana, i.e. an initial P-protein body stage, an intermediary disaggregating stage displaying primarily tubular P-protein, and a mature sieve element stage with dispersed, fibrillar P-protein. The tubular P-protein had an average diameter of 190Å to 220Å with an electron-lucent lumen and radial arms apparent in cross-section. The fibers measured 110Å to 140Å in width and were generally striated. Such stages can be correlated to changes in the thickness of the nacreous cell wall. Studies are continuing on Degeneria vitiensis I. W. Bailey and A. C. Smith, and Liriodendron tulipifera L.

41. Novel assay procedure for prunasin hydrolase activity employing purified mandelonitrile lyase.

M. GROSS, G.H. JACOBS and J.E. POULTON

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

We wish to report a convenient assay system for prunasin hydrolase activity, employing the cooperation of β -glucosidase-free mandelonitrile lyase, for use in studies on amygdalin (Laetrile) metabolism in plants and animals. Mandelonitrile lyase was purified to near homogeneity from commercial almond emulsin using a rapid one-step ion-exchange chromatographic procedure. Emulsin was applied to a DEAE-cellulose column, pre-equilibrated with 50mM imidazole-HCl buffer, pH 6.0. Mandelonitrile lyase, possessing negligible β -glucosidase activity, was subsequently eluted using a 0-50mM NaCl gradient in this buffer and its purity was assessed by PAGE.

We determined by kinetic analysis the following optimum conditions for assaying prunasin hydrolase activity. The crude tissue extract, containing an unknown amount of prunasin hydrolase, is incubated with excess purified mandelonitrile lyase (≈ 140 m-units) and saturating concentrations (≈ 5 mM) of prunasin. Under these conditions, the mandelonitrile formed by prunasin hydrolysis may be calculated from the rate of change of absorbance at this wavelength.

42. The association of calcium oxalate crystals with aerenchyma tissue of Typha angustifolia L. (Typhaceae).

A. P. Kausch and H.T. Horner, Jr.

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

Raphide crystal idioblasts are formed within meristematic regions and were observed with light and electron microscopy only within aerenchymatous tissues in all major vegetative organs. In young leaves raphide crystal idioblasts develop in circular arrays and specifically circumscribe parenchymatous tissues which break down to form foliar compartments. In roots and rhizomes, idioblasts develop amidst stellate cortical

aerenchyma. The appearance and development of crystal idioblasts is concomitant with physical separation, attenuation, and apparent dissolution of middle lamellar wall material. We suggest that crystal idioblasts may function in localized calcium regulation during aerenchyma formation, and that this method of air space development may represent a model for the formation of aerenchyma in other aquatic plants.

43. CALCIUM OXALATE CRYSTALS IN LEAVES OF RHYNCHOSIA CARIBAEA DC. AND TWO OTHER LEGUMES; THEIR DISTRIBUTION, STRUCTURE, AND DEVELOPMENT.

H. T. HORNER, JR. AND ELISABETH ZINDLER-FRANK

FAKULTÄT FÜR BIOLOGIE, UNIVERSITÄT KONSTANZ, D-7750 KONSTANZ, FEDERAL REPUBLIC OF GERMANY.

CRYSTALS OCCUR IN TRIFOLIATE LEAVES. IN RHYNCHOSIA THEY ARE IN BUNDLE SHEATH AND IN MESOPHYLL. IN PHASEOLUS THEY ARE IN BUNDLE SHEATH WHILE IN CANAVALIA THEY ARE IN EPIDERMAL CELLS OVER VEINS. CRYSTALS APPEAR AS TWIN PRISMS WITH ONE PER CELL. ALL CRYSTALS HAVE BEEN IDENTIFIED AS CALCIUM OXALATE BY HISTOCHEMISTRY, X-RAY POWDER DIFFRACTION, AND INFRA-RED SPECTROSCOPY. THE CRYSTALS VARY NOT ONLY IN THEIR LOCATION BUT ALSO IN TIME OF FORMATION. OUR EXPERIMENTS HAVE BEEN CONDUCTED TO DETERMINE WHETHER PHOTOSYNTHESIS IS INVOLVED IN CRYSTAL DEVELOPMENT. TISSUE CULTURES ARE BEING USED TO STUDY OTHER ASPECTS OF THE CRYSTALLIZATION PROCESS.

44. GROWTH OF DRUSE CRYSTALS AS A FUNCTION OF INTRACELLULAR DEVELOPMENT IN ANTERS OF CAPSICUM ANNUUM (SOLANACEAE).

H. T. HORNER, JR. AND B. L. WAGNER

DEPARTMENT OF BOTANY, ISU, AMES, IA 50011

CRYSTALS ORIGINATE IN VACUOLES OF ACTIVELY DEVELOPING ANTHER STOMIUM CELLS IN ASSOCIATION WITH MEMBRANE COMPLEXES. THESE COMPLEXES APPEAR FIRST IN CONJUNCTION WITH PARACRYSTALLINE BODIES THAT WE TERM NUCLEATION SITES. EACH DRUSE CRYSTAL BEGINS AS A SINGLE CRYSTAL TWIN AT A NUCLEATION SITE. ADDITIONAL TWIN CRYSTALS FORM FROM EACH SITE AND GROW INTO AN AGGREGATE DRUSE CRYSTAL. MANY DRUSES DEVELOP WITHIN EACH CELL, EVENTUALLY FILLING IT BY THE TIME OF POLLEN RELEASE. A COMBINATION OF MICROSCOPIC TECHNIQUES HAVE BEEN UTILIZED TO SHOW HOW AND WHERE THIS MINERALIZATION PROCESS OCCURS. IDEAS REGARDING THE VALUE OF THESE CRYSTALS TO THE ANTHER ARE THAT THE CRYSTALS MAY SERVE THE FUNCTION OF PROTECTION AGAINST FORAGING ANIMALS, SINCE THE CRYSTALS ARE CALCIUM OXALATE; OR, THE CRYSTALS REPRESENT A CONCENTRATION OF CALCIUM BY THE CELLS IN A WAY THAT WEAKENS THE ENTIRE STOMIUM, AND THUS AIDS IN THE RELEASE OF THE POLLEN.

45. Notes on Iowa fungi III. The genus *Cordyceps* in Iowa.

LOIS H. TIFFANY AND GEORGE KNAPHUS

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

Cordyceps, one of the largest genera in the Ascomycete order Clavicipitales, is presently represented in Iowa by five species parasitic on the juvenile and adult stages of insects and by two species parasitic on hypogeous ascocarps of *Elaphomyces*.

Cordyceps militaris (Fr.) Link, parasitic on lepidopterous larvae or pupae is the most common species. *Cordyceps melolonthae* (Tul.) Sacc. var. *melolonthae* and *Cordyceps ravenelii* Berk. and Curt. develop on larvae of Coleoptera in soil. *Cordyceps variabilis* Petch has been collected once on larvae in very rotten wood. *Cordyceps clavulata* (Schw.) Ell. and Everh. has also been collected once on adult scale insects on choke cherry. *Cordyceps ophioglossoides* (Fr.) Link is not uncommon throughout the state on *Elaphomyces* ascocarps in the soil in midsummer. *Cordyceps capitata* (Fr.) Link occurs infrequently on the same host in the fall.

46. Studies on scaled chrysophytes from Iowa, a summary.

James L. Wee

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

Taxonomy of scaled chrysophytes (Synuraceae, Chrysophyceae) is based upon the morphology of the siliceous scales that form a lorica around the cell. Accurate identification of species in this family usually requires electron microscopy (EM) of the scales. Prior to the beginning of this study in 1975 only five species of *Mallomonas* and *Synura* had been reported from Iowa on the basis of light microscopy. Using EM observations of samples collected in central, north central and nw Iowa, this study has shown that four more genera, *Mallomonopsis*, *Paraphysomonas*, *Spiniferomonas*, and *Chrysosphaerella* occur in Iowa as well as additional species of *Mallomonas* and *Synura*. Information is provided on the distribution of these organisms in Iowa waters.

47. Cell wall structure and development in *Oedogonium undulatum* (Chlorophyceae).

M. A. Buchheim and N. L. Pearlmutter

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

The structure and composition of *Oedogonium undulatum* cell walls was examined by light and electron microscopy. Mature cells are enclosed by a cell wall consisting of a straight, thin outer wall and a thick, undulate inner wall. In addition, amorphous materials are often present on the cell surface. The outermost cell wall stains positively for the presence of a sulfated polysaccharide component and is composed of alkali-soluble microfibrillar material. The

undulate inner wall physically contacts the outer wall only at the outer peaks of the undulate layer. Within the inner cell wall layers, microfibrils are not easily detected but cytochemical staining of these layers indicates the presence of cellulose. Development of the algal cells appears to be accompanied by fundamental changes in wall composition and structure. Young filamentous cells have neither a demonstrable outer wall layer nor a positive reaction for the presence of sulfated polysaccharides. The apical division ring and the elongating wall material stain positively for pectic substances with stain intensity decreasing as undulations develop in the daughter cell wall.

48. Antheridogen activity of *Anemia mexicana* Klotzsch

J. E. Nester

Dept. of Botany, Iowa State University
Ames, Iowa 50011

Antheridogen activity is demonstrated for gametophytes of *Anemia mexicana*. Spore size and days from sowing until germination, meristem formation and archegonia formation varied, but all gametophytes grown in mono-spore cultures produced organized meristems and archegonia. In multispore cultures, two reproductive morphologies (antheridiate and archegoniate) occur, thus, gametophyte interaction is necessary for antheridia formation. Gametophytes of *A. mexicana* and *Lygodium japonicum* treated with extracts of old culture media of *A. mexicana* show precocious antheridia formation; gametophytes of *A. phyllitidis*, *Pteridium aquilinum* and *Ceratopteris thalictroides* do not. Old media extracts also promoted dark germination of spores in *A. mexicana*, *A. phyllitidis* and *L. japonicum*, but not in *P. aquilinum* and *C. thalictroides*. Thus, antheridogen activity of *A. mexicana* appears to be limited to schizaeaceous species.

49. Macro-invertebrate herbivory on ferns in Iowa.

JAMES H. PECK

Dept. Botany, Iowa State University, Ames, IA 50011

Frequency, extent, and character of herbivory and the abundance and diversity of macro-invertebrates was studied for sporophytes (14 spp.), sporelings (5 spp.), and gametophytes (5 spp.) in Woodman Hollow, Webster Co. Additional observations contrasted damage and fauna by 1) type of damage to fronds, 2) on early and late summer fronds, 3) to three size classes of fronds, and 4) to isolated versus colonial plants. Faunal data was obtained by hand-picking and by Berleze processing techniques. These woodland ferns have 1) a varied and abundant macro-invertebrate fauna, 2) a fauna with a varied set of relations with fern fronds, including a high level of phytophagy, and 3) spiders which act as predators

on the herbivores. The observations provide a basis for study of host-herbivore-predator ecology and host-plant switching and specificity strategies by macro-invertebrates on ferns and adjacent flowering plants.

50. Leaf and stem disease severity, and coppice ability of four *Populus* hybrids.

H. S. McNABB, JR., R. S. SONNELITTER and M. E. OSTRY.

Iowa State Univ., Ames, IA 50011 and North Central Forest Experiment Station, St. Paul, MN 55108.

A short-rotation, intensive-cultured plantation of 1440 *Populus* trees (hybrids NC5271-*P.* 'Charkowiensis' X *P.* 'Caudina', NC5331-*P.* 'Betulifolia' X *P.* *trichocarpa*, NC5262-*P.* 'Candicans' X *P.* 'Berlinensis', NC5272-*P.* *nigra* X *P.* *laurifolia*) was established at 1m x 1m spacing with rooted softwood cuttings at the 4-H Camp, June 1977. Three-fourths of the stand was coppiced in January 1980. Sprouting data, obtained after the 1980 growing season, showed clonal differences for stump survival, sprout number and sprout size. Clone NC5272, shown in previous studies to have excellent coppice ability, had poorest sprouting with 30% of the stumps not sprouting as compared to 3% or less for the other hybrids. Higher leaf (*Septoria musiva* and *Marssonina brunnea* leaf spots) and stem (*S. musiva* canker) disease ratings in 1979, the last season before coppicing, correlated with reduced coppice ability. Trees of NC5272 were affected most heavily with leaf spot and had the highest ratings for stem canker.

51. The effects of lilac on the root growth of germinating radish seeds

J. L. Ferrell and C. S. Radandt

Maurice-Orange City High School
615 Eighth Street, S.E.
Orange City, IA 51041

Very few higher plants can survive under lilac bushes which may be due to allelopathic effects of lilac. Root growth and length of radish seedlings were retarded by a substance in the lilac bud. Radish seeds treated with lilac bud extract were germinated in the dark at 22°C. Germination, root length and the presence of root hairs were recorded every 24 hours for 72 hours with a final recording at 158 hours. The stunted root growth of the treated seedlings was statistically different from the control. Our evidence indicates that germination and root length were retarded by the extract.

52. Seasonal variation in the Toxicity of White Snakeroot, *Eupatorium rugosum*

G. W. Kaufmann

Loras College, Dubuque, Iowa 52001

White Snakeroot is a perennial composite whose foliage is poisonous to livestock, causing a disease called trembles. People who drink the milk of affected livestock are afflicted with a similar disease called milksickness. Foliage of White Snakeroot was gathered on a monthly basis in 1977 and 1978. The extract of plants gathered in July and August 1977 proved to be the most poisonous to minnows *Notropis* spp. used in bioassay. The highest levels of tremetol were found in leaves taken from plants gathered in August and September 1978. However, the ketone in the tremetol mixture which causes trembles has yet to be identified, and minnows are susceptible to the most prevalent ketone (tremetone) which does not cause trembles.

53. A preliminary study of the germination of *Petalostemon villosum*

B. J. DUMKRIEGER

University of Northern Iowa. 729 West Fifth St., Waterloo, Iowa 50702

Viability and germination of *Petalostemon villosum* were investigated. It was observed that seed coat color was an indication of seed viability. Light colored seed coats had a 76-93 % viability while dark seed coats had a 10-20 % viability. The effect of light, temperature, carpel presence, and scarification on germination was examined. Germination occurred over a wide temperature range, 8 C to 32 C, with the maximum rate of germination occurring at 24 C. Within 24 hours, 40-80 % of the seeds germinated. Presence of the carpel totally prevented germination whereas scarification enhanced germination: carpel present, 0 %; carpel absent, unscarified seed coat, 30 %; carpel absent, scarified seed coat, 100 %.

54. Regional and local variation in community structure of tall-grass prairie.

Jon A. White and D.C. Glenn-Lewin

Dept. of Botany, Iowa State University, Ames, 50011

Early studies of prairies classified communities by relating idealized combinations of species to general environment, making generalized observations of many geographically diverse samples. More recent studies by gradient analysis concentrate mostly within geographically limited areas. Our study analyzes community structure in tall-grass prairie from both regionally diverse and locally concentrated samples to identify both regional and local patterns of vegetation varia-

tion. Ordination results indicate that vegetation is strongly influenced by variations in micro- and macrotopographic position, drainage patterns, soil texture, and perhaps precipitation. Soil moisture exerts a primary effect on community structure both regionally and locally, but site characteristics and individual species' biology interact with soil moisture to produce local patterns. Community composition and species populations at the regional and local level do not resolve into one consistently continuous transition along the moisture gradient.

55. Soil lichens of two prairie sites in northwest Iowa.

MARGI OARD AND LOIS H. TIFFANY

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

Collections of soil lichens in remnant prairie stands in western Iowa have been made over the past five years. In 1980, intensive field observations were made during mid-summer at two sites in northwestern Iowa. The prairie soil lichens were particularly obvious at these sites following a rainy period in early August. Seven species were observed at both sites. Dermatocarpon lachneum (Ach.) A. L. Sm., Endocarpon pusillum Hedw., Bacidia bagliettoana (Mass. and DeNot.) Jatta, Diploschistes gypsaceus (Ach.) Nyl., Collema tenax (Sw.) Ach., and Cladonia sp. were present on soil. Caloplaca citrina (Hoffm.) Th. Fr. was common on old weathered grass rhizomes. Three other species were not uncommon at only one site.

Our collections and field observations over the period of study indicate that the soil lichens are much more common in upland Iowa prairies and involve a more diverse lichen flora than has been recognized previously.

56. Plants from northern Manitoba, Canada and their substrates

R. W. COLEMAN AND S. L. WELSH

Dept. of Biology, Upper IA. Univ., Fayette, IA 52142 and Dept. of Botany and Range Science, Brigham Young Univ., Provo, UT 84601

78 plant species from northern Manitoba, Canada and their substrates were studied in 25 transects. In relation to soil substrates Agrostis scabra, Eriophorum chamissonis, Ledum groenlandicum, Scirpus cyperinus, and Vaccinium vitis-idaea were related to acidic environments in the pH 4.6 to 4.8 range. Anemone canadensis, Phragmites communis, Plantago major, Puccinellia distans, P. cf. vaginata, Scirpus acutus, S. americanus, S. paludosus, and Triglochin maritima were found in soils in the pH 8 range. Cicuta sp., Salix sp., and Scirpus acutus were reported in water of pH 8.65, 13 grains per gallon total hardness with the total alkalinity within the range of 13 grains per gallon calcium carbonate, and 1 ppm iron. Soil analyses for texture, organic content, pH, available phosphorus, potassium, replaceable calcium, sulfate, and other nutrients are also noted.

Cell Biology

57. Prenatal exposure to ethanol (EtOH) causes abnormal brain development.

J. R. West, C. A. Hodges, and A. C. Black, Jr.

Dept. Anatomy, Univ. Iowa, Iowa City, IA. 52242.

Pregnant Sprague-Dawley rats were given a liquid diet containing 35% EtOH-derived calories during days 1-21 of gestation. This period is equivalent to the first and second trimesters in humans because the rat brain is much less well-developed at birth. Daily EtOH consumption was 12.15 ± 1.15 gm/kg body weight (mean \pm standard error). Paired controls were given a liquid diet in which EtOH was replaced by isocaloric maltose-dextrin. Controls received lab chow and water ad libitum. Litters were culled to 8 pups at birth, and cross-fostered to normal mothers. They were sacrificed at 60 days and their brains processed by the Timm's sulfide silver technique which stains the zinc-rich granule cell axons of the mossy fiber system projecting to the hippocampus (HC). The EtOH group exhibited alterations in mossy fiber topography indicating abnormal connections between dentate gyrus granule cells and HC pyramidal cells. Such connections may play a role in the CNS dysfunction observed in the fetal alcohol syndrome. Supported by Grant AA03884 from N.I.A.A.A. and a grant from the National Council on Alcoholism to J.R.W.

58. A novel technique for ethanol administration to neonatal rats.

C. A. Hodges, A. C. Black, Jr., and J. R. West.

Dept. Anatomy, Univ. Iowa, Iowa City, IA 52242.

Maternal alcohol consumption during pregnancy in humans produces the "fetal alcohol syndrome", involving mental retardation, mid-facial hypoplasia, and microcephaly. The rat brain is much less well developed at birth than the human. The first 10 days of postnatal life are equivalent to the third trimester in humans. However, maternal ethanol administration to a lactating female rat alters milk secretion and maternal behavior. We have developed a gastrostomy technique (originated by Dr. Thomas Anderson) which avoids these difficulties. A hypodermic syringe filled with ethanol diet is driven by an infusion pump to deliver a precise amount of ethanol via a plastic tube implanted into the stomach of a newborn rat. Pups are maintained in an aquarium at 37°C. An aerator bubbles air through the aquarium to supply a gentle rocking motion needed to stimulate gastric motility and urination. This technique permits studying the effects of ethanol on rat brain development during a period equivalent to the third trimester in humans. Supported by a grant from the National Council on Alcoholism to J.R.W.

59. Ethanol does not inhibit axon sprouting in the rat dentate gyrus.

M. D. Lind, A. C. Black, Jr., and J. R. West.

Dept. Anatomy, Univ. Iowa, Iowa City, IA 52242.

Axon sprouting may be responsible for recovery of function following brain damage. Destruction of the entorhinal cortical projection to the dentate gyrus in rats results in the sprouting of cholinergic septal fibers in the molecular layer. To determine whether ethanol alters axonal sprouting, adult Sprague-Dawley rats were given ethanol daily for 2 weeks prior to and for 9 days after unilateral lesion of the entorhinal cortex. One group received 6 g/kg/day ethanol via intragastric intubation (20% v/v solution), while another received 12 g/kg/day ethanol as 35% ethanol-derived calories in a liquid diet. Rats were sacrificed and their brains processed for acetylcholinesterase (AChE) histochemistry. Sprouting of the cholinergic input, indicated by intense AChE staining in the outer molecular layer of the dentate gyrus and the widening of the commissural/associational clear zone in the inner molecular layer, occurred despite heavy exposure to ethanol. The question of whether long-term ethanol intake alters axonal sprouting following brain damage requires further study. Supported by Grant AA03884 from N.I.A.A.A. to J.R.W.

60. Ethanol causes blockade of hippocampal (HC) cyclic GMP production.

A.C. Black, Jr., G. Cohen, D. Sandquist, J.R. West

Dept. Anatomy, Univ. Iowa, Iowa City, IA 52242.

Stimulation of rat HC *in vitro* at 37 C for 2.5 min with 500 μ M bethanechol, 2.2 mM CaCl₂ and 5 mM theophylline results in maximal cyclic GMP production. Sprague-Dawley rats received 6 gm/kg ethanol as a 15% (v/v) solution by gastric intubation. At various times after ethanol administration, rats were decapitated and their HC incubated and analyzed for cyclic GMP.

Time	Cyclic GMP pm/mg Prot.	N	%Control
15 Min	0.25 \pm 0.08	8	48%
30 Min	0.19 \pm 0.03	8	35%
1 Hr	0.11 \pm 0.03	8	21%
2 Hr	0.16 \pm 0.04	8	30%
4 Hr	0.065 \pm 0.004	6	12%
7 Hr	0.080 \pm 0.01	8	15%
24 Hr	0.069 \pm 0.01	8	12%
48 Hr	0.080 \pm 0.02	8	15%
Control	0.53 \pm 0.03	6	100%

Thus, ethanol produces a rapid depression of cyclic GMP synthesis in rat HC, possibly due to damage of HC neurons receiving muscarinic cholinergic synapses. (Supported by a grant from the National Council on Alcoholism to A.C.B.).

61. Effect of ATP on cell-penetrance by Trypanosoma cruzi.

G. E. Walter and E. C. Bovee.

University of Kansas, Lawrence, Kansas, 66045.

What regulates cell-penetrance by T. cruzi is not known, but since ATP at certain concentrations enhances movement, it may affect cell-penetrance. T. cruzi enters primary rat fibroblasts, endothelial cells or myocardial cells in tissue culture, as well as mouse-L-cells and chinese-hamster-ovary cells at about the same frequency. When T. cruzi exposed 24 hrs to 1×10^{-4} M or 1×10^{-6} M ATP were added to cultured cells, penetrance was enhanced in 8 to 10 hrs in either fibroblasts or myocardial cells compared to controls, but penetrance did not occur in fibroblasts by T. cruzi exposed to 1×10^{-5} M ATP & did not occur significantly in myocardial cells. At 1×10^{-4} M ATP, T. cruzi entered greater numbers of fibroblasts, one per cell; in myocardial cells two parasites more often entered a single cell than in controls. At 1×10^{-5} M ATP movement of T. cruzi is inhibited and penetrance reduced; at 1×10^{-4} M and 1×10^{-6} M, motility and penetrance are enhanced. (Supported by a summer research fellowship from the Graduate School, University of Kansas).

62. ANTIBODY-DEPENDENT Cell-Mediated Immunity in F₁ Generation of Rats Exposed to Iodine-131.

L.A. Ridnour, R.H. Stevens, and D.A. Cole

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

A major concern for potential hazards posed by nuclear power plant accidents is the release of iodine-131 into the environment. We have initiated the present study to determine whether a perinatal exposure to this radionuclide may have an effect upon the potential for the offspring to ultimately develop cancer. This investigation involved the exposure of female Fischer F344 pregnant rats (16-18 day of gestation) to varying exposures of Na¹³¹I (0.01 μ Ci to 200 μ Ci). At 3 months post-exposure the antibody-dependent cell-mediated (ADCC) immunity was determined in both the dams and pups. ADCC was quantitated by the increased release of radioiodinated membrane proteins from X-ray induced rat small bowel adenocarcinoma cells which were injured by normal peripheral blood lymphoid cells (PBLC) in the presence of serum from the exposed rats. The results suggest that perinatal exposures to radioiodine induce cellular changes that are recognized as cancerous and result in antitumor immune responses at the young adult state. Supported by grant 1R01-ES02352-02 awarded by the National Institute of Environmental Health, NIH.

63. ANALYSIS of Transition Metal Teratogenicity

P.J. Johanns, R.H. Stevens, D.A. Cole, and D.D. Gay

University of Iowa, Radiation Research Laboratory, Iowa City, Iowa 52242; and DuPont Company, Savannah River Laboratory, Aiken, South Carolina 29801.

One of societies greatest responsibilities is to maintain and improve the quantity of its progeny. Little success has been realized in the past to achieve this goal as over 3% of all newborn infants have some form of congenital defect requiring medical attention. Estimates have attributed as high as 3-5% of all these congenital problems to be the result of perinatal exposures to environmental teratogens. With the increasing heavy metal concentrations in our environment, we have begun a study to establish their role in producing birth defects. Teratogenicity was determined by the inhibition of the binding of rat embryo cells to a Concanavalin-A derivatized plastic surface induced by the exposure to the test substance. Binding was established by measuring the quantity of radioiodinated peripheral and integral membrane proteins associated with the fetal cells. Our studies of the transition metals now suggest that they may have an important role in contributing to the over 10% of all live births exhibiting some degree of congenital abnormalities. Supported by National Institute of Environmental Health, NIH grant R01-ES02352.

Chemistry: Inorg., Anal., Phys.

A. Platinum-based antitumor drugs and their biological effects.

B. L. BERGQUIST

Dept. of Biology, University of Northern Iowa, Cedar Falls, Iowa 50614.

Cisplatin [cis-dichlorodiammine platinum (II)] is an effective chemotherapeutic agent for the treatment of certain cancers. Chemically, it is a relatively nonpolar molecule and therefore able to penetrate characteristically lipid cellular membranes. The molecule has been shown to bind to protein, lipids and nucleic acids; of these, the binding to nucleic acids appears to be the key location for its antitumor action.

A multitude of experimental work has demonstrated the action of the drug with metabolically important biological molecules. Much of this work has been done *in vitro* and a good background for *in vivo* studies thereby established. Ongoing *in vivo* studies are seeking to define the quantitative and qualitative nature of the drug's action, especially its complexation with DNA.

The nature of the drug, its analogs and representative research concerning its biological effects will be discussed.

B. The involvement of free-radicals in reactions of some cobalt and chromium alkyls

J. H. ESPENSON

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

Radicals are involved in the formation of organochromium and organocobalt complexes, and in many of their subsequent reactions. Unimolecular homolysis (S_H1 mechanism) occurs as the rate-limiting step for the overall oxidative cleavage of certain complexes (e.g., $Cr-CH_2C_6H_5^{2+}$, $Cr-C(CH_3)_2OH^{2+}$, and $Co(dmgh)_2CH(CH_3)C_6H_5$) but not for others (e.g., $Cr-CH_2OH^{2+}$). It is also the key initiation step in certain autoxidation reactions (e.g., $Cr-CH(CH_3)_2^{2+}-O_2$). Bimolecular radical displacement reactions also provide important mechanistic steps, which can be generalized further if 17-electron metal complexes are included in the definition of a free radical.

C. Spectroscopy of Novel Iron Porphyrin Compounds

Harold M. Goff

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

Hemoproteins serve to catalyze diverse types of biological reactions as a consequence of the rich coordination and redox possibilities for the iron porphyrin prosthetic group. Various ligation and redox states which are important in hemoprotein function may be simulated in isolated model iron porphyrin compounds. In this regard, the highly conjugated, planar porphyrin ligand is known to stabilize unusual spin and oxidation states of the central metal atom. Nuclear magnetic resonance spectra of these various paramagnetic states are distinctive, and detailed interpretation of the hyperfine shift patterns permits definition of electronic structure and understanding of electron delocalization. Correlation of NMR shift patterns have for example been used to characterize "iron(IV)" porphyrins, and unusual spin-admixed $S=5/2, 3/2$ iron(III) porphyrin complexes.

64. Room temperature phosphorescence of selected indoles.

Catherine A. Haustein and Ronald T. Pflaum

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

Many substituted indoles are known to exhibit physiological activity. In particular, tryptamine, tryptophan, and serotonin serve specific functions in the human body. These indoles and their metabolites are found in abnormal levels in fluids of persons with psychiatric disorders, carcinoid syndrome, or muscular dystrophy.

Indoles having conjugated ring systems act as phosphors when excited molecules are immobilized on a solid support. When spotted onto filter paper,

phosphorescence is exhibited at room temperature upon excitation with high intensity ultraviolet radiation in the wavelength range of 295+10nm. The characteristics of the emitted luminescence and the effects of heavy atoms, moisture, oxygen, pH, and solid supports upon phosphorescence intensities will be discussed. A procedure for the determination of indoles, encompassing the advantages of small sample sizes, simple procedures, and high sensitivities, will be described. Potential applications to the determination of substituted indoles in biological samples will be presented.

65. The Reaction of TiF_4 with $Ca_{10}(OH)_2(PO_4)_6$

C. Edwards, T. H. Jordan, S. Webster and J. Wefel

Cornell College, Mt. Vernon, Iowa 52314

The effectiveness of TiF_4 in reducing cavities has led us to study the chemical reaction of the components involved.

Reactions with TiF_4 and : 1) powdered hydroxyapatite [$HA, Ca_{10}(OH)_2(PO_4)_6$] or 2) $Ca(OH)_2$ and H_2PO_4 in a Ca/ PO_4 ratio of 5/3 were run for 24 hours in plastic beakers in a 37°C water bath. The reactions were magnetically stirred. The products were filtered, dried in vacuo and subjected to x-ray diffraction analysis.

In reactions with 0.5 to 9% TiF_4 and Ti/ PO_4 ratios of 1 or less, apatite is the only product. At Ti/ PO_4 ratios of 2 or greater, the apatite is completely broken down and two new compounds, T and OP, are formed. Compound T has been isolated and found to contain Ti, F and PO_4 but no Ca. The composition of compound OP is not yet known.

Powdered dental enamel, essentially hydroxyapatite, was used in three reactions with TiF_4 . The results obtained were similar to the same three reactions run with HA and TiF_4 .

66. Reversed phase high performance liquid chromatography of metal complexes of acetylacetone and benzoylacetone.

R.C. Gurira and P.W. Carr

Grinnell College, Grinnell, Iowa 50112

Liquid chromatographic behavior of Mn(II), Be(II), Co(III), Cr(III), Rh(III), Ru(III), Pt(II), Pd(II) and Ir(III) acetylacetone and Cr(III) benzoyl acetone complexes was investigated by reversed phase HPLC using a Supelco and a Perkin-Elmer C_{18} columns. Separations were successfully demonstrated by using either methanol/water or acetonitrile/water mixtures as mobile phases. Solvent mixtures necessary to effect separations of various sets of complexes were established. In addition elution order of the complexes was found to be dependent on the organic solvent in the eluent mixture. As many as seven complexes (metals) were baseline resolved in about 10 minutes or less. The complexes gave highly symmetrical peaks indicative of the absence of both adsorption and decomposition on the column. The complexes absorb very strongly in the uv. Consequently, limits of detection in the ng range can be achieved. Criterion for predicting chromatographic behavior will be discussed.

67. Synthesis and crystal structure of a salt containing the tetrastannide(2-) anion Sn_4^{2-} .

S. C. Critchlow and J. D. Corbett

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

Black, plate-shaped crystals of $(K^+-2, 2, 2\text{-crypt})_2Sn_4^{2-}\cdot en$ are one of several products from a reaction of KSn_2 , K_3Bi_2 , and 2, 2, 2-crypt in ethylenediamine (en). The compound crystallizes in the monoclinic space group $P2_1$ with $a=12.640(3)$, $b=20.943(5)$, $c=12.353(3)$ Å, $\beta=118.97(2)^\circ$, and $Z=2$. Data were collected on an automated diffractometer (Mo- K_α radiation) and the structure solved by Patterson and Fourier methods using 2650 independent reflections ($I>3\sigma(I)$). The 62 nonhydrogen atoms refined to $R=0.093$ and $R_w=0.114$. This structure provides the first conclusive evidence for an 18-electron tetrahedral cluster. The Sn_4^{2-} anion is only slightly distorted from T_d symmetry (the perfect tetrahedron would be first-order Jahn-Teller unstable), with one edge [$2.934(3)$ Å] significantly shorter than the other five [$2.956(3)$, $2.962(3)$, $2.962(5)$, $2.969(7)$, and $2.972(7)$ Å].

68. The synthesis and crystal structure of yttrium monochloride.

J. E. Ford and J. D. Corbett

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

The reaction of Y with YCl_3 in sealed tantalum containers at 850-900°C leads to the new compound YCl . The structure of YCl was refined on the basis of single-crystal diffractometer data by least squares techniques ($R\bar{3}m$, trigonal cell; $a=3.753(1)$, $c=27.528(4)$ Å, $Z=6$; $R=0.039$, $R_w=0.054$ for 101 independent reflections taken with Mo K_α radiation). YCl has a sheet structure consisting of close-packed homoatomic layers sequenced ($Cl-Y-Y-Cl$) along [001]. The yttrium atoms have an antiprismatic coordination while the chlorine atoms have prismatic coordination. Each yttrium atom has three metal neighbors in the next layer at 3.511 Å, six yttrium neighbors in the same layer at 3.753 Å, and three chlorine neighbors in the opposite layer at 2.750 Å. Weak chlorine-chlorine interactions between sheets at 3.753 Å contrast with the strong yttrium-yttrium binding within the sheets. This phase is thus polytypic (ignoring the difference in the metal atom) with $ZrCl$ and isostructural with $ZrBr$.

69. Monitoring energy distribution for $D+F_2$ and $F+D_2$ systems using a new experimental technique termed chemiluminescence mapping.

JOSEPH T. WANNA and DWIGHT C. TARDY

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

Nascent DF product vibrational distribution from $D+F_2 \rightarrow DF(v \leq 15) + F$ and $F+D_2 \rightarrow DF(v \leq 4) + D$ were measured by this new experimental chemiluminescence method. DF from the $D+F_2$ system shows a much larger fraction (78%) of the reaction exothermicity channeled into product vibration than is suggested by conventional chemiluminescence measurements on the parallel $H+F_2$ system. For the $F+D_2$ reaction the Chemiluminescence Mapping results are in good agreement with the results using other experimental methods, although it gave a higher DF($v=4$) population than other methods. This new method, termed Chemiluminescence Mapping for its simultaneous recording of spectrals and temporally resolved chemiluminescence differs from the earlier arrested relaxation and measured relaxation methods by introducing a short duty cycle pulsed molecular reagent source, a modified dissociation source, and signal averaged, time resolved detection of DF infrared emission.

70. Multiphoton dissociation in a series of monofluoroalkanes: HF elimination from 1-fluorobutane and 1-fluorohexane.

JOSEPH T. WANNA and DWIGHT C. TARDY

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

Unimolecular HF elimination from 1-fluorobutane and 1-fluorohexane is induced by the $p(22)$ line of the $00^0_1-02^0_0$ transition of the CO_2 laser which corresponds to a C-F stretch. These two compounds were studied separately and as a mixture as a function of energy fluence in a uniform fluence cell geometry. The 1-fluorobutane and 1-fluorohexane reaction probability for HF elimination varies with fluence according to the 7.1 power for a fluence range of 2 to 5 j/cm^2 in a pressure regime of 0.2 and 0.5 torr where intermolecular collisions are insignificant. In the mixture the %CPF (percent conversion per flash) for 1-fluorohexane is less than that of 1-fluorobutane, while separately their respective %CPF are comparable. HF^\dagger emission from the separately irradiated 1-fluorobutane, 1-fluorohexane, and the mixture each at a pressure of 0.2 torr was observed with the mixture displaying a later emission. Discussion of the results in terms of energy transfer due to collisional process will be discussed.

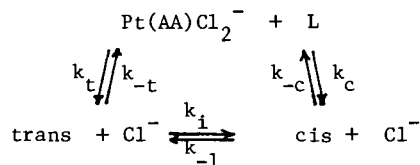
71. Kinetics and mechanisms for isomerization of trans-[Pt(glycine)(π -ligand)Cl].

T. A. Ferrett and L. E. Erickson

Grinnell College, Grinnell, Iowa 50112

The kinetics of the interconversion of $Pt(AA)Cl_2^-$ and the *cis* and *trans*(N,L) isomers of $Pt(AA)LCl_2^-$, where AA = glycine and L = DMSO, allyl alcohol, or

2-methyl-3-butene-2-ol, have been investigated by NMR spectroscopy. Computer simulation techniques, using a program MIDAS to solve the non-linear differential equations, were used to estimate the 6 second-order rate constants in the scheme below.



The isomerization pathway involving k_1 and k_{-1} was required to fit the rate data; this strongly suggests that both pseudorotation and consecutive displacement mechanisms are involved in the Cl^- catalyzed isomerization of the *trans* isomer.

Chemistry:Org.& Biol.

72. Attempts to Prepare 1-Methyl-2-phenylperhydroazepine-1-acetamide

Stanley Wawzonek and Jan Michael Shradel
Department of Chemistry
University of Iowa

Iowa City, Iowa 52242

Attempts to prepare 1-methyl-2-phenylperhydroazepine-1-acetamide from 1-acetamino-1-methyl-2-phenylperhydroazepine and 1-amino-1-methyl-2-phenylperhydroazepinium iodide were unsuccessful. The former gave with methyl iodide a mixture of 1-acetylamino-2-phenylperhydroazepine hydroiodide and 1-acetyl-2,2-dimethyl-2-(6-phenyl-5-hexenyl)-hydrazinium iodide. The latter when treated with ethyl acetate and potassium *t*-butoxide gave a mixture of 1-methyl-1-(6-phenyl-5-hexenyl)-hydrazine and 1-methyl-3-phenylperhydro-1,2-diazocine.

73. Anomalies of the pinacol coupling reaction

M. L. Drake, M. J. Haganman, R. J. Johnson,
K. E. Leonard, B. P. Mundy, R. J. Warnet

Simpson College, Indianola, Iowa 50125

The titanium-mediated reductive coupling of aliphatic carbonyl compounds has been shown to give superior yields of pinacols, as compared to the classical aluminum amalgam method. There is the tacit assumption that the titanium intermediate enhances the degree of coupling, as observed by higher yields, without affecting product composition. We now present evidence to unequivocally demonstrate that the pinacol product is not the same from the titanium-mediated reaction as from the classical method. A preliminary suggestion of the two mechanisms involved will also be presented.

74. The degenerative chemistry of natural malondialdehyde.

VASU NAIR* and CURT S. COOPER

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

Malondialdehyde is formed in animal tissue as an end product of lipid peroxidation and as a side product of prostaglandin and thromboxane biosynthesis. Although MDA has been reported to be reactive towards biomolecules such as proteins and DNA, structural details of such linkages are not fully understood. We have utilized model systems to delineate on a molecular level the nature of some possible structural alterations of biomolecules that may be induced by malondialdehyde. These include formation of enaminals, vinamidines, pyrimidines, thiazolidines, tetrahydro- β -carboline and other moieties by reaction with amino acids, and formation of various complex heterocyclic systems from nucleic acid bases. This paper will discuss the details of these transformations.

75. Rabbit lung Cathepsin L.

R. Chatterjee, M. Lones, and G. Kalnitsky.

Department of Biochemistry, The University of Iowa,
Iowa City, Iowa 52242.

Cathepsin L was purified from rabbit lung and was obtained in an apparently homogeneous form.

Cathepsin L was composed of isozymes (with pI values of 5.8 to 6.2) and hydrolyzed azocasein with a pH optimum of 5.0. This enzyme readily hydrolyzed Angiotensin I (a decapeptide) and renin substrate (a tetradecapeptide), specifically cleaving peptide bonds Tyr(4)-Ile(5) and His(9)-Leu(10) in both substrate, plus the Leu(11)-Val(12) bond in renin substrate. The enzyme was readily inhibited by leupeptin and polypeptide chloromethyl ketones such as Ac-Ala-Ala-Phe-Val-CH₂Cl. This enzyme is a cysteine proteinase and requires a free -SH group for activity. With cysteine activation taken as 100%, activators like glutathione, β -mercaptoethanol, homocystein, and β -mercaptoethylamine activated the enzyme 70-80%. A synthetic thiol compound, D-2-methyl-3-mercapto-L-proline, at a concentration of 0.1 mM, activated Cathepsin L 140%, and, at 4 mM conc., inactivated the enzyme 50%. This may indicate a possible mechanism of regulation of thiol enzymes by similar naturally occurring compounds under physiological conditions. Supported by NIH grant HL16920 and by a Wellcome Research Travel Grant.

76. Purification and characterization of Cathepsin B2 from rabbit lung.

M. Lones, R. Chatterjee and G. Kalnitsky

Department of Biochemistry, The University of Iowa,
Iowa City, Iowa 52242.

Cathepsin B2 has been obtained in an apparently homogeneous form from rabbit lung acetone powder. This lysosomal protease has a molecular weight of about 52,000 and is composed of two subunits of equivalent

molecular weight (as determined by gel filtration, ultracentrifugation under native and denaturing conditions with guanidine-HCl, SDS polyacrylamide gel electrophoresis and amino acid composition). This protease is active on an endopeptidase substrate, Benzoyl-arginyl-amide (optimum pH 6.0), and a carboxypeptidase substrate, Hippuryl-arginine (optimum pH 5.0), requires a high concentration of reducing agent for maximum activity (10 mM dithioerythritol) and is a glycoprotein. Cathepsin B2 is inhibited by leupeptin, antipain, Ac-(Ala)₄-CH₂Cl, iodoacetate, TLCK and TPCK; in all cases the inhibition is \sim equal with both substrates. Cathepsin B2 exhibited strong carboxypeptidase and endopeptidase activities on oxidized insulin β chain. Thus, it appears that Cathepsin B2 has bifunctional capacity in that it can act as a carboxypeptidase and an endopeptidase. Supported by NIH Grant HL16920 and by a Wellcome Research Travel Grant.

77. Anthramycin-induced damage to Tetrahymena DNA

Paul B. Volker and Elliott L. Uhlenhopp

Chemistry Department, Grinnell College, Grinnell,
Iowa 50112

Anthramycin, a benzodiazepine antibiotic, has been shown to cause single- and double-strand breaks to DNA during in vivo exposure to Tetrahymena cultures. Now several aspects of the antibiotic-DNA interaction are known, including a proposed mechanism of attack. Using the technique of viscoelastometry, we have shown significant single- and double-strand damage to Tetrahymena DNA, as well as that organism's ability to repair at least part of its fractured DNA, presumably via the cell's normal polymerase repair mechanisms. The unusually high frequency of double-strand breaks lends support to the novel theory of interaction between the double helix and the anthramycin molecule.

78. Novel, biologically-active cyclic nucleotides.

VASU NAIR* and RONALD J. WIECHERT

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

Adenosine 3',5'-cyclic monophosphate (cyclic AMP) plays a major role in initiating and modulating a number of fundamental biochemical processes within cells. Our interest in understanding the fundamental aspects of the chemistry of cyclic AMP led to the synthesis of a novel class of analogues of this regulatory nucleotide. The synthesis, structural and stereochemical studies, and enzymological evaluation of these synthetic cyclic nucleotides will be presented. The enzymology will include activation of cyclic AMP-dependent protein kinases and inhibition of 3',5'-cyclic nucleotide 3'-phosphohydrolases. The implications of the structural characteristics of the synthetic cyclic nucleotides on the observed activity towards these enzymes will also be discussed.

79. A natural repellent of leafcutter ants.

DIANE C. ALES⁺, DAVID F. WIEMER⁺ and STEPHEN P. HUBBELL[#]

⁺Department of Chemistry and [#]Department of Zoology, University of Iowa, Iowa City, IA 52242

Leafcutter ants are important agricultural pests in much of Central and South America. While they inflict extensive damage upon many introduced plant species, many native plants appear to be defended against leafcutter attack. We postulated that native plants might have evolved chemical defenses, and using a bioassay which measures ant feeding preferences, we have pursued the isolation of repellent compounds. One of the plant species examined was *Lasiacanthus fruticosus*, and we have isolated a pure, active compound from these leaves. After a series of degradative reactions, we proposed a hydroazulene structure for the natural product. We have confirmed the proposed structure by synthesis. The details of our isolation, structure determination and synthesis, as well as the biological activities of these compounds, will be reported.

80. General base catalysis in the Photo-Smiles Rearrangement.

G. G. Wubbels and D. W. Celandor

Grinnell College, Grinnell, Iowa 50112

Base catalysis of the photochemical Smiles rearrangement of β -(3-nitrophenoxy)-ethylamine giving β -(3-nitroanilino)-ethyl alcohol has been studied. For reactions monitored by product absorbance at 405 nm, catalysis by the general bases, OH⁻, OAc⁻, HCO₃⁻, HPO₄²⁻, and morpholine is observed. At [OH⁻] $\geq 2 \times 10^{-3}$ M, the quantum yield for the rearrangement is proportional to [OH⁻]; however, at [OH⁻] $\leq 5 \times 10^{-4}$ M, the quantum yield is independent of [OH⁻]. We conclude that an uncatalyzed pathway and a general base catalyzed pathway occur simultaneously for the photochemical Smiles rearrangement of β -(3-nitrophenoxy)-ethylamine. A mechanism and a kinetic scheme for this rearrangement will be discussed.

Conservation

81. Homestead Reforestation

ROSS L. IVERSON

Miller Junior High
South 11th St.
Marshalltown, Iowa 50158

In 1976 a project was started to reforest a thirteen acre homestead and to bring soil erosion under control. This presentation is a description of some of the experiences, good and bad, encountered. Plantings include walnut, maple, ash, honeysuckle, red, white, and scotch pine, white and norway spruce, and a wild life packet. Orchard grass, brome, alfalfa and crows vetch were also planted. There is much left to do, but some of the findings are now reportable and may be valuable to others that want to undertake such a project.

82. Conservation practices at the IAS Parish farm.

Paul A. Christiansen and Robert H. Hibbs

Cornell College, Mt. Vernon, Iowa 52314

Over the past 10 years considerable progress has been made in installing conservation practices at the IAS Parish farm near Reinbeck, Iowa. The use of minimum tillage, tile outlet terraces and wild-life plantings are illustrated.

83. Aerial photographic keys for forest community analysis in land use planning for Iowa

G. L. HIGHTSHOE

Department of Landscape Architecture, Iowa State University, Ames, IA 50011

The natural forest vegetation of Iowa represents only a small percentage of the entire landscape cover. Development pressures continue to dilute and reduce our forest heritage. Aerial Photographic Keys for vegetation analysis can be used as a tool enabling land use planners and landscape managers to evaluate the quantity and quality of the remaining forest resource and to make a determination of its suitability/capability for preservation, conservation or alteration. Objectives included the development of photo-interpretation keys and forest community models which would make it possible to identify Iowa forest cover types on aerial photographs and their evaluation in an objective manner so as to obtain some perspective as to usefulness. Ground truth and field check records enabled the investigator to successfully evaluate the potential/limitations of each film-season-scale combination reviewed. The methods developed and the very high interpretative accuracies established in preliminary test results should be useful in assisting the manager to quantify rankings, make value judgments, or other interpretations of vegetation character important to the decision-making process.

84. The effect of ELF radiation on basswood (Tilia) growth.

D.A. Sabelka and L.S. Weilgart

Luther College
Decorah, Iowa 52101

One clump of basswood trees growing directly under a 345 kV transmission line was compared to another clump at least 100 feet away from the line to determine the effect of ELF (Extremely Low Frequency) radiation on growth. The environment about each clump was similar in that both experienced somewhat equal crowding or competition by other trees and equal water availability. The trees were all ca. 8-12 years in age and grew up after the powerline was constructed. Analysis of variance revealed a very highly significant difference between trees, between years, between clumps, and all interactions thereof. Mean annual growth for the clump underneath the powerline was greater. In particular, trees in their younger years seemed more sensitive to the possible growth-enhancing effect of ELF radiation.

85. Ecology of the land snail Oxyloma retusa in northwestern Iowa.

R. V. Bovbjerg and M. Lannoo

Department of Zoology, University of Iowa,
Iowa City, Iowa 52242

Among the lakes, ponds, and sloughs of N.W. Iowa the land snail O. retusa is restricted to a band along the moist margins. Transects at this margin of two sloughs and a bay of Lake W. Okoboji, demonstrated a peak density in the second meter from water's edge. Density tailed to 5-7 m inland. Marked experimental animals selected the same mode and dispersion. After heavy rains and inundation, emergent vegetation was ascended; this ascent was also seen during dewey nights. With drought, the band of snails followed the retreating shore to the center. Water is avoided and the entire life cycle is restricted to the dense, moist detritus of the shore. However, when trapped in water they may glide on the undersurface like pond pulmonates. Two color morphs have overlapping but zoned dispersion from the shore inland, the amber morph further inland than the dark. The observed capacity to disperse and experimentally demonstrated tolerance of drying are adaptations to this stressful and ever changing habitat.

86. Growth and food habits of larval tiger salamanders (Ambystoma tigrinum) in northwestern Iowa.

M. J. Lannoo and M. D. Bachmann

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

A. tigrinum larvae occupy the marshes surrounding the larger lakes in northwestern Iowa, generally maturing and metamorphosing in one season. The purpose of this study was to relate the growth of

these larvae to their food habits over the course of a season. During this study, larval size increased from an average of 22 to 58 mm snout-vent length before metamorphosis. Daphnia and other small prey items were eaten by all size classes of larvae; larger larvae tended to eat larger prey sizes and a greater diversity of prey. Specialized feeding adaptations are discussed and related to food habits and prey choice. In combination with other studies, these results allow generalizations to be made about the food habits of the larvae of this species across their whole range.

87. Nesting ecology of vesper sparrows breeding on Iowa cropland

Nicholas Rodenhouse and Louis Best
Animal Ecology Dept.
Iowa State University
Ames, IA 50011

The nesting biology of 55 pairs of vesper sparrows breeding on corn and soybean fields was studied in Story County, Iowa during 1980. Territory selection was related to the amount of residual cover on the crop field, and the proximity of nonproductive areas (fencerows, grassy waterways, weedy washes). Initial nesting sites were in fields with the most residual cover. The location of subsequent nests was influenced by tillage operations and crop development. Of the 44 nests found, 29% fledged at least one young, 29% were destroyed by agricultural operations, 33% by predators, 7% were deserted (primarily due to parasitism), and 2% were destroyed by weather related events. 13 nests were parasitized by the brown-headed cowbird. Most parasitism (92%) occurred before June 15. Nesting success (Mayfield method) during the first half of the breeding season was 8%, but 23% during the second half. Evolutionary preadaptations of the vesper sparrow for breeding in intensively cultivated areas will be discussed.

88. Ruffed grouse population trends

T. W. Little
Iowa Conservation Commission
Wildlife Research Station
Boone, IA 50036

Northeast Iowa ruffed grouse (Bonasa umbellus medianus Todd) populations were monitored with spring roadside drumming counts (1961-78), activity center counts (1966-78) and hunter surveys (1968-78). Drumming indices ranged from 1.0-2.2 drums per stop and appeared stable compared to northern grouse populations. Declines in activity center counts were related to secondary vegetative succession. Fall population indices fluctuated independently from spring indices except following peak years for the spring index. Reproductive success related to annual summer weather variations probably has a greater effect on fall populations than minor changes in breeding population levels. Grouse examined in hunter's bags were 58% juvenile and 67% in the red color phase. Iowa ruffed grouse appear to exhibit population parameters which fall on a gradient between cyclic northern and more stable southern populations.

89. The Indiana Bat in Iowa--
a status report

John B. Bowles

Central College
Pella, Iowa 50219

The federally endangered Indiana bat, *Myotis sodalis*, reaches the north-western limits of its summer range in Iowa. Forty-two bats, including pregnant or lactating females and flying juveniles, were mist-netted in five south-central counties in summer 1980. All were netted over streams or clearings in upland forests, but no maternity colonies were located.

90. Manipulation of bass-bluegill populations by summer drawdown.

K.H. Hill

Iowa Conservation Commission
Cold Springs State Park
Lewis, Iowa 51544

Relative abundance of five fish species was determined in Meadow Lake before and after a lake drawdown. Bluegill was the most abundant species before and after drawdown, but mean catch rates for electrofishing and fyke nets suggest a 50% reduction in bluegill numbers. Largemouth bass catch rates increased about 50% after the drawdown. Length-weight regression and condition factors indicated bluegill and largemouth bass were in poor physical condition before the drawdown, but condition factors for both species improved following the drawdown. Both species showed an increase in growth of age 0 fish following the drawdown. Proportional stock density (PSD) values for bluegill and largemouth bass were 32 and 36 respectively, before the drawdown, but were 44 and 47 respectively after the drawdown.

91. Phytoplankton gradients in Red Rock Reservoir.

David. M. Søballe

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

In the main body of Red Rock Reservoir the phytoplankton standing crop (as measured by chlorophyll-a) is maximal in the river inlet and declines monotonically toward the dam. Light limitation contributes to this pattern but does not seem to be a dominating factor. The strong, longitudinally constant, relationship between chlorophyll-a and net primary productivity implies that physiological deterioration is not causing the observed algal gradient. P:R ratios in the upper reservoir imply an increase in algal crop, but this is not the case.

Sedimentation experiments show that algal sinking phenomena may be responsible for patterns of phytoplankton abundance in Red Rock, but field confirmation is needed.

92. Distribution of fecal coliforms and fecal streptococci in the Catfish Creek Watershed

Kathy M. Konzen and Kevin J. Imoehl

Loras College, Dubuque, Iowa 52001

Water samples were taken for ten consecutive weeks during the summer of 1980 to determine the fecal coliform and fecal streptococci concentrations at thirteen designated areas of the Catfish Creek, Dubuque County. The geometric mean values of fecal coliforms at each site were in compliance with the Class "B" rating of the watershed. The highest coliform values ranged from 1600-1700 org./100ml while the highest streptococci values ranged from 1300-1400 org./100 ml. Moderate trends existed between fecal coliform levels and water temperature and between fecal coliform levels and sediments. Significant differences in bacterial concentrations were noted when rainfall exceeded one inch.

93. *The benthic macroinvertebrates of the Upper Iowa River: impacts from Decorah*

S. D. Prill and M. L. Meierhoff

University Hygienic Laboratory, University of Iowa, Oakdale Campus, Iowa City, Iowa 52242

In the spring and summer of 1980, the Limnology Division of the University Hygienic Laboratory conducted an extensive benthic macroinvertebrate survey of the Upper Iowa River basin. One purpose of this survey was to establish the impacts (if any) from the discharge of the Decorah Wastewater Treatment Plant (WWTP) on the benthic macroinvertebrates. A control sampling site (Station 1) was established just upstream from Decorah. Station 2 was located approximately 100 meters downstream from the outfall of the Decorah WWTP. The low densities at this station indicated that the benthic macroinvertebrates were severely stressed and included such pollution tolerant "indicator organisms" as sewage fungus and moth fly larvae. At Station 3 (approximately 1 kilometer downstream from the Decorah WWTP outfall) the benthic macroinvertebrates were even more severely stressed with very low densities in the spring and summer collections. The benthic macroinvertebrates had recovered by Station 4 (approximately 5 kilometers downstream from the outfall) to density and diversity conditions similar to those found at Station 1.

94. Survey of Ringgold County Iowa pastures and recommendations for improvement

Peggy A. Whitson

Iowa Wesleyan College Mt. Pleasant, IA 52641

During the summer of 1980, 89 farmers of Ringgold County were interviewed to determine the types of pasture and their present management. A questionnaire included the farmers' ratings on the most productive pasture type, the forage supporting the most cattle per acre, and the best mid-summer forage. Orchardgrass (*Dactylis glomerata*) was rated as the farmers' first choice in this survey. Management practices surveyed were fertilizer and liming application, stocking rates and weed control. It was found that 80% of the farmers used chemical fertilizers and about 2/3 of those applied only every five or more years. Of the 77% who applied lime, 40% applied on a three year rotation, while another 40% applied only every five or more years. The average stocking rate was slightly over two acres per cow. Only 27% of the Ringgold farmers used any chemical weed control, and almost 2/3 agreed thistles were the main weed problem. One suggestion for improvement involved soil testing for more effective fertilizer and lime utilization. Increased weed control was promoted. Switchgrass (*Panicum virgatum*), a native prairie grass, was recommended because of its warm season tolerance, large biomass production and its higher stocking rates.

Engineering

95. A Terrestrial Pesticide Exposure Model

J. M. Runde, J. Schnoor

215 Water Plant University of Iowa 52242
Iowa City, Iowa

Dieldrin residue levels for five animals are modeled over three years, wt-footed mice, crickets, earthworms, an omniverous beetle, and a carnivorous beetle. The calculated metabolic-excretion rate constants are .01/day, .085/day, .021/day, .3/day, and .1/day respectively. The observed peak residue levels for any year after field applications of 1# Aldrin/acre were 1.32, .56, 3.11, 3.29, and 36.2 ppm respectively. The soil residue averaged .25 ppm. The predicted peak residue for the same years are 1.78, 1.0, 3.2, 10.0, and 55.0 ppm respectively. Important factors in residue levels include time of diapause and emergence for the insects, and proportion of diet containing animal matter. The model has shown that the animals maintain a steady state level through the late fall and winter, are dose exposed at application time creating a peak residue level, and then slowly recover to the previous steady state concentration. Best management practices may be simulated using the model, including partial pesticide application, with substantial adverse effects,

96. Microbiological air study of a municipal solid waste processing facility

Linda L. Lembke and Richard N. Kniseley

Ames Laboratory-USDOE, Iowa State University, Ames, Iowa 50011.

The microbiological air quality of a municipal solid waste processing facility has been under study in Ames, Iowa. Because high levels of airborne particulates are present in the processing area of the facility, problems are encountered in the collection of air samples. Sampling techniques will be presented which minimized these problems. Levels of airborne total and fecal coliforms will be detailed. Other types of bacteria and fungi which we recovered will be reported.

97. Hazardous waste disposal: problems and priorities in Iowa

R. Rajagopal, K. Franklin

The University of Iowa, Iowa City, IA 52242

This paper provides a comprehensive overview of existing hazardous waste and related environmental information, compares selected provisions in the laws of Iowa with the corresponding provisions in laws of a few other states, and identifies certain crucial short-term policy questions and options. Iowa's hazardous waste related problems are closely related to its industrial production and distribution patterns. Concentrated development has occurred in the southeast quadrant of the state, especially along the corridors of the Mississippi, Cedar, and Iowa Rivers. As detailed site-specific data gathered by the U.S. Environmental Protection Agency and the Iowa Department of Environmental Quality becomes available, several management and policy options outlined in this study can be further analyzed for specific evaluations.

On the basis of a limited comparison, the areas of siting and funding mechanisms appear to be particularly weak in Iowa law. The proposed siting board bill, when enacted, would possibly alleviate some of these shortcomings. Recommendations to modify, clarify, or add certain provisions to proposed and existing laws followed by a series of management, control, and research options for consideration by the state agency responsible for hazardous waste are provided.

98. Energy balance for grain alcohol production

A. N. Shekar, M. L. Holden and T. F. Smith

Division of Energy Engineering, The Univ. of Iowa, Iowa City, Iowa 52242

The energy balance for a grain alcohol process has often been the center of controversy especially after the advent of gasohol as an automotive fuel. A unified energy balance approach that defines the boundaries of the system realistically and establishes guidelines for the inclusion or exclusion of different material and energy interactions in the energy balance is presented and employed to analyze the input-output relationships. An attempt has been made to assign energy credit values that are on the same thermodynamic level. Farm energy inputs have

been tabulated from a survey of literature and from discussion with farmers. Process energy values have been arrived at from design experience with the University of Iowa Solar Energy Assisted Ethanol Plant, and from published values. The feed value of distillers' dried grain has been related to that of corn and a proportional energy credit is assigned to it. It is shown that the end use of alcohol influences the energy balance significantly. Furthermore, the energy balance is distinctly favorable for the above cases.

99. Vacuum distillation of fuel alcohol using solar energy

M. L. Holden and T. F. Smith

Division of Energy Engineering, The University of Iowa, Iowa City, Iowa 52242

Utilization of solar energy to assist in fuel alcohol distillation reduces the non-renewable energy input for this liquid fuel production. The feasibility of solar energy was made possible by lowering the distillation temperature to 115 F by performing the distillation at a vacuum of one-tenth atmospheric pressure. At this temperature, low cost, flat plate solar collectors operate efficiently. Results from experimentation with a 0.10 m diameter, 9.1 m high column coupled to a 18.6 m² solar collector and an electric back-up energy source are presented. The research goal is to produce a data base for distillation parameters consisting of pressure, solar energy availability, daily production, product quality, energy consumption, and column design.

100. Optimal liquification temperature of corn starch in solar assisted ethanol production

C. P. Burkhart and J. O. Osburn

Division of Energy Engineering, The Univ. of Iowa Iowa City, Iowa 52242

As the production of fuel ethanol from corn becomes increasingly popular, it is necessary to transform this old art into an energy efficient process. High technology equipment such as cooking extruders reduce the energy necessary to convert corn starch to sugar, the liquification process. Alternatively this process can be addressed from a different viewpoint, namely utilization of low density solar energy to supply a portion of the energy needs. As auxiliary energy (of a conventional form) may be needed to obtain the desired liquification temperature (70-100°C), it is important to optimize this temperature for the maximum output/input energy ratio. By assigning an energy value to the product ethanol and assuming the only factor governing the amount of ethanol produced is the percent of starch converted, the optimal solution for the system may be found. The purpose of the study is to develop a technique for locating the liquification temperature where the maximum ratio of energy out to energy in is obtained for a given combination of vessel design, enzymes, and pH.

101. Optimal solutions to transportation problems

J. W. Patterson

Materials Science and Engineering
110 Engineering Annex
Iowa State University
Ames, IA 50011

Distribution problems requiring haulage to (or from) a central facility - such as a processing plant, a warehouse, a mineshaft, etc. - are described. Some very surprising invariance properties of the optimal solutions to such problems are then presented. These tend to defy the engineer's intuitive (but mistaken) expectation that the solution behaves like or is equivalent to a centroid or center of gravity. An easy-to-grasp mechanical analog is then described which quickly provides the user with a correct intuitive understanding of optimal solutions to haulage problems. The insight gained from the analog is not easily gleaned from the computer-oriented methods usually used to solve such allocation problems.

102. Blast furnace feed from power plant fly ash

M.S. DOBBINS and G. BURNET

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

Several processes have been proposed to remove minerals such as alumina from coal fly ash. A common step in most of these processes is the separation of an iron-rich magnetic fraction containing 40-50 wt. percent iron as iron oxide. Caustic leaching of this material removes contained silica and alumina, raising the iron content of the residue to 60 wt. percent. Temperature, hydroxide concentration, reaction time and solid-liquid ratio effects on the leaching have been investigated. The removal of silica and alumina has been found to be inhibited by the formation of insoluble sodium aluminosilicates. Increasing the solid-liquid ratio or decreasing extraction temperature or caustic strength, promotes formation of these precipitates. A mild acid wash of the extracted solids dissolves this precipitate so that a combination caustic leach-acid wash treatment will produce a high iron content product suitable as a blast furnace feed for steel production.

103. Use of cement kiln dust in the lime-soda sinter process

A.A. EL-HOUT, M.J. MURTHA and G. BURNET

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

The Lime-Soda Sinter process is used to recover alumina from power plant fly ash, clays, oil shale and other non-bauxite raw materials. Significant amounts of limestone and soda ash are required

which add to the cost. It has been discovered that kiln dust, a waste from the manufacture of portland cement, can be used to replace all of the limestone and a portion of the soda ash. The kiln dust represents about 20 wt. percent of the throughput of a cement kiln and typically will contain 45 wt. percent CaO and 4 wt. percent Na₂O and K₂O combined. When fly ash is the alumina source, the kiln dust from one 1,000,000 ton per year cement plant will supply the lime to process the fly ash from a 1,000 Mwe power station, effectively disposing of two difficult waste materials. The residue from the Lime-Soda Sinter process is primarily dicalcium silicate which can be returned to the cement plant as kiln feed.

105. Unusual beach deposits in an oolitic environment--Mississippian and Recent

ARTHUR J. GERK CALVIN O. LEVORSON

714 Third St. S.W., Mason City, Iowa 50401

Thousands of small fossils were collected from unusual lenses within the *Cyathophyllum* Zone, Gilmore City, Limestone (Mississippian) near Humboldt, Iowa. These rare lenses were located within a large quarry, occurring in a zone 1 to 2.5 m in thickness showing an extreme variability of facies. Despite an intensive search of the Gilmore City outcrops in Iowa, no similar lenses were discovered. The small fossils confined to these lenses could be interpreted as a dwarf fauna. However, the rest of the zone contained larger fossils and fossil fragments. The small fossils are remarkably well preserved, the gastropods particularly so. Observations of the Gilmore City Limestone and of Recent oolitic deposits of the Bahamas leads to the conclusion that these unusual lenses were a back shore deposit. The Bahamian deposits demonstrate logically why these fossil assemblages are to be interpreted as size-sorted rather than dwarfed. Finally, a hypothesis is presented to explain the exceptional preservation of the fossils.

Geology

104. Self-trained paleontologists and Iowa geology

W. I. Anderson

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

Self-trained paleontologists have made important contributions to Iowa geology and to paleontology in general. Charles Wachsmuth (1829-1896), Frank Springer (1848-1927), and Burnice Beane (1879-1966) achieved recognition for their work with crinoids, although none of the three completed formal courses in paleontology. Charles Herbert Belanski of Nora Springs possessed only a high school degree, but he was recognized as an expert on Devonian paleontology. Belanski's contributions would undoubtedly have been greater, but he died at an early age. Carlyle Campbell of Knoxville lacked conventional training in paleontology, and his formal education ended at the fifth grade. Nevertheless, he made notable contributions through recovery of conodonts and collection of cephalopods. Preeminent among modern self-trained paleontologists is Harrell Strimple of Iowa City. Strimple, recently retired as research associate and curator at the University of Iowa, is author of over 280 papers on crinoids and a contributor to the authoritative Treatise on Invertebrate Paleontology. Contributions of other self-trained workers are reviewed, including Calvin Levorson of Riceville, Arthur Gerk of Mason City, and Amel Priest of Peru.

106. Petrology and diagenesis of the Plio-Pleistocene volcanoclastic sandstones, Cagayan basin, Northern Luzon, Philippines

Mathisen, M. E.

Department of Earth Sciences, Iowa State University, Ames, Iowa 50011

The volcanoclastic sandstones of the Cagayan basin vary in composition and diagenetic alteration by age and inferred depth of burial. The Plio-Pleistocene sandstones, litharenites and feldspathic litharenites, are very porous (20-30%), contain little detrital matrix, and are only slightly compacted. Authigenic mineral cements, however, are abundant. Clay rims or clay coats have formed on most framework grains. Zeolites, clinoptilolite, stilbite, chabazite and analcime also are present and commonly line or fill pores. Analcime occurs only in the oldest Plio-Pleistocene sediments which were buried to a depth of at least 700 m. Dissolution of framework grains has occurred in nearly all samples increasing porosity to as great as 42%. The Pleistocene sandstones are compositionally different, lithic arkoses and arkoses, and have not been as extensively altered as the Plio-Pleistocene sediments. Authigenic clays are thin and discontinuous and dissolution of framework grains has not significantly altered the mineralogy or reduced porosity.

107. Pyroclast deposits of Northern Luzon, Philippines

Ross, C. M.

Department of Earth Sciences, Iowa State University, Ames, Iowa 50011

The Cagayan Valley, Northern Luzon, Philippines, is an interarc basin situated between the Sierra Madre Range to the west. It contains several N-S trending asymmetrical anticlines which were formed by gravity sliding during the uplift of the Cordillera Central. The Range was volcanically active during the Pleistocene. Pyroclast flow deposits of the type found in the Cagayan Valley are produced by Plinian volcanism. These deposits were studied on the west flank of Enrile Anticline, 60-70 kilometers east of the source area. They are up to 11 meters thick and are interbedded with fluvial deposits of the Awidon Mesa Formation. Field relationships indicate the pyroclast flow deposits consist of 3 flow units of an ignimbrite or 3 separate ignimbrites. In either case, they were emplaced at relatively closely spaced time intervals and collectively formed one cooling unit. Gas escape and other structures are very well preserved, and air fall and rain flush ashes are associated. More recent volcanic activity is indicated by the presence of a surge deposit which occurs as a valley fill within the older ignimbrite.

108. Paleoenvironments of the fossiliferous Los Isidros Member, Venta Del Moro-Villatoya Formation, Cabriel basin, Valencia, Spain

Mathisen, M. E.

Department of Earth Sciences, Iowa State University, Ames, Iowa 50011

The fossiliferous Los Isidros Member of the Venta Del Moro-Villatoya Formation was deposited by a late Miocene meandering stream system. Thirty-eight species of vertebrates, which include species characteristic of both arid and humid environments, were deposited in floodplain and lacustrine environments associated with the stream. The interpretation of paleoenvironments is based on the recognition of two major lithofacies. The red, polymictic cross bedded conglomerate, sandstone, mudstone and concretionary carbonate facies is the dominant facies of the 300 m thick Los Isidros Member. It is interpreted as meandering stream point bar and flood plain deposits with caliche paleosols suggestive of an arid depositional environment in the Cabriel basin. The second facies, the fossiliferous gray mudstone, lenticular carbonate and lignite facies occurs in the upper part of a point bar sequence and is interpreted as flood plain and lacustrine deposits of a wet floodplain environment proximal to the stream channel.

109. Post-Hypsithermal climatic change in southwestern Iowa: the fossil record

L. P. FAY

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

Garrett Farm (ca. 3400 RCYBP) and Pleasant Ridge (1450 RCYBP) local biotas were recovered from alluvial sediments along Waubonsie Creek, Mills Co., Iowa. Two horizons at Pleasant Ridge and five at Garrett Farm have produced vertebrates, molluscs, and plant macrofossils. These local biotas offer insight into the nature of climatic adjustment from the maximum post-glacial warming of the Hypsithermal to the present.

Fossils from both localities indicate drier but cooler conditions at time of deposition than at present, according to environmental reconstruction by several biogeographic methods. A marked decline in prairie-habitat affinity mammals and less severe drop in boreal taxa from 3400 years ago to the present shows that the shift from Hypsithermal climate to current conditions was not simply a recovery from a maximum hot/dry post-glacial event. The adjustment mirrors the late and post-glacial pattern of biogeographic change; current biomes forming from a hypothetical mosaic precursor as environmental conditions change.

110. Temporal and spatial distribution of landslides in the central portion of the Gros Ventre River Valley, Gros Ventre Mts., Wyo.

Cloud, T. A.

Department of Earth Sciences, Iowa State University, Ames, Iowa 50011

The Gros Ventre mountains are tectonically and seismically active. Twenty-three landslides were studied along the 18.6 km reach of the Gros Ventre River between the moraines at Crystal Creek and Fish Creek. Relative ages of the landslides were based on boulder weathering, soil development, surface morphology, and cross-cutting relationships.

The weathering and morphologic data are interpreted to indicate that the distribution of landslides in time is uniform; this distribution precludes a climatic control which should be pulsating. Cross-cutting relationships indicate that 9 landslides rest upon outwash terraces and 4 terminate on older failures and are thus younger. These relationships preclude slope oversteepening due to stream incision. Seismicity and tectonic activity cannot be precluded as possible initiating factors for these 13 failures. The remaining 10 landslides terminate on the floodplain and could have been initiated by slope oversteepening due to basal stream erosion.

111. Chronology of the Upper Gros Ventre Landslide, Upper Slide Quad., Gros Ventre Mountains, Wyoming

Jensen, Joseph M.

Department of Earth Sciences, Iowa State University, Ames, Iowa 50011

The Upper Gros Ventre Landslide was first described by Blackwelder in 1912 as an earthflow. He noted its reactivation between 1908 and 1911 and attributed it to a series of wet winters. Baily later postulated (1972) that recurrent activity is probably due to undercutting of the toe by the Gros Ventre River.

The Landslide consists of three superimposed earth flow lobes. Crosscutting relationships indicate the toe is the oldest while the upper slump-flow is much younger. Field analysis of 120 tree cores indicates three periods of recurrent movement in the past 100 years. The upper slump-flow was active from 1907 to 1930. The lower two lobes were stable from 1885 to 1910 when they were reactivated. Portions of the toe failed by slumping in 1927.

The lower two lobes were probably active just prior to 1885. The 1910 movement appears to have been a bulging of the lower lobes of the slide under loading by the upper slump-flow. Basal undercutting of the toe could not have been responsible for the 1910 reactivation.

112. Geotechnical characteristics of some Holocene alluvial valley fills: Western Iowa

A. J. Lutenecker, R.O. Lamb, E.A. Bettis III

Iowa State University, Geotechnical Research Lab, Ames, Iowa 50011

Interest in the basic engineering properties of Quaternary sediments in Iowa has led to some recent investigations to evaluate the geotechnical characteristics of alluvial materials. Samples of valley fill deposits taken from the Smokey Hollow Valley near the Little Sioux River, Woodbury County, were tested for classification, consolidation characteristics and shear strength parameters for both undisturbed and remolded samples. In addition, in-situ electrical resistance sounding was conducted to determine material changes and stratigraphic boundaries. These Holocene alluvial materials represent typical sediments which occur over a large majority of side valleys in the thick loess area. Comparison of these data with other typical deposits, both alluvial and wind blown, is made as an aid in interpreting the origin of these surficial materials. The results give general values, illustrate some of the potential hazards to be avoided for simple engineering structures and indicate some limitations of use as foundation and building material.

113. Cherokee Group sandstones of central Iowa: Field characteristics and depositional environments

D. R. Burggraf, Jr., H. J. White, and J. Lemish

Department of Earth Sciences, Iowa State University, Ames, Iowa 50011

Within the strata comprising the middle Pennsylvanian Cherokee Group of central Iowa are two types of sandstone deposits here recognized as the lenticular fine- to medium-grained sandstone facies and the fine-grained sandstone facies. Exposures of the lenticular fine- to medium-grained sandstone facies commonly occur as vertical cliffs to 20 m high; exhibit markedly erosional basal surfaces; almost always consist of stacked sets of either large-scale planar or trough cross-strata; and include abundant carbonized and/or permineralized branch and tree trunk casts. Paleocurrent indicators, the lenticular body geometries, primary sedimentary structures, and associated sediments suggest that deposits of this facies represent major distributary channels of a delta complex. Deposits of the fine-grained sandstone facies are poorly exposed but occur as tabular or lenticular parallel-laminated to ripple-bedded sandstone bodies enclosed either by light-colored siltstone or gray mudstone. These strata are interpreted to represent crevasse splay and crevasse channel environments of deposition.

114. Delineation of Iowa aquifers potentially impacted by agricultural drainage wells

Graeff, R., Esling, S. and Drake, L.

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

An estimated 700 agricultural drainage wells (ADW) eliminate surface and tile water from Iowa farmland, where ditch drainage is impractical. Most of the ADW's are concentrated on the Des Moines Glacial Lobe with the remainder on the Iowan Erosion Surface. Detailed lithologic and hydrologic cross-sections have designated the potentially impacted aquifers beneath these poorly drained landscapes. Because most ADW's would receive large silt loads, the prime target for drillers would have been the most shallow carbonate aquifers with sufficient secondary porosity to rapidly accept turbid water without clogging. Beneath the Iowan Surface and the northern part of the Des Moines Lobe, the Silurian-Devonian Aquifer is most likely affected. In the central and southern portions of the Des Moines Lobe, the Mississippian Aquifer is probably impacted. No aquifer suitable for receiving agricultural well drainage is present beneath the northern and northwest fringes of the Des Moines Lobe. Within the study area, aquicludes pinch westward, providing opportunity for hydrologic exchange between the major bedrock aquifers.

115. Ground water quality in coal spoil

J. A. Klingshirn

Department of Earth Sciences, Iowa State University,
Ames, Iowa 50011

Recent legislation provides for the reclamation of orphaned spoil. Reclamation of aged spoil will disturb it and may cause renewed oxidation of pyrite. This study will provide data on the quality of ground water in unreclaimed spoil, belatedly reclaimed spoil, and immediately reclaimed spoil. The comparison of water quality among spoil with different reclamation histories will aid in evaluating the effects of belated reclamation.

In Mahaska County, a portion of the Hull mine was belatedly reclaimed a decade ago. The remainder of the mine remains in the original spoil ridges, cast some three decades ago. Adjacent to both is the active ICC mine which is being immediately reclaimed. The three contiguous sites thus provide a controlled experiment wherein only time of reclamation varies.

Research procedure will be to emplace clusters of boreholes in each of the three sites and to monitor ground water quality and level. Surface water samples will also be collected and analyzed.

116. Study approach to groundwater quality in properly reclaimed spoil

Kathleen E. Galloway

Department of Earth Sciences, Iowa State University,
Ames, Iowa 50011

The contamination of surface and ground waters by acid mine drainage may be inhibited by the rapid burial of spoil beneath a non-acid forming cover. Although rapid burial is a common procedure, few field studies exist to demonstrate its effectiveness. This study addresses this deficiency.

In Mahaska Co., 3 contiguous mines were reclaimed at different times and to different levels. They thus provide a controlled experiment wherein only time, level and method of reclamation are variables. The Iowa Coal Project Demonstration Mine was immediately reclaimed to best possible standards. The adjacent Star Mine was immediately reclaimed to state standards which are lower. The ICO mine was belatedly reclaimed to state standards after four years of aging. A comparison of the groundwater quality between the 3 mines will evaluate the effects of different reclamation standards, procedures, and spoil aging.

The research plan is to utilize the borehole network in the ICPDM and extend it into the ICO and Star Mines. Wells will be sampled monthly.

117. A statewide screening for acid rainfall

J.O. Kennedy, A.E. Granston, Jr., and
R.C. Splinter

University Hygienic Laboratory, H.A. Wallace Bldg.,
East Ninth & Grand, Des Moines, Iowa 50319

From April through October 1980, a statewide

screening for acid rainfall was conducted in Iowa. Ninety-seven National Weather Service observers were provided with pH color indicating strips to measure and record the pH of every precipitation event. Results of the screening indicate pH values of rainfall ranged from a low of 4.0 to a high of 7.0. The pH values 5.7 and 5.9 were observed most often and represented 66.4% of the 4,197 values measured. Approximately 80% of the rainfall pH values fell in the 5.7 to 7.0 range and 20% in the acid rainfall range (5.6 or less). Median pH values calculated for the 97 sampling locations ranged from 5.1 to 6.2 with medians of 5.7 and 5.9 occurring most frequently. With the exception of one three county area, most of the eleven sampling locations demonstrating acid rainfall (median values 5.6 or less) were widely separated and probably represent localized problems. Three adjacent counties located in southeast Iowa had low median pH values and this area is recommended for future study.

118. ACID RAIN

D.J. Schmidt, Department of Biology

Fitchburg State College, Fitchburg, Mass. 01420

During the summer of 1980, the precipitation at Fitchburg, Mass. was monitored for pH, Nitrate and Sulfate concentrations. A cadmium reduction method was used for Nitrate analysis and a Barium Sulfate Turbidometric method was used for Sulfate. Average readings during the study period were as follows: pH - 4.15, sulfate - 5.2 mg/l, Nitrate-0.69 mg/l.

An ongoing water quality study (1967-1981) in the Fitchburg, Mass. area has shown very little change in the pH of natural waters. Apparently the buffering capacity of natural waters in this area has been able to accommodate the influx of acid precipitation up to this time.

History & Philos. of Sci.

119. Enrique Beltrán, pioneering biologist in Mexico.

E. C. Bovee.

University of Kansas, Lawrence, Kansas, 66045.

In developing countries, advancement of sciences often depends on the tireless efforts of a few able, dedicated and industrious persons. One such, still actively working at 78, as a pioneering biologist, is Dr. Enrique Beltrán, Director of the Mexican Department of Natural Resources in Mexico City. He was trained as a protozoologist at Columbia University and has since served in many professorial and administrative roles in Mexican Universities. His publications include over 30 books on a variety of

biological topics, 130+ papers on conservation and natural history, 100+ papers in protozoology, especially medical protozoology, another 100+ papers in history of sciences and 25+ in sociology and education. He has served Mexico in many governmental appointments, including Undersecretary for Forestry and Conservation and has received many medals, honorary degrees and honorary memberships, including the French Legion of Honor, the Aldo Leopold Wildlife Medal and honorary membership in the American Microscopical Society. He has held many offices in scientific societies, worldwide, and is the Permanent Secretary and Honorary President of the Mexican Natural History Society. He is currently writing a Spanish text in protozoology and a History of Protozoology, besides his other activities.

120. Why 3 is the first number

John M. Crossett

Cornell College, Mt. Vernon, Iowa
52314

The set of natural numbers (1,2,3...n) is not a trueset, if by "set" we mean a collection of things having something fundamental in common.

(1) has no parts and does not show plurality;
(2) shows plurality but differs from (3,4,5...n) in the following ways: both have sameness of kind but (3,4,5...n) has difference of degree, i.e., 3 is 2 plus 1, 4 is 3 plus 1, etc., whereas 2 is 1 plus 1.

If we think the central common feature of number is plurality, then the set of numbers can include 2, i.e., (2,3,4...n); but since 2 differs in the ways specified above, it is better to make the set of numbers consist of (3,4,5...n).

Hence 3 is the first number.

Mathematics

121. Boolean groups.

I. H. Anellis

Dept. of Mathematics, University of Iowa,
Iowa City, Iowa 52242.

Abstract groups are Boolean if they are constructed from Boolean ordered lattices and equivalence relations, closed under *, rather than, like normal groups, defined as multiplicative sets. All Boolean groups are Abelian if Boolean algebra is commutative.

Physics

122. EEG, consciousness and statistical physics

C. Tourenne

Maharishi International Univ., Fairfield, IA 52556

Physical analysis of EEG signals is proposed on the basis of methods of statistical mechanics. The power spectrum of the EEG is analyzed over a large number of 4-sec epochs and the statistical entropy of the power distribution is calculated for each oscillator of the spectrum. From the average power and the entropy thus defined an EEG temperature is calculated for each frequency. This method has been applied to the EEG during periods of wakefulness and periods of practice of the Transcendental Meditation (TM) technique. Preliminary results indicate that the behavior of the brain as revealed by the EEG seems to obey the third law of thermodynamics: when EEG temperature decreases, the EEG entropy decreases. Furthermore, these two quantities have been found to be significantly lower during periods of TM practice than during wakefulness in the same subject. The concept of order as defined by thermodynamics is found to be valuable in the study of states of consciousness.

123. Solar instrumentation.

Liviu Tomuta

Divine Word College, Epworth, IA 52045

The paper will present a) some of the instrumentation used in measurements of solar installations, such as thermometers, temperature sensors, flowmeters, pyranometers, chart recorders and data loggers, b) experiments involving measurements of solar radiation, solar collector performance and heat storage losses.

124. Solar thermal concentrator systems: A review

Arthur C. Meyers III

Energy Division, Institute of Basic and Applied
Research, P.O. Box 1671, Ames, IA 50010

This paper will review the work currently being done to develop solar thermal concentrator systems to expand their application to small and medium size commercial and light industrial, including agricultural, uses. The work reported on has been completed after three years of funded studies. The presentation will review general principles and potential areas of application, before discussing the uses here studied. The results of design studies, small systems and laboratory modeling and computer simulations will be presented. The emphasis will be on the most currently economic and technically feasible applications, namely solar thermal production of co-generation power systems, repowering, and process heat production, as well as utility options. The possible applications to agriculture include feed mill operations and grain drying. From both an energy

and materials analysis, the concentrator systems are cost effective. Both trough and central receiver systems will be considered and discussed. The talk will emphasize the basics and general principles so that persons with a general physics background can appreciate the consequences and potential as well as provide information the researcher will find useful.

125. An undergraduate fiber optics experiment

D.W. Olson and M.D. Shilhanek

University of Northern Iowa, Cedar Falls, IA 50613

The rate at which information can be transmitted by an optical fiber is limited by the amount pulses are broadened as they travel through the fiber. An experiment for semiquantitative measurements of pulse broadening and attenuation by optical fibers will be shown. The source of the three nanosecond width optical pulses is an infrared diode laser. The detector is a PIN photodiode followed by a wideband amplifier. The output pulse is displayed on a sampling oscilloscope with an effective bandwidth of one Ghz. Some of the topics students may explore include: i) voice transmission by pulse-coding, ii) comparison of broadening in step-index and graded-index fibers, iii) characteristics of the diode laser, iv) problems of fiber manipulation including breaking techniques and quality testing of the fiber ends, v) fiber coupling techniques, vi) theory of light propagation in fibers.

Inv. The new particles in high-energy physics and what they mean.

G.W. INTEMANN

University of Northern Iowa, Cedar Falls, IA 50614

Since the earliest of times man has searched for an underlying unity to the rich diversity observed in nature. That search has taken him from the world of atoms and molecules to the domain of sub-nuclear particles and quarks as powerful accelerators have enabled physicists to probe smaller and smaller distances with higher and higher energies. The last six years have been especially significant in high-energy physics. During this brief period there have been unexpected discoveries of certain particles that carry new properties of matter described by such whimsical names as charm and beauty. We shall review these recent developments and explain the role which these new particles may play in attempts to identify the fundamental building blocks of matter.

126. Basic physics applied to automobile fuel economy

F. D. Trumpy

Des Moines Area Community College
Math/Science Dept.
2006 Ankeny Blvd.
Ankeny, Iowa 50021

A method is presented for calculating the maximum possible fuel economy to be expected for an automobile powered by a heat engine. By applying basic physics as taught at the high school or college freshman level, a simple experiment is described which determines that the power required for a small, four-passenger sedan to overcome rolling and wind resistance at 55 miles per hour is 14 horsepower. Assuming that the automobile's engine is as efficient as a Carnot engine, the upper limit of fuel economy for this small sedan is calculated to be 100 miles per gallon. This result is compared with claims made by promoters of various schemes purporting to increase the fuel economy of ordinary automobiles to well above 100 miles per gallon.

Inv. The analysis of musical sounds

William R. Savage

Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242

A musical sound has been defined as a sound that consists of a finite set of harmonic or nearly harmonic sinusoidal component sounds. One aspect of the analysis of a musical sound is to identify the acoustical spectral components and measure the relative strength of them. The usual technique is to represent the actual time evolution of the sound by a rapid succession of Finite Fourier Transforms. The waveform and changes in it with time can also provide information about the characteristics of a sound. Musical sounds can be distinguished from each other by the increases and decreases in amplitude known as attack and decay transients. The sustained portion of a sound may show variations in amplitude or frequency as a modulation of the waveform. Spectral analysis done in real-time permits the association of the time evolution of spectral components with the perceived sound. Accurate measurement of the transients and the degree of harmonicity requires accurate waveform and impedance measurements.

127. Analysis of sounds from guitar strings

R.J. Hanson

University of Northern Iowa, Physics Dept.,
Cedar Falls, Iowa 50613

The sounds from plucked guitar strings have been studied with a real-time frequency spectrum analyzer (Rockland Model FFT 512/S). The changing spectra of partials (harmonics) during the first

few tenths of a second after the pluck have been observed by utilizing the transient capture mode of the analyzer with different time delays after the initiation of the pluck. A series of spectra have been obtained over longer periods after the pluck (from about 0.3 second to 3 seconds) with an analyzer-microcomputer interfaced system. This system can store data from 24 consecutive spectra (one every 0.25 sec) after initiation of the pluck. The varying decay rates of the different harmonics can then be obtained from this data. Spectra of new and "old" classical guitar strings (nylon) exhibit significant differences in the intensity and rate of decay of different harmonics. "Old" here refers to strings which have been played intensively for several weeks or months. The air and main wood resonances of the guitar are also clearly exhibited in spectra obtained within about one-tenth of a second after the pluck of the highest string.

128. Design of an acoustically isolated sound recording room

Edward L. Kottick and William R. Savage

Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242

The equipment used to measure and record the acoustical aspects of musical sounds can produce sound levels that interfere with the study. Room sounds and street noises can obscure the lower level sounds produced by the musical instrument. Analysis of sound in a space that represents rooms used in performance requires an acoustically isolated recording studio. Such a room has been built with interior dimensions of 2.5 x 3.4 x 4.0 metres for our studies. The walls, ceiling and floor are of double wall construction. Entrance to the room is through gasketed double doors. The entire structure is supported on rubber isolation pads and short stacks of several materials selected to provide poor coupling of floor vibrations to the room. An attenuation of outside noise by 45 to 50 dB was achieved. The interior walls of the room were treated by attaching bulkheads to them so that sharp resonances or echoes were minimized. The room has proved satisfactory for the study of plucked and bowed strings, clarinet and oboe.

129. Understanding dispersion relations from the study of air-water interface waves

R. A. Powers, M. E. Verkade, and J. L. Stanford

Department of Physics, Iowa State University, Ames, IA 50011

Dispersion, in which the phase velocity v of wave motions depends on wavelength λ , is common to a wide variety of physical phenomena, including electromagnetic, fluid, and quantum waves. The complexities of these phenomena, however, often obscure the basic and ubiquitous nature of dispersion. We describe simple experiments with waves on an air-water interface in which the dispersion relation $v(\lambda)$ can be more easily appreciated. In

particular, three different regimes exist for such waves:

1. For very short λ , where surface tension effects dominate, v varies as $\lambda^{-1/2}$.
2. For somewhat longer λ , but $\lambda \lesssim$ water depth h , v varies as $\lambda^{1/2}$.
3. For very long λ ($\lambda \gg h$), $v = (gh)^{1/2}$, independent of λ .

130. **Modeling the end of exponential growth patterns**

PAUL A. SMITH

Physics Department, Coe College, Cedar Rapids, Iowa, 52402

There are quantitative and psychological aspects to the problem of dealing with the depletion of any finite resource or opportunity. In the early phase of the depletion process use grows exponentially until the resource is half gone, a transition takes place and use decreases exponentially. If f = the fraction used to date the differential equation for the use pattern tends to be close to $df/dt = f(1-f)$ where t = the number of mean-lives before the date of "half-gone". The solution of the differential equation is expressible as $f = 1/(1 + \text{EXP}(-t))$. The author will provide algebraic, graphical, and nomographical representations of relevant quantitative aspects of the probable pattern for resource depletion---suitable for copying and production of transparencies.

Physiology

131. Effects of ATP, ADP, AMP and cAMP on the growth and activity of Trypanosoma cruzi.

G. E. Walter and E. C. Bovee.

University of Kansas, Lawrence, Kansas, 66045.

Roles of adenosine triphosphate (ATP) in energy metabolism and for generating cyclic adenosine monophosphate are well-known, but few have tested ATP, ADP, AMP or cAMP on growth of protozoa. For T. cruzi, ATP added to growth-medium at 1×10^{-4} M or 1×10^{-3} M stimulates, but 1×10^{-5} M inhibits. ADP or cAMP at 1×10^{-4} M, however, stimulates, AMP at 1×10^{-5} M and 1×10^{-4} M stimulate, but 1×10^{-3} M inhibits. ATP also affects swimming and change of morphology. In controls, swimming decreased only after 72 hrs; in 1×10^{-2} M, little decrease even at 120 hrs; in 1×10^{-3} M

no decrease up to 120 hrs; in $1 \times 10^{-4} M$, sudden decrease at 120 hrs, none to 96 hrs; but in $1 \times 10^{-5} M$, slowing, with appearance of sphaeromastigotes in 9 hrs and cell-death onset at 48 hrs. Sphaeromastigotes appeared at 24 hrs in controls, in $1 \times 10^{-4} M$ and $1 \times 10^{-5} M$ ATP, not again, except in $1 \times 10^{-4} M$ at 120 hrs (35%). These changes in ATP may alter the efficiency of cell penetrance by the parasite in vivo. (Supported by the Graduate Teaching Fund of the Department of Physiology & Cell Biology, University of Kansas).

132. Effects of D-ala²-met⁵-enkephalinamide administered intravenicularly on selected cardiovascular responses in the non-human primate

M.D. Owen, C.V. Gisolfi, and D.G. Reynolds

The University of Iowa, Dept. of Physiology and Biophysics, Iowa City, Iowa 52242

Recent studies have suggested that the cardiovascular depressant effects of hypovolemic and endotoxic shock are mediated by the release of endogenous opiates in the CNS. In an attempt to determine the central cardiovascular site of action of endogenous opiates, D-ala²-met⁵-enkephalinamide (DAME) was injected directly into the 3rd ventricle of two Cynomolgus monkeys. These monkeys had previously undergone stereotaxic neurosurgery in order to implant a guide cannula into the 3rd ventricle. Prior to injection, baseline HR and systolic BP (SBP) were recorded. 100ul of DAME (1mg/1ml) was injected over a 5 min. period using a Harvard infusion pump. HR dropped in animal 1 from a control mean of 201.7 ± 0.81 (SEM) beats per minute (bpm) to 176 within 15 min. post-injection. Within the same time, SBP dropped from 96.5 ± 2.60 mmHg to 62. Animal 2 showed a decrease in HR from 168.6 ± 2.03 to 124 bpm, while SBP decreased from 130.9 ± 3.35 to 52 mmHg within 16 min. From these preliminary results, it appears that opiate receptors associated with the shock syndrome are located in para-third-ventricular tissue.

133. Acute effects of swimming on the cardiorespiratory responses of hypertensive rats.

M.D. Sturek, T.G. Bedford, R.D. Matthes, J.E. Edwards, and C.M. Tipton. Exercise Science Program, University of Iowa, Iowa City, IA 52242.

Swimming training produced adaptations similar to running; yet, the physiological demands are frequently lower. To study this matter in greater detail with an animal model, spontaneously hypertensive rats (N=5) were cannulated via the carotid artery and blood withdrawn at various time intervals during a 90-min swim. The results obtained from weighted (2% of their BW) animals were as follows: (X̄, SE, *p<0.05).

	Swimming Baseline		Between	
	0-10 min		80-90 min	
TTS (sec)	30.3±6.2		210.2±49.8*	
P _a O ₂ (Torr)	95.5±3.3		76.5±1.6	
P _a CO ₂ (Torr)	32.3±1.0		50.3±1.7*	
pH _a	7.375±0.04		7.135±0.039*	
Heart rate (B/M)	430±18		345±17*	

At rest, the heart rate was 325±12 beats/min. These results suggested that intermittent periods of

submergence (TTS) would produce significant changes in acidosis and hypercapnea that could be contributing to a training adaptation even though the energy demands were lower than running. (Supported in part by NIH grants HL-21245-04, and GM-07045-03.)

134. Influence of diet on liver and muscle glycogen repletion in rats.

P. Kershner, K. Rowlett, T. Bedford, & C. Tipton

Exercise Sci. Prog., U of Iowa, Iowa City, IA 52242

Dietary manipulation and "carbohydrate loading" are frequently used after exhaustion in athletic circles. To study this matter in animals, 23 rats were exhausted using a treadmill test and assigned to groups receiving either a standard (E-S), high glucose (E-G), or high fructose (E-F) diet. A control group of non-exhausted rats (N=23) consumed the S diet (C-S). Glycogen levels (GLYC) were measured in liver and skeletal muscle 24 hrs after exhaustion. The results were as follows (X̄ and SE, X*=significance at 0.05 level.)

Glyc. (mg/g)	Liver			Soleus			Plantaris		
	X̄	SE	N	X̄	SE	N	X̄	SE	N
C-S	38.2	±2.7	23	3.8	±0.3	10	5.4	±0.3	25
E-S	28.8	±4.1	8	3.7	±0.2	8	5.4	±0.3	7
E-G	21.6	±6.5*	7	4.3	±0.3	7	6.5	±0.5	6
E-F	15.7	±4.3*	8	4.4	±0.3	8	6.0	±0.3	8

Compared to the controls, liver values in all groups did not return to within normal limits, whereas the muscle had been repleted by this time. Food consumption in the exhausted groups was significantly lower than the C-S rats, indicating that appetite and/or taste preference had changed and that muscle glycogen repletion occurred at the expense of the liver. (Supported in part by Ia. Corn Prod. Assoc.)

135. CHLORIDE of the bullfrog gastric mucosa

Hogben CAM & Ingram MJ.

Physiology Research Laboratory, University of Iowa, Oakdale, Iowa 52319

By conventional wet chemistry analysis the chloride content of the bullfrog gastric mucosa is unusually high. Unless Cl is subject to substantial extracellular adsorption, its intracellular concentration would have to fall between 56 for oxyntic and surface epithelial cells and 141 mEq/l for the latter alone (Mineral Metabolism 2B:145, 1962).

The electron microprobe analyzer has been used to validate localization of gastric mucosal Cl. Bullfrog gastric mucosa was prepared by shock-freezing, freeze-drying, osmium tetroxide vapor fixation and embedding in Epon (Dev. Appl. Spect. 6:43, 1968). The block was faced with a microtome. As expected K was concentrated intracellularly in both cell populations (J. Gen. Physiol. 51:245s, 1968) and Na sporadically dispersed in the extracellular phase. Unexpectedly Cl was concentrated extracellularly in an irregular band 20-100μ thick overlying the surface epithelial cells and corresponding to the location of the mucous coat. The preparative technique for electron microprobe analysis does not dislocate the diffusible Cl ion. We are not aware of a precedent for selective adsorption of Cl by mucin.

Psychology

136. Sequential hypothesis testing

S. Kress and D. Arkkelin

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

Past studies have indicated the processes of problem-solving and hypothesis-testing involve both a "confirmation bias" in the types of information sought and an "inertia effect" in the utilization of evidence contradicting a current hypothesis. Platt suggested strong inference, a procedure in which two or more competing hypotheses are tested simultaneously, as a way to avoid these biases. This study compared the performance of four groups of subjects on a hypothesis-testing task. Subjects receiving early confirmation of an incorrect hypothesis were less likely to reject the hypothesis after later disconfirmation than were subjects receiving early disconfirmation of an incorrect hypothesis. Both groups were less likely to identify the correct hypothesis than were subjects testing either the correct hypothesis or multiple hypotheses. The results are discussed in terms of the value of strong inference, and the greater attention paid to early than to late disconfirmation of an incorrect hypothesis.

137. Preparation for parenthood and interest in childrearing information.

A. R. GILPIN

University of Northern Iowa, Cedar Falls, IA 50614.

Most programs designed to prepare young adults for parenthood implicitly assume that lack of adequate preparation reflects lack of opportunity to learn about childrearing techniques. This led to the prediction that measures of preparation should be negatively correlated with interest in learning more about childrearing. In the present study, 100 male and 100 female undergraduate college students completed two tests measuring preparation for parenthood--the Experience With Young Children Scale, and the Maternal and Child Health Test--and a version of the Childrearing Learning Interests Scale. Interest was positively correlated with experience, and uncorrelated with knowledge of health; females exceeded males in interest, and Protestant subjects had higher interest scores than Catholics. These results were interpreted as supporting the hypothesis that lack of preparation reflects lack of interest in childrearing, rather than lack of opportunity. They also imply that programs for prospective parents should be tailored to the specific interests of particular target populations.

138. Physician beliefs and practises regarding sudden patient death

J. C. Greenwood

St. Ambrose College, Davenport, Iowa 52803

A mail survey of 200 Quad City physicians brought 130 responses to questions concerning their training, attitudes, and practises in cases of sudden patient death. Consensus was found on numerous questions irrespective of specialty or frequency of contact with patient death. They reported an obligation to provide support to survivors but felt poorly prepared and somewhat uncomfortable. They disagreed on the need to counsel colleagues whose patients died and whether to express emotion to survivors. Other death-related medical and psychological practises were examined. There were few age or sex differences, but were differences by specialty. Surgeons were somewhat more controlled and distant from survivors and colleagues. This suggests a model of ego defense based on high personal responsibility (but low contact duration) for patient outcomes. Other interpretations are considered. The sample strongly endorsed the need for physician training in grief counseling and the data confirm this need to aid in survivor and physician recovery from this severe trauma.

139. Sex, handedness, and hemispheric specialization in a visual-spatial task

Hull, B.L., and Tatum, B.C.

Cornell College, Mt. Vernon Iowa 52314

The experiment was designed to test the relationship between sex, handedness, and hemispheric specialization. Forty subjects (20 men and 20 women, half of each right-handed and half left-handed), were tested for recognition of a series of visual-spatial dot patterns. It was hypothesized that the right hemisphere of females and left-handed subjects is not as specialized for visual tasks as the right hemisphere of males and right-handed subjects. It was expected that right-handed subjects and males would do best on a visual-spatial task presented to the right hemisphere, and that left-handed persons and females would perform best when the stimuli were presented to the left hemisphere. The critical findings of the experiment show a significant interaction between sex and hemispheres. In other words, as predicted, males were superior to the females when the stimuli were presented to the right hemisphere, whereas the females were superior when the stimuli were presented to the left hemisphere. However, contrary to expectation, no relationship was found between handedness and hemisphere.

140. Sex roles and career preference

J. Rollins and D. Arkkelin

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

This study was conducted to determine the effects of sex-role orientation on ratings of the desirability of stereotypically "masculine", "feminine" and "neutral" occupations. Subjects were 40 general psychology students at Wartburg College. The students were divided into 4 categories according to their scores on Bem's Sex Role Inventory. The categories were: 1) sex-typed males, 2) sex-typed females, 3) androgynous males, and 4) androgynous females. Each subject was asked to rate the desirability of 24 occupations on a 7 point scale, assuming that they had the necessary skills or abilities for any of the occupations. Results indicated that sex-typed individuals exhibited significant preferences for "sex-appropriate" over "cross sex" occupations, while androgynous individuals showed no preference. Ratings by sex-typed men and women differed significantly for both "masculine" and "feminine" occupations, but ratings by androgynous men and women did not differ for either "masculine" or "feminine" occupations.

141. Leadership and sex-roles

R. Simmons and D. Arkkelin

Wartburg College, Psychology Department, Wartburg College, Waverly, Ia. 50677

Recent studies have indicated that people describe a "good manager" as possessing a masculine, as opposed to a feminine or androgynous sex-role orientation. In the present investigation subjects rated combinations of "masculine" traits as more desirable in a leader than combinations of "feminine" traits, but not more desirable than "androgynous" combinations (i.e., masculine and feminine traits). Ratings of the relative desirability of masculine versus feminine traits were significantly influenced by subject's sex and sex-role orientation. That is, sex-typed men rated "competitive" as more desirable than did androgynous men, and sex-typed women rated "sympathetic" as more desirable than did androgynous women. Methodological differences between the present investigation and previous research are discussed in the context of sex-roles and requisite management characteristics.

142. Unconscious comprehension of unattended prose.

Marty Junkins and Jack Yates

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

Skin conductance (SC) was assessed during verbal shadowing to determine the effect of an interesting but unattended message. While subjects repeated verbatim a passage heard in one ear, the other ear received a message describing events in a bar. A control condition, which preceded or followed the

experimental passage, contained the same text but sentences were in scrambled order. SC increased markedly during the experimental but not during the control passage. SC responses did not increase in frequency or strength, nor did shadowing accuracy decrease. These are indications that the shadowing task successfully occupied attention, a conclusion supported by subjects' responses to questions about the unattended material at the end of the experiment. The results indicate that subjects can process continuous prose without attention or awareness.

143. Pharmacology of the Human Mind

S. W. Newell

Simpson College
Indianola, Iowa 50125

Pharmacology, the study of drugs and their effects upon the mind, is a very old and universal knowledge found in many cultures around the planet. But in the knowledge of chemistry and emotions, we do not know what is causal. Do drugs cause feelings? Although drugs alter one's state of perception, do they actually alter one's state of consciousness?

Both normal and abnormal behavior are studied in regards to the question of causality, chemical or cognitive. My argument is that although drugs can facilitate changes in attitude, no chemical means of happiness can be found. Drugs are not causal to any emotion, only facilitative.

144. Taste aversion conditioning and pharmacological aversion therapy of alcoholism.

R. W. Pohl, S.H. Revusky, & C.S. Mellor

Upper Iowa University, Fayette, Iowa 52142

Since the early 1950s, alcohol abusers have often been treated by pharmacological aversion therapies. Such therapies involve pairing the taste of alcohol with the effects of an illness-inducing drug; frequently used drugs include emetine, apomorphine and Antabuse. The relationship between alcohol and the second drug in aversion therapy parallels the situation which exists in experiments on taste aversion conditioning. Therefore, Revusky, Pohl and others have applied principles of taste aversion conditioning to aversion therapy of alcoholism. Experiments that I have conducted suggest: (1) taste aversions can be strongly conditioned to highly familiar flavors like the taste of alcohol, and (2) that highly unpleasant drugs (e.g., Antabuse) are not required to cause alcohol abusers to form flavor aversions to alcohol. These experiments, and additional studies by other investigators working in the field, will be discussed.

145. The Transcendental Meditation Technique, Field Independence, and Short-Term Memory

Timothy J. Szal, Michael Dillbeck PhD.

Maharishi International University
Box 372 - Fairfield, Iowa 52556

The effect of the Transcendental Meditation (TM) technique on field independence and short-term memory were investigated in a twelve-week longitudinal time-series study in which the Rod and Frame Test and "Match Me" computerized memory game were administered daily to a pair of 11-year-old boys and a pair of 14-year-old girls. One of the boys and one of the girls began the TM technique after six weeks. The data were analyzed by factorial ANOVAs which were appropriate because of absence of autocorrelations or correlations between factors. Predicted increases in short-term memory were found among experimental subjects in contrast to controls; a significant increase in field independence was found not only in the experimental male in contrast to his control, but among both female subjects.

- A. A cultural historiography of science.

Robert E. Schofield

Department of History, Iowa State University
Ames, Iowa 50011

When one applies to the history of science some of the concepts of the cultural historian, Ernst Cassirer, in a manner suggested by Gerald Holton and Thomas S. Kuhn, it appears possible to designate style periods for science as one does for the plastic arts, music and literature. It is, indeed, appropriate to use the same style terms: Gothic, Renaissance, Baroque, Rococo, Romantic, or Esistential; that one uses for the arts, for many of the designating characteristics for scientific styles are the same as for those of the arts. When this is done, it becomes clear that science is one of the most imaginative of mankind's creative activities and that positivism in science is the revenge of philosophers for nineteenth-century scientism.

- B. Michael Faraday: A case study in the cognitive psychology of science.

Ryan D. Tweney

Department of Psychology, Bowling Green State University, Bowling Green, Ohio 43403

The English physicist Michael Faraday (1791-1867) kept extensive laboratory notebooks; a source of data which can be used to test hypotheses derived from cognitive psychology. One such test concerns the question of whether disconfirmatory evidence is used in a logically normative fashion by

experimental scientists. Quantitative data derived from Faraday's notebooks will be presented which show that, in most circumstances, Faraday did not use disconfirmatory evidence to reject or to modify hypotheses. However, important exceptions were found, in which a single disconfirmatory result overthrew important substantive hypotheses. What conditions account for the difference? Several possible explanations will be considered.

- C. A philosophical analysis of the psychology of science.

David Kline

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

Philosophers have often questioned whether or not a psychological study of science is possible. Writers dealing with the logic of discovery and the logic of justification have suggested that such an endeavor is not possible. However, current research on the psychology of science suggests that this line of inquiry is feasible. This research is discussed in the context of the logic of discovery and justification.

Science Teaching

146. A manual concerning science safety in the elementary classroom (K-6)

G. E. Downs
J. A. Gerlovich

Iowa State University, Quadrangle, Ames, IA 50011
Department of Public Instruction, Grimes Building,
Des Moines, IA 50319

Presentation of the development and substance of a new Iowa safety manual for elementary school settings. Components of the manual include: accident statistics; legal liabilities; eye protection and eye care; life sciences; physical sciences; chemicals and handling; fire hazards; equipment; physical plant facilities; science safety for handicapped students; outdoor activities and first aid.

Pending National Science Foundation funding, inservice programs will be offered throughout Iowa during the 1981-82 academic year. The inservice will occur in 3 phases: phase 1, classroom teachers; phase 2, Area Education Agencies, city science supervisors, and elementary principals; phase 3, college/university elementary science methods instructors.

147. Science teachers' values and teaching of values

PAUL A. SMITH

Physics Department, Coe College, Cedar Rapids, Iowa 52402

Discussions of the social responsibilities of scientists tend to focus upon the uses which are made of the discoveries of research scientists and of the technological developments which flow from scientists' work. Questions tend to be formulated in terms which are congruent with the technical ways of scientists; i.e., legalistically, moralistically, ethically, formally, systematically. We need to identify the values which dominate science teaching and the ways in which those values are transmitted from generation to generation. We need to focus upon the values which are notably absent from graduate school training in the sciences, and formulate more balanced programs of preparation of college and university science teachers. Some of the basic issues pertaining to the social responsibilities of scientists have to do with the professional values which dominate the lives of science teachers and the content and style of their teaching.

148. Communication By Writing: A Basic Part Of Science Education

D. J. Schmidt and R.S. Tapply

Fitchburg State College, Fitchburg, MA 01420

One hundred eighty five students were involved in a study utilizing an Introductory Life Science Course as the vehicle for improving writing skills. Two laboratory groups were used as the experimental population, the others were used as controls. The experimental groups were given carefully designed writing problems related to the various laboratory activities they were experiencing. A member of the English Department teamed with a member of the Biology Department to assist the students with the writing activities.

Significant improvement in attitude and ability to face writing tasks were observed. The experimental groups scored above the national norm on a standard writing apprehension scale after participating in this study. Conclusion: Students can and will learn to write if they have "real-world" experience to write about and if they are given considerable constructive criticism during the process. Useful writing experience does not need to be reserved for English class!

149. PROJECT PARISH

J. E. SCHILDROTH

RURAL ROUTE #1, REINBECK, IA 50669

MY PROJECT IS DESIGNED TO BE ADAPTABLE TO A VARIETY OF LEARNING EXPERIENCES AND INSTRUCTION WHICH DEAL WITH CONSERVATION PRACTICES AND OUTDOOR EDUCATION AT THE IOWA ACADEMY

OF SCIENCE FARM NORTH OF REINBECK. MY OBJECTIVES ARE AS FOLLOWS: TO DEVELOP AN AWARENESS THAT THE CHILD'S LIFE STYLE IS VERY DEPENDENT ON THE SOIL; TO DEVELOP AN UNDERSTANDING OF HOW IMPORTANT IT IS TO "SAVE OUR SOIL"; TO EXCITE THE CHILD TO WANT TO TEACH OTHERS AND INFORM THEM ABOUT CONSERVATION PRACTICES; TO TEACH HOW TO USE A KEY--WHETHER IT BE TREE, FLOWER, BIRD, PRAIRIE GRASS OR WHATEVER; AND, TO LEARN TO STOP, LOOK, AND LISTEN TO NATURE--TO BECOME AWARE! BECAUSE I NEVER KNOW WHICH CLASSROOM I'LL BE IN OR FOR HOW LONG, THIS PROJECT NEEDS TO BE VERY FLEXIBLE AND ADAPTABLE FOR VARIOUS GRADE LEVELS. I USE WHAT WILL APPLY FOR A GIVEN SITUATION.

150. Confronting "scientific creationism" in the public school science classroom

L. D. Salyer

Holmes Jr. High School
Cedar Falls, IA 50613

Science educators challenged to include "creationism" in the curriculum may decide to deal with it in an unemotional, straight-forward manner, but, at the same time, feel inadequately prepared to do so. This paper discusses how "creationism" can be handled during a unit on origins in a biology or earth science class. The results of opinion surveys from 612 students, who completed the unit, are reported. The topics covered in the paper are:

- I. Rationale for a unit on origins
- II. Background information needed for the unit
- III. Handling students' religious questions
- IV. Content of the unit
- V. Results and conclusions
- VI. Bibliography of suggested materials

151. Confronting science-related issues in science classes

G. Magrane
J. A. Gerlovich

Southern Prairie Area Education Agency, Rt. 5,
Box 55, Ottumwa, Iowa 52501
Department of Public Instruction, Grimes Building,
Des Moines, Iowa 50319

A state project is being designed to assist secondary science teachers in addressing a diversity of science-related controversies.

The purpose of this project is to develop new materials and strategies for dealing with science-related issues in school science classrooms. The areas of concern include biosocial, bio-ethical,

and the pseudosciences issues; such as eugenics, euthanasia, and special creation. This project will bring together knowledgeable science personnel to clarify, design and provide assistance with issues that are creating problems for science teachers. All levels of educational institutions will be involved in the development and use of curriculum materials and guidelines. A 5 state pilot program and project evaluation will lead to a publication which should have significance in science classrooms across the nation.

152. Laboratory teaching competencies for science teachers

Rita K. Voltmer

Malcolm Price Laboratory School
University of Northern Iowa
Cedar Falls, Iowa 50613

Many people would agree that direct laboratory experiences are important if the learning of science is to be effective for the secondary science student. An important point to consider, however, is that many teachers probably do not possess the laboratory teaching competencies necessary to successfully operate laboratory-based instruction. One purpose of this study was the identification of specific laboratory teaching competencies which science educators viewed as necessary for a secondary science teacher (grade 7-12) to possess.

A survey instrument developed by the researcher and composed of a demographic section and a list of 70 laboratory teaching competency items was utilized. Likert-type scales were used to assess the subjects' perceptions of the appropriateness of each item presented and also the extent to which each competency had been developed by the students.

153. Authoring considerations in writing computer programs for instruction.

Hartman, K. A.

Ames Senior High School, 20th and Ridgewood,
Ames, Iowa, 50010

The development of effective computer programs for use in an instructional setting requires a knowledge of the programming language and authoring techniques. The authoring process described is divided into five parts: problem definition, problem analysis, procedure, programming, and computer solution. Emphasis is placed on program design involving the layout of the display, use of instructions, use of special effects, proper input procedures, answer checking, and the use of reinforcers in CAI programs.

154. Non technical ninth grade General Science

R. L. Iverson and G. A. Cunningham

Miller Junior High School S. 11th St. Marshalltown,
Iowa 50158

After nearly 2 years there are some observations to be made. They deal with the levels of supervisory, structure of lessons, & subject matter. The intent of this effort was to outline a course in General Science for 9th grade student who is not likely to elect Science at the high school &, or would have small chance of success in the regular Physical Science program. The course needed to be: A. of high interest, B. geared to the ability of the student in terms of the materials designed & selected, C. student centered, D. highly structured, E. content oriented for a terminal student. The course deals with all three aspects of Science. That is to say it deals with process, product and social impact. The social impact will be dealt with heavily because of the nature of the student. All major content of Science will be included in a basically nonsegregated manner and when possible will be integrated into a larger concept area. The skills of reading, writing computation and notation will be attended to on a day by day basis. Each day they will do some reading. Some things will be read aloud by the students. Each day there will be a specific assignment that will require some writing.

155. The chemistry program at Ames Senior High School

F.F. Sturtevant and M.E. Buck

Ames Senior High School, 20th and Ridgewood, Ames
Iowa 50010

Chemistry at Ames Senior High School is taught at three levels of difficulty as a senior elective. Students may choose the level that meets their needs and abilities. Chemistry A assumes no physics background. In Chemistry B and Honors Chemistry, the student must have one year of PSSC physics. One factor of our successful chemistry program at AHS is the physics background required for Chemistry B and Honors Chemistry. This presentation will illustrate some of the methods that we use to maintain a high level of interest and thus have an excellent enrollment in our chemistry program.

156. Inhibition of phosphorylase by caffeine-containing beverages.

C. J. Briggs, D. J. Graves and B. J. White

Iowa State University, Ames, Iowa 50011.

A laboratory experiment has been developed which correlates the amount of caffeine in beverages such

as coffee, tea, cocoa, and soda with the inhibition of phosphorylase, an enzyme of carbohydrate metabolism. Pure caffeine has been shown to inhibit phosphorylase in vitro. This experiment uses a novel assay, an iodine-glycogen color complex, to measure enzyme activity. A broad range of caffeine-containing beverages was tested for inhibitory effects using this assay. The amount of inhibition correlates well with the caffeine content of the beverages, as determined by thin-layer chromatography and ultraviolet spectroscopy. Possible interference of tannins in the activity assay was investigated. Tannic acid did not inhibit the enzyme. Physiological implications of the caffeine inhibition will be discussed.

157. Hawaii and Jamaica - teacher workshops

E.L. Pizzini, J.E. Penick

The University of Iowa
Science Education Center
455 Physics Building
Iowa City, Iowa 52242

The presentation will focus on two new workshops for teachers which have been designed to enhance their understanding of science and field techniques through "on-site" investigation and study. The workshops utilize the unique settings of Hawaii and Jamaica as "living laboratories" to observe and complete field studies in marine biology, geology, botany and the social sciences. The programs are flexible allowing for independent study in special areas of interest. Pre-sessions are held to teach techniques, such as snorkeling, that will be utilized during the workshop. The workshops can be taken for credit, if desired. Slides will be shown depicting the "natural" classroom on-site study areas. The workshops are designed to encourage teachers to take students on field excursions and maximize the use of natural laboratories.

158. Solar Energy Experiments: Solar Thermal Demonstration Package; An introductory set of activities.

Arthur C. Meyers III and Carolyn Sumners

Energy Division, Institute of Basic & Applied Research, inc., P.O. Box 1671, Ames, IA 50010

Experiments and activities have been developed to illustrate, demonstrate, or teach the principles of solar energy utilization. The first group of these are for the purpose of introducing solar thermal concepts to the beginner. Using simple materials and concepts, both flat plate and concentrating systems are studied by the use of self built collection devices. These troughs, dishes, heat boxes, and ovens are built by the student using simple and inexpensive items and tools any teacher or home will have. The systems built will produce predictable

and reproducible results, on which assignments and activities designed to enhance the learning experience can be based. This presentation will show both how to design and build the apparatus and how to use it with various student interest groups. The results presented are based on extensive testing in both the field and the classroom. Student interest and response has been tested and the results will be presented. Information on the rest of the activities will be available to interested parties, with the emphasis on direct use in the present classroom

Zoology

159. Avian blood parasites from two species of birds of the Lake Okoboji Region, Iowa

Farmer, J.N.

Dept. of Zoology, University of Oklahoma,
Norman, OK 73019

Hematozoa from 41 grackles (Quiscalus quiscula) and 17 bluejays (Cyanocitta cristata) trapped at Iowa Lakeside Laboratory, Spring 1980 are reported; the prevalence of Haemoproteus sp in grackles and bluejays was 36%(15/41) and 23%(4/17); of Leucocytozoon sp was 73%(30/41) and 82%(14/17); of Trypanosoma sp was 17%(7/41) and 29%(5/17) and of Plasmodium sp was 5%(2/41) and 12%(2/17) respectively.

Data are presented concerning host specificity of the species of Plasmodium, the periodicity of trypanosomes and the taxonomic position of Haemoproteus sp in bluejays. Transfer of Plasmodium sp within a population was successful; cross infections were not. Periodicity of Trypanosoma sp in bluejays was nocturnal while in grackles a strict periodicity was absent. Histological and exflagellation rate studies of Haemoproteus sp in bluejays are described. It is suggested that these haemoproteids are not members of the genus Haemoproteus but rather Parahaemoproteus.

160. Experimental infection in mice with Caryospora sp. (Coccidia)

R. S. Wacha and J. L. Christiansen

Biology Dept., Drake University, Des Moines, IA 50311

Oocysts of a Caryospora sp., isolated from a Timber Rattlesnake (Crotalus horridus), were inoculated per os into laboratory white mice. One of the inoculated mice was fed to a Massasauga (Sistrurus catenatus), which subsequently produced a patent infection of Caryospora. Endogenous stages were demonstrated both in the inoculated mice and in the Massasauga, but not in control animals. This finding suggests a heteroxenous life cycle pattern for parasites of the genus Caryospora.

161. Infections of the myxozoan, Myxobolus osburni in pumpkinseed sunfish from West Lake Okoboji

Karla M. Ingram and Lawrence G. Mitchell

Department of Zoology
Iowa State University
Ames, Iowa 50011

Myxobolus osburni infections were found in endocrine and exocrine pancreas in 119 (79.3%) of 150 pumpkinseeds examined from West Lake Okoboji, northwest Iowa, from June through September, 1980. None of 341 bluegills were infected. Large lobate cysts located posteromedial the gallbladder contained sporulating plasmodia and mature spore masses. Inflammatory responses were observed in endocrine and exocrine tissue and were characterized by engorged blood vessels, pyknosis of endocrine cell nuclei, dark pigment deposition, leukocytic infiltration, proliferation of fibroblasts, and fibrosis. Most severe reaction occurred in tissue containing unencapsulated spore masses.

162. Seasonal distribution and ecology of three helminth species infecting carp in NW Iowa

D. R. Sutherland

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

Between June 1978 and November 1980, 495 Cyprinus carpio from the Little Sioux River and Lower Gar Lake, Dickinson Co., were examined for intestinal helminths. Length, weight and age were determined for each fish. The intestinal tract of each carp was divided into eight sections of equal length. Numbers of each parasite species from every section were recorded. Data were statistically analyzed to ascertain correlations between parasite mix and host parameters. Site selection and intra- and inter-specific interactions of the three predominant helminths (Khawia iowensis, Pomphorhynchus bulbocollis and Capillaria sp.) were demonstrated. Between April 1979 and November 1980, carp of the Little Sioux River were examined monthly to determine if a seasonal periodicity was exhibited by any of the three helminths. The maturity and length of all Khawia and the sex of each P. bulbocollis were determined. A pronounced seasonal periodicity exists for Khawia. Recruitment of young worms occurs throughout spring, summer and fall. Egg production occurs primarily during summer and fall. Khawia are absent from fish during the winter.

163. Zooplankton vertical migration in two New Zealand lakes.

Marianne Moore

Iowa State University
Animal Ecology Department
Ames, IA 50011

Zooplankton were sampled during 5 different 24 hour periods in two monomictic New Zealand lakes

during 1978. In Lake Grasmere, a glacial mesotrophic lake, the zooplankton fauna was dominated by a small cladoceran only found in New Zealand and Australia, Bosmina longirostris. The larger cosmopolitan cladoceran, Ceriodaphnia dubia, was the dominant zooplankton in Lake Matheson, a dystrophic glacial lake. Weak zooplankton vertical migration patterns were observed in Lake Grasmere while no migration was seen in Lake Matheson. These results may be related to low fish predation intensity and a lack of invertebrate predators in both lakes. Other unusual aspects of the New Zealand zooplankton, the lack of cyclomorphosis, low species diversity, and a lack of invertebrate predators, will be discussed and compared to zooplankton communities in North America.

164. Countering lethality of UV-radiation to Blepharisma americanum with vitamin-E.

D. C. Lennartz and E. C. Bovee.

University of Kansas, Lawrence, Kansas, 66045.

Blepharisma americanum is a large, pink ciliate of sphagnum bogs. Its pigment is light-sensitive and is changed to a toxin by ultra-violet light. When treated with α -tocopheryl-succinate (vitamin-E) at 1×10^{-7} M to 1×10^{-4} M, the ciliates convert to the giant form in 8 to 12 hrs. However, when exposed to a pulse of UV-radiation ("black-light", 2537 nm) that kills controls, the conversion to giantism is suppressed and the vitamin-E promotes repair and survival, probably by acting as an antioxidant. The numbers of survivors is related to the amount of vit-min-E available, 1×10^{-4} M promoting almost 100% survival. (Supported by the Biomedical Research Fund of the Graduate School, University of Kansas).

165. Genetic variation in social mammals: the marmot model

O. A. Schwartz and K. B. Armitage

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

Yellow-bellied marmots located in the East River Valley of Gunnison County, Colorado, were the subject of population and behavioral studies for the last 17 years. The detailed knowledge of population processes and colonial substructure provided the background for the study of the dynamics of electrophoretic variation in this species. Blood samples were taken from 112 marmots in 1976 and 1977, and 8 of 20 allozyme systems were found to be variable. There was significant genetic heterogeneity among the colonies. The analysis of population substructure with Wright's F statistics showed that this population system is one that acts to retard the fixation of genetic variation, hence it does not suitably model the conditions leading to rapid mammalian evolution as envisioned by Wilson, Bush, Case, and King (PNAS, USA 70:5061-5065).

Author	Abstract	Page	Author	Abstract	Page
Ingram, K. M.	161	38	Salyer, L. D.	150	35
Intemann, G. W.	Inv.	29	Savage, W. R.	128, Inv.	29,30
Iverson, R. L.	81,154	19,36	Schildroth, J. E.	149	35
Jensen, J. M.	111	26	Schmidt, D. J.	118, 148	27,35
Johanns, P. J.	63	15	Schofield, R. E.	A	34
Johnson, S. K.	3	1	Schwartz, O. A.	165	38
Jordan, J. L.	14,15,16,22-25	3,4,5	Semken, H. A.	D	8
Junkins, M.	142	33	Seyedin, N.	17, 18	4
Kaufmann, G. W.	52	12	Shekar, A. N.	98	22
Kausch, A. P.	42	10	Simmons, R. E.	141	33
Kennedy, J. O.	117	27	Smith, P. A.	130, 147	30,35
Kershner, P. L.	134	31	Soballe, D. M.	91	21
Kline, D.	C	34	Staniforth, D. W.	19	4
Klingshirm, J. A.	115	27	Sturek, M. D.	133	31
Konzen, K. M.	92	21	Sturtevant, F. F.	155	36
Kress, S. E.	136	32	Sutherland, D. R.	162	38
Lannoo, M. J.	86	20	Sweets, L. E.	6	2
Lembke, L. L.	96	22	Szal, T. J.	145	34
Leonard, K. E.	73	17	Tachibana, H.	7	2
Lind, M. C.	59	14	Tiffany, L. H.	45	11
Little, T. W.	88	20	Tomuta, L.	123	28
Lones, M.76		18	Tourenne, C.	122	28
Lutenegger, A. J.	112	26	Trumpy F. D.	126	29
Magrane, G.	151	35	Turner, G. W.	38	9
Martinson, C. A.	8	2	Tweney, R. D.	B	34
Mathisen, M. E.	106, 108	24,25	Vaughan, H. C.	21	5
McBratney, B. C.	2	1	Verkade, M. E.	129	30
McGee, D. C.	20	4	Volker, P. B.	77	18
McNabb, H. S., Jr.	50	2	Voltmer, R. K.	152	36
Meyers, A. C.	124, 158	28,37	Wacha, R. S.	160	37
Moore, M. V.	163	38	Wanna, J. T.	69,70	17
Murtha, M. J.	103	23	Warren, D. M.	32	7
Nester, . E.	48	11	Wawzonek, S.	72	17
Newell, S. W.	143	33	Wee, J. L.	46	11
Oard, M.	55	13	Weilgart, L. S.	84	20
Odom, D. G.26		6	West, J. R.	57	13
Olson, D. W.	125	29	White, B. J.	156	36
Owen, M. D.	132	31	White, J. A.	54	12
Patterson, J. W.	35, 101	7,23	Whiteford, M. B.	30	7
Peck, J. H.	49	49	Whitson, P. A.	94	22
Pizzini, E. L.	157	37	Wiechert, R. J.	78	18
Pohl, R. W.	144	33	Wilson, D. B.	34	7
Poulton, J. E.	41	10	Young, C.	1	1
Prill, S. D.	93	21			
Rajagopal, R.	97	22			
Ridnour, L.	62	14			
Rodenhouse, N.L.	87	20			
Rodgers, D. M.	4	1			
Rollins, J.	140	33			
Ross, C. M.	107	25			
Rugenstein, S. R.	37,39	9			
Runde, J. M.	95	22			