

ABSTRACTS OF PAPERS PRESENTED AT THE SPRING COLLEGIATE MEETINGS

EASTERN REGION  
BRYAN COLLEGE

*A Study of the Effect of Concentration on the Reaction of Copper and Trichloroacetic Acid in Dimethylsulfoxide*, Terry Lee Puckett, Bryan College. Rate studies of the reaction of trichloroacetic acid and elemental copper in a Dimethylsulfoxide medium have produced data that indicates the initial rate order is modified during this reaction. The reaction appears to follow precisely none of the conventional rate laws. It is indicated that the overall reaction is composed of several complex reactions occurring simultaneously perhaps in the fashion of  $A \xrightarrow{k_{12}} B \xrightarrow{k_{23}} \dots C \rightleftharpoons D$  with the heat of reaction of one reaction possibly providing the energy of activation for another.

A unique characteristic of the reaction is that different concentration ratios of the reactants yield products unique to that particular ratio. It is suspected that the pH of the solution provided by the trichloroacetic acid is an important factor in the reaction. One of the systems studied yielded a product with the empirical formula  $Cu_2Cl_2 \cdot 1.5 DMSO$ . This is an indication that DMSO serves as both solvent and reactant just as water forms a hydrate in an aqueous solution.

*A Study of the Kinetics of the Reaction of Copper and Trichloroacetic Acid in DMSO*, Linda Benson, Bryan College. A kinetic study was made of the reaction between trichloroacetic acid and copper in dimethylsulfoxide (DMSO) at room temperature. This was done by following the rate of carbon dioxide evolution in various concentrations of the reactants. It appeared that with increases in concentration above 0.01M of either of the reactants the rate changed. In addition, an alteration of the rate, the mechanism, and the energy of activation could have taken place. In any event, the products of the reaction involving excess copper are significantly different from those obtained from the reaction involving excess acid. From the data obtained in these studies it was impossible to formulate the rate law for this reaction.

*A Study of the Kinetics of the Reaction of Copper and Trichloroacetic Acid in Water*, Carol Crisler, Bryan College. A kinetic study was made of the reaction of copper and trichloroacetic acid in water by following the rate of carbon dioxide evolution. The reaction was carried out at the reflux temperature of water and, at first, appeared to be first order with respect to trichloroacetic acid and zero order with respect to copper when comparing only the volumes of gas evolved. Upon calculating and comparing the reaction rates however, the reaction appears to be much more complex than at first thought to be. The rate remains relatively the same with a change in the acid concentration or a change in the copper concentration, but the graphs of concentration versus time do not indicate a clearly defined order for the reaction. Different mechanisms must be involved in the overall reaction because different products are obtained by varying the copper and acid concentrations. Since this is a heterogeneous reaction, the rate also seems to be dependent on the surface area of copper in contact with the trichloroacetic acid and water solution. Further studies will be necessary to establish the rate law for this reaction.

*Synthesis of N-Substituted Aspartic Acids*, Irving T. Glover and Dennis Handy, Roane State Community College. Primary and secondary amines add to the carbon-carbon double bond of diethyl maleate and diethyl fumarate in polar solvents to give N-substituted diethyl aspartate esters. Hydrolysis of the esters with aqueous KOH yields the corresponding N-substituted aspartic acid derivatives. The reaction proceeds smoothly with n-butylamine, but is incomplete when cyclohexylamine or piperidine is used. No addition to the carbon-carbon double bond was detected when dimethyl maleate was used in place of diethyl maleate. With dimethyl maleate, the only product isolated was dimethyl fumarate.

*Arrhenius Energy of Activation for Isomerization of Diethyl Maleate to Diethyl Fumarate Catalyzed by Diethylamine*, Irving T. Glover and Melissa Edwards, Roane State Community College. Cis-Trans isomerization of diethyl maleate to diethyl fumarate is catalyzed by primary, secondary, and very slightly by tertiary amines. The kinetics of the reaction may be conveniently followed by gas-liquid chromatography or nuclear magnetic resonance techniques. Specific reaction rate constants for the isomerization catalyzed by diethylamine were determined at 0.8°C, 19.2°C, 30.0°C, 35.6°C, and 42.0°C, by gas-liquid chromatography. The Arrhenius activation energy was calculated to be 7.7 kcal mol<sup>-1</sup>.

*Investigation of Yellow Creek*, Charles R. Geyer, Lincoln Memorial University. During the summer of 1981, an investigation of the pollution of Yellow Creek in Bell County, Kentucky was undertaken. Emphasis was directed toward the presence of heavy metals in this aquatic system and

documenting the life forms in the creek. While water analysis of 16.5 ppm for Zn, 13.5 ppm for Pb, 6.34 ppm for Cr and 0.23 ppm for Cd. The mean level of dissolved oxygen is 8.42 mg/l; the mean level for carbon dioxide, 19.45 mg/l; the mean for alkalinity, 72 mg/l CaCO<sub>3</sub>; the mean pH, 7.7 and the mean volume of flow 45.5 cfs. Twenty-one species of fish were found. Creek Chub, *Semotilus atromaculatus* was the most abundant fish, followed by Golden Redhorse, *Moxostoma erythrurum* and Carp, *Cyprinus carpio*. Interestingly, only a single darter, *Etheostoma* sp. was collected. While shell fragments were present, no living gastropods or mollusks were found. Several aquatic macrophytes were found. Three species, *Potamogeton foliosus*, *Potamogeton* sp. and *Alisma subcordatum* did not occur below the point of pollution entry. Investigations are continuing and analysis of plant and animal tissues will be conducted for the presence of heavy metals.

MIDDLE REGION  
TENNESSEE TECHNOLOGICAL UNIVERSITY

*Synthesis of Diarylmethane Derivatives*, Tennessee Technological University. Dana Alred and Eugene A. Kline. The use of model compounds in the study of coal liquefaction is well established. The complexity of the structure of coal necessitates studying only parts of the process at a given time. One accepted mechanism for coal liquefaction is a thermal cleavage of weaker benzyl-benzyl carbon bonds followed by abstraction of hydrogen from an H-donor solvent to give lower molecular weight compounds. One-carbon bridges, however, are much more resistant to thermal cleavage and have the potential of being a donor solvents. Model compounds include various diarylmethanes which needed synthesized. Procedures for the syntheses of 9-phenanthryl-9'-phenanthrylmethane, 9-phenanthryl-9'-anthrylmethane, and 9-phenanthryl-1'-pyrenyl-methane are described. The general method for all three included the reaction of the phenanthryl grignard reagent with the corresponding aldehyde, followed by reaction with HBr/HOAc and then reduced with lithium aluminum hydride. Analysis was made with high pressure liquid chromatography, melting points, and nuclear magnetic resonance.

*Aromatic Substitution Using Hydrotrimethylsilyl ethers*, Lowry B. Powers and Eugene A. Kline, Tennessee Technological University. Electrophilic substitution of polynuclear aromatics occurs only at positions with high electron densities. Substitution at the other positions have been accomplished in very poor yields with many reactions. The generalization of substituting trimethylsilyl groups with typical Friedel-Crafts reagents was found to have some merit. Synthesis of a single isomer, 9,10-bis(trimethylsilyl)-9,10-dihydroanthracene was accomplished with lithium metal in dry THF with anthracene followed by reaction with trimethylsilyl chloride. Reactions with this material were carried with acetylchloride/CS<sub>2</sub>/AlCl<sub>3</sub>, benzoylchloride/CS<sub>2</sub>/AlCl<sub>3</sub>, benzylchloride/CS<sub>2</sub>/AlCl<sub>3</sub> and tertiary butylchloride/CS<sub>2</sub>/AlCl<sub>3</sub>. The best yields obtained were with the t-butylchloride and benzoylchloride while the worst was with benzylchloride. Analyses were carried out with vapor phase chromatography and nuclear magnetic resonance and the results indicate some usefulness for this reaction.

*A Preliminary Report of a Baseline Water Quality Study on the Big Creek Watershed*, U of Tenn, Chatt. Alan Ball, Kevin Davis, Mary Beth Hibbs, Ann Johnson, Tom Landis, Steve Meyers, Holly Mills, Dave Pasko, Trish Phelan, Dwane Spires, Dennis Upton, Marc Williams. To determine the water quality of the Big Creek watershed system in the southern portion of the Cherokee National Forest, we have been monitoring physical, chemical, and biological parameters at six sites within the stream network. Many standard tests, as well as specific biological sampling for periphyton and chironomids, are being executed. Our major concerns are the effects of acid rain and logging activity on this previously undisturbed stream system.

This project was begun as a class research project in January 1982, but will be continued throughout the coming year by a trio from the original class.

WESTERN REGION  
CHRISTIAN BROTHERS COLLEGE

*Generation and Isolation of Queuine Auxotrophs of Chlorella Pyrenoidosa*, Sherry L. Neyman, Christian Brothers College. The use of a queuine auxotroph in a bioassay for queuine, a modified base incorporated

posttranscriptionally into t-RNA, is proposed as a simpler alternative to assays presently used. Colonies of *Chlorella pyrenoidosa* (1230 Chick) resulting from mutagenesis with ultraviolet light at  $1.0 \times 10^{-3}$  W-cm<sup>2</sup> for 30 sec. were tested by sampling and replica plating with sterile toothpicks onto-enriched medium plates which had (Q+) or had not (Q-) been spread with 0.05 A<sub>260</sub> units queuine. Colonies which grew on Q+ but not on Q- plates were studied further. One mutant (SN-2A) requiring queuine for growth in darkness at 37° C has been isolated. Several other mutant phenotypes have been noted but not yet purified, including one (SN-4B) whose growth in light at 39° C appears to be inhibited by the presence of queuine.

*An Investigation of Procedures for Purification of Bacteriophage OX174*  
Blake D. Barton, Christian Brothers College. The purpose of this study was to determine the best method of purifying bacteriophage X174. Virus particles were allowed to infect *Escherichia coli* C at high and low cell densities, and incubated for various times. Progeny viruses were harvested by high or low salt lysis and purified by centrifugation on a 5-25% linear sucrose gradient. The amount of virus isolated increased with increasing time of incubation up to 3½ hours for both lysis conditions and both cell densities. Lysis in high (0.75M) salt gave less virus, but higher purity at all times after infection and both initial cell densities. Infection of *Escherichia coli* C at a high cell density gave a higher (but not proportionally higher) yield of virus particles, indicating a lower per cell yield at the higher density.

*Antibiotic Sensitivity of Staphylococcus Aureus Isolated from Throat Cultures*, Grace Jeu, Christian Brothers College. Cultures of *Staphylococcus aureus* isolated from twenty-seven individuals were tested for sensitivity to five antibiotics by the Kirby-Bauer Method. Of the cultures isolated, sensitivities outside the Food and Drug Administration normal range were found in 11% when tested with ampicillin and in 30% when tested with chloroamphenicol and penicillin G. All isolates showed sensitivities to erythromycin and tetracycline which were within the normal range.

*Synthesis, Characterization and Structure of Vinyl Trimethylenedioxyboronate*, David M. Kranc, Memphis State University. Boron containing amino acids are potentially useful for preparation of labeling agents for proteins, such as immunoglobulins, which in turn, are the basis for slow neutron capture therapy of neoplasia. This work reports the synthesis of a new boronic ester, vinyl trimethylenedioxyboronate, a precursor of a valuable cysteine analog. Reaction of boron trichloride with tetravinyltin *in vacuo* yields vinylchloroborane which, when allowed to react with excess 1,3-propanediol, forms the desired boronate. Structural conformation was obtained from infrared and proton and carbon-13 nmr spectra. The signal corresponding to the carbon attached to boron is not observed in the ambient temperature C-13 nmr spectrum but is clearly present at low temperatures; this results from the quadrupolar relaxation by the I=3/2 spin of boron-11. The cyclic ester is stable to hydrolysis and ammonolysis, possibly because of mesomeric B-C  $\pi$ -bonding and/or inductive effects from the ring oxygens and from the ring itself.

*Versatility of Erythrocyte Carbonic Anhydrase in Terms of Both Hydrase and Esterase Functions*, David Goodman, Christian Brothers College. The versatility of erythrocyte carbonic anhydrase, in terms of both hydrase and esterase functions, has been investigated in the past. Using carbon dioxide as a substrate, carbonic anhydrase was shown to act in a hydrating manner. When methyl or ethyl pyruvate were assayed, carbonic anhydrase served as an esterase. Methyl and ethyl pyruvate had K<sub>m</sub> values of  $2.44 \times 10^{-2}$  M and  $3.07 \times 10^{-2}$  M, respectively. Methyl and ethyl pyruvate had V<sub>max</sub> values of  $3.70 \times 10^{-2}$  M and  $2.97 \times 10^{-2}$  M, respectively. From this, and other evidence (i.e., stereospecific), carbonic anhydrase showed higher affinity for methyl pyruvate.

*Bacterial Growth in Pasteurized Milk Stored at 21° C or 4° C*, Brenda Belman, Christian Brothers College. A comparison was made between the rates of bacterial growth in sweet and skimmed pasteurized milk stored at 4° C or 21° C using the standard plate count method. Samples were analyzed on the day of purchase and at 24 hour intervals thereafter for 72 hours. Bacterial content increased more rapidly at the higher storage temperature. Samples stored at 21° C showed chemical changes detected by odor and appearance within 48 hours. The doubling time of bacteria in milk stored at 4° C was more than four times that of bacteria in milk stored at 21° C. No difference in rate of growth at either temperature was seen for the types of milk used. The need for low temperature storage of pasteurized milk was clearly shown.

*Metal Carboranes*, Blake D. Barton, Christian Brothers College. and (PPh<sub>3</sub>)<sub>2</sub>HRhCPB<sub>2</sub>H<sub>11</sub> can be synthesized by reacting tris(Triphenylphosphine) chlororhodium (I) with the appropriate potassium salt in tetrahydrofuran. ((PPh<sub>3</sub>)RhC<sub>2</sub>B<sub>9</sub>H<sub>11</sub>)<sub>2</sub> is produced by the oxidation of I seems to have no catalytic effect on the hydrogenation of 1-hexene or cyclohexene nor does it catalyze the dimerization of phenylacetylene.

*The Effect of Oral Contraceptives on Soy Bean Root Shoots and Intact Plant Growth*, Linda Harty, Christian Brothers College. The effectiveness of the increasingly common practice of introducing outdated oral con-

traceptives to the soil of house plants to promote plant growth was investigated. Auxins and gibberellins are known growth stimulators and have some of the same properties as the synthetic hormones in oral contraceptives. Three phases of experimentation explored the effect of different oral contraceptive solutions on root shoots and intact plant growth. Auxin solutions were used as a control. The results did not allow for a strong conclusion to be drawn, however, it appeared as though the oral contraceptive may have had a small stimulatory effect and a strong maintenance of growth effect.

*Studies of Excited Oxygen Molecules Produced by Atom-Recombination on the NASA Space Shuttle Orbiter Tiles*, Alan D. Bradbury, Murray State University. A visible emission spectroscopic method is developed which permits the determination of the amounts of excited singlet and triplet oxygen molecules produced by atom recombination on the NASA Space Shuttle Orbiter Thermal Protective Tile Systems. Catalytic microcalorimetry is an auxiliary method also used as a probe measurement of recombination at elevated temperatures. The method incorporates the interface of a 48K Apple II Plus microcomputer to the system equipped with a BASIC Applab Card and peripherals which control, store, print, graph, and recall the spectroscopic and catalytic microcalorimetric data as needed. System design allows for significant change in conditions including tile orientation, introduction of mercury vapor (used as a scavenger), and variations caused by change in exciton-specific metal deactivators. The system allows rapid and precise analysis of data and gives results consistent with tentative mechanisms and a resulting heating model for the gas stream/tile surface interactions. Implications for their potential contribution to the Shuttle surface reentry heating fluxes are discussed and conclusions dealing with the actual surface chemistry leading to these processes are drawn.

*Spin Labels Incorporated in Clathrate Crystals*, Michael Steffan, Christian Brothers College. Model systems of spin labels incorporated in clathrate crystals have previously been studied and determination of the a-proximate orientation of the spin label within the clathrate has been found. The molecular attractive forces which incorporate the spin label are not known but are attributed to hydrogen bonding. Since hydrogen bonding is the molecular attractive force between the macromolecule and the spin label in the biological system, then it is imperative that the model system be analogous. To show that the spin label is incorporated by hydrogen bonding the -OH groups of the compounds used to form the clathrate crystal were selectively deuterated. The crystal was then analyzed by electron paramagnetic resonance for differences and similarities between the deuterated crystal and a protonated crystal.

*A Simple Experiment to Prove (again) That Alpha-Particles ARY Helium Nuclei*, Betsy Eiford, Southwestern At Memphis. Alpha Particles from 35 grams of uranium were allowed to accumulate in a small electrodeless gas discharge tube. We calculated that after about 20 days the Helium concentration will be about 1ppm if the pressure of the other gases is about 10 atmosphere. We believe that this concentration should give an observable Helium spectrum with the very high resolution spectrograph at Southwestern at Memphis. As of this time, the Helium spectrum has not been observed, but we hope for conclusive results by the time of the TAS meeting.

*Mechanistic Aspects of the Behavior of Transition Metal Compounds as Fire Retardant Additives For Poly(Vinyl Chloride) as Determined by Observed Effects on Model Compounds*, Mary Phelps, Christian Brothers College. The ability of MoO<sub>2</sub>Cl<sub>2</sub> to catalyze *cis*- to *trans*- isomerization in 2-pentane was tested by heating small amounts of each pure compound with a small amount of MoO<sub>2</sub>Cl<sub>2</sub>. The results show that MoO<sub>2</sub>Cl<sub>2</sub> does, indeed, catalyze a *cis*- to *trans*- isomerization in alkenes, a basic premise of the Lewis acid theory of flame and smoke retardance by molybdenum compounds. A comparison of the ability of CuCl, MoO<sub>3</sub>, and MoO<sub>2</sub>Cl<sub>2</sub> to inhibit dehydrochlorination of 3-chloropentane was performed, with the CuCl causing more of the 3-chloropentane to remain in the sample after heating.

*Isolation of Oligosaccharide From Glycophorin A of Red Blood Cell Membranes*, Robert Wilson, Christian Brothers College. Various studies have been performed involving calcium ion binding to the red blood cell membrane. Studies involving <sup>13</sup>C NMR yield useful results as to the mode of metal ion binding. The research done involved the isolation of oligosaccharides from the glycophorin (especially glycophorin A) from the red blood cells. The actual oligosaccharides were obtained from whole red blood cells. Centrifugation was the major mode of separation along with dialysis and phenol/water extractions to remove impurities. Final purification was done through the use of a gel filtration chromatographic column. <sup>13</sup>C NMR analysis was to be done to confirm the purity of the project. The isolated oligosaccharide was then to be used in <sup>13</sup>C NMR binding studies with various metal ions. The sugar to be isolated was a tetrasaccharide consisting mainly of sialic acid (N-Acetylneuraminic acid).

*Studies of Methionine Adenosyltransferase in Rat Liver Utilizing Methionine and Ethionine as Substrates*, Ellen Kline, Christian Brothers

*College.* The synthesis of S-adenosyl-L-methionine (SAM) from methionine and ATP, catalyzed by methionine adenosyltransferase, was studied *in vitro* employing enzyme isolated from rat liver. Methionine adenosyltransferase activity towards ethionine in the presence of ATP to produce S-adenosyl-L-ethionine (SAE) was also investigated. A time curve

and protein curve utilizing L-methionine were established. From Lineweaver-Burk plots obtained from substrate curves,  $K_m$  and  $V_{max}$  values were found to be 0.816mM and 18.69 nanomoles SAM/mg protein/20 min. for methionine and 2.77mM and 12.58 nanomoles SAE/mg protein/20 min. for ethionine, respectively.

## **JTAS OCTOBER AND APRIL ISSUES TO BE COMBINED**

**Due to financial constraints imposed by the loss of State funding, JTAS issues for July and October 1982 will be combined into a single issue to be published in October. January and April issues will also be combined and published in April.**

## **ASZ AND FIVE OTHER SOCIETIES TO MEET AT LOUISVILLE, KENTUCKY, DECEMBER 26-30, 1982**

The 1982 Annual Meeting of the American Society of Zoologists with the Crustacean Society, International Association of Astacology, American Microscopical Society, Animal Behavior Society and Society of Systematic Zoology will be held at the Galt House in Louisville during the traditional post-Christmas period.

The Call for Contributed Papers has been issued by ASZ, and an *August 27* deadline for receipt of abstracts of papers (oral or poster presentations) has been set.

Symposia presently scheduled are: (1) Cellular mechanisms of ion regulation in Arthropods, (2) Molecular aspects of early development, (3) Gastrulation, (4) Alternative reproductive tactics, (5) Biomechanics, (6) Crayfish distribution patterns, (7) Factors influencing Crustacean growth, (8) Phylogentic relationships of the lizards, (9) Evolution of neural systems in the vertebrates: Functional-anatomical approaches, (10) Evolution of the vertebrate lymphocyte, (11) The evolution of endocrine systems in lower vertebrates, (12) Biochemical adaptations of parasites, (13) Protozoa and algae of bogs, (14) The place of T. H. Morgan in American biology.

Meeting plans include several socials, special programs, commercial exhibits and a Job Placement Service. Hotel rates are \$29 for single rooms, \$36 for double/twin rooms and \$43 for triple rooms at the Galt House and Hyatt Regency. This meeting is hosted by The University of Louisville with X. J. Musacchia heading the Local Arrangements Committee.

For more information contact: Mary Wiley, Business Manager, American Society of Zoologists, Box 2739 California Lutheran College, Thousand Oaks, Ca. 91360 (telephone (805) 492-3585).