by a "higher course" if the calculus is to prove an effective working tool in the handling of problems originating outside of mathematics, since along with much else even the subject of differential equations has been postponed beyond this text.

BROWN UNIVERSITY ALBERT A. BENNETT

SOCIETIES AND MEETINGS

SPECIAL RESEARCH CONFERENCES ON CHEMISTRY

THE third series of conferences on chemistry, under the auspices of the Section on Chemistry of the American Association for the Advancement of Science, will be held at Gibson Island, Md., from June 17 to August 2. It will consist of six groups of papers and discussions in important fields of chemistry. Each of the six groups will occupy a period of five days, in each of which only one or a few formal papers will be presented, leaving ample time for discussions. In the following outline the paper or papers in each group, will be presented on successive days.

I. *Frontiers in Petroleum Chemistry.* June 17–21. C. R. Wagner, *chairman.* Program: Frederick D. Rossini, "The Analysis of Petroleum as Exemplified by Project No. 6 at the Bureau of Standards"; Gustav Egloff, "The Production of Aromatic Hydrocarbons from Petroleum"; E. V. Murphree, "Alkylation"; C. W. Montgomery, "Isomerization"; L. L. Davis, "Oxidation of Lubricating Fractions"; J. A. Boyd, "Investigations of the Combustion of Characteristics of Pure Hydrocarbons."

II. *Catalysis.* June 24–28. E. C. Williams, *chairman.* Program: Otto Beeck, "Modern Physical Methods in the Study of Catalysis"; R. B. Burk, "Theories of Polymerization and their Consequences"; P. H. Emmett, "Surface Area Measurements in Studying Catalytic Reactions"; Kenneth Blanchard, "Fermentation"; H. S. Taylor, "The Definition of Absorption and Surface Characteristics of Catalysis."

III. *Organic High Molecular Weight Type Compounds.* July 8–12. H. L. Bender, *chairman.* Program Committee: R. H. Kienle, S. S. Kistler and H. L. Bender. Program: E. O. Kraemer, "The Molecular Basis of Resin Behavior"; Emil Ott and H. M. Sprulin will conduct a discussion of high molecular weight compounds; H. Mark, "The Elastic Behavior of High Molecular Compounds"; W. T. Busse, "The Effect of Temperature and Hysteresis on the Tensile Properties of Rubber in Shear"; B. S. Garvey, Jr., "Mixed Polymers and Vulcanizable Plasticizers"; R. M. Fuoss, "Electrical Properties of Polyvinyl Chloride Plastics"; H. Hetenyi, "Photoelastic Tests with Heat Hardening Resins at Elevated Temperatures"; W. Sisson, "X-Ray Studies Regarding the Structure and Behavior of Cellulose Fibers"; Henry Eyring, "Rate Processes Involving Large Molecules."

IV. *Vitamins.* July 15–19. C. G. King, *chairman.* Program Committee: J. W. M. Bunker, A. D. Emmett and C. G. King. Program: H. C. Sherman, "Vitamin A Values: Determination by Bioassay and Interpretation in the Light of Natural Variations"; A. D. Holmes, leader of discussion; Harden F. Taylor, "Physico-chemical Methods of Vitamin A Assay"; Norris Embree, leader of discussion; E. M. Nelson, "The Development of Enforcement Policies Relative to Assays and Analyses"; H. T. Scott, "Problems and Possible Improvements in Vitamin D Bioassays"; N. A. Milas, "Physico-chemical Methods of Vitamin D Assay"; Walter C. Rissell, leader of discussion; S. B. Binkley and E. A. Doisy, "The Chemistry of Vitamin K"; S. Ansbacher, "The Bioassay of Vitamin K"; O. A. Bessey, "The Techniques of Analysis and Assay of Vitamin C"; C. J. Farmer, "Vitamin C Analyses in Relation to Clinical Problems"; D. K. Tressler, "Vitamin C Values in Fruits and Vegetables"; O. L. Kline, "Bioassays for Factors in the Vitamin B-Complex with Special Reference to Vitamin B_1"; C. N. Frey, A. S. Schultz and L. Atkin, "The Fermentation Method for the Determination of Thiamine"; C. H. Hunt, "The Anti-gray Hair Factor"; W. L. Sampson, "The Chemistry and Pharmacology of Vitamin B_6"; G. C. Supplee, "Bioassays and Chemical Tests for Riboflavin"; W. H. Sebrell, Jr., "Bioassay for Factors in the Vitamin B-Complex, with Special Reference to Nicotinic Acid"; Paul György, "Skin and Vitamins, with Particular Reference to the Vitamin B-Complex"; C. D. May, "Clinical Studies of Vitamin A Deficiency"; E. A. Sharp, "Anemias Associated with Vitamin Deficiencies"; Tom D. Spies, "Multiple Deficiencies Associated with Pellagra"; H. R. Butt, "Clinical Studies of Vitamin K Deficiency"; G. Dalldorf, "Clinical Studies of Vitamin C Deficiency."

V. *Relation of Structure to Physiological Action.* July 22–26. Walter Hartung, *chairman.* Program Committee: D. L. Tabern and Walter Hartung. Program: C. M. Suter, "The Syntheses and Bactericidal Properties of Phenolic Compounds"; R. S. Shelton, "Correlations of Chemical Structure and Germicidal Activity Among Some Quaternary Ammonium Salts"; Warner Carlson, "Cinchona Alkaloids: (I) "A Survey of the Relation of Structure to Anti-Malarial Action," (II) "Certain Biological Aspects of Anti-Pneumococcal Action"; Alice Renfrew, "Structure of Anti-Pneumococcic Activity and the Cinchona Series"; F. F. Blicke, "Chemistry of Antispasmodics"; C. W. Geiter, "Pharmacology and Evaluation of Antispasmodics"; A visit to the Baltimore hospitals; D. L. Tabern, "Intravenous Anesthesia"; Oskar Baudisch, "Biological Orientation in Minor Element Research: Formation, Reactivity and Structure of Chemical Groupings which Capture and Concentrate Elements Selectively."

VI. *Applications of X-Ray and Electron Diffraction.* July 29–August 29. Maurice L. Huggins, *chairman.* Program: J. L. Hoard, "X-Ray Studies of Complex Inorganic Compounds"; H. Mark, "X-Ray Studies of Long-Chain Compounds"; I. Fankuchen, "X-Ray Studies of Proteins"; D. M. Wrinch, "The Interpretation of X-Ray Data on Proteins"; Wm. L. Fink and D. W. Smith, "Preferred Orientations in Metals"; Charles S. Barrett, "X-Ray Diffraction from Strained Metals and Alloys";

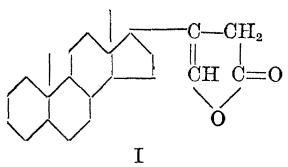
P. Debye, "Theory of X-Ray and Electron Diffraction"; J. Y. Beach, "Electron Diffraction Studies of Gaseous Molecules"; H. R. Nelson, "Electron Diffraction Studies of Solids and Solid Surfaces"; L. H. Germer, "Electron Diffraction Studies of Thin Films."

Since the accommodations on Gibson Island are very limited, it is advisable to make registration and reservations in advance. The registration fee is $3.00 per week per person, payable to Section C, A. A. A. S. On receipt of check, a registration card will be sent which will admit one to the island and entitle him to all the guest privileges of the island, including a reservation for a room. Rooms are $2.00 per day per person and board is *a la carte*. It is possible to make a few week-end reservations if made in advance. Any person making advance registration and reservations and finding later he is not able to attend may have his registration fee returned and his reservations cancelled, providing that a notice is received at least one week in advance of the date of the conference. The registration fee, request for room reservation or request for any additional information should be addressed to the Director of the Conferences, Neil E. Gordon, Central College, Fayette, Missouri.

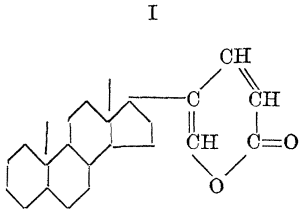
SPECIAL ARTICLES

SYNTHESES OF MODEL UNSATURATED LACTONES RELATED TO THE CARDIAC AGLYCONES

THE structures of the cardiac aglycones rest on a reasonably complete foundation as a result of the investigations of Jacobs, Windaus, Tschesche, Stoll and their collaborators.[1] For purposes of chemical classification the aglycones may be conveniently divided into two groups, *viz.*, those of the digitalis-strophanthus group the members of which are characterized by the presence of a side-chain consisting of the lactone of an enolized β-aldehydo-acid carrying the cyclopentanophenanthrene ring system on the β-carbon atom (type formula I), and those of the squill-toad venom group in which the cyclopentanophenanthrene ring system is present as a substituent in the 5-position of an α-pyrone ring (type formula II).



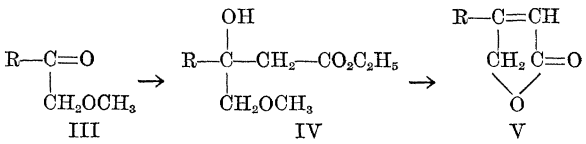
I



II

We have succeeded in synthesizing simple 5-substituted α-pyrones to serve as models for further work. Ethyl hexene-2-oate on condensation with ethyl oxalate in the presence of potassium ethylate gives diethyl 4-ethylhexene-2-on-5-dioate-1,6. This, after hydrolysis of the ester groups, on heating with hydrogen bromide in acetic acid yields 5-ethyl-6-carboxy-α-pyrone (calculated for $C_8H_8O_4$: C, 57.2; H, 4.8; found: C, 57.6; H, 4.9) which on distillation with copper powder yields 5-ethyl-α-pyrone.

At the same time we have been engaged in the synthesis of unsaturated γ-lactones related to the digitalis-strophanthus type, and have succeeded in preparing β-substituted $\Delta^{\alpha,\beta}$-unsaturated γ-lactones containing phenyl, cyclohexyl and *n*-butyl groups as representative substituents. ω-methoxy-methylketones (III) are readily prepared by the action of an appropriate Grignard reagent on methoxyacetonitrile.[2] These on condensation with ethyl bromoacetate in the presence of zinc give glycol-ether-esters (IV) which, after saponification of the ester, give unsaturated lactones (V) when heated with hydrogen bromide in acetic acid.[3]



III IV V

For the typical case where R is cyclohexyl: Calculated for $C_{10}H_{14}O_2$: C, 72.3; H, 8.5; found: C, 72.5; H, 8.8.

The properties of the latter lactones are not without interest. Thus the cyclohexyl lactone on treatment with a solution of potassium hydroxide in absolute methanol apparently undergoes irreversible isomerization to the $\Delta^{\beta,\gamma}$-lactone which adds the elements of water either during the reaction or during the subsequent working up to yield the hydroxylactone (VI). (Calculated for $C_{10}H_{16}O_3$: C, 65.2; H, 8.9; found: C, 65.7; H, 8.8.) Substances of the latter type have been shown to exist in equilibrium with the corresponding aldehyde-acid (VII).[4] The presence of both an aldehyde group and a carboxyl group in VI

[1] Elderfield, *Chem. Rev.*, 17: 187, 1935; Tschesche, *Ergeb. d. Physiol.*, 38: 31, 1936.

[2] Henze and Rigler, *Jour. Am. Chem. Soc.*, 56: 1350, 1934.

[3] Stoermer, *Ber.*, 39: 2297, 1906.

[4] Perkin, Jr., and Sprankling, *Jour. Chem. Soc.*, 75: 11, 1899; Harries and Alefeld, *Ber.*, 42: 159, 1909.