

## REPORT

### RECENT ADVANCES IN PHYTOCHEMISTRY.

AN INTERNATIONAL conference, "Recent Advances in Phytochemistry", was held at The University of Texas on April 6-8, 1966, under the auspices of The Plant Phenolics Group of North America and The Department of Botany, University of Texas. The conference featured discussions of the chemistry of several major classes of secondary plant constituents with emphasis on their biological and systematic implications. In an introductory lecture, Professor W. G. Whaley, Director of The Cell Research Institute, University of Texas, expressed the view that the interpretation of complex biological phenomena at the molecular level will require an even greater fusion of chemistry and biology than now prevails. Dr. Whaley presented several examples of specific biological problems which support this point of view. For instance the nature of the forces governing the alignment of cellulose fibers in the cell wall as revealed by electron microscopy is yet unexplained. It was also pointed out that the powerful analytical tools of the organic chemist have only recently been applied to investigations of enzymes, nucleotides, and other biological molecules.

The first symposium session, under the chairmanship of Professor W. D. Ollis (Sheffield, U.K.), dealt with the betacyanin-betaxanthin pigments, sulfur compounds, and alkaloids of the Papaveraceae. In the first paper, Professors A. S. Dreiding (Zurich) and T. J. Mabry (Austin) introduced the expression "betalains" to describe the class of pigments to which both the betacyanins and betaxanthins belong. The chromophore responsible for the color of both the betacyanin and betaxanthin pigments contains a 1,7-diazaheptamethinium cation which may be derived biogenetically via the condensation of the aldehyde group of a theoretical precursor, betalamic acid, and an amino acid or amine. The presence of betalains and absence of anthocyanins in ten plant families constituting the order Centrospermae represents a dramatic example of the systematic significance of chemical data.

Professors A. Kjaer (Copenhagen) and M. G. Ettlinger (Austin and Copenhagen) pointed out that although a number of organic sulfur compounds such as sulfur-containing co-enzymes and protein amino acids are universally distributed in the plant kingdom, other such compounds are of more restricted distribution and therefore are potentially of greater taxonomic value. For instance, the thioglucosides, which can yield isothiocyanates, nitriles and thiocyanates, occur in relatively few higher plant families, e.g. notably in the Cruciferae. In addition certain genera of the Compositae elaborate polyacetylenic thiophenes.

Professor F. R. Stermitz (Utah State University) suggested that alkaloids represent a group of secondary compounds not yet fully exploited for taxonomic investigations. Detailed analyses of the alkaloids of the genera *Papaver* and *Argemone* of the family Papaveraceae have already provided new insights into the natural divisions of these genera.

The second session, chaired by Professor T. A. Geissman (U.C.L.A.), was devoted to discussions of natural products derived from the acetate and mevalonic acid pathways. Professor W. Herz (Florida State University) gave a comprehensive review of the chemistry and taxonomic importance of the pseudoguaianolides in two tribes, Heliantheae and Helenieae, of the Compositae. The sesquiterpene lactone chemistry of *Ambrosia* and *Parthenium* supports a taxonomic alignment of these genera since thus far most species in the two genera which have been investigated contain a closely related group of pseudoguaianolides or substances whose biogenesis must involve pseudoguaianolide precursors.

The phylogenetic significance of the several hundred naturally occurring tri- and di-terpenes was considered in a paper by Dr. G. Ponsinet, Professor G. Ourisson, and Dr. A. C.

Oehlschlager (Strasbourg, France). The bitter principles of the Cucurbitaceae, the cucurbitacins, which combine a unique triterpene carbon skeleton with distinct oxidation patterns, have been found outside the Cucurbitaceae only in one species of the Cruciferae. It was suggested that the wide occurrence of (–)-kaurene derivatives is related to the fact that kaurene is a precursor of the plant growth hormone, gibberellic acid.

In the final paper of the second session, Professor N. A. Sørensen (Trondheim, Norway) discussed the systematic significance of acetylenic compounds in the plant kingdom. The diversity of polyacetylenes produced by the Compositae is remarkable, particularly since one of the most widely distributed acetylenes in this family is an explosive penta-acetylene. However in the tribes, Inuleae, Heliantheae, Helenieae and Cynareae of this family the penta-acetylene types are frequently cyclized to thiophenes.

Professor R. E. Alston (Austin) presented the first of three papers in a session, chaired by Dr. T. Swain (London), which was concerned with phenolic plant constituents. Professor Alston expressed the opinion that the number of different types of C-glycosyl flavonoids (now known to be more than forty) is probably comparable to that of the O-glycosyl flavonoids. New evidence was presented suggesting that C-glycosylation in the family Lemnaceae occurs at or prior to the formation of the open-chain C<sub>15</sub> precursor of flavonoids.

Professor W. D. Ollis (Sheffield, U.K.) presented a survey of the chemistry of new structural variants upon the isoflavonoid and neoflavanoid ring systems. Investigations of *Dalbergia* and *Machaerium* species established the neoflavanoids as a new class of natural products, which frequently occur naturally with benzylstyrenes and isoflavonoids.

Professor H. Grisebach (Freiburg, Germany) discussed the results of recent investigations in his laboratory on the biosynthesis of flavonoids. He described evidence to support the *in vivo* activation of cinnamic acids by the formation of Co-enzyme A esters of the acids. Labeled chalcones (flavanones) have been shown to be precursors for anthocyanins, flavonols, flavones, catechins, isoflavones, and coumarono-coumarins.

In a special address, Professor H. Erdtman (Stockholm) reviewed the development of the field of chemotaxonomy and discussed the future of this area, particularly with respect to the need for biosynthetic and structural investigations of natural products.

The meeting closed with an exploratory open discussion of the nature and meaning of taxonomic criteria.

The proceedings of the meeting will be published: *Recent Advances in Phytochemistry* (Edited by T. J. Mabry, R. E. Alston and V. C. Runeckles), Appleton-Century-Crofts, New York (1967).

The Plant Phenolics Group of North America recently voted to become a Phytochemical Society, which will represent all areas of plant chemistry and biochemistry. The 1967 meeting of the Phytochemical Society of North America will be held August 24–26, 1967, at the Wisconsin Center, Madison, Wisconsin. The meeting will feature a Symposium on "Modern Instrumental and Chemical Approaches to Phytochemistry" and will be co-sponsored by the Forest Products Laboratory, USDA; and the Department of Plant Pathology, University of Wisconsin.

TOM J. MABRY

President

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*Department of Botany and Cell Research Institute,  
University of Texas, Austin*