Cambridge in April, 1965, was a three-day symposium on "Comparative Phytochemistry", a report of which is given in the following article.

Much of the knowledge of the chemistry of plants has been gained by the search for pharmacologically active substances, so that the applications of phytochemistry in the pharmaceutical field can also be expected to be prominently featured in the Group's programme. But there is a field of at least equal interest and importance in the occurrence of physiologically active compounds in actual or potential foods and feeding-stuffs. Outstanding examples of these are the oestrogens in leguminous crop plants and the recent discovery of aflatoxin in spoiled groundnuts. Besides these harmful constituents there is a growing need for chemical knowledge—and, in gas chromatography, the means of obtaining it—of the nature of aroma substances in foods. It is to these constituents that so much of the attractiveness, or unattractiveness, of food is due. Both in the breeding and growing of the fresh foods, and in the preservation and enhancement of fresh quality the demand is for an understanding of the nature of the aroma substances. Just as our knowledge of the pigments has advanced during the past few years so our knowledge of the 'aromatics' can be expected to grow during the coming years, and these aroma substances cover a far wider range than the comparatively few kinds of substances to which the plant pigments are confined. The usefulness of this knowledge can be expected to extend, and is, indeed, already extending, to the palatability of animal feeding-stuffs, now that intensive feeding methods are beginning to assume so much importance in stock raising and dairy farming.

While some regard must be given to sectional interests in the activities of the Group, its objectives will be much better promoted by emphasizing the more general aspects of phytochemistry. With the increasing complexity and specialization both of academic chemistry and the various branches of industry there is a tendency for departmentation and segregation to increase. It will be one of the great advantages of meetings of the Group that departmental barriers can be broken down in the discussion of such topics as biosynthesis and chemical taxonomy, subjects which not only embrace the whole range of natural products, but which also possess an exciting and rewarding intellectual content. These are satisfying activities for the increasing number of those for whom chemistry for chemistry's sake and botany for botany's sake are not enough.

[1] *Chemical Taxonomy*, edit. by Swain, T. (Academic Press, 1964).

COMPARATIVE PHYTOCHEMISTRY

By DR. J. B. HARBORNE
John Innes Institute, Bayfordbury, Hertford

AN international symposium on comparative aspects of plant chemistry, organized by the Phytochemical Group with the financial assistance of the Scientific Affairs Division of NATO, was held in Cambridge during March 30–April 1. The main theme of the meeting was the taxonomic implication of the natural distribution of the various groups of plant constituents, but their biogenesis, evolution and general biochemistry were also discussed. The taxonomist's view of phytochemistry was given by Prof. V. H. Heywood (Liverpool) in the introductory lecture. He dealt with the problems of incorporating chemical data into classification and showed why it was impossible to recommend the phytochemist to use one rather than another of the various plant classifications that are available. He pointed out that a number of systems will always be needed to fulfil different objectives.

In a second introductory lecture, Prof. C. R. Mentzer (Paris) expounded his well-known biogenetic classification of plant constituents, in which substances are placed together according to their biogenetic origin rather than on the basis of chemical complexity as in Beilstein.

The first main session, under the chairmanship of Prof. L. Fowden, was devoted to the distribution of nitrogenous compounds. Dr. E. A. Bell (London) described the distribution patterns of non-protein amino-acids he had obtained using paper electrophoresis of legume seed extracts. These patterns, he said, could be used to divide each of the genera *Lathyrus* and *Vicia* into several distinctive biochemical groups. He pointed out that comparisons of biosynthetic pathways were probably more valuable with unusual amino-acids than considerations of the distribution of single compounds. Prof. R. Hegnauer (Leiden), in considering the taxonomic significance of the comparative chemistry of the alkaloids, found many examples of parallelism and diversification. One of the conspicuous successes of chemical taxonomy has been the discovery that betacyanins and betaxanthins are restricted to one order of plants, the Centrospermae, and the final paper in this session, given by Dr. T. J. Mabry (Texas), dealt with these purple and yellow alkaloidal pigments. After describing the chemistry of these substances, Dr. Mabry considered the various arrangements that have been proposed for the betacyanin-containing families and showed that his results definitely discounted the Hutchinson system in this context.

The second session was devoted to phenolic constituents and included a consideration of hydroxyquinones (Dr. C. Mathis, Strasbourg), dihydrochalcones (A. H. Williams, Bristol), glycoflavones (Prof. H. Wagner, Munich) and flavonoid pigments (Dr. J. B. Harborne, John Innes Institute). It was clear from these papers that although phenolics are among the most promising of taxonomic markers, they have not as yet made much contribution to plant systematics. For example, the dianthrone hypericin, as Dr. Mathis found, is characteristic of the genus *Hypericum*, but it only occurs in about half of the 300 species examined. One difficulty in evaluating the results of surveys is the occurrence of 'chemical races' within a single species. A dramatic example of this phenomenon was uncovered by A. H. Williams, who found that some samples of the dihydrochalcone-containing *Smilax glycyphylla* either lacked phenols altogether or contained the xanthone, mangiferin, instead. Glycoflavones are more widely occurring than dihydrochalcones but little is known of their detailed distribution at the generic level. One of the main difficulties with glycoflavones is distinguishing them from the more common flavone *O*-glycosides, and Prof. Wagner dealt mainly with this aspect of their phytochemistry in his lecture. Because of their importance as petal pigments, the flavonoids are very interesting from an evolutionary point of view, and Dr. Harborne, therefore, sought correlations between flavonoid structures and evolutionary advancement. He also described some recent surveys in the Gesneriaceae and Plumbaginaceae, in which novel correlations have been found between anthocyanin distribution and pollen or leaf morphology.

The third session, under the chairmanship of Prof. H. Erdtman (Stockholm), dealt with hydrocarbons and their derivations. Dr. G. Eglinton (Glasgow) said that the alkane distributions so far studied indicated a reasonable

species constancy, but that the chemotaxonomic use of alkane patterns had so far met with only moderate success. The acetylenic compounds also present taxonomic difficulties, occurring as they do in such disparate groups as the fungi Polyporaceae and the highly advanced Compositae. Dr. J. D. Bu'Lock (Manchester) pointed out that some of the anomalous aspects of acetylene distribution within the Compositae could be explained by considering biosynthetic pathways, so that more knowledge of biosynthesis is vital in this series. Dr. G. Weissman (Hamburg), in considering the occurrence of terpenoids in plants, also found that biogenetic relationships were of prime importance in understanding distribution patterns. In the final lecture of this session, Prof. T. W. Goodwin (Aberystwyth) mentioned that carotenoids were of considerable systematic importance in lower plants, but were of little significance in the angiosperms since all green leaves contain the same set of major carotenoids. Fruit carotenoids do, however, show interesting variations as they can be divided into four categories, but the interest here is mainly their biosynthetic origin rather than their systematic distribution.

The first paper in the fourth and final session of the symposium was given by Dr. E. Percival (London). In surveying the vast and complex field of polysaccharide chemistry, she pointed especially to similarities and differences in structure between algal and higher plant acidic polysaccharides. She concluded that generic and species differences will only emerge when the fine details of these macromolecules have been elucidated. Prof. A. J. Kjaer (Copenhagen) also had a large area to cover, since he dealt with sulphur-containing amino-acids and alkaloids, thiols, simple sulphides and polysulphides. His main theme, however, was the distribution of the isothiocyanate-producing glucosides, which show a number of interesting correlations with taxonomy. In a joint paper, Dr. T. Swain (Cambridge) dealt with the chemistry and Dr. E. C. Bate-Smith (Cambridge) the distribution of a class of substances including aucubin and asperuloside, now known collectively as iridoids. It was pleasing to find that their distribution in families in the order Tubiflorae fits in particularly well with the recently published twelfth edition of Engler's *Syllabus of Plant Families*. Finally, Dr. Ruijgrok (Leiden) outlined the distribution of the lactone ranunculin in the Ranunculaceae and correlated its occurrence with those of cyanogenetic compounds, which are also present in this family. This talk concluded a very successful meeting, in which both chemists and taxonomists contributed to discussions of the many papers. It is planned to publish the proceedings in full later this year.

HOT-LABORATORY WORKING METHODS

AN international symposium on working methods in high-activity hot laboratories, organized by the European Nuclear Energy Agency in collaboration with Euratom, was held at the French Centre d'Etudes Nucléaires in Grenoble during June 14–18. The symposium provided a forum for discussion, by some 130 experts from hot laboratories in the nuclear research centres of 15 European and American countries of OECD and Euratom, of specialized methods and equipment for handling radioactive materials with activities greater than 1,000 curies.

The main purpose of hot laboratories, of course, is to permit experimental work on these highly radioactive materials without endangering the personnel carrying out the work. Although in the past such experiments have usually been related to research and development programmes, there is now a growing amount of purely routine work—such as regular analysis of irradiated fuel samples to determine burn-up—for which comparatively simple standardized equipment could often replace the complex and unnecessarily flexible apparatus of the pure research laboratory.

Equipment for both purposes was discussed at Grenoble and it became clear, even for complex research purposes, that laboratory experts preferred simple and economical rather than highly sophisticated equipment provided only that it would do its job in a safe and efficient manner.

Throughout the symposium there was repeated emphasis on the need for designers of hot-laboratory facilities to work more closely with the users, so avoiding the need to make an installation unnecessarily flexible through lack of foreknowledge of its purpose. Improved liaison was also often possible between the hot-laboratory operator and his "client"—the reactor operator or research engineer—so that the one could know as accurately as possible what the other wanted him to do. The earlier this liaison took place, the less complicated the hot-laboratory equipment might well be.

On the other hand, a too-rigid limitation of use could lead to considerable expense when, as was often the case, advancing technology required modifications to what had become standard test procedures. Economics and flexibility were in fact often in opposition, and an efficient compromise was not always easy to find.

Although the symposium was concerned with hot laboratories for all purposes, most of the papers presented dealt with installations for work on irradiated fuels, and several stressed the problems to be expected from the advancement of fast reactors. Monsieur André Valentin (Commissariat à l'Energie Atomique, Fontenay-aux-Roses, France), in summing up the situation, mentioned that such reactors would undoubtedly operate to very high fuel burn-ups—for example, it was generally thought that plutonium carbide fuels would not be interesting unless taken to burn-ups greater than 50,000 MW days/tonne. This was likely to lead to considerable and important developments in hot-laboratory methods.

Mr. K. R. Ferguson (Argonne National Laboratory), in reviewing present techniques in the United States, stressed the value of experience in building up these techniques. Such experience enabled consistently reliable results to be obtained from comparatively simple apparatus having the highest standards of safety and protection, while less-experienced operators would feel impelled to use more complex equipment which was certainly less economical and could also be less reliable.

A discussion of various types of 'enclosure' directed attention to the advantages of incorporating all or most of the remote handling operations of a particular process within a single complex of interconnected containments. By thus reducing the frequency of transfer across the containment barrier, both containment reliability and operating efficiency could be greatly increased. Such cell complexes are to be used at the Fuel Recycle Pilot Plant at the Hanford Laboratories, the Oak Ridge Transuranium Laboratory, the Oak Ridge Thorium-uranium Recycle Facility, and the Alpha-Gamma Metallurgical Hot Cell at Argonne.

Concerning the use of 'boxes' within hot cells, it was generally agreed that these were necessary for handling materials above a certain activity (for example, above a total alpha count of 10^{15}/min was suggested) to avoid excessive time loss in decontamination and to provide added assurance of safety. Boxes were also needed to avoid cross-contamination between different materials handled simultaneously in the same laboratory.

There was some discussion on methods and equipment for both individual and general dosimetry, and here again