esting is Ford's work on the butterfly *Maniola jurtina*. The populations of this insect show no local differentiation throughout southern England, but there is a distinct race in Cornwall and a series of distinguishable populations on the Isles of Scilly to the West. The boundary between the "Southern English" and the "Cornish" races has been localized very precisely. Not only has this boundary proved to be quite sharp, but it has been observed to shift from year to year. Ford concludes that there are "powerful selective forces acting at the boundary between the races." Observations on this phenomenon throw light on some fundamental problems of race and species formation. Other highlights are the chapters that deal with the evolution of mimicry (based mainly on the work of Clarke and Sheppard), and on the isolated colony of the moth *Panaxia dominula* near Oxford (the latter is perhaps the most intensely studied natural population of an insect in the world).

Biologists interested in evolutionary problems will find here a rich source of information and ideas. A crystal-like clarity of presentation and a style which is at the same time elegant and free from all pedantry make this book pleasant reading.

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Chemotaxonomy

Chemotaxonomie der Pflanzen, vol. 2, *Monocotyledoneae*. R. Hegnauer. Birkhauser, Basel, Switzerland, 1963. 540 pp. Illus. F. 98.

This volume, covering the chemotaxonomy of the Monocotyledoneae, is the second of a projected series on the comparative chemistry of plants. Volume 1 treated algae, fungi, bryophytes, ferns, and gymnosperms.

A number of comprehensive treatments of the chemistry of natural products have been published rather recently—*Konstitution und Vorkommen der organischen Pflanzenstoffe* (Birkhauser, Basel, 1958) by W. Karrer; *The Chemistry of Flavonoid Compounds* (Macmillan, New York, 1962) edited by T. A. Geissman; *Ergebnisse der Alkaloid Chemie bis 1960* (Akademie Verlag, Berlin, 1963) by H. Boit; and *Annual Index of the Reports on Plant Chemistry* (Hirokawa, Tokyo, 1961, 1962, and 1964) edited by T. Kariyone. But, with some justification, Hegnauer considers such books of limited value to the taxonomist because in most of them the taxonomy is incidental to the chemistry, and because only the years 1957 to 1961 are now covered by Kariyone's *Index*. As stated in the preface to volume 1, our knowledge of plant chemistry is still quite fragmentary; nothing is known about the chemistry of extinct plants; and only limited biosynthetic data are available. Newer analytical methods have nonetheless made a vast amount of chemical data available to the chemotaxonomist. *Chemotaxonomie der Pflanzen* is therefore organized to emphasize the taxonomic implications of the chemistry and to provide the chemical data in a form useful to the taxonomist.

In addition to the strictly chemical survey, the author has included "anatomical" data based on structures derived from specific chemical entities—myriophyllin cells, calcium oxalate crystals, carbohydrate reserves, and others. Despite the fact that traditionally such characters have been acknowledged to be within the domain of the chemotaxonomist, I consider these substances, collectively, of slight systematic value. Therefore the significance of the inclusion in the present work of an "anatomical" section for each family or other taxonomic category is debatable. The author, in an attempt to provide a comprehensive treatment of chemical data, also included references to pharmacological activity, insecticides, quantitative data on dried storage organs, minerals, oil characters, and the like when such data were available. Since the chemotaxonomic literature has accumulated in large part through commercial and pharmaceutical interest, and not systematically, this type of organization makes it difficult for the reader to separate the wheat from the chaff.

The taxonomist may be sorry to find this statement in the preface of volume 2—"Leider zeigte sich im Lauf der Arbeit, dass in den meisten Fällen unsere Kenntnisse über die Inhaltstoffe noch dermassen unvollständig sind, dass eingermassen begründete chemische Sippenvergleiche unmöglich sind." However, the numerous instances throughout the book where a specialized chemistry is correlated with delimited taxonomic groups should provide some compensation.

The degree to which chemotaxonomy must progress before it will be possible to employ chemical data extensively to supplement other taxonomic criteria is emphasized in the concluding observations at the end of a 68-page section on the Gramineae: "Die Gramineae, sind Kieselsäureakkumulatoren. Sie zeichnen sich ferner durch die Tendenzen zur Erzeugung von cyanogenen Verbindungen und zur Ersetzung der Stärke in den vegetativen Organen durch Fructane aus. Andere chemische Charakterzüge sind das Fehlen von Leucoanthocyanen in den Blättern und das vermutlich häufige Auftreten von nicht allegemein verbreiteten flavonoiden Verbindungen (Tricin, Glykoflavone)." The absence of leucoanthocyanins is likely to be of relatively limited importance. (Probably the presence of *p*-OH benzoic acid type monomers in grass lignin is more significant). A recent survey of a number of grass genera failed to disclose free tricin, a flavone analogous to the anthocyanidin, malvidin, although tricin glycosides were present as minor flavonoid components of most of the grasses, and glycoflavones were extremely common. It is doubtful that more than a small fraction of the approximately 6000 grass species has been investigated with respect to their secondary chemistry. It is possible that eventually a complex flavonoid chemistry will be exposed within this family, despite the absence of showy floral structures, but for the present only a few suggestive correlations, such as the frequent association, *together in a species*, of O-glycosides of tricin and C-glycosides of certain other flavones (glycoflavones), are available for the speculations of the chemotaxonomists.

If the present book falls short of providing an integrated chemical superstructure to classical taxonomy, it is testimony to our fragmentary knowledge of plant chemistry. Hegnauer's work represents a major achievement in collecting diversified and widely scattered chemical knowledge under a comprehensive taxonomic focus. He has been cautious in the application of these data to "solve" taxonomic problems, yet he has called attention to those instances in which chemical data are corroborative or contradictory with respect to a specific hypothesis. The chief point of difference, from my viewpoint, involves the more restricted conceptual basis of chemotaxonomy implicit in Hegnauer's work. I antici-

pate a progressive increase in the applicability of macromolecular data through the eventual development of greater facility in the analysis of the primary structures of proteins as in the impressive comparative studies of hemoglobins and cytochrome oxidase.

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Polymer Reviews

Newer Methods of Polymer Characterization. Bacon Ke, Ed. Interscience (Wiley), New York, 1964. xvi + 722 pp. Illus. $22.50.

This tome, volume 6 in the series entitled "Polymer Reviews," contains 16 generally well-edited and well-written reviews by 17 authors. The methods discussed fall into two broad categories—characterization in solution and characterization in the solid state. The topics in the first category are microtacticity (Krigbaum), optical rotary dispersion (Yang), fluorescence (Oster and Nishijima), column fractionation (Screaton), high temperature solution properties (Chiang), and density gradient centrifugation (Hermans and Ende). The topics that may be loosely categorized as applying to the solid state are deuteration and polarization effects on infrared spectra (Liang), optical methods (Stein), small angle x-ray (Statton), electron diffraction (Fisher), high resolution nuclear magnetic resonance (McCall and Slichter), differential thermal analysis and differential thermometry during mechanical deformation (Ke), flow birefringence (Tsvetkov), elasto-osmometry (Hermans), and monomolecular films (Beredjick).

Bacon Ke, the editor, has succeeded in maintaining an organizational unity throughout the book. Each chapter presents a brief exposition of the theoretical basis for the method discussed and contains abundant illustrations and data, and most chapters also include some discussion of the method's potentialities. All the contributors have done an admirable job of covering the literature. With respect to the book title, the word "newer" is applicable in only the broadest sense and the use of the word "methods" is perhaps misleading. The title promises an emphasis on the experimental manipulations as well as the difficulties of the methods, but such information is most often omitted from papers published in today's journals. Unfortunately, the critical approach implied in the title is not presented; instead the papers review results that are generally available in the literature, a policy which the editor has followed with some exceptions—that is, descriptions of apparatus and experimental manipulations are omitted except when such information is not readily available elsewhere.

A few of the chapters are textbook-like in that the reader is primed and made ready to attack the literature and use the method. However, in too many instances the chapter is written to serve the expert, and a high level of sophistication is a prerequisite for appreciating and using the information presented in the review. Thus, the book falls short of providing an introduction to polymer characterization for newcomers, and it may be of only passing interest to the expert who is not ready to embrace one of the methods. The book as a whole is not for those who wish to be brought up to date. But a scholarly review is always useful, and the generally high quality of the various chapters recommends this book as a worthwhile addition to the reference shelf.

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Mathematics Textbook

Modern Basic Mathematics. Hobart C. Carter. Appleton-Century-Crofts, New York, 1964. xii + 466 pp. Illus. $6.50.

In the preface of this book are made some commendable claims which, unfortunately, seem not to be realized. The author had intended to write a rigorous book which would be suitable for the type of mathematics course usually called a "terminal" course but which would not preclude the student's being able to step into the regular mathematics sequence without loss of time and with the proper background. The author probably characterizes the inherent difficulty in achieving his goal in the following statement: "It is often difficult to say exactly what you mean and it is often more difficult to decide what another person means" (p. 10).

The contents consist of the usual topics of elementary algebra, trigonometry, and analytic geometry and of topics mainly concerned with sets, logic, foundations, abstract algebra, and polynomial calculus, with brief developments of some ideas of projective geometry, probability, statistics, and finite differences. The first four chapters contain essentially all the "modern" ideas, and except for some isolated instances, these play practically no part in the subsequent exposition.

It is doubtful that reading this book will enable the intended reader to develop much feeling for logic and the logical development of mathematics. Several key definitions are faulty; seemingly technical words are used without explanation; italic, block, and regular type are used in a haphazard manner, making distinction between intended formal and informal exposition difficult, and concepts are used prior to their definition and development. Thus, on page 1, the author refers to "set" as a "well defined collection"; on page 51, he tries to explain "well defined". Again, on page 1, the set of positive integers is introduced as "1, 2, 3,4,5,6,7,8,9,10,11,12,13, . . . where the three dots are read 'and so on'"; induction is discussed on page 71. On page 8, "ordered pair" is introduced, but the concept of "order" is delayed until page 44. On page 121, the notation for functions of several variables is used; it is explained in part on page 187. On page 10, a proposition is defined as "a statement which can be classified, either actually or hypothetically, as either 'true' or 'false' but not both," and "an argument is a set of propositions where one of the propositions is said to follow from the others." One also finds that to a conditional argument "temporary premises" (unexplained) may be added and later "discharged" (unexplained), and that "an argument is valid if the conclusion is inescapable." Unfortunately this does not exhaust the questionable aspects of these chapters.

The remaining chapters of the book are written in much the same manner. However, they are concerned mostly with the more usual topics of elementary mathematics, and as such the level of exposition seems equivalent to that of many of the other books covering the same material.

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