Space forbids a detailed account of other chapters in this excellent book. Suffice to say that there are appropriate reviews on cardiac glycosides, lipids, steroids and phenylpropanoids and that the regulation, biotransformation, analysis and catabolism of these various substances in cell cultures are fully discussed. One unexpected biochemical feature of tissue culture is the variety of conjugates that may be formed when exogenous compounds are supplied. In describing this phenomenon, W. Barz reports the discovery of his own group at Münster that nicotinic acid is metabolized *either* to the *N*-methyl derivative trigonelline *or* to the *N*-arabinoside, depending on the taxonomic position of the plant culture used. Nicotinic acid metabolism in cell culture thus represents a new chemosystematic marker for assessing relationships in the plant kingdom.

The book is produced in camera copy but up to the usual high standards of Springer. It is nicely illustrated and has an adequate subject index. Tissue culture buffs will doubtless read it from cover to cover, since it contains splendid up-to-date reviews of the very latest developments. Phytochemists should not, however, be misled by the title; there is much of interest here for them too!

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Chromenes, Chromanones and Chromones: edited by G. P. ELLIS. Wiley, New York, 1977. £75.

Here is another volume (the 31st) in the well known series from Weissberger and Taylor on heterocyclic compounds, and a particularly welcome one. Notwithstanding its scope and importance, the subject matter has not been comprehensively summarised since the 1950s in the Elderfield series. The book does not treat the major subdivisions known as flavonoids, coumarins, or xanthenes, yet it has still taken nigh 1200 pages to encompass the rest. The cost is correspondingly high so that, while the book is in any case an essential purchase for a chemistry library, individual purchasers may well feel dubious about the outlay unless they are assured that their particular needs will be met. The rest of this review was undertaken with that point in mind.

Even when the large groups mentioned above have been set aside, chromene and chromone derivatives are so numerous as to necessitate further selection to keep the book to a reasonable size. Most derivatives of chroman will be found in another volume unless the dihydropyran ring happens to be modified by carbonyl groups or hydroxy substituents so that the closest structural affinity is with chromone. The book does deal with naphthopyrans and with compounds in which the benzene ring is reduced, and also with certain lactones that might have been given the alternative classification as coumarin derivatives. The book does not normally treat chromenes fused to a second heterocycle even when this is itself derived from pyran or chromene.

To make it manageable the subject matter has been strictly systematized by chemical constitution. There is a chapter devoted to chromone itself; alkylchromones, hydroxychromones, alkoxychromones, halochromones, nitrochromones, aminochromones, ketonic chromones, chromone carbonitriles, tetrazoles, aldehydes, and carboxylic acids all have chapters of their own. Other chapters deal with chromenes, chromanols, chromanones, and chromandiones. Throughout special attention has been paid to naturally occurring compounds and to those with important physiological activities. There are special sections and sometimes chapters devoted to spectroscopic properties and reactions of analytical value. Bischromones, bichromones, and spiropyrans are all accorded separate sections, and some attempt has been made to guide the reader through the confusing maze of nomenclature changes over the years.

Although necessary, the strict assignment of structural types between the various other volumes in the series and between various chapters in this one has some rather unfortunate consequences that have not always been sufficiently mitigated by cross referencing, For example, Chapter III perforce deals with chroman-3,4-diols without mentioning the important chemical and stereochemical studies on samidin and its congenors; since these are also coumarins they have to be sought in a different volume. Again, tautomerism in the chroman-2,4-diones is a great nuisance from a systematic point of view, because it can furnish derivatives of 2-hydroxychromone or of 4-hydroxycoumarin; reasonably, therefore, it has been decided that such diones and their enols should be considered together in this volume notwithstanding the fact that some are properly coumarins. However, this decision seems to have left an area of uncertainty, so that the enol ethers (if chromones) are mentioned only in a Table, or (if coumarins) are not discussed at all. The extensive studies on 3,3′-methylene-bis-(4-hydroxycoumarin) and its important anticoagulant activities are likewise barely touched upon, and not indexed, though several more complex related compounds receive due mention.

Although the authors have tried hard to avoid it, the high degree of compartmentation results in a good deal of repetition that was not really necessary. Thus the reaction of 3-acylchromones with amines is dealt with as a reaction of 3-acylchromones, as a means of preparing chromones, and as a means of orientating substituents in some chromones. One full discussion, cross referenced, would probably have been shorter and more vivid than the three partial discussions presented. A more extreme case is found upon reading a series of spectroscopic sections, each of which makes such standard points as the shift of carbonyl frequency produced by hydrogen bonding with an adjacent (*ortho*) hydroxy groups.

The coverage is remarkably extensive, and there are many tables listing compounds according to details of their structures. Your reviewer found no omissions of importance, and a good deal of information that he had not known existed before. As a rule the authors have kept to straight reporting, seldom offering any

criticism or making any correlations—with so enormous a task before them already they could hardly be asked for even more effort. The reader should therefore discount references to chromones in sebum (p. 466) that, when the paper is read, turn out to be imaginary, to reaction pathways that a student could better (p. 760), to a rather wild biosynthetical speculation (p. 459—your reviewer regrets that he was the originator), and so on. If it is in the literature and is not definitely wrong, then it is almost certainly in this book.

The style is clear and so are the diagrams, formulae, and tables, and the incidence of typographical and similar errors is low for a work of these dimensions. It is a little odd that, with so much to do, the authors sometimes add totally useless information, e.g. an R_f value of no obvious interest and, with no solvent or supporting phase mentioned, no significance (p. 468). More worrying is a sprinkling of scientifically inaccurate statements; examples: a 'thermal Simonis' reaction (p. 469), a confusion between pK_A and pK_B (p. 560–561), DDQ reductions (section heading p. 61), reaction with methyl lithium in the presence of perchloric acid (p. 719). And a very short section on p. 667 that starts by stating—correctly—that alkaline hydrolysis opens the pyrone ring of chromones, and finishes by stating that it does not. The use of the term 'dehydrating agent' for a Friedel–Crafts catalyst (p. 227) seems antiquated nowadays, while the separation of Friedel–Crafts cyclisations of acids from that of their esters (p. 236) results in unnecessary repetition.

Having now established my credentials as a reviewer by carping in the traditional manner, let me say that in this volume is condensed an immense and important literature that previously was almost without access routes. What faults there are are greatly outweighed by the merits; I have used this book with advantage almost every working day for the last three months. Those interested in this field of chemistry owe a considerable debt to Dr. G. P. Ellis, who wrote more than half the book himself besides editing it, and to his three colleagues: I. M. Lockhart, Deborah Keeder-Nycz and and E. E. Schweizer.

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Flowering Plants—Evolution and Classification of Higher Categories: edited by K. KUBITZKI. Springer, Vienna, 1977. 416 pp. DM 198 (approx. £50).

This publication stems from a symposium held in Hamburg in September 1976 and contains 23 review papers dealing with the problems of arranging angiosperm families into a system of classification which expresses evolutionary relationships. Indeed, a number of such systems exist—notably those of Cronquist & Takhtajan —but, as is pointed out here, the evidence upon which such systems have been erected is often suspect. V. H. Heywood, in a brilliant iconoclastic opening address, makes this abundantly clear. He points out, for example, the dangers of using morphological features, e.g. those of the so-called primitive flower, for constructing such systems. As he says "the difficulty about all these ingenious (or, in some cases, ingenuous) theories is that there is no way they can be tested, short of finding actual fossils for confirmation and what is more, they have fed on each other to such an extent that the body of apparent evidence is so impressive that it is difficult at times to remember there is no factual basis for it beyond the present day starting point and general trends in the fossil record".

Having started in this salutary manner, the remaining contributors in the book are concerned with picking up some of the pieces and, at least, justifying parts of the present system of classification based on critical, modern experimental approaches. K. R. Sporne, for example, argues from character correlations for some kind of evolutionary system and points out that it is possible to find 122 positive correlations among dicotyledons between 26 morphological, anatomical and biochemical characters. All these characters can be regarded as primitive, from their abundance in families known from fossil records to be very early in origin. Biochemical data on their own, of course, provide a line of independent evidence which on biosynthetic arguments, can be tested against phylogenetic trees derived from morphology or anatomy. In a challenging chapter, O. R. Gottlieb describes some new ways of presenting alkaloidal, isoflavonoid and furanocoumarin data in the form of three dimensional diagrams that can be used directly by taxonomists. Unfortunately, the ascertainment of these biochemical features is still limited and the use of such data is restricted at present to rather small groups of plants, i.e. to parts of the Leguminosae, the Apocynaceae, Amaryllidaceae and Umbelliferae. In another important paper, H. T. Clifford describes the numerical approach to classification, as applied to the monocotyledons. By using 51 attributes, he is able to sort 88 liliate families into 4 major clusters, two of which correspond to traditional groupings. The other two clusters differ from any recognized groupings but each shows a strong internal homogeneity in containing either mainly wind-pollinated or mainly insect-pollinated families. While the distinction between monocot and dicot families would seem, to some, to be one of the few really clear-cut divisions in the angiosperms, H. Huber in a later paper indicates that this apparent difference is to some extent illusionary and that the primary separation of plant families based on cotyledon number masks a whole range of other features which unites mono and dicots. Indeed the monocots are so intimately related to ranalean dicots that the author argues for placing them together in a single super order.

The only chapter in the book dealing with a specific phytochemical character is that of R. Hegnauer who presents a masterly account of cyanogenic compounds as systematic markers in plants. However, the distri-