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Contents

On Toadstool Soup and Legal Species of Marihuana

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We should have a great many fewer disputes in the world if words were taken for what they are, the signs of our ideas only, and not for things themselves. John Locke—Essay on Human Understanding. III. 10 (1690).

A provocative botanical debate is in progress in North America. In brief, botanists have become embroiled and polarized in an explosion of court challenges to legislation governing the proscriptions against marihuana and other cannabis drugs (hashish, hashish oil). The basis of the challenge rests with (1) the almost universal use of the name Cannabis sativa in legislation dealing with cannabis drugs; and (2) the claims that there are other species of Cannabis, that these are not proscribed, that they can furnish marihuana, that one cannot distinguish from which species marihuana comes since the diagnostic characters are not available in crumbled plant material, and that accordingly the laws proscribing cannabis drugs are simply not enforceable. This legal maneuver is nearly half a century old, but only acquired credibility in 1971 when reputable botanists were found who were willing to testify that there were three "species" of the marihuana plant (Fig. 1)

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It is not my intention to debate here either the legal or scientific aspects of this dispute (note Small 1974, 1975b, 1975c, 1976). However, the issue represents a pioneering exploration of how society may legitimately use "scientific names" denoting taxonomic groups. Misunderstandings concerning biological nomenclature have developed, and these can be exploited to invalidate legislation governing living creatures and biological materials in general. Using the debate over Cannabis as an example, this note attempts to point out that a fundamental distinction must be drawn between correct scientific usage of botanical terminology, including Latin nomenclature of organisms, and popular usage of such terminology. Failure to appreciate this distinction can result in the devastation of considerable legislation. At a time when scientists are becoming increasingly conscious of their social responsibilities, I believe this is an appropriate forum to raise this issue.

Since 1753 when Linnaeus proposed one species of Cannabis, C. sativa, many additional names have been created at the specific and varietal ranks. Among these, interest has fixed on two species names: C. indica, coined in 1785 by the French biologist Lamarck, and C. ruderalis, designated in 1924 by a Russian botanist, Janischevsky (Fig. 2). The distinctions which Lamarck and Janischevsky attempted to delineate in proposing additional species of Cannabis are very important but, I believe, have been misunderstood.

Lamarck was apparently only vaguely aware that the distinction he was drawing in Cannabis reflected the fact that this genus, through domestication, has been subjected to intensive disruptive selection, which has produced two kinds of plant. On the one hand, plants have been domesticated for the valuable phloem fibres in the bast. To maximize quality and obtainability of these fibres, man has selected plants which are tall, relatively unbranched, with long internodes, and with a relatively hollow stem (Fig. :3). Lamarck termed such plants C. sativa. Such domesticated plants have been characteristicly grown in Europe, northern Asia, and North America. "Wild" plants of such northern areas of the world (Fig. 4) tend to be somewhat similar, either because they have escaped back to wild existence from cultivated fibre strains, or because they have been influenced by hybridization with such domesticated strains.

In contrast, man has also selected cannabis plants for the ability to produce an inebriant. Cannabis synthesizes a resin in epidermal glands which are abundant on the leaves and flowering parts of the plant (Fig. 3). This resin comprises a class of terpenoid chemicals called the cannabinoids. Two are of particular importance: the non-intoxicant cannabidiol (CBD) and the highly intoxicant L 9-tetrahydrocannabinol (THC), shown in Fig. 6. Pre-dominance of CBD characterizes the resin of fibre strains, and also strains selected for the valuable oil content of the fruits (achenes). Predominance of THC characterizes "narcotic" strains of Cannabis. Drug strains do not exhibit features related to harvesting the fibre. They are often fairly short, possess short internodes, are highly branched, and have comparatively woody stems (Fig. 3). It

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was this type of plant that Lamarck named C. indica. Such plants are characteristic of southern Asia and Africa where Cannabis has been used for millenia as a source of the drug. "Wild" plants of such relatively southern areas of the world tend to be similar, either because they have escaped back to wild existence from drug strains, or because they have been influenced by hybridization with such domesticated strains.
seeds which germinate comparatively slowly and irregularly, have comparatively well developed abscission zones, and have attenuated bases capable of easily launching the achenes away from the plant. The latter features are obviously related to the needs for dispersal of wild plants. Additionally, the fruits of the wild plants are covered with a papery material which produces a mottled or marbled appearance, which Janischevsky interpreted as camou-

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Within the generally northern low-intoxicant kind of plant, and within the generally southern high-intoxicant kind of plant, highly domesticated and relatively "wild" plants can be distinguished by features of the achenes (Fig. 7). The distinctions are very similar to those characterizing many plant species with coexistent wild and domesticated components.

The differences between northern, low-intoxicant wild and domesticated plants were first clearly described by Janischevsky (1924). Wild fruits are smaller, have flage against herbivores. This papery material, which represents perianth, is usually present to a limited extent in cultivars, but generally sloughs off. Janischevsky named the wild plants C. ruderalis (or alternatively C. sativa var. ruderalis), contrasting them with fibre cultivars, to which he restricted the name C. sativa. The famous Russian student of economic plants, Vavilov, recognized that parallel variation to that described by Janischevsky could be found between wild and domesticated plants of the southern, drug phase of Cannabis (Vavilov and Bukinich 1929; cf. Small 1975a).

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The overwhelming consensus of botanical opinion has been to include all variants of Cannabis within the single species C. sativa (Schultes 1970; Emboden 1972). My research has convinced me of the wisdom of this. I have found that different populations of Cannabis are fully interfertile (Small 1972), that the chemical groupings one can recognize overlap (Small and Beckstead 1973a, 1973b; Small, Beckstead and Chan 1975), that there are no sharply defined groupings based on morphological study of herbarium specimens (Small 1975a) or of plants cultivated under standard environmental conditions, scored for dozens of attributes, and analyzed with the techniques of numerical taxonomy (Small, Lefkovitch and Jui 1975). Dr. Arthur Cronquist and I will propose in a forthcoming publication that Cannabis be recognized as comprising one species, consisting of two subspecies (the northern low-intoxicant phase and the southern high-intoxicant phase), each composed of two varieties (wild plants and domesticated plants) (cf. Fig. 8).

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Recently some botanists have advocated the rein-statement of the three "species" of Cannabis (Schultes et al. 1974, Emboden 1974). The present dispute concerning whether and how the traditional, .accepted taxonomic disposition of Cannabis ought to be altered should be viewed with the same dispassion afforded similar taxonomic disagreements. As I shall point out, the question of recent scientific opinion on how many species of Cannabis should be recognized serves only to obscure and is only marginally germane to the critical legal issues at hand. Rather, valid resolution of the problem rests simply with clarification of usage of the names in question by society. Before addressing the forensic aspects of usage of "scientific names", it will be instructive to examine two famous exemplary cases in which botanical terminology was critically examined.

In 1887 a merchant launched an attempt to escape duties on tomatoes imported into New York from the West Indies. The tax had been collected under a tariff act which levied duties on vegetables. His argument that tomatoes were exempt since they really were fruits was carried to the Supreme Court of the United States in 1893. The Supreme Court ruled as follows (Nix v. Hedden, 13 S.Ct. 881, 882, 149 U.S. 304, 37 L.Ed. 745): "Botanically speaking, tomatoes are the fruit of a vine, just as are cucumbers, squashes, beans and peas. But in the common language of the people, whether sellers or consumers of provisions, all these are vegetables, which are grown in kitchen gardens, and which whether eaten cooked or raw, are, like potatoes, carrots, parsnips, turnips, beets, cauliflower, cabbage, celery and lettuce, usually served at dinner in, with, or after the soup, fish or meats which constitute the principal part of the repast, and not, like fruits generally, as dessert.

"The attempt to class tomatoes as fruit is not unlike a recent attempt to class beans as seeds, of which Mr. Justice Bradly, speaking for this court, said: `We do not see why they should be classified as seeds, any more than walnuts should be so classified. Both are seeds in the language of botany or natural history, but not in commerce nor in common parlance' " (Robertson v. Salomon, 1889, 9. S.Ct. 559, 130 U.S. 412, 32 L.Ed. 995).

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The next case involves a dispute not over a technical term, but a "common name". The issue achieved considerable notoriety in England (The Financial Times,

Fri. May 8, 1959, City Edition, no. 21, 771, p. 14). In Britain in 1959 the right of four large corporations to utilize the name "mushroom" for a soup which they manufactured was challenged. It was pointed out that the companies were using Boletus edulis in their soup, and it was claimed that most British citizens would refer to the Agaric as a "toadstool", not a mushroom. Accordingly the soup really was "toadstool soup". The companies imported Boletus edulis because soup made from this fungus, when dried, is much tastier than that made from dried material of the common mushroom (a species of Agaricus) being produced by British mushroom growers. Fortunately for the four companies involved, the aid of E. J. H. Corner (author of "Life of Plants" (1964) etc.) was obtained. In a delightful personal letter, Dr. Corner kindly furnished the following description of the outcome of the case:

"The defense succeeded in its claim that mushroom, like champignon, was a general name of Agarics (not necessarily Agaricus), e.g. Parasol Mushroom (Lepiota), St. George's mushroom (Tricholoma), and that Boletus was covered by this sense. [Moreover, British] Customs required dried Boletus to be described as 'dried mush-room'.

"The case ended thus (after a whole day's hearing):

"Counsel for Prosecution (graduate of Oxford University): 'Mr Corner, as a lecturer at Cambridge, you will take a learned view of these problems, but I want to ask you a simple question. What do you suppose an undergraduate, a really raw undergraduate, would expect when he buys a packet of mushroom soup?

"Mr. Corner (slowly and thoughtfully): 'That is a very difficult question to answer.' (The court is hushed. Eight magistrates on the bench stare at me and look at their watches to see if they will catch their trains.)

"Prosecuting Counsel (eagerly thinking he has won): 'Then Mr. Corner, can you help me in the decision?'

"Mr. Corner: 'Well, you see we never get any raw or really raw undergraduates at Cambridge.'

"I have never seen so many persons burst into the laughter of relief. The bench was convulsed. In a minute the case was dismissed."

The two examples presented have dealt with a technical term and a common name, and were resolved simply on the basis of accepted societal usage. The dispute over the comprehensiveness of the name C. sativa is one which concerns a "scientific name". Is there anything fundamentally different in this? There is not, but because of misunderstanding of the nature of biological names there has been rampant bewilderment, over the issue. The con-fusion is due to unfamiliarity with (1) the complexities of the variation patterns of living things; (2) the appreciably subjective and arbitrary nature of taxonomic delimitation; and (3) the conventions of biological nomenclature, particularly the type method and its capacity for producing equivocal names. Only those trained in taxonomy are familiar enough with the frailties of biological names, and the misleading character of the phrase "scientific name", that they can easily appreciate certain difficulties.

The examination of biotaxy from the point of view of numerical taxonomy has indicated that there are two "Achilles' heels" which dictate a degree of arbitrariness to any circumscription of a taxonomic group. These are concerned with the aspects of taxonomy which fall under the headings of measurements of similarity and clustering procedures. Both areas have been detailed by Johnson (1970) and by Sneath and Sokal (1973), and others. I shall not belabour these subjective aspects of taxonomic delimitation, since I believe that in the practical world discontinuities in the variation pattern are sufficiently evident that we are usually able to recognize taxonomic groups worth recognizing. In the words of Gertrude Stein, a "Rose is a rose is a rose is a rose".

Much more pertinent for our purpose are the semantic limitations which characterize scientific names. Is the scientific name Rosa inherently more precise than the common name "rose"? Or to be more apropos, is the scientific name C. sativa innately more specific than the vernacular term "marihuana"? The answer which I shall defend is that while scientific names often are very much more definitive than common names and vernacular terms, the substantial possibilities for ambiguity latent in scientific names dictate that for purposes of secular law, as with vernacular and scientific terms and common names, they must be interpreted in terms of accepted popular usage, with common sense and regard for context, and not exclusively by the standards of a minority or even a majority of botanists. The rationale for this modus operandi was enunciated by Shakespeare: "That which we call a rose By any other name would smell as sweet".

The type method at the heart of biological nomenclature is enigmatic and recondite to laymen, who are quite unfamiliar with a system which sacrifices conceptual stability for name stability. The type method is of course designed to stabilize the use of names by providing permanent reference points for the names, while allowing the concepts which the names govern to be altered according to the understanding of individual botanists. Accordingly names can be conceptually ambiguous. Although preposterous exercises are possible within the rules of biological nomenclature (note for example Dennis' (1962) witty for-

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mal recognition of golfballs as the genus Golfballia), it is assumed that a botanist would not capriciously utilize or change any of the three determinants of a taxon (circumscription, rank, and position) without good evidence. But like beauty, a "good" taxonomic group is in the eyes of the beholder, and hence to an appreciable degree usage of scientific names is subjective--chacun a son gout. It is shattering for those unfamiliar with nomenclature to learn that frequently taxonomists with drastically different conceptions (i.e. circumscriptions) of groupings are forced by the Code of Botanical Nomenclature to use exactly the same name. (This of course occurs when the circumscriptions overlap at least to the extent that the earliest applicable type for both is the same.) It is also disillusioning for laymen to be informed that taxonomists often differ on whether taxa should be assigned to different species or different varieties of the same species. What Janischevsky named C. ruderalis (and also simultaneously C. sativa var. ruderalis!) many botanists have called C. sativa var. spontanea. What Lamarck named C. indica many botanists have called C. sativa var. indica.

Unfortunately the revelation that there are lumpers and splitters, and that differences of opinion exist regarding circumscription, often generates disrespect for taxonomy. This is unwarranted, since whether a scientific name is used in a comprehensive sense (sensu lato) or in a narrow sense (sensu stricto), or in different comprehensive senses, or different narrow senses, is of little importance, provided that it does not hinder communication. It is my conclusion that the attempt to label certain variants of Cannabis as different species is unjustified, since the variants differ primarily in artificially selected attributes, are completely interfertile, appear to be substantially panmictic, and are not consistently distinguishable by the use of a heritable combination of environmentally stable morphological characteristics. Should other taxonomists reject these criteria for recognizing species of higher plants, or should they disagree with my assessment, they are free to circumscribe, rank and position variants of Cannabis in whatever manner they wish. As long as botanists and society understand how scientific names are being employed, no harm is done by the existence of alternative schemes of classification.

Unfortunately considerable mischief can result from the present forensic debate concerning Cannabis. Given the common lack of appreciation of the public for the subtle but profoundly important distinctions between "concepts", "groups", and "categories", and the ways these relate to "species" (see chapter 18, Blackwelder 1967) it is a simple matter for lawyers to deceive laymen by arguing that a given variant is a different species from one liable to controls, without explaining that one hās simply chosen to label as a different species a variant which is clearly covered by the legislation. As scientists we recognize that some terminological choices are superior to others, and that the collective wisdom of recent, philosophically moderate, competent specialists generally provides the best available guide to good scientific usage. But science is much more than semantics, and as citizens we must be clear when society turns to us for guidance on interpreting names and terms, that its need for clarification of a mundane problem in semantics is not confused with a question of scientific fact.

Regrettably, the present debate has fractured an ominous Pandora's Box. The issue has received so much publicity that the precedent is now widely known and will inevitably be emulated with other materials subjected to legislation. One such area, for example, concerns the opium poppy. Is an "opium poppy" only Papaver somniferum, or is it also one of the other "species" of Papaver, notably P. setigerum, which possess opium alkaloids? Will botanists now be employed in an attempt to circumvent the spirit of the laws proscribing herion and related addictive drugs, as has been the case for Cannabis? Or may scientists choose to offer their expertise only when they personally subscribe to the invalidation or preservation of particular statutes? What about the host of additional materials and living things, both plant and animal, which have been subjected to legislation? Are we on the verge of an outbreak of challenges to legislation which will make it much more difficult for society to proscribe, regulate, and protect living things and their products?

I believe that in coming years the botanical fraternity will increasingly become involved in interpretation of legislation controlling biological materials. Legislators would well be advised to seek out expert botanical opinion whenever laws are enacted governing living things or their products. Botanists in turn must be prepared to accept this weighty responsibility, and should be willing to view the appropriateness of terminology not merely from the chauvinistic confines of their particular discipline, but with common sense, impartiality, and the needs of society paramount in importance.

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BOTANICAL XEROGRAPHY

James W. Cox
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Quite by chance while doing a summer session course for elementary teachers, I tried our Xerox machine as a way to copy plant materials. Teachers had traditionally done this sort of thing with leaves in elementary schools using spatter paint outlines, blueprint outlines, wax paper lamination, etc.

I was surprised, almost shocked, by the quality of the plant images that resulted from the Xerox process, the more material I tried the more impressive the results. I have included a sample of such Xerox prints of plant specimens from our area, both Rocky Mountain natives and introduced ornamentals, that show best the detail and three dimensional capabilities of the method.

Since that time last summer the use of this local discovery has spread on campus. One graduate student is using the method to illustrate his dissertation having to do with varieties of lovegrass. The lecturer in the course Cultural Botany has produced a folder of Xerox prints of local flora for students as an inexpensive textbook. An added virtue of the method is that excellent, overhead transparencies can be made of the same plants on the same copying machines for projection by lecturers.

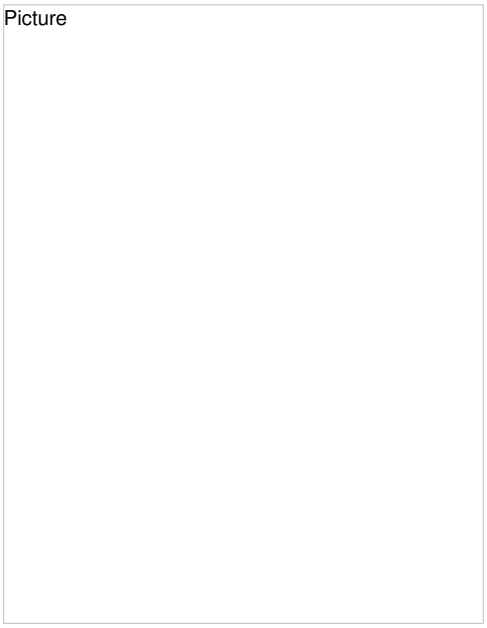
While, no doubt, this use of the copying machine is being discovered by teachers and researchers independently all over the country, it seems important to disseminate the idea among the vast majority who may still not have tried it.

During the past year of experimenting with the method, we have developed a few trial and error insights we might mention. First is that all copying machines are not equally satisfactory for copying plant materials. Details of leaf floral parts require halftone reproduction which gives the illusion of a three dimensional object. The Xerox 4000, the Xerox 3100, the IBM Copier Two are the best.

Furthermore, additional copies of the original print are not nearly so good as copies of the biological material itself. If one wants multiple copies it is better to make them immediately while the plant is on the machine.

These machines, well suited for halftone reproduction, are the same ones that can produce excellent acetate projectuals. For this purpose perhaps the Xerox 3100 is the best.

Lastly, and astonishingly enough, the new Xerox 6500 now being introduced will do these same prints and transparencies in color!



Arberia, A Proposal for a New Journal of Structural Botany

Rudolf Schmid* and Dennis Wm. Stevenson**

Nearly all the botanical journals issued today are characterized by a similarity of emphasis, the focus usually being "mere records of observations and experiments" or descriptions of new taxa. There are few "journals of ideas". This is not to say, of course, that ideas are lacking in the journals of today, but simply that interpretative aspects of plant form and structure are all too frequently made secondary to descriptive emphasis. Taxonomists have their TAXON, and TAXON today perhaps comes closest to being a lively, stimulating botanical journal, one out of the mainstream of observational records. TAXON, however, still is the vehicle of taxonomists and systematists. What is needed is a journal of structural botany (one free of the necessay nomenclatural embroilment of TAXON), which makes ideas and concepts primary to experiments and descriptional data.

Structual botany has had a number of attempts at this type of journal. Prominent serials appearing entirely in English that must be mentioned are ANNALS OF BOTANY, THE BOTANICAL GAZETTE, THE NEW PHYTOLOGIST, and of course, PHYTOMORPHOLOGY.

All these excellent journals, however, have deviated considerably from their original general, synthetic nature and goals and have become increasingly reductionistic. Two of these journals no longer even publish book reviews. In all these journals the written word has succumbed more and more to photographic documentation.

Although this reductionistic tendency is perhaps indicative of the times, it was also evident in the 1920s and 1930s. Arthur George Tansley, who is quoted above, founded and edited for 30 years (1902-1931) THE NEW PHYTOLOGIST and repeatedly therein stressed the need for a "journal of ideas" (New Phytol.

1:1-3, 221-222, 7:207-208, 30:301-302; see also 31:1), almost as frequently lamenting the difficulty of achieving this goal. Nevertheless, THE NEW PHYTOLOGIST for the first 25 or so years of its existence largely attained, under the editorial help of Tansley, the goal of being a "journal of ideas".

We believe that today there is just as valid a need for such a journal, perhaps more so in view of the overall reductionistic trend of science. The need is particularly critical in structural botany (anatomy, morphology, paleobotany, and systematics) since so much of its emphasis today is evolutionary and even philosophical. There are two alternatives open: either a revitalization of PHYTOMORPHOLOGY, with new goals, so that in con-tent is appears more like its first issues, or else a new journal of structural botany. We prefer the latter course for a variety of reasons. The purpose of this note is to solicit reaction to various proposals and, hopefully, to obtain some quantitative expression (in the form of written opinions) from the botanical community so that if such is forthcoming, as we hope and expect, a society and publisher will assume financial and editoral responsibility of a new journal of structural botany.

The paragraphs above repeatedly contain the phrase "journal of structural botany". While this would be an appropriate enough title, it is too prosaic. We would like to suggest ARBERIA as the title of such a new journal. This would serve two purposes. Foremost, it pays tribute to Agnes Arber (nee Robertson) (1879-1960), who has been called "the most distinguished as well as the most erudite contemporary British plant morphologist" (Tansley, 1951, New Phytol. 50:400-403, p. 400); it also honors Edward Alexander Newell Arber (1870-1918), Agnes Arber's husband and a paleobotanist of considerable renown. Secondly, the journal title is brief and in the tradition of one-word periodical titles so dear to the heart of Elmer Drew Merrill (see Merrill, 1931, "One-name periodicals", Brittonnia 1:1-5). Perhaps the best title of this proposed new journal would be ARBERIA: A JOURNAL OF STRUCTURAL BOTANY.

We anticipate several editorial guidelines for ARBERIA in order to make it a true "journal of ideas". Emphasis would be given to anatomy, morphology, and paleobotany since systematics today is well covered not only by TAXON but also by the forthcoming SYSTEMATIC BOTANY. Contributions dealing with both vascular and non-vascular plants would be welcome. ARBERIA could (should!) contain general articles, "critical reviews of current literature" and "of rapidly developing subjects", notes and comments, brief "stimulating suggestions arising as incidentals in re-search", notices and essay reviews of recent books as well as classical ones, as well as lively correspondence among botanists. Emphasis would be on verbal communication, partly to attempt a revival of the lost art of writing.

Figures would be permissible, but extensive photographic documentation would be discouraged, if not prohibited. Summary diagrams, if not extensive, would be more appropriate (in part to attempt a revival of the lost art of drawing!). Strictly taxonomic articles describing new taxa below the rank of family, or anatomical/morphological papers involved mainly with "mere records of observations and experiments" would be expressly banished to other publications. The purpose of ARBERIA would be to afford "easy communication and discussion" on all subjects of structural botany. The goal would be to make ARBERIA, if not "a `cockpit' of botanical controversy", at least lively and different from the "ordinary type of botanical journal."

We have quoted Tansley in the above proposal since the goals he stated for THE NEW PHYTOLOGIST more than 40 and 70 years ago seem equally valid today. Both of us have examined the first 40 or so volumes of THE NEW PHYTOLOGIST and have been impressed by the stimulating, provocative, timely, and significant nature of the articles, notes, and reviews which appeared in its pages. Suggestions and commentary (including ones dealing with practical aspects as editoriship, frequency of issue, cost, sponsorship, etc.) are now invited from concerned structural botanists in the hope that a journal such as ARBERIA might be a reality in a few years.

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BOTANICAL POTPOURRI

THE DOCENTS' FUND OF THE UNIVERSITY OF CALIFORNIA BOTANICAL GARDEN (BERKELEY) has been established to support various programs at the garden including acquisition of seeds or living material from the field. Areas of particular interest are the Mediterranean region, temperate Chile and Argentina, the Andean uplands, New Zealand, southwestern and southeastern Australia (including Tasmania), montane Papuasia, montane eastern Africa, Taiwan, Japan, the Himalayas, and certain portions of the People's Republic of China. Botanists who plan to travel to these areas, who wish to supplement their field expenses, and are willing to collect desiderata for the Botanical Garden, are eligible for modest subsidies from this fund. Applications should include a curriculum vitae of the applicant, the planned itinerary, a statement of anticipated costs not met by other funding. Applicants should also arrange to have a letter of recommendation sent separately; in the case of graduate students, the letter should come from the research advisor. Grants will generally be less than $500. Applications and supporting letter should be sent to: Robert Ornduff, Director, University of California Botanical Garden, Berkeley, California 94720.

THE NEW YORK BOTANICAL GARDEN is pleased to announce that beginning with the January-March issue 1976, BRITTONIA will again become a publication of the Garden, having served as the journal of the American Society of Plant Taxonomists for 18 years. Continuing with much the same format, it will include publications of

the staff of the New York Botanical Garden and outside contributors. Papers will be concerned with systematic botany in a broad sense, including such fields as chemotaxonomy, numerical taxonomy, morphology, anatomy, cytology, palynology, ecology, geography, and paleobotany insofar as they have a systematic bent. All groups of plants will be treated.

Manuscripts are being considered now for the first issue under NYBG editorship. Potential contributors should request instructions from the Editor, John T. Mickel. Papers are to be of short to medium length as in the past. Publication costs of $30 per printed page will be charged. One goal is for relatively rapid publication, 4-6 months after final acceptance.

You are invited to subscribe to BRITTONIA at a special individual rate of $10 per year; institutional subscriptions are $25.

THE 1975 GREENMAN AWARD was presented to James E. Rodman, Yale University, for the publication "Systematics and Evolution of the Genus Cakile (Cruciferae)" which appeared in Contributions from the Gray Herbarium 205: 3-146. 1974.

The Award of $250 is presented each year by the Alumni Association of the Missouri Botanical Garden. It recognizes the best paper in plant systematics based on a doctoral dissertation published during the previous year. Papers published in 1975 are now being considered for the 1976 Award. Reprints of such papers should be sent to Peter H. Raven, Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, Missouri 631.10 U.S.A., before 1 May 1976.

WORLD METEOROLOGICAL ORGANIZATION (WMO) Issues New Catalog of Publications: Over 200 publications on meteorology, air pollution, water resources, agriculture, marine and aviation sciences, climatology and weather modification are described in the fully an-notated catalog of publications just issued by WMO.

The 119-page catalog lists publications of World Weather Watch (WWW) and Global Atmospheric Re-search Programme (GARP), technical monographs, manuals and guides, and atlases. Publications are listed by subject and indexed by title and series.

The catalog of publications is available free on request from Unipub, the exclusive United States distributor of WMO publications.

Send requests to: UNIPUB, Box 433 - Murray Hill Station, New York, NY 10016.

PERSONALIA

Dr. Olga Lakela was recently awarded an honorary Doctor of Science degree by the University of South Florida. Emeritus Professor of Botany, University of Minnesota, Duluth, she is the author of A Flora of Northeast-ern Minnesota, Co-author of A Flora of Tropical Florida, as well as author of numerous scientific papers on the taxonomy of flowering plants. After serving for fourteen years as Research Associate in the Herbarium of the University of South Florida, she has retired to Phoenix, Arizona where she now resides.

Dr. Frederick Essig has been appointed Director of the University Botanical Garden and Assistant professor of biology, University of South Florida. Dr. Essig,

Dr. Preston Leig has been appointed Director of the University Botanical Garden and Assistant professor of biology, University of South Florida. Dr. Leig, presently of Cornell University, will join the faculty in September, 1975.

James L. Luteyn has recently joined the staff at The New York Botanical Garden as Associate Curator. Dr. Luteyn received his Ph.D. degree from the Department of Botany, Duke University, where his research involved a taxonomic revision of the Mexican-Central American species of the genus Cavendishia (Vacciniaceae). His interests and future research will involve the taxonomy and phylogenetic systematics of the neotropical Vacciniaceae-Ericaceae.

On June 15, 1975 the University of Montana awarded the degree, Doctor of Science, Honoris causa, to Dr. C. Leo Hitchcock, Professor Emeritus of Botany at the University of Washington. Dr. Hitchcock was cited as a peerless teacher of botany to young students, foresters and interested adults as well as a definitive researcher and authority of plants of Montana and the Pacific Northwest.

He directed and was principal author of the monumental Vascular Plants of the Pacific Northwest and the Flora of the Pacific Northwest. He began this important work while a faculty member at the University of Montana from 1932-37.

PROFESSIONAL OPPORTUNITIES

DEPARTMENT OF BOTANY, UNIVERSITY OF IOWA, Iowa City, is initiating a search for a full time faculty member in plant ecology. Some preference will be given to candidates with special interests in Physiological Ecology or the genetical aspects of population analysis, but anyone trained or with teaching and research experience in basic plant ecology is welcome to apply.

Materials required for a completed application:

1. Curriculum vita including resume of current research interests and teaching experience.
2. Transcripts of college and graduate school records.
3. List of persons qualified and willing to write letters of recommendation, if asked to do so.
4. Reprints of published research and any other data you feel would help.

Send application papers before Jan. 1, 1976 to: R. L. Hulbary, Chm., Department of Botany, University of Iowa, Iowa City, IA 52242.

CONSULTANT IN CULTURE OF HORTICULTURAL CROPS with major emphasis on greenhouse and nursery container production of ornamental plants. Ph.D. preferred. Academic background in plant physiology, phytopathology, soils, entomology and economics include areas of particular interest. Work includes field inspection, sampling, consultation followed by written report. Resumes to Soil & Plant Laboratory, Inc., P. O. Box 11744, Santa Ana, CA 92711. Positions available in Southern California and Oregon.

DIAGNOSTIC PLANT PATHOLOGIST, commercial laboratory working primarily with ornamental horticulture. Applicant must have good mycology background and plant disease clinic type experience. Opportunity to extend activities including research. Inquire: Soil & Plant Laboratory, Inc., P. O. Box 11744, Santa Ana, CA 92711.

Arturo Erhardo Burkart
1906-1975

On Friday, April 25, 1975, Arturo Erhardo Burkart, one of Argentina's outstanding botanists passed away after a short, sudden illness. Just three months earlier, he had received the Bernardo A. Houssay prize from the Organization of American States (OAS) in recognition of his pioneering work in the biology and breeding of alfalfa as well as his careful work on the taxonomy of the Leguminosae and studies of the flora and vegetation of Argentina.

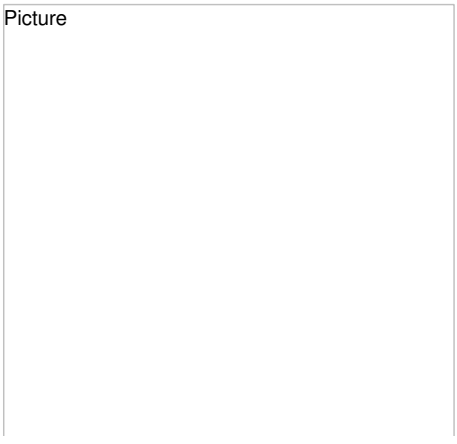
Professor Burkart was born in Buenos Aires on September 25, 1906. In 1925 he enrolled in the School of Agriculture at the University of Buenos Aires where he studied under Professor Lorenzo Parodi. After he received his degree of Ingeniero Agronomo, he studied in Germany with Erwin Bauer at the Plant Breeding Institute of Muncheberg and with Curt Stern at the Kaiser Wilhem Institute of Biology in Berlin. Upon his return he published the first work on Drosophila genetics that appeared in the South American literature. From 1930 to 1936 he was a collaborator of Professor Parodi in Botany and Professor S. Horovitz in Genetics. In 1939 he was appointed Professor of Forage Crops at the University of La Plata and, in 1957, Professor of Vascular Plants at the University of Buenos Aires.

Since 1936 he was director of the Darwinion Institution, a botanical center supported by the National Academy of Exact, Physical and Natural Sciences and the National Council of Scientific and Technical Research. Under Burkart's directorship, the herbarium and its library became one of the most important in Latin America. In addition, he edited for almost 40 years Darwiniana, the botanical publication of the Darwinion Institution.

Twice President of the Argentine Botanical Society, Professor Burkart was also a corresponding member of the Botanical Society of America (since 1972), the Chilean Academy of Natural Sciences, the Ecuadorian Institute of Natural Sciences and the Peruvian Botanical Society.

Versatile in his scientific endeavours, he published more than 170 articles dealing with aspects of general botany, genetics and agriculture. His book, Las Leguminosas Argentinas (1943, 1952), the result of many years of painstaking studies in this family, is widely used both in Argentina and abroad. One of his last research projects completed just before his death was a complete revision of Prosopis, a difficult genus which he began studying in 1937. At the time of his death he was actively engaged in the preparation and publication of the Flora of Entre Rios, two volumes of which have already appeared.

Professor Burkart was a generous scientist and loved to teach, advise and stimulate young botanists either visiting the Darwinion or at the University of Buenos Aires where he taught for 45 years. Throughout the Argentine political upheavals which often involved the universities during the last three decades Professor Bur-kart provided an example to his students, collaborators and fellow biologists. Endowed with a strong personality, he was kind, honest, brave and idealistic but he always argued openly for what he believed was right for Argentina or its institutions. Whenever his colleagues were in difficult situations, he did not hesitate to give them needed support. He gained the respect of Argentine scholars because he was a gentleman, a rigorous scientist,



a man of integrity and altruistic objectives. His death is a significant loss to the Argentine scientific community.

Professor Burkart is survived by his wife Nelida Troncoso, also a distinguished taxonomist and his great collaborator in the development of the Darwinion, his daughter Silvia, a plant physiologist, and his sons Rodolfo, a plant ecologist and Arturo, a chemist.

Juan H. Runziker
Departamento de Ciencias Biologicas

Facultad de Ciencias Exactas y Nqturales
Buenos Aires, Sue. 28. Argentina

Roger E. Wilson
1936-1975

Roger E. Wilson, Associate Professor of Botany, Miami University, died in a tragic automobile collision on April 26, 1975. He has served on the Miami faculty since 1968. His undergraduate study was completed at Ohio Northern University (B.S. Ed., 1960), after which he taught in the Berea Ohio District. During this service he was nominated as one of Ohio's outstanding biology teachers. Graduate study was completed at the University of South Dakota (M.A., 1965) and Oklahoma University (Ph.D., 1968). Dr. Wilson's memberships included the Ecological Society of America, the Botanical Society of

America, the Ohio Academy of Sciences, the Southern Appalachian Botany Club, the International Association for Ecology, and Sigma Xi. For the Botanical Society he served as a member of the Conservation Committee and the Charter Flight Committee for the Leningrad Congress.

Broadly trained in ecology, his chief interest was in allelopathy and its role in plant succession. This interest was emphasized in his research and that of his students on succession in abandoned fields. He, with his students, contributed journal articles on these studies, and he had reviewed progress in this work as a participant in symposia at national and international meetings.

Dr. Wilson fulfilled an integral role in the undergraduate and graduate programs in the Department of Botany. Noted as an interesting and stimulating lecturer, he was an effective, popular teacher who was frequently sought as a speaker or resource person. He was one of the founders of the Institute of Environmental Sciences at Miami University and contributed importantly to its program. He served as Chairman of the President's Environmental Quality Task Force and later as Chairman of the President's Environmental Committee. These services, among others, attest to the high respect which was held for his judgment and ecological expertise throughout the University.

Charles Heimsch Miami University

Books Received by PSB for Review

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BOOK REVIEWS

STREET, H. E. (editor). Plant Tissue and Cell Culture. University of California Press, Berkeley. 1975. $19.75.

The advances in plant tissue culture have been many in the years that have passed since P. R. White and R. Gautheret wrote their respective compendia more than two decades ago. Among the many new methodologies are protoplast cultures, transgenosis (gene transfer), protoplast fusion, monoploid cultures derived from microspores or from gametophytes, single-cell cloning, the widespread use of high-salt media, newly discovered hormones, and so on. Much of this new material is presented in Plant Cell and Tissue Culture, edited by H. E. Street of Leicester University, whose work with nutritional and developmental aspects of cultured plants' cells is well-known. Street has contributed several chapters to the book; other contributors were P. A. Aitcheson, D. N. Butcher, E. C. Cocking, P. K. Evans, P. S. Ingram, P. J. King, J. Reinert, N. Sunderland and M. M. Yeoman. Although their work generally is also well-known, I feel the book would have benefited from a short biography and perhaps a photo of each contributor. The chapter headings are as follows: introduction, laboratory organization, (tissue callus) cultures, — techniques, cell (suspension) cultures — techniques, the isolation of protoplasts, general cytology of cultured cells, nuclear cytology single-cell clones, pollen and anther culture, growth patterns in tissue (callus) cultures, growth patterns in cell cultures, aspects of organization — organogenesis and embryogenesis; the origins, characteristics and culture of plant tumour cells; growth of plant parasites in tissue culture, old problems and new prospectives. Therefore, we see that with the possible exception of embryo and ovule culture, the field of plant cell, tissue and organ culture is adequately covered.

Books composed of a collection of chapters authored by various experts in the specialties of a burgeoning area of research are becoming quite commonplace. This particular one is a long step from P. R. White's first book on plant tissue culture, and I suppose it proves how far we have come in that it now requires a number of writers to cover the field once the bailiwick of one man. The shepherding of several authors by an acknowledged expert to produce a synthesis of this kind has advantages. Certainly, we receive the benefit of the combined wisdom of specialists. At the same time, such a book often tends to be disjointed. Street has done an admirable job of putting together a number of highly individualized offerings and the resulting book is a useful one. That it too suffers from discontinuities and a certain patchiness of style is perhaps to be expected, and is not particularly objectionable.

A nice historical introduction is presented by Street and covers many of the highlights of plant tissue culture serving to place the modern work in perspective. In the following chapter, on laboratory organization, the approach gets a bit heavy handed with floor plans, fancy glassware, and elaborate devices attended by practitioners in surgical dress. This needlessly complicates matters and obscures the point that much useful and important tissue culture work is done in an ordinary laboratory with fairly unsophisticated equipment. The late Carl LaRue used to say that the beauty of plant tissue culture was that it could be done almost anywhere with a very modest outlay.

Once past the imposing array of laboratory equipment, we are into the actual culturing of plant tissues. This part generally is well-written and interesting and presents a variety of well known and reliable methods and media. (However, a drawback of the book in my estimation is the omission of a list of vendors.) Tissue culturists of course have their favorite techniques and no doubt some have been left out that should have been included, but a beginning tissue culturist will find just about everything needed to get well underway. However, this is not simply a recipe book, and chapters on cytology and development of cell and tissue cultures deal with many of the theoretical aspects of the science.

Taken as a whole, I recommend the book to those who are hoping to learn tissue culture, as well as to those who are already doing tissue culture.

Knut Norstog Northern Illinois University

NOBEL, PARK S. Introduction to Biophysical Plant Physiology. W. H. Freeman and Co., San Francisco. 1974. 488 pp. $13.50.

Botanists in practically all disciplines will find this to be a fascinating, yet demanding treatment of biological applications of physical chemistry and to be of great interest and value in their own field. The applicable knowledge of botany, physics and chemistry are brought together in a very readable form by Dr. Nobel to provide a basic understanding of physiological processes in plants. The eight chapters develop the bio-physical-chemical principles that control the physiological processes in plants. The chapter subjects are cell, water, solutes, light, photosynthesis bio-energetics, leaves and plants. In the last two chapters he brings together the physiological role and energetics of water, CO2 and solar energy in the physiological processes of leaves and whole stands of plants.

The book is well illustrated and referenced. For in-stance, the chapter on cells contains an extensive discussion on function with illustrations of various plant cells, their location in the plant and their structure. The body of the text contains many references for those wishing to go into greater detail. Also, there is a set of problems at the end of each chapter. These help to demonstrate the usefulness of the biophysical models in different disciplines of botany ranging from the level of the whole plant through cellular to organelle and from algae to trees. (P. S. the answers are given in the back of the book.)

The appendices are an important part of this book and most useful not only in conjunction with the text but in their own right. In addition to the usual sections on abbreviations, constants and variables, there are sections on calculus, Gibbs free energy and chemical potential, and some comments on irreversible thermodynamics. These last three sections are most helpful to anyone who needs some reassurance or review in these areas.

Dr. Nobel has produced a well written, easy to read and use text and reference book. I would recommend it as a text for advanced undergraduate and graduate courses in plant physiology as well as a reference hook for all botanists whose work is in or even touches on any aspect of physiology.

Henry Hellmers Duke University

GOOD, RONALD. The Geography of Flowering Plants, 4th edition. Longman. London, 1974. 557 pp. $27.00

Ronald Good's plant geography book (first published in 1947) is a classic but, unlike many other classics, it has been brought up to date on three occasions (1953, 1964 and, now, 1974). Throughout it has remained the standard reference book for all kinds of flowering-plant botanists by reason of its extensive lists of

taxa with various patterns of distribution, its excellent appendices and a superb range of indexes (Plant Names; Persons and Places; Subjects). There are 951 references in the Bibliography of the 4th edition, 27 well-chosen plates and 86 other illustrations (most but not all maps) tastefully and appropriately chosen. Professor Good has an easy-toread writing style which converts this reference book into interesting literature.

Consequently, it is easy and truthful for me to write, as my reviewer's opinion, that this book should be purchased by all libraries and by every botanist who is concerned in any way with the evolution and dispersal of flowering plants. Nevertheless, a review should be critical and I must point out some less than optimal features of the book, most of which result from its updating rather than rewriting (after all, more than a quarter of a century has gone by since it first appeared). Maintaining the bulk of the text and making additions (particularly at the ends of chapters) no doubt kept down the cost of the newest edition (and we should be grateful for that), but it some-times leads to informational disparities. Too frequently one encounters statements such as that on page 357 (in a discussion of methods of studying geological history and its relationship to past distributions of plants), "Most recently of all an entirely new method has been applied ... — and this turns out to be '4C dating! A sentence on page 355 that includes the phrase "opinion today" (on the causes of ice ages) refers simply to publications by Zeuner in 1945 and 1950. In the consideration of "The Factors of Distribution" outdated simplicity rears its head in such statements as "There are now generally recognized to be `short-day plants', `long-day plants' and `day-neutral plants', the first including essentially those of the tropics and the second those of temperate lands."

Professor Good was an early supporter of theories of Continental Drift and took account particularly of the writings of Wegener and Du Toit. However, with the flood of papers that has burst forth in the past decade on Plate Tectonics, Sea-floor Spreading, and the like, it is rather unfortunate that for this topic the end-of-chapter addition is brief in proportion to the textual material surviving from previous editions.

All of us hope to become Emeritus Professors, and we may dream of our retirement as the opportunity for freedom to read and write with no conflicting demands upon our time, but we often forget that the retired professor usually lacks some of the facilities and assistance that "active" faculty take for granted. In these circumstances, Professor Good, who retired in 1959, has kept up remarkably well with the books that have been published since 1964. Understandably, he seems to this reviewer to have been less successful in reviewing the mass of journal articles that has appeared in this decade, particularly with regard to material that has a supportive function rather than being directly plant geographical. He would probably not claim to be a plant physiologist or a population geneticist, so the biological explanations that he gives for the phytogeographical facts are few and tend to be rather superficial. But it must be emphasized that the phytogeographical facts are there and those who are specialists in the more esoteric disciplines have much to draw upon in `The Geography of Flowering Plants'.

Some chapters in this book have scarcely been touched in revision because little alteration was called for. Whereas the world picture has changed considerably in recent years, understanding of the plant geography of the British Isles has changed less and the picture for Professor Good's favorite English county, Dorset, has scarcely changed at all. Incidentally, this feature of the book — its illustration of the differences of approach necessary in moving from world scale to regional scale and even county scale studies — remians one of its very valuable instructional aspects.

I would be remiss if I did not acknowledge that in reading this "Fourth Edition" in order to be able to write this review, I found many items that have spurred me into further thought about my own research. I believe that this will be the common experience of readers and it means that a botanist's outlay of twenty seven dollars plus sales tax (but keeping in mind an income tax deduction) is well worth while. I am most grateful to the Editor of the Plant Science Bulletin for saving me the expense which, otherwise, I should have undertaken cheerfully.

Herbert G. Baker University of California, Berkeley

TRALAU, HANS, Editor-in-chief. Index Holmensis - A world Index of Phytogeographic Maps. Volume I. Equisetales, Isoetales, Lycopodiales, Psilotales, Filicales, Gymnospermae. pp. 1-264. 1969. SFr 115. Volume II. Monocolyledoneae, A-I, pp. 1-224. 1972. SFr 125. Volume III. Monocotyledoneae, J-Z. pp. 1-224. 1973. SFr 125. (all in cloth) The Scientific Publishers Ltd., Zurich.

The first three volumes of this ambitious and much needed index have been published and have been found very useful by all workers in the field of plant geography who have access to it.

The first three volumes is organized by orders, the species in each being listed alphabetically. Each species is accompanied by precise bibliographical references to map-containing publications listed by dates. The area covered by each map is placed in parentheses at the end of each citation. The text appears in two columns per page.

The second and third volumes cover the Monocotyledoneae without being separated into smaller groups. The text is in smaller, but readable, type, and is organized into three columns per page. Volume I has as a frontpiece a photograph of the famous Swedish phytogeographer, Professor Eric Hulten, to whom the Index is dedicated. Volume II has a portrait of Joachin Frederik Schouw, and Volume III, that of Heinrich K. H. Hoffmann.

The number of maps already published illustrating distribution of plants is astounding, although there are many species with only a few, and numerous with none.

Dr. Hans Tralau is to be congratulated for initiating this Index, and his international board of editors are due our gratitude for their assitance in making this valuable tool available. It is hoped that they will be given the sup-port necessary to prepare the volumes for the Dicotyledoneae, and continue the publication of Addenda as new material appears. The Index Holmensis is a necessity for all workers who use plant distribution in their teaching or research.

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KARTASHOVA, N. N, Stroenie i funktsiya nektarnikov tsvetka dvudol'nykh rastenii. Izdatel'stvo Tomskogo Universiteta, Tomsk. 1965. 194 pp., plus 8 unnumbered pages figures.

The nectary (both extra-floral and floral or nuptial) and its secretion products have long been favorite subjects of study. Since the lengthy and classic treatments of Bonnier and Behrens in 1878 and 1879, respectively, there has been no full length account of the structure and function of nectaries. Short summaries (the old one by Sperlich in the 1939 Handbuch der Pflanzenanatomie, Bd. 4, or the recent one by Abraham Fahn in his Plant anatomy, 1967, 1974) or long papers on specific aspects of nectaries (Erich Daumann on monocotyledonous nectaries in the 1970 Feddes Repert., or Eva Frei on vasculature in the 1955 Ber. Schweiz. Bot. Ges.) have, of course, appeared.

It is thus of considerable interest and importance to anatomists and morphologists that there does indeed exist a book of 194 pages (plus plates) which treats in extenso the structure and function of nectaries: Structure and function of nectaries of dicotyledonous flowering plants by N. N. Kartashova of Tomsk State University, U.S.S.R. Unfortunately, this book exists only in Russian and, worse yet, in a very limited printing with restricted circulation. Consequently, although this exceptionally useful tome has been available since 1965, it is virtually unknown outside the Soviet Union (Daumann is the only non-Soviet author I have seen citing the work).

The book contains six chapters: brief ones on history, morphology and topography, and evolution of nectaries; lengthy chapters on anatomy, the relationship between nectar secretion and developmental stage of the flower, and the morphological nature and classification of nectaries. Many of the data seem to represent previously unpublished work. Nectaries of various species of Rosaceae, Leguminosae, Labiatae, Scrophulariaceae, Onagraceae, Boraginaceae, and Campanulaceae are treated in detail.

The 12-page bibliography of 226 Russian and 182 non-Russian entries is invaluable in bringing together the apparently extensive and largely unknown Russian literature on the subject. There are 104 good quality diagrams and several pages of generally forgettable photographs. The former contain considerable usable in-formation on histology and vasculature of the entire flower. Twelve tables summarize data ranging from sugar concentration of nectar to nature of xylic and/or phloic vasculature of nectaries. The latter table (Kartashova's Table 10) deals with 206 species (mostly temperate) in 58 families of dicotyledons and is a valuable supplement to the well-known findings of Frei (cited above) on nectary vasculature in 158 species in 37 dicotyledonous families. Only 30 families and 34 species are common to the studies of these workers, who, happily, disagree on the mode of nectary vasculature of only two species. Both workers are in

54 species are common to the studies of these workers, who, happily, disagree on the mode of nectary vasculature of only two species. Both workers are in agreement that nectary vasculature is predominantly phloic in nature.

The book, being vintage 1965, has a decided classical or perhaps old-fashioned air to it. There is no electron microscopy, a currently active area of research by Fahn, Nele Findlay, F. V. Mercer, Eberhard Schnepf, and others. The book is anatomical/morphological rather than physiological/ecological/coevolutionary in scope. The lack of concern with pollinators and other animals is particularly regrettable. Nectar is discussed as consisting of various sugars — an oversimplification in view of the ex-citing recent work of Herbert and Irene Baker on amino acid and other non-sugar components of nectar.

Monocotyledons are excluded by titular fiat, so for nectaries of these recourse will have to be made to Daumann's recent monograph mentioned above. Finally, Kartashova's work perpetuates the old north temperate bias since most of the examples she discusses are from this region.

Nevertheless, the book is invaluable in providing basic anatomical and morphological data for nectaries, data which must form the basis for subsequent more sophisticated studies. Tentative arrangements have been made for a translation of this useful work, and it is hoped that in two or three years the botanical community will be served a translation of a classic work in its field.

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DAY, PETER R. Genetics of host-parasite interaction. W. H. Freeman and Co., San Francisco. 1974. 238 pp. $8.50.

In these times of concern about feeding an overpopulated world and reducing the levels of pesticides in the environment, the appearance of a book which may aid in understanding some of the complexities of both problems is welcome. This is an exhaustive survey of the recent literature (nearly 600 references) on variation in parasites and breeding for resistance in crop plants. It deals with the genetics of parasites, their plant hosts, and their interactions. General principles are illustrated with examples taken mainly from fungal parasites, but also in-sects, nematodes, bacteria, and viruses where information is available. Professor Day has provided in seven short chapters a speculative discussion of our current knowledge which will help to stimulate entomologists, plant pathologists, and plant breeders to develop and use their under-standing of genetics to control plant pathogens and pests.

The concept that all biological phenomena are under genetic control is introduced in Chapter 1 along with some initial definitions to set the stage for the book. Subsequent chapters deal with the genetics of resistance, the genetics of pathogenicity, the gene-for-gene concept, and gene function in the host-parasite interaction. These are followed by chapters on pest control and the genetics of epidemics. Throughout the book a good knowledge of basic genetics is necessary for a complete understanding on the part of the reader. However, each major group of parasites treated is carefully introduced so that no other special knowledge is required. The photographs and electron micrographs are well chosen and generally of high quality. One wonders if additional figures would not have been helpful and easily justified even if the price were slightly higher.

This inexpensive and well bound book is intended for advanced students and researchers in genetics, plant breeding, plant pathology, entomology, epidemiology, and ecology. A copy is recommended for the library of anyone who is interested in one or more of these areas while a complete understanding of the information contained therein is essential to those who would develop intelligent methods of crop and plant protection.

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SHOSTECK, ROBERT. Flowers and Plants: an Inter-

national Lexicon with Biographical Notes. Quad-

rangle/ The New York Times Book Co., N.Y. xx +

329 pp. illust. 1974. $9.95.

This book is a dictionary of 1,150 plants, mostly from the United States and Canada, arranged in alphabetical

order by common or vernacular name. It includes plants that occur in the wild, are cultivated as desirable productions or thrive as weeds, and a few that are utilized as house plants. A book, "Words for Birds" by Edward S. Gruson, inspired Robert Shosteck to publish "on my love, botany".

In the introduction the author provides a brief history of the origin of plant names, tracing their beginnings not only from the customary European sources, but also from American Indian and other languages, Greek and Roman mythology, names of notable personalities, natural history, and geography. He also discusses the influence of the Doctrine of Signatures on the origin of plant names and provides a lucid explanation of botanical nomenclature.

Most of the book, 298 pages, is allotted to "Flowers and Plants" — from abelia to zinnia. For each plant, Shosteck provides the common and scientific name, followed by the origins of the generic name and the specific and, if required, the varietal epithet. For those honoring a person, e.g., Claytonia, thunbergii, the author gives a thumb nail sketch, usually including birth and death dates, important positions held, and, in some cases, other interesting facts about the person. In a like manner, he shows the origin of common names. For many plants he provides interesting information on their use as a food or medicine, their toxic qualities, religious aspects, and their impact on folklore. He also provides nearly 400 well executed illustrations to assist the reader in plant identification. The volume includes a foreward by James L. Crowe, U. S. Botanic Garden, a glossary, a bibliography, and an index.

My criticisms are few. For the sake of precision, the author of the scientific name could have been included. I wish Shosteck would have followed Eiten's treatment of the genus Oxalis and the nomenclature of recent manuals for our American wild pansy which is considered specifically or varietally distinct from the European form and honors Rafinesque. His spelling of Penstemon does not follow that of Mitchell, the author of the genus. Although he cited the toxic qualities of many species, he omitted this for the castor bean, one to three of which can be fatal to a child and eight usually fatal to an adult. There were few errors in proofreading or spelling: violent for violet (p. 159) and lillifolia for lilifolia (p. 273, 319).

Robert Shosteck's style makes reading easy. He shows that scientific names are not just dull "handles" but have fascinating origins and are indeed meaningful. He clarifies the meaning of obscure common names. Because his book contains a significant amount of botanical, etymological, and biographical information, it should he of interest to botanists, even those who are not systematists, and to those in applied botanical pursuits, the amateurs, and students. This book has a definite place in public libraries and should appeal to high school students interested in the biological sciences.

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LIBBERT, EIKB: Lehrbuch der Pflanzenphysiologie. Jena: VEB Gustav Fischer 1973, 472 p., 341 fig.

This textbook follows the tried classical division in physiology of metabolism, growth, development and movement. But this is more than a usual textbook of plant physiology. It will satisfy both younger and older students, and even teachers will find valuable information, which sometimes goes very deep into the field of scientific hypothesis. Bike Libbert not only gives facts, but reasons, background, and sometimes critical comments. Moreover, she gives her engaged opinion about biological-philosophical aspects. The excellent short introduction in phylogenesis of metabolism and orga no-chemical evolution is motivating to a young student. The sub-division into large and small printing will help in quickly finding the essential knowledge, the basic facts. The small printed chapters give more details about the certain subjects. Worthy of mention also are the extraordinary exact phrases. Even chapters with abstract contents, e.g. thermodynamics, oxidoreductive processes with their electrodynamic background, are easy to understand, though Like Libbert sometimes goes deeply into these fields. Overall this textbook permits the student to form critical opinions about established scientific facts. The only critical remarks about this book are the following: In the chapter about structure and function of protoplasm and cell structure one misses the usual electronmicroscopic pictures, which cannot be replaced by explanations and drawings. The subject matter of molecular genetics and biochemical regulations, though vividly described, are superfluous. There are many

explanations and drawings. The subject matter of molecular genetics and biochemical regulations, though vividly described, are superfluous. There are many excellent textbooks about these topics and Eike Libbert should only call student's attention to those books. Overall this might be the best plant physiology text written in German, which covers all important fields about plant, physiology in such an extraordinary manner. It was a pleasure to read. One might hope that Bike Libbert's plant physiology will be translated in English, so that more students and teachers can read this excellent work.

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