The Great Zoological Gallery of the British Museum, with royal portraits, Easter Monday 1845. [Reprinted from the *Illustrated London News*, 11 October 1845, in *A Century of Zoology at the British Museum*]

pal contribution to the Museum. The overall roles of the two men are not, of course, as clear-cut as this. Gray made significant contributions through his own scientific researches and Gunther furthered the development of zoology at the British Museum through his curatorial procedures. Among other things Gunther established the principle that as a national museum the British Museum was the proper repository for natural history collections gathered at national expense. Both men were important figures in 19th-century British zoology.

This book was not written as a formal or full history of the zoological activity at the British Museum. Its purpose, to present that history as related to the lives of the two keepers, is adequately fulfilled, but the reader will find many questions posed by the account and will wish the book had gone further in answering some of them. For example, Richard Owen, the leading mid-19th-century zoologist in Great Britain and the superintendent of the natural history departments of the British Museum, is discussed in his relations with Gray and with Gunther, but the effects on the Museum's collecting policies and procedures of differences or similarities in the ideas of the three men are not explored in any depth. Many questions concerning the influence of the scientific community on Gray and Gunther and of the British Museum on scientific activity in general occur, but most are left unanswered. Both men disavowed evolution, but it is not at all clear just what effect this had on the Museum.

The fact that such questions occur to the reader may be one of the best aspects of this book. The book brings an important aspect of 19th-century science to the fore and should encourage deeper inquiry into the many questions it leaves unanswered.

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Neuroendocrinology

Neurosecretion. The Final Neuroendocrine Pathway. Proceedings of a symposium, London, 1973. FRANCIS KNOWLES and LUTZ VOLLRATH, Eds. Springer-Verlag, New York, 1974. xii, 348 pp., illus. $48.40.

In this book, the initial chapter by Sir Francis Knowles paints in warm colors the history of the study of neurosecretion. The chapter was written as an introduction, but will remain as an epitaph for the man who was called the ambassador of neurosecretion, since Knowles died while the book was in press.

The book is the proceedings of the sixth in a series of international meetings on neurosecretion that began in 1953. An unusual feature is the presence of not one but three summary chapters, each reviewing and synthesizing an aspect of the meeting. Another feature is selection of only some of the papers that were delivered at the meeting for full publication, with the remaining represented by abstracts. The section headings indicate the orientation of the editors. One section is called Peptidergic Neurosecretion, and this is subdivided into two parts, one on classical neurosecretion and one on hypophysiotropic neurosecretion. There is an additional separate section headed Aminergic Mechanisms in Neuroendocrine Control. Many of the chapters are so short that their value is limited, but some contain information of appreciable significance. For example, Cross's chapter is an excellent summary of data on the electrical properties of vasopressin- and oxytocin-secreting neurons. The chapter by Björklund and associates, which is a good review of the anatomy of the dopaminergic neurons in the hypothalamus, points out that the posterior lobe as well as the median eminence has a dopaminergic innervation and that there are appreciable numbers of dopaminergic neurons in the hypothalamus in addition to the tuberoinfundibular system. Overall, the coverage of the field is broad, and the book is of value in providing references and some synopses of active areas in neuroendocrine research.

A reviewer would be remiss, however, if he did not challenge the title the editors have chosen for the book. The term "neurosecretion" was coined over 40 years ago, when it was discovered that certain neurons had the morphological characteristics of endocrine as well as neural cells. Since that time, considerable effort has been expended at each symposium on neurosecretion to update the term so that it remains consonant with new discoveries in the burgeoning neurosciences. The definition finally espoused by the editors of this book has three components. They view neurosecretory neurons as peptidergic neurons that secrete their product into the bloodstream and serve as the final link by which the nervous system regulates the endocrine system. However, there is reason to believe that peptidergic neurons end on other neurons as well as blood vessels in various parts of the nervous system. Furthermore, the neuronal products entering the circulation are not all peptides. Most of the circulating norepinephrine comes from sympathetic nerve endings, rather than from the adrenal medulla, and there is considerable evidence that the hypothalamic prolactin-inhibiting hormone is dopamine secreted into the hypophyseal portal vessels by the tuberoinfundibular neurons. The final neuroendocrine pathway is peptidergic in some instances, but in others it is clearly aminergic or cholinergic. Examples include the adrenergic innervation of the renal juxtaglomerular cells, the adrenergic innervation of the pineal gland, and the adrenergic and cholinergic innervations of

the α- and β-cells of the pancreatic islets. Finally, recent data at least raise the possibility that certain "neurosecretory" neurons concerned with the control of anterior pituitary secretion are bipolar, with one process secreting a hypothalamic hormone into the hypophyseal portal vessels and another process presumably secreting the same hormone in the anterior hypothalamus as a synaptic transmitter. Given these facts, one wonders about the continued utility of the term "neurosecretion." Our debt to the concept is great, but perhaps it is now time to move on to other, less ambiguous terms which better describe the operation of the nervous system as we understand it today.

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Anatomy and Habitat

Ecological Strategies of Xylem Evolution. SHERWIN CARLQUIST. University of California Press, Berkeley, 1975. xii, 260 pp. + plates. $12.50.

Carlquist's book is the result of ideas he has developed after many years of observation. As a comparative plant anatomist with an extensive collection of wood samples from all over the world, Carlquist clearly recognizes the influence of specific environmental conditions upon xylem structure. It is quite unusual that a plant anatomist is concerned with the physiology (in this case mainly the water balance) and the habitat of the species with which he is dealing.

The study of the relationship between plant structure and function is not new, having been a widely recognized line of research at least since the first edition of Haberlandt's *Physiological Plant Anatomy* in 1884. Carlquist's book goes one important step further. It explains the structure of a particular plant tissue by reference to its environment as well as its function. The complex tissue xylem is analyzed through the main groups of vascular plants. The results, whenever possible, are related to the specific environmental conditions. Example: Desert and chaparral shrubs have much shorter and narrower vessel elements than dicotyledons in general. This feature has an adaptive advantage because these narrower vessel elements withstand collapsing better than wider ones (xylem tensions in the creosote bush approach −80 bars).

In order to make his point the author frequently uses frankly teleological terminology, but it is apparent that it is used only as a means for pregnant expression.

The book is not easy to read. There are no concessions to the biologist who is not familiar with xylem anatomy. A wealth of information, much of which has come from Carlquist's own research, is accumulated. Xylem features of the principal groups of vascular plants are treated in separate chapters, and structural patterns and their phylogenetic implications are thoroughly discussed. The stelar theory, specialization in dicotyledon wood, and sieve elements are other topics considered. Abundant information is gained from the examination of tropical trees of the Southern Hemisphere. This is an important contribution because the present understanding of xylem structure has been based largely on anatomical data accumulated from the deciduous trees and conifers of the temperate zone of the Northern Hemisphere.

Some randomly chosen topics may serve as examples of the points brought forward in the book: The success of the angiosperms compared to the other groups of vascular plants is explained by the structural efficiency of the flowering plant's conductive system; gymnosperms are not really limited in geographical range but more in diversity of habitat. They have not radiated into the xeric environment. The lack of vessel elements has restricted them to the mesic environment. The fact that the length of their reproductive cycle prevents the evolution of annuals imposes another restraint on the gymnosperms; the evolutionary transition from the scalariform thickening to the more advanced simple perforation plate in the dicotyledonous vessel element is polyphyletic; the dimensions of vessel elements have to be evaluated in terms of environmental conditions. On this last point it becomes clear that much more ecological information is needed. The anatomical data accumulated in the literature rarely include information regarding the ecological situation of the sample species. The author himself complains that he is forced "to couple relatively precise anatomical details with vague ecological observations." Even an apparently uniform tropical rain forest shows enough microclimatic variation to account for distinct species distributions and the exposure of individual trees to different environmental conditions.

The author makes it clear that he does not have answers to all the questions he raises. Neither does he expect all his conclusions, which are often speculative, to be accepted without criticism. The book is full of stimulating and unorthodox ideas; future research on the phylogeny of vascular plants has to take them into account.

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Plant Reproduction

Pollen. Biology, Biochemistry, Management. R. G. STANLEY and H. F. LINSKENS. Springer-Verlag, New York, 1974. x, 308 pp., illus. $24.60.

Pollen is a most unusual biological material. Essential for the reproduction of both angiosperms and gymnosperms, it has long fascinated botanists and plant breeders. The many ways in which pollen has been studied are reflected in this important new book by Stanley and Linskens, both of whom have made significant contributions to our understanding of the subject.

The book covers three major aspects of work with pollen. The first section, which is entitled Biology, gives a very good review of the development of pollen, including the origin and development of the sperm cells. Included in this section is a chapter on wall formation, which is still one of the less known aspects of pollen development. The wall of the pollen grain is one of the most intensely examined and studied cell walls in existence, and yet there remain many problems concerning its formation and indeed its chemistry. This material is well reviewed by Stanley and Linskens. In this section they also deal with a miscellany of other subjects, including dehiscence, size range, quantity produced, and distribution.

These lead them quite naturally into the management of pollen. Pollen is commercially collected and used in agriculture and in breeding, but pollen collection and storage are rarely treated in books on pollen. Stanley and Linskens devote a section to this topic and include a wealth of interesting and important information. The chapter on the nutritive role of pollen, which deals with the role of bees in collecting it and the relevant physiology, is intriguing.

The third section of the book is on pollen biochemistry. Here the authors do an outstanding job. A chapter on the general chemistry of pollen is followed by individual ones on carbohydrates and cell walls, organic acids, amino acids and proteins, pollinosis, nucleic acids, enzymes and cofactors, pollen pigments, and growth regulators. Again, there is a wealth of in-