and that the structure of the genetic covariance matrix places real constraints on selection. They have convinced me. We certainly do not need simply to measure more genetic covariances. We do need to see what relation their plasticity has to phenotypic plasticity, what mechanisms lead to pleiotropy and place limits on the general structure of covariance matrices, and how covariance matrices change under the application of environmental stress. Genetics is certainly necessary and useful, but it is not sufficient, for evolutionary theory.

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Plant Metabolism

Cellular and Subcellular Localization in Plant Metabolism. Proceedings of a meeting, Ithaca, N.Y., Aug. 1981. LEROY L. CREASY and GEZA HRAZDINA, Eds. Plenum, New York, 1982. x, 278 pp., illus. $37.50. Recent Advances in Phytochemistry, vol. 16.

The eight papers in this book of symposium proceedings demonstrate that there have been substantial technical advances in the isolation of cell types and organelles from plant tissue, which has allowed parallel advances in knowledge of organelle function and interactions between cells at the biochemical level. Being the result of a symposium, the book covers selected topics in some depth rather than providing a general comprehensive view. For most subjects, the current state of knowledge is discussed and aspects needing further research are noted.

Chapters on vacuoles, peroxisomes, and chloroplasts describe functions of the organelles relative to metabolic processes in other parts of the cell. Other chapters, such as those on guard cells and C_4 leaf photosynthesis, deal with specific functions of cell types.

At the organelle level, scientists interested in vacuoles should find a paper by Wagner useful with respect to techniques of vacuole isolation, pitfalls in methodology for determining distribution of material between vacuole-extravacuolar space, and specific substances or enzymes found to be located in vacuoles from a variety of tissues. Examples are given with various plant tissues where material is found located in vacuoles or appearing exclusively in the cytoplasm. Some views are given on metabolite transport, but, considering that plant vacuoles were isolated in good yields seven years ago, there has been relatively little progress on this subject. Though it is not stressed by the author, it is the opinion of this reviewer that the low percentage of cytoplasmic space relative to vacuole space (1 percent or less in some tissue, for example in plants that utilize Crassulacean acid metabolism) makes it extremely difficult to determine whether a compound is exclusively located in the vacuole and what the relative concentrations are between the vacuole and extravacuolar space. Also, in transport studies it is not clear if all methods used in preparing vacuoles from protoplasts will result in preparations free of the plasma membrane (hence the need for specific plasma membrane and tonoplast markers).

In a paper on plant mitochondria, Siedow notes unique features of plant mitochondria, in particular the alternative (cyanide-insensitive) pathway. The review brings out an important subject for future research, since the identification of components of this pathway and its function in most instances remain uncertain.

The book contains a thorough review by Huang of higher plant, algal, and fungal peroxisomes. There appears to have been little new information on higher plant peroxisomes over the past few years, with the result that the paper treats peroxisomes from the lower plants at somewhat greater length. The author's emphasis on the need to understand transport of reductive power between peroxisomes and the cytoplasm, the permeability of peroxisomes to various metabolites, and the properties and functions of peroxisomes in C_4 and Crassulacean acid metabolism plants is well deserved.

A paper by Huber on chloroplasts reflects, in part, the progress in using different plant species to study photosynthetic carbon metabolism. Emphasis is placed on how factors outside the chloroplast, such as *p*H, P_i (inorganic phosphate), Mg^{2+}, and K^+, may regulate carbon metabolism in the chloroplast.

From studies of functions of various cell types made over the last decade, Outlaw analyzes carbon metabolism of guard cells, giving particular attention to evidence for malate fluctuations in guard cells and the associated metabolism. Campbell and Black review a progression of studies on carbon, nitrogen, and, most recently, sulfur metabolism in the two photosynthetic cell types of C_4 plants. In a review by Cutler and Conn of the biosynthesis of cyanogenic glycosides, a discussion of the use of "channeled enzyme complexes" to compartmentalize and confine intermediates of a pathway to a particular part of the cell is particularly interesting.

Though the book covers research developments in the last decade on selected aspects of subcellular metabolism, the reader will find some aspects (for example, peroxisomes and photosynthesis) more extensively developed and understood than others (for example, compartmentation of biosynthesis of natural products, the role of microtubules in cellulose biosynthesis, and the mechanism-function of the alternative pathway in plant mitochondria).

What is notably missing in the book is studies of specialized function of cells within the vascular tissue and their significance relative to intercellular transport. Perhaps this reflects a lag in development of techniques for isolating and studying these cells relative to development of those for studying other tissues.

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Antarctica

Antarctic Geoscience. Papers from a symposium, Madison, Wis., Aug. 1977. CAMPBELL CRADDOCK, JANET K. LOVELESS, TERRI L. VIERIMA, and KATHY A. CRAWFORD, Eds. University of Wisconsin Press, Madison, 1982. xxviii, 1174 pp., illus. $35. International Union of Geological Sciences Series B, no. 4.

Antarctic geology is fascinating not only in its own right but also for its key role in the study of Gondwanaland. Most readers of this volume, like the reviewer, will never have set foot in Antarctica and are unlikely to do so. But all students of the geology of other parts of Gondwanaland will find it a truly valuable source of information. It is a well-edited and arranged compilation of about 150 papers contributed by workers from 15 countries, and, although it has taken five years to bring the book out, the great majority of the contents does not appear in any way out of date. The geographical terms of reference are interpreted generously, and there is substantial coverage of the Scotia Arc and southern South America and oceanic islands as far north as Bouvet and Amsterdam as well as of Antarctica proper. All the major fields of geology and geophysics, including marine geology and geophysics and glaciology, are represented, as is the subject of meteorite hunting.