problems to which the reader is accustomed in his own field of specialization. We also encounter some other perennial views defended with vigor and enthusiasm, such as the embryonic versus the primitive nature of cartilage and the fresh-water origin of vertebrates. But no inordinate amount of space is devoted to these old favorites, and controversies of broader scope, possibly more subject to ultimate resolution, such as those that concern the evolution of Lower Paleozoic vertebrates, the origin and nature of vertebrate classes, and the origin and taxonomy of mammalian orders, make up the bulk of the book. Whether he agrees with them or not, Romer's treatment of all opinions that he considers significant is fair, temperate, and knowledgeable.

It should be noted that the period covered by *Notes and Comments* has been marked by a great deal of activity in vertebrate paleontology, with respect to both new discoveries and development of theory. Romer has contributed heavily to this progress and continues active in the field, and his commentary, coming just at this time, is valuable not only as a review of the state of the art but also as a signpost for the future.

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Plant Form

Growth and Organization in Plants. Structure, Development, Metabolism, Physiology. F. C. STEWARD. Addison-Wesley, Reading, Mass., 1968. xii + 564 pp., illus. $15. Addison-Wesley Series in Life Sciences.

This is an unusual book by an unusual man. While it could not possibly be recommended for use as a textbook, or even as a reference source for a balanced review of the entire area of plant growth and development, it should be consulted by all advanced workers in the field as a provocative synthesis of the ideas of one of our most versatile and literate plant physiologists. For those who have never heard Steward lecture on "Carrots and Coconuts" (can there be anyone, anywhere, who has not experienced these tours de force, punctuated by toy-pistol clicks to signal slide changes?), this monograph will communicate some of the color, dash, and style of his memorable oratory, and also of his often controversial concepts of plant function.

The book was first organized as a series of lectures given to college teachers of biology. Steward has obviously chosen to expound at greatest length on topics closest to his own researches; thus of the slightly more than 500 references in the bibliography, 87 bear his name as an author, and another 10 refer to work done by his students or colleagues. The result is a skewness in content and in the analysis of subjects to which Steward has contributed. For example, one certainly gets the impression (pp. 141–42) that Steward and Caplin, not van Overbeek, Conklin, and Blakeslee, first introduced coconut milk into plant tissue culture media. Nowhere is it mentioned that Letham has isolated zeatin riboside, a cytokinin, from coconut milk and that its presence probably accounts for some of the properties of coconut milk; rather, the impression is left that the unique growth promotion elicited by coconut milk is due entirely to amino acids, auxins, inositol, and other components isolated in Steward's laboratory. In all the discussion of cellular totipotency in tissue culture there is no mention of the classic paper of Muir, Hildebrandt, and Riker, who probably first showed unambiguously that single isolated plant cells can grow to tissue masses from which formed plant organs can later be made to differentiate. The natural occurrence of 1,3-diphenylurea in coconut milk is stated as a fact, though doubts as to this have been publicly expressed, there being a possibility that the substance was accidentally introduced into the batch being industrially concentrated. All this takes many pages, while topics like tropisms, endogenous rhythms, abscisic acid, ethylene, and phytochrome are barely mentioned, despite their much greater importance.

On the other side of the coin, Steward is at his best when discussing broad questions of organization and form. It is here that his encyclopedic grasp of growth and differentiation brings him to clear and exciting expositions, punctuated by frequent references to insufficiently quoted older literature. His distrust of the practice of applying to higher plants facile explanations based on simplistic views of genetic regulation in procaryotes leads him to rely on more complex mechanisms. This may be good medicine for students who were raised in an age characterized by relatively uncritical acceptance for all organisms of events so far found to occur only in *Escherichia coli* and its relatives.

Both because of its insights and its controversial views of many subjects, this mind-stretching book deserves to be read carefully and appreciatively by a large audience.

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Turbulent Flow

Physics of Negative Viscosity Phenomena. VICTOR P. STARR. McGraw-Hill, New York, 1968. xvi + 256 pp., illus. $9.95. Earth and Planetary Science Series.

The most controversial thing about this book is its title. The motion of the ocean and atmosphere is almost invariably turbulent, the structure of the flow being governed by the balance among the energy inputs, the effects of rotation and stratification, and the interactions between the eddies of the turbulence and the mean flow. It is an old idea to seek an analogy between the random eddying motions in the turbulence and the random motion of the molecules of a gas; the latter gives rise to molecular viscosity acting on a macroscopic motion, the former being conceived to produce an "eddy viscosity" that acts on mean, larger-scale flow. The work of Taylor, Townsend, Corrsin, and others showed 20 years ago that the analogy is in principle erroneous; the "eddy viscosity" is not in general a local parameter but, because of large-scale exchange processes, one that depends upon the whole field of flow and its time history. Despite this, the idea is often a useful one in calculating the properties of simple turbulent flows, and its use in dynamical meteorology and oceanography is widespread.

Molecular viscosity is, for thermodynamic reasons, essentially positive; it represents a diffusive process. In turbulence, on the other hand, particularly in stratified and rotating fluids such as the atmosphere and ocean, inertial effects can lead to concentrations of momentum such as exist in the Gulf Stream and the atmospheric jet stream. If wave motions are involved, momentum can be extracted from the mean flow at one point and released elsewhere, the transfer being essentially radiative. If we insist on making param-