

a comprehensive description of the morphological forms the finished virus particles assume in the cells. She also provides an extensive bibliography of previous research related to visualization of viruses within plant cells.

Of particular interest to the reviewer is Esau's demonstration that intact BYV particles can be seen traversing the pores through the cell walls of adjacent phloem cells, whereas there is no evidence that intact TMV passes through phloem pores or plasmodesmata linking other cell types. These findings reinforce the view that transmission of TMV from cell to cell may be via TMV RNA. Also of interest is the demonstration that intact TMV particles can be found within nuclei, chloroplasts, and the cytoplasm but not within mitochondria. The discovery of TMV particles within dividing cells, sometimes in close proximity to chromosomes, with the opportunity for virus particles to become distributed between two new cells as mitosis is completed, is a compelling demonstration of how TMV can continue to invade new cells arising in meristems. It would be of great interest to extend this type of analysis to pollen and egg cells to see if it could provide an explanation for the exclusion of TMV from cells which give rise to seeds that are largely free of virus. I do not believe that direct visualization of TMV within cells provides much insight into the actual sites and mechanisms of TMV RNA reproduction and TMV protein synthesis, but visualization has certainly provided definitive evidence as to what cells and organelles are invaded by plant viruses. The quality of the techniques used for electron microscopy and the clarity of the writing in this book could not be surpassed.

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Genetics

Modern Genetics. Vol. 3. J. A. SERRA. Academic Press, New York, 1968. xii + 793 pp., illus. \$27.50.

Is genetics now too big for adequate treatment by a single author under one title? This is the third volume of a three-volume treatise on the entire domain of modern genetics, to the neglect only of population genetics—"a completely revised and rewritten edition of a book first published in Portuguese about four-

teen years ago . . . successfully used as an advanced genetics text. . . . It would, of course, have been incomparably easier to write a more specialized or concise book, but it would be difficult to justify yet another short text on genetics . . ." (from the author's preface).

There is room in the 1634-page text of this treatise to treat far more than the simpler type-systems, and Serra does. In the final volume, one chapter each is devoted to extrachromosomal inheritance, variations in chromosome number, variations in chromosome structure, position effect and variation in genes, and sex determination.

Serra begins each chapter by establishing terminology in which to couch elaborate distinctions among categories of phenomena. He presents, in considerable detail, often undeservedly neglected examples. Prominent among these are: the distinctive behavior in germ line and soma of chromosomes in *Sciara*, gall midges, and coccids; the meiotic peculiarities associated with parthenogenesis and polyploidy in several insect orders, oligochaetes, and numerous other animals and plants; the role of heterochromatin in position-effect in *Drosophila* and in the mouse; and modes of sex determination when the array of possibilities includes hermaphrodites and intersexes. Most of the more commonly encountered examples are also presented under each heading. Serra concludes each chapter with interpretation that attempts to gather the pieces into a coherent whole. The interpretative framework, however, is itself an elaborate construction fragily based in evidence. For this reason, the work is better regarded as a monograph than as a text.

Much of Serra's terminology, although consistently and persistently applied, is not in common use and is difficult to master merely from context. The reader who desires enlightenment on any of the subjects in this third volume must refer to definitions in both previous volumes. Fortunately the cross-referencing is extensive.

One key term defined earlier is *treption*. As distinct from mutations, treptions are changes in specific segments of the genetic material (which Serra considers by no means restricted to DNA) that are regularly inducible by specific agents, adaptive in character, normally restricted to somatic tissues, physiologically programmed, but occasionally induced by experimental mimicry of the cellular regulatory mechanism. In magnitude, treptions range

from changes in chromosome number to changes in specific nucleotides. For the latter Serra adduces evidence best judged to be equivocal. Treptions provide "mass mutations" when such are appropriate to adaptive evolution. At least a third of the volume is devoted to distinguishing between instances and mechanisms of treption and mutation.

Other opinions with which the reader may take issue concern the nature of heterochromatin and the involvement of episomes, the organization of the chromosome, the genetic role of enzymes acting on DNA, or the existence of nongenetic DNA in eucaryotic chromosomes when the chromosomes are "condensed" but not when they are extended. There are also errors that escaped revision between the first writing and the time of publication. These seem inescapable in so compendious a work.

The book is difficult reading. Translation from the Portuguese produced an English that is not terse or clear or idiomatic. The publisher added nothing to its readability by printing large sections on a high-glare paper. The figures are not always clearly drawn or labeled.

Its chief merits lie in its huge bibliography, its collection of genetic phenomena still begging for explanation, and its inadvertent demonstration that we are not yet in a position to provide a coherent explanation for them. Unless and until such coherence is possible, genetics is too big for adequate treatment in a single work, except at the introductory level. Hence I recommend the book only to specialists able to discriminate the obsolete from the conjectural from the genuinely mysterious.

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History of Mathematics

A Source Book in Mathematics, 1200-1800. D. J. STRUIK, Ed. Harvard University Press, Cambridge, Mass., 1969. xviii + 430 pp., illus. \$11.95. Source Books in the History of the Sciences.

With the upsurge of interest in things mathematical in recent years the book market is teeming with new English translations of significant works of giant mathematicians, or at least of portions of such works. As a result it is becoming ever more possible to use the classical mathematical documents