lar interest is the seemingly bottomless reservoir of viruses in domestic ducks in China, in one of the most densely populated rural areas of the world. Much is made of the opportunities for interspecies transmission of viruses when people and animals live under the same roof or in close association.

No consensus is reached and no conclusions are drawn, but the evidence is strong that China may indeed present a unique opportunity for interspecies transfer, leading to new subtypes of influenza A viruses. That such viruses can be transferred from animals to humans has been demonstrated naturally on several occasions, most notably in 1976 in an outbreak of swine influenza in New Jersey. Closely related viruses in animals may also have originated in humans. It is not possible at this late date to prove that the pandemic viruses of 1918, 1957, and 1968 originated through interspecies transfer or the exchange of gene segments between animal and human influenza viruses. However, this workshop is one more step toward being prepared to better understand the origin of the next pandemic virus. The book is recommended for the serious student of influenza.

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Contractility

Muscle and Nonmuscle Motility. ALFRED STRACHER, Ed. Academic Press, New York, 1983. Vol. 1. xii, 374 pp., illus. $45. Vol. 2. xii, 213 pp., illus. $34.50. Molecular Biology.

Stracher's declared aim for this new multivolume series is that it provide an in-depth review of contractility, both by describing research that has been done since the 1973 edition of Bourne's *Structure and Function of Muscle* was published and by comparing muscle and nonmuscle systems. The first two volumes suggest that, though most of the contributing authors may reach the first and more modest goal, comparison of motile tissues will, for the most part, be left to readers.

Volume 1 begins where any such series should: with Huxley's review of the structural basis of contraction in vertebrate striated muscle. Magisterial as ever, Huxley makes only small changes in the chapter he wrote for Bourne's series, and a brief addendum on time-resolved x-ray diffraction studies of contracting muscles barely hints at the time and effort that have gone into these experiments since 1975. Although these x-ray studies have so far failed to reveal the detailed nature of the force-producing transitions in the myosin-actin complex, they have established that a number of structural changes predicted by the "swinging crossbridge" model do occur at a speed sufficient to account for the known dynamics of force production. The didactic and historical value of Huxley's chapter ensures that it will remain one to which new students of motility are sent for their introduction to muscle.

Regulation of muscle contraction is covered briefly by Ebashi, with provocative notes on several as yet poorly characterized proteins that apparently control motility in slime mold and in certain smooth muscles of vertebrates and ascidians.

The most substantial contribution comes from Martonosi, who reviews the multitude of biochemical studies on membrane calcium pumps. The sarcoplasmic reticulum in vertebrate skeletal and cardiac muscles, as well as the pumps in the plasma membranes and endoplasmic reticulums of some two dozen cell types are described. The broad scope of this comparative survey, with its bibliography containing over 1000 references, will make it an important resource for anyone interested in how diverse cell types regulate their cytoplasmic Ca^{2+} concentrations with a precision that allows the ion to act as a ubiquitous messenger. Since this chapter was written, there have been rapid advances in structural studies of the sarcoplasmic reticulum by electron microscopy and image analysis. Martonosi and his collaborators made a critical contribution to this development; the three-dimensional structure of the sarcoplasmic reticulum Ca^{2+} adenosine triphosphatase should soon be solved at low resolution and may suggest general principles of action for such calcium pumps.

Volume 2 covers structural aspects of several nonmuscle systems, including the dynein-tubulin complex responsible for ciliary and flagellar motion, the spectrin-actin-protein 4.1 cytoskeleton that endows the erythrocyte with its remarkable resilience, and the clathrin cage that encloses coated vesicles. In none of these cases is it yet clear how the protein interactions exert force, although Bell and Gibbons show that the analogies between the dynein-tubulin and myosin-actin systems now extend to adenosine triphosphatase kinetics and to the multiple head-tail structures of the two enzymes.

Gratzer's review of the red blood cell and its membrane-associated cytoskeleton stands out as the most literate and critical chapter in the book; it is marred only by frequent mispunctuation. Gratzer shows that normal red cell morphology depends on the integrity of the cytoskeleton (in turn accounted for by the structure and interactions of spectrin and actin—with the assistance of protein 4.1) and its association with the membrane through protein 2.1 (ankyrin) and possibly also by interactions with the integral membrane protein band 3. How cell fusion, vesiculation, and calcium-induced shape changes may be related to altered cytoskeletal structure or cytoskeleton-membrane interactions remains to be established.

Future volumes in the series will include reviews of platelet motility, as well as the assembly of cytoplasmic microtubules, actin, and intermediate filaments. If the standard of the first two volumes is maintained, the series will prove a worthwhile addition to the library of any research laboratory concerned with cell morphology or motility.

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The Neurobiology of Vision

Parallel Processing in the Visual System. The Classification of Retinal Ganglion Cells and Its Impact on the Neurobiology of Vision. JONATHAN STONE. Plenum, New York, 1983. xvi, 438 pp., illus. $55. Perspectives in Vision Research.

One of the most interesting and exciting subjects of research in the field of sensory physiology is parallel processing in the visual system. The discovery of X and Y cat retinal ganglion cells by John Robson and Christina Enroth-Cugell has led to hundreds of new insights into the visual mechanisms of many species. Particularly significant to humans as perceivers is that the seamless and unified experience of visual perception is an illusion, perhaps the central perceptual illusion. In humans, as in all vertebrates, the visual world is transformed by the retina into several different neural representations, which are connected to the brain separately, in parallel. Furthermore, the separation of these parallel channels of visual information continues

all the way to the cerebral cortex. How the effortless integration of the visual information carried in these parallel neural pathways is achieved is one of the major unsolved mysteries of the brain.

As interesting as parallel processing is, what primarily interests Jonathan Stone in the book under review is the proper methodology for classifying retinal ganglion cells. Actually, the subtitle of the book, "The Classification of Retinal Ganglion Cells and Its Impact on the Neurobiology of Vision," is a much more accurate description of the book's contents and the author's main concerns than is the book's title. The first part of the book is entitled The Classification of Retinal Ganglion Cells. The second part, On the Methodology of Classification, seems to me to be the part that is closest to the author's heart and is most carefully written. It contains quotations from Eccles, Popper, Foucault, Aristotle, Mill, Darwin, and Kuhn. Only after this excursion into philosophy does the author deal, in part 3, with the impact of ganglion cell classification.

Dealing with a subject about which there are many controversies, this book is very polemical. It is unusually lively reading. It is also extremely biased. In Stone's opinion, the path to truth requires a "hypothetico-deductive," "falsificationist," "parametric" methodology of classification of retinal ganglion cells. The sin of "essentialism" in Stone's opinion is to base one's classification on one property only. He advocates a multifactorial "parametric" approach based on several properties. Unfortunately, much of his argument is fuzzy, in particular what he means by a "property." Scientists who disagree with Stone's interpretations are dismissed as "essentialists." This name-calling is no substitute for an intellectual effort to explain the source of substantive differences, and it gives the book an ungenerous tone. Moreover, the author seems biased in favor of using evidence about the conduction velocity of nerve fibers as the basis for sorting cells into groups. He also seems unaware of the implications of experiments on spatial summation for understanding receptive field mechanisms. This has important substantive consequences. For instance, in his discussion of parallel visual processing in the monkey's visual system, he overvalues conduction velocity and ignores or misinterprets recent findings about spatial summation, contrast sensitivity, and receptive field properties. This leads him to support the hypothesis that parvocellular neurons in the monkey's lateral geniculate nucleus have a functional role similar to that of X-geniculate cells in the cat. This hypothesis is almost certainly incorrect.

In part 2 of the book, Stone quotes Popper as follows: "The history of philosophy is the history of its problems. If you want to explain Heraclitus, tell us first what his problem was" (p. 127). The same can be said of Jonathan Stone. If we want to understand why he wrote this book the way he did, first we have to find his problem. I believe it is W cells, the retinal ganglion cell class found and named by Stone and his colleague K. P. Hoffmann. In 1972, Stone and Hoffmann reported that the unusual and most highly specialized retinal ganglion cells of the cat—the "on-off," "suppressed-by-contrast," directionally selective, and "luminance units" varieties—all had axons with a low conduction velocity for nerve impulses. They called them all "W cells," even though the only physiological property they had in common was low conduction velocity. Ever since, Stone has been struggling to defend his idea that the "W cells" form a separate and distinct group, while he and others have continued to find that W cells are really of many different functional types. It is somewhat ironic that Stone has written this book attacking "essentialists" when his definition of W cells on the basis of a single property, conduction velocity, is a most egregious example of essentialism. However, it does explain the bias in favor of conduction velocity and against quantitative measurements of receptive field properties.

Fortunately, the author devotes quite a bit of the book to parallel processing. This part of the book contains many provocative ideas. There is an important and original critique of views that have been put forth concerning parallel and serial processing in the visual cortex. There is also a comprehensive review of research on the different topographic distributions of ganglion cell types in the retina. The monograph closes with relatively brief and weak discussions of visual psychophysics and parallel processing in other sensory pathways. The book is generally well written, though there are some potentially misleading errors—as when on p. 36 the author writes that spatial frequency was "reduced" when he means "increased." Anyone interested in neurobiology can learn valuable facts from this book, but it should be read critically to enable the reader to process the reliable evidence and the author's advocacy separately.

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