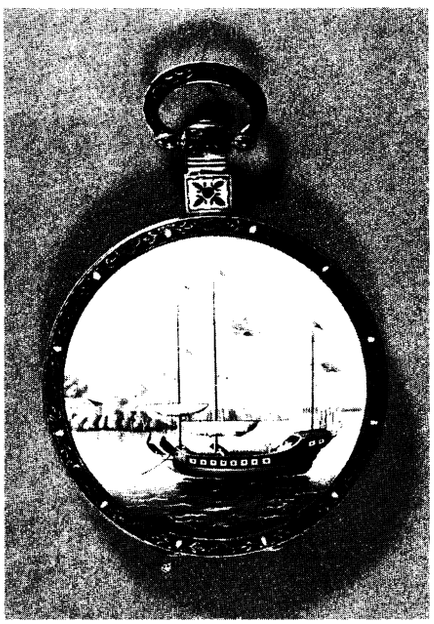

"An expensive Fleurier watch for the China trade, c. 1830. Signed 'Tevob,' which is Bovet spelled backward. The Bovets of Fleurier were the leading merchants in the export of Swiss watches to China in the second quarter of the century, drawing their stock from *établisseurs* who organized production in Fleurier and the surrounding area. Why they signed some of their pieces 'Tevob' is hard to say. These were not a second-quality line. The above has an elegant polychrome enamel painting of a Chinese water scene—this at a time when Chinese painters were busily decorating porcelain with analogous scenes of European life for export to the West. Such watches were usually fitted with jump center-second hands and highly engraved, eccentrically shaped bridges to suit what was perceived to be the Chinese taste." [From *Revolution in Time*; Collection of the Musée d'Art et d'Histoire, Geneva]

book has much in common with Landes's superb 1969 study of technical change and industrial development in Western Europe since 1750, *The Unbound Prometheus*. Although clocks and watches figured hardly at all in that study, here they are the most important technology of industrial civilization. Now it appears that "no other branch of production has done so much . . . to teach others the use of tools and machines and the advantages of division of labor" (p. 13). The cause of this dramatic shift in the author's assessment of the importance of timekeeping technology and manufacture is not clear, and one wonders why that question is not addressed more directly.

Revolution in Time returns at its conclusion to an Asian topic—the Japanese triumph in the recent and revolutionary technology of quartz watches, ending a centuries-long Western (especially Swiss) dominance of the market. The book closes abruptly, without returning to the themes of cultural influences on economic and technological history. This is puzzling, because Landes uses his cultural model to account at various times for the preeminence of French-speaking Swiss, of English, and of American competitors in the timekeeping industry. Even more puzzling is the fact that, unlike Cipolla's *Clocks and Culture*, this book takes no note of the Japanese adoption of clock technology in the early era of European manufacture of the mechanical clock, a time when the Chinese regarded it purely as a toy.

The cultural explanation of technological and economic change, though powerful and useful, is a crude and limited device. It is clearly helpful in understanding why China did not lead the world into the industrial era, but it is much less satisfying when used to explain differences in the economic performance of essentially similar cultures (such as those of 19th-century Britain, Switzerland, and the United States). Cipolla's more restrained and consistent use of this kind of cultural analysis may be sounder.

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Influenza Viruses

The Origin of Pandemic Influenza Viruses. W. G. LAVER, Ed. Elsevier, New York, 1983. xvi, 309 pp., illus. $59.50. From a workshop, Beijing, Nov. 1982.

Periodic antigenic shifts of influenza A viruses have resulted in worldwide epidemics or pandemics. The names of these viruses are household words: the swine flu of 1918, the Asian flu of 1957, the Hong Kong flu of 1968, and, more recently, the Russian flu of 1978. Antigenic shifts associated with these pandemic strains have occurred in both of the major surface structures, the hemagglutinin and the neuraminidase, or in only the hemagglutinin. The antigenic change makes it possible for a virus of epidemic potential to circumvent the accumulated influenza antibody in the population and spread rapidly throughout the world.

How and exactly when these shifts occur has been the subject of speculation for many years. According to influenza folklore, pandemic viruses originate in China. The inaccessibility of the People's Republic of China during the 1957 and the 1968 pandemics and the absence of any information from that area heightened the mystery and fueled speculation about the origin of these viruses. It is only fitting that the workshop that is the basis of this book was held in Beijing.

The proceedings cover a wide range of topics including the structure and antigenicity of the hemagglutinin and the neuraminidase, gene expression and virus multiplication, immune responses, influenza viruses from birds and lower mammals, and control of influenza. Over half of the proceedings is devoted to molecular biology, and rightly so. Answers to the puzzle of antigenic shift and drift (the phenomenon of gradual changes in the surface antigens during interpandemic periods of virus prevalence) ultimately lie in our understanding of the structure, composition, and function of the virus. This workshop serves to confirm and expand the rapidly accumulating information on the surface structure. It is now generally accepted that there are four principal regions on the hemagglutinin that interact with antibodies and undergo amino acid alterations during periods of antigenic modifications; that a single amino acid substitution in the appropriate location can alter antigenicity; and that carbohydrates of the glycoprotein can affect immune recognition, presumably by steric interference. These findings have made possible a more precise definition of pandemic viruses and a better understanding of drift and shift. They also explain many of the seemingly bizarre antigenic relationships between viruses.

Data from this workshop provide continued support for the hypothesis that the pandemic virus, with its abrupt and extensive changes in amino acid composition of the hemagglutinin, is a major genetic, as well as epidemiologic, event. The most common explanation, at least for the viruses that caused the 1957 and 1968 pandemics, is that the "new" virus arises through the exchange of gene segments with influenza A viruses of animals. Viruses antigenically related to known human viruses have been isolated from time to time from the gene pool in domestic ducks and pigs in China. The significance of animals as reservoirs of prospective human viruses has been considered for years. Influenza viruses affect animals such as horses, pigs, and many avian species. This book focuses on the relationships between humans and domestic animals known to be infected with influenza viruses. Of particu-

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