

## Book Reviews

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*Machina carnis. The Biochemistry of Muscular Contraction in its Historical Development*, by DOROTHY M. NEEDHAM, Cambridge University Press, 1971, pp. xvi, 782, illus., £18.

Not only does this book provide a magnificent treatment of the field of muscle biochemistry, but it deals with a number of other chapters of the general history of biochemistry such as glycolysis, respiration, or oxidative phosphorylation.

After dealing with the prehistory of the subject and with the theory of 'inogen molecule' splitting with development of energy, Mrs. Needham reviews the relationship between mechanical events, heat production and metabolism as studied before 1930. During a period which lasted more than twenty years it was believed that lactic acid provided the direct energy provision for contraction. Phosphagen of muscle was discovered in 1927 by Eggleton and Eggleton and by Fiske and Subbarow simultaneously and identified by the latter authors with phosphocreatine in 1929. It was considered until 1934 as providing the direct energy provision but was replaced in that role by ATP which had been discovered by Lohmann in 1928. Besides these studies on the process of energy provision for contraction, the nature of the 'muscle machine' [*machina carnis*] had been the subject of some attention since the seventeenth century, but it became the object of very active inquiry in the course of the nineteenth century. The author, in the seventh chapter of her book, recalls the microscopic studies on muscle and the biochemical studies on the proteins extracted from muscle in the period preceding 1939, the date of the breakthrough accomplished by Engelhardt and Ljnbimova when they discovered the ATPase activity of myosin. This gave the start for a number of studies on the interaction of myosin and ATP (chapter 8).

Chapter 9 of Mrs. Needham's book describes a number of theories of muscle contraction derived from the actomyosin-ATP relationship, before another breakthrough came in 1953 with the first formulation of the concept of the sliding-filament mechanism by E. H. Huxley.

Returning to muscle proteins, the author, in Chapter 10, discusses the properties of myosin, of actin and also of tropomyosin discovered by Bailey in 1946. One of the most striking results of these protein studies has been the decomposition of the macromolecules of myosin in long and short polypeptide chains. The knowledge of the nature of the actin filament was also greatly increased.

A thorough history of the sliding-filament mechanism is narrated in chapter 11, while the mechanism and energy-derivation of the sliding-mechanism are considered in Chapter 12.

Mrs. Needham, in Chapter 13, returns to the tracing of the history of electrophysiology and deals with the concepts of excitation, excitation-contraction coupling and relaxation. She gives a complete historical record of the relaxing factor and of the importance of calcium and of the calcium pump.

In 1949, A. V. Hill had challenged the biochemist to finally afford a convincing proof of the dependence of contraction on ATP breakdown. It therefore became urgent to determine the metabolism of a single muscular twitch. As related in Chapter 14 of this book, the long-lasting wish formulated by A. V. Hill was finally fulfilled

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when Davis *et al.* in 1962, demonstrated the breakdown of ATP in a single tetanic contraction of a muscle treated with 1-fluoro-2, 4-dinitrobenzene.

Chapter 15 is devoted to *rigor mortis*.

Preceded by chapters on the general history of respiration (Chapter 16) and of oxidative phosphorylation (Chapter 17), Chapter 18 is concerned with the regulation of carbohydrate metabolism for energy supply to the muscle.

In Chapter 19 the author compares the white and red striated muscles of vertebrates, while the effect of denervation is considered in Chapter 20. Muscle diseases form the subject of Chapter 21. Invertebrate muscles are considered in a historical perspective in Chapter 22, and the smooth muscles of vertebrates in Chapter 23.

In Chapter 24, the author retraces the knowledge accumulated during the last twenty-five years on the presence of ATP and ATPase in diverse cells showing motility and even other uses of ATP, for instance in the production of electric current or osmotic work.

'Living beings' as the author concludes, 'differ in glory but, in deeper ways than the apostle thought, their flesh is one.'

Since the book was completed, S. Lowey and D. Risby (*Nature*, 1971, **234**, 81) have demonstrated that myosin from fast skeletal muscles consists of two large sub-units (each about 200,000 daltons) and four smaller (in the range of 20,000 daltons). While ATP has been recognized as hydrolyzed at the onset of contraction, its hydrolysis is in muscle contraction, coupled to a process which remains obscure. It may be hoped that this mystery will be solved when the most interesting and informative book of D. M. Needham appears in a second edition.

There is another aspect of the book which should be emphasized: it is that only such an expert as D. M. Needham could provide us with a historical treatment in such a thorough and stimulating manner which makes the book of prime importance not only to historians but to active biochemists, as the domains surveyed with such talent and authority by Dorothy M. Needham remain the background of modern research.

MARCEL FLORKIN

*Charles Bonnet, Lettres à M. l'Abbé Spallanzani*, ed. by C. CASTELLANI, Milan, Episteme Editrice, 1971, pp. lxiii, 566, illus., £15.

The edition of the 96 letters sent by Bonnet to Spallanzani between 1765 and 1791 is very interesting for the historian of eighteenth-century biology, the subjects mentioned in this correspondence being of a great variety (they range from the physiology of plants to the reproduction of higher vertebrates).

At a first glance this volume, well printed and illustrated by contemporary etchings, makes an excellent impression. It is only after careful reading that one becomes disappointed. First of all there is an incredible number of typographical mistakes in the text of the letters, the footnotes and the index of personal names (where Frederick II becomes Frederich, Dortous de Mairan Dourtuous, Réaumur Réamur and A. Trembley Trebley). Such errors should have been avoided in a scholarly work.

But there are more important grounds for complaint. The editor although an excellent historian of biology and medicine is not a naturalist. This is obvious in