Muscle Physiology

Plasticity of Muscle. Proceedings of a symposium, Konstanz, Germany, Sept. 1979. DIRK PETTE, Ed. De Gruyter, Hawthorne, N.Y., 1980. xxvi, 626 pp., illus. $90.

For a long time the term "plasticity of muscle" was used to characterize its resistance to stretch. The essential condition for such plasticity is that actin and myosin filaments not be linked together, and this state requires the presence of adenosine triphosphate. The concept of plasticity is extended in the book under review, which deals with the ability of muscle to adapt to changed conditions. Thus, muscle shows plasticity in response to changes in the environment elicited by neuromuscular and metabolic interactions, diverse stimuli, or disease. Alternatively, plasticity may involve the antigenic properties of myosin or the effects of thyroid hormones on muscle.

Plasticity of Muscle is a collection of papers dedicated to the memory of Ernest Gutmann, a distinguished Czechoslovakian muscle physiologist. It is divided into seven sections covering the heterogeneity of metabolic and molecular properties of muscle fibers, the development and growth of muscle, the interaction of nerves and muscle, the influence of use on muscle, the effects of long-term stimulation on muscle, mechanisms of hypertrophy and atrophy, and the effects of thyroid hormones.

The properties of fast and slow muscles are discussed in the majority of the papers. Fast and slow myosins appear in sequence during myogenesis, and their subunit composition is modified following cross-innervation or cordotomy. Long-term electrical stimulation changes the fuel uptake and performance in fast skeletal muscle, induces changes in its enzymic activities, and alters the protein composition of the sarcoplasmic reticulum. Studies on fast and slow muscle fibers from patients with Duchenne dystrophy are especially valuable. Glycogen phosphorylase is severely affected in fast fibers, and β-hydroxyacyl coenzyme A dehydrogenase is severely affected in slow fibers.

It has been recognized for some time that the division of skeletal muscles into only two groups, fast and slow, is an oversimplification. Thus, fast muscle may be further divided into type A, which produces energy through oxidative metabolism and is resistant to fatigue, and type B, which produces energy mainly through glycogen breakdown and fatigues rapidly. This symposium reports a broad heterogeneity of muscle fibers when investigated by highly sensitive techniques, such as enzymology, microphotometry, and immunology. Homogeneity probably exists in fibers of one motor unit.

Several papers are devoted to elucidating the factors that determine fiber type. It seems likely that the control occurs at the gene level and that the expression of the genes responsible for the fast or slow muscle is regulated by fast or slow innervation, respectively. How long-term stimulation changes the muscle type and how the frequency of stimulation determines the nature of polypeptide synthesized in the muscle cell are still moot questions.

Many of the data presented at the symposium are already in the literature. Summary or conclusion is generally missing at the end of the papers. The book is recommended for general biology and medical school libraries.

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Enzymatic Transformations

Enzymatic Basis of Detoxication. WILLIAM B. JAKOBY, Ed. Academic Press, New York, 1980. In two volumes. Vol. 1. xvi, 416 pp. $43. Vol. 2. xiv, 370 pp. $38.50. Biochemical Pharmacology and Toxicology.

In recent years a great deal of interest has centered on mammalian enzyme systems that metabolize substances foreign to the body, such as drugs and pollutants. Many of these compounds are potential carcinogens. Some of the enzymatic transformations generate compounds that are more toxic to the organism than the parent compounds, whereas others render the compounds less toxic. In Jakoby's terms, the latter process is "detoxication." The study of the physiological significance of these enzymes has been aided by advances in enzymology, as well as in chemistry, genetics, pharmacology, and other fields, and an explosion of basic knowledge about them has occurred in the past ten years.

These two volumes treat the individual enzymes. Although the term "detoxication" appears in the title, most investigators now realize that many of the enzymes treated here can have either beneficial or deleterious roles, depending upon the substrate involved and the model system that is being investigated. Many of them also exist in multiple forms that have different catalytic activities toward different substrates. Most of the enzymes discussed metabolize certain chemicals endogenous to the body as well as foreign chemicals. Whether the enzymes have developed to handle foreign or endogenous chemicals has not been clearly resolved in most cases.

The book begins with a short introduction by the editor on the general role of enzymes in reactions involving detoxication, which is distinguished from the more commonly utilized term "detoxification." Chapters dealing with pharmacokinetics, human genetics, enzyme induction, and comparative aspects of metabolism follow. The remainder of the text treats individual detoxication enzymes organized into several categories: mixed-function oxidases (cytochrome P-450, NADPH cytochrome P-450 reductase, and microsomal flavin-containing monooxygenase), other oxidation-reduction enzymes (alcohol dehydrogenase, aldehyde reductase, aldehyde oxidizing enzymes, ketone reductase, xanthine oxidase and aldehyde oxidase, superoxide dismutase, glutathione peroxidase, and monoamine oxidase), and enzymes involved in conjugation and hydrolic processes (glucuronidases, *N*- and *O*-methylases, glutathione *S*-transferases, enzymes involved in peptide bond and mercapturic acid formation, cysteine conjugate β-lyase, thio *S*-methyltransferase, acetylase, aryl hydroxyamic acid acyltransferase, sulfotransferase, thiotransferase, rhodanese, glyoxylase, epoxide hydrolase, and carboxylesterases and amidases). The scope of the work is thus very broad.

Most of the chapters cover the physiological roles of the enzymes as well as purification techniques, protein characterization, evidence for and against multiplicity, and other matters. The chapters vary in breadth, with some largely focused on an author's own work and others more comprehensive. Several, both on specific enzymes and general topics, are clearly excellent, among them that by Wislocki, Miwa, and Lu on the various reactions carried out by cytochrome P-450. There is a minimum of overlap between the papers, but a few are similar to others published by the same authors elsewhere.

The volumes present a nice marriage between pharmacology and biochemistry, and one can recommend them to workers in both fields as a reference. Most of the reviews cover the literature up to early 1979. With their overall breadth and readability, these volumes could also be used well by graduate-level