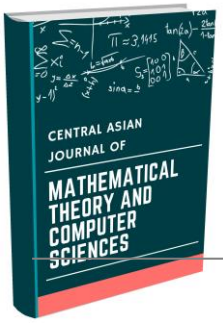

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Muscle Biochemistry

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Abstract

Our muscles need to be healthy more than ever. We need to know not only the structure, function and physiology of muscles, but also their biochemistry. Most people are not interested in it. If you don't know the chemical structure of the muscle, if you don't know the mechanism by which it grows, it's like adding sugar to the soup. This analogy is often applied to athletes and boys. Studying the origin of muscle diseases, prevention of muscle disease and treatment of the disease would be appropriate if it were carried out "biochemically". Studying muscle biochemistry is very important to you and us.

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Indroduction: Mobility is a characteristic of various life forms; the accurate alignment and distribution of chromosomes in the mitotic apparatus, the jumping of a flea, as well as the amazing movements of human sheep and the heavy work of leg muscles can be shown. But there are many chemical mechanisms involved in the implementation of these various functions. The contractile apparatus of vertebrate skeletal muscles is the best studied system. Muscle tissue makes up 40-42% of body weight. The main dynamic function of a muscle is to provide mobility due to contraction and subsequent relaxation. When muscles contract, work is done related to the conversion of chemical energy into mechanical energy.

Main part: Contraction occurs as a result of the interaction of 2 different protein threads, which are located in parallel in the muscle, consisting of actin and myosin. The voltage generation takes place due to the successive formation and breaking of the cross-bridge between two types of threads. This ensures the movement of actin filaments to the central area of myosin filaments. As a result of the rupture of the transverse bridge and the return of the filaments to the primary state, emptying occurs. Such a cycle is initiated by the propagation of the depolarizing impulse from the neuromuscular contact along the length of the muscle fiber in two directions; upon reaching the opening of the transverse tubule, the excitation process spreads inwards and ensures the release of Ca from the sarcoplasmic reticulum. Troponin binds to protein C, which is located in sarcoplasmic reticulum actin, and changes the conformation of this protein. This, in turn, allows another protein - tropomyosin - to move, preventing the formation of cross bridges between actin and

myosin. It accounts for the energy released as a result of the formation of a cross-bridge. At the end of the state of excitation, the sarcoplasmic reticulum Ca4-Mg+i-ATF-ase ensures the return of calcium into this system. When the Ca+2 concentration reaches a low level, the cross-bridge breaks and the muscle fiber relaxes. 3 types of muscles differ from each other as follows: 1) skeletal muscle; 2) heart muscle; 3) smooth muscle. 72 to 80% of water is stored in the muscle tissue of adults and animals. 20-28% of muscle mass is dry matter, mainly proteins. In addition to proteins, solids include glycogen and other carbohydrates, various lipids, nitrogen-retaining extractives, salts of organic and inorganic acids, and other chemical compounds. Muscle proteins. A. Ya. Danilevsky for the first time divided proteins extracted from muscles into 3 classes: water-soluble, extractable with 8-12% ammonium chloride solution, and separated with diluted solutions of acids and alkalis. Currently, muscle tissue proteins are divided into 3 main groups: sarcoplasmic, myofibrillar and stroma proteins. Of all muscle proteins, the first is 35%, the second is 45%, and the third is 20%. These proteins differ dramatically in their solubility in water and salt solutions with different ionic strengths. Important proteins of myofibrils are myosin, actin, actomyosin, which are soluble in highly ionic salts, as well as control proteins tropomyosin, troponin, alpha- and P-actinin. Myosin, the main protein of myofibrils, is 50-55% of its dry mass. The amount of myosin increases, the number of free HS-groups in it increases, i.e. the ability of muscles to break down ATP; Reserves of energy sources necessary for ATP resynthesis (creatine phosphate, glycogen, lipids, etc.). The activity of enzymes that catalyze anaerobic and aerobic oxidation processes increases significantly; The amount of myoglobin in the muscles increases, which creates a reserve of oxygen in the muscles. The amount of proteins in the muscle stroma, which provides the mechanics of muscle relaxation, increases. Observations of athletes show that the ability to relax muscles increases under the influence of training. Adaptation to one factor increases resistance to other factors (for example, stress, etc.); The preparation of a modern athlete requires a high intensity of physical activity and their large volume, which can have a one-sided effect on the body. Therefore, it requires constant monitoring by doctors, sports medicine specialists based on the biochemistry and physiology of sports. Skeletal muscle contains a number of important nitrogen-fixing extractives: adenyl nucleotides (ATF, ADF, AMF), non-adenylic nucleotides, creatine phosphate, creatine, creatinine, camosin, anzerin, free amino acids, etc. Creatine and creatine phosphate nitrogen account for 60% of muscle non-protein nitrogen. They participate in chemical processes associated with muscle contraction as a source of energy. Creatine is mainly synthesized in the liver and transported through the blood to the muscles. There, creatine is phosphorylated and turns into creatine phosphate. 3 amino acids are involved in the synthesis of creatine: arginine, glycine, methionine. Kamozin and anzerin V.S. It is an imidazole-retaining peptide discovered by Gulevich. It is almost never found in tissues other than the brain and muscles. The concentration of ulamin in muscles is around 100-200 mg per 100 g of tissue. In muscular dystrophy and denervation, the amount of myofibrillar and some sarcoplasmic oxygen, as well as myalbumin, is sharply reduced. The concentration of ATF and creatine phosphate, the amount of carnosine and anzerine decreases. In developing muscular dystrophies associated with the breakdown of muscle tissue, changes in the composition of muscle phospholipids are observed: the concentration of phosphotidylcholine and phosphotidylethanolamine sharply decreases, sphingomyelin and lysophosphatidylcholine increase. In the period of E-avitaminosis, when muscles are denervated, when their movement is limited (when plaster is applied), when tendons are cut, muscle fibers are torn by force. Atrophy of muscles in E-avitaminosis is due to the damage of the muscle lysosomes of the membrane with products of lipid oxidation in the presence of peroxide, because in the absence of an antioxidant (vitamin-E), such oxidation is more active. Changes in creatine metabolism and its large excretion in urine (creatinuria) are characteristic of muscle tissue pathologies. Its amount is 2 g per night. In patients with chronic myopathy, creatinuria is the result of impaired creatine retention and phosphorylation in skeletal muscle. Due to the violation of creatine phosphate synthesis, creatinine is not formed and its amount in urine decreases sharply. Creatinuria and creatine synthesis as a result of its violation, the urine creatine index of keratin/keratin increases sharply. Although cardiac muscle cells (also called cardiac myocytes or cardiomyocytes) are linear like skeletal muscle cells and use the same biochemical mechanics for contraction, cardiomyocytes have different physiological properties and electrochemical activation processes. An important difference between these two striated muscle types is that, although cardiac muscle cells are innervated by the sympathetic and parasympathetic nervous systems,

they do not require activation of the innervation to contract. The autonomic nervous system serves to modulate, rather than initiate, cardiac contractile activity, as opposed to initiating contractile activity.

Conclusion: Muscles convert energy from metabolic substrates into mechanical work. Efficiency determines the proportion of consumed energy that can be seen as work. This review provides an overview of the relationship between muscle biochemistry and thermodynamics to illustrate various definitions of efficiency and their values. Thermodynamic efficiency is the best measure of muscle efficiency, and muscle comparisons show that the overall efficiency of skeletal muscle varies from ~15% for mouse muscle to 35% for turtle muscle. These values reflect 20%–50% bridging efficiency and 75%–80% mitochondrial efficiency, depending on species and fiber type. Evidence is provided that the maximum possible cross-over efficiency (i.e., work/free energy conversion from ATP hydrolysis) is ~50%, and this can only be achieved through production capacity. The overall muscle efficiency ranges from 15% to 35%, with values for fast muscles being lower than for slow muscles.

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