OPEN ACCESS Freely available online

ISSN: 0974-8369
Biology and Medicine

Perspective

Understanding Muscle Physiology, Types and Contraction Mechanisms

Katherine Cronin*

Department of Myology, University of Goettingen, Goettingen, Germany

DESCRIPTION

Muscles are important for human movement and function. They are of various types, each with distinct characteristics and roles. The mechanism of muscle contraction involves biochemical and physiological processes, allows us to perform tasks from the simplest to the most complex. There are three main types of muscle in the human body: Skeletal muscle, smooth muscle, and cardiac muscle. Skeletal muscles are commonly associates with movement. They are under voluntary control and are attached to bones *via* tendons. Skeletal muscles are striated due to the arrangement of contractile proteins and are responsible for generating movement, maintaining posture, and supporting the body's structure. Smooth muscles are found in the walls of organs and structures like blood vessels, the digestive tract, and the respiratory system. They are not under voluntary control and exhibit a smooth appearance under a microscope due to the lack of striations. Smooth muscles are involved in involuntary movements such as peristalsis (in the digestive system) and vasoconstriction (in blood vessels). Cardiac muscle is present in the heart. It is striated like skeletal muscle but has a specialized structure that allows it to contract rhythmically and autonomously. Unlike skeletal and smooth muscles, cardiac muscle is both involuntary and highly resistant to fatigue, ensuring the continuous pumping of blood throughout a lifetime.

Muscle contraction is the fundamental process enabling movement which is a result of coordinated interactions between proteins within muscle fibers. The sliding filament theory explains how muscle contraction occurs at the molecular level. It involves the interaction between two main proteins: actin and myosin. During contraction, myosin heads attach to binding sites on actin filaments, forming cross-bridges. ATP provides the energy for myosin heads to pivot and pull the actin filaments toward the center of the sarcomere, resulting in muscle shortening. Sarcomeres are the basic functional units of skeletal muscles. They consist of overlapping actin and myosin filaments, giving skeletal muscles their striated appearance. The arrangement of sarcomeres and the organization of actin and myosin filaments allow for efficient muscle contraction. Calcium ions play an essential role in muscle contraction. When an action potential travels along a motor neuron and reaches a muscle fiber, it triggers the release of calcium ions from the sarcoplasmic reticulum, a specialized structure within muscle cells. Calcium binds to regulatory proteins, exposing binding sites on actin filaments and initiating the cross-bridge formation with myosin. Bridging the gap for muscle contraction to occur, a neural signal must be transmitted to muscle fibers at the neuromuscular junction. This is where motor neurons and muscle fibers communicate.

When an action potential reaches the end of a motor neuron, it triggers the release of neurotransmitter acetylcholine into the synaptic cleft, a small gap between the neuron and muscle fiber. Acetylcholine binds to receptors on the muscle fiber's membrane, initiating an action potential in the muscle fiber. The action potential travels along the muscle fiber's membrane and leads to the release of calcium ions from the sarcoplasmic reticulum. The Cellular Energy Currency Adenosine Triphosphate (ATP) is the primary source of energy for muscle contraction. ATP helps in the movement of myosin heads, allowing them to detach from actin and reset for the next contraction cycle. During sustained muscle contractions, ATP regeneration depends on aerobic metabolism (oxygen-dependent) or anaerobic metabolism (oxygen-independent). By understanding the muscle types and the mechanisms involved in muscle contraction not only explains about human physiology but also provides insights into optimizing performance, maintaining health, and conditions that affect muscles.

Correspondence to: Katherine Cronin, Department of Myology, University of Goettingen, Goettingen, Germany, E-mail: cronin@kath.de

Received: 25-Jul-2023, Manuscript No. BLM-23-22817; **Editor assigned:** 28-Jul-2023, Pre QC No. BLM-23-22817 (PQ); **Reviewed:** 11-Aug-2023, QC No. BLM-23-22817; **Revised:** 18-Aug-2023, Manuscript No. BLM-23-22817 (R); **Published:** 25-Aug-2023, DOI: 10.35248/0974-8369.23.15.597.

Citation: Cronin K (2023) Understanding Muscle Physiology, Types and Contraction Mechanisms. Bio Med. 15:597.