GUYTON AND HALL – CHAPTER 6 SHORT OVERVIEW

- **I Band** – actin filaments
- **A bands** – myosin filaments

- **MYOSIN MOLECULE**
  - Six polypeptide chains
  - Two heavy chains
  - Four light chains

- **Myosin filament** – made of 200 or more myosin molecules
- **Body of filament** – formed by myosin tails
- **Cross bridges** – protruding arms and heads of myosin molecules

- **Actin filament have:**
  1. F-actin protein (double stranded)
  2. Troponin
  3. Tropomyosin

- **G-Actin molecule** – each strand of F-actinn protein called G-actin. G-actin have ADP. These ADP are the active sites.

- **Tropomyosin** – lie over active site and prevent contraction
- **Troponin:**
  - Attach tropomyosin to actin
  - Three subunits:
    1. Troponin I – strong affinity for actin
    2. Troponin T – strong affinity for tropomyosin
    3. Troponin C – strong affinity for calcium ions
       Troponin C is believed to initiate contraction process

- **MALIGNANT HYPERTHERMIA** is a severe reaction to certain drugs used for anesthesia. This severe reaction typically includes a dangerously high body temperature, rigid muscles or spasms, a rapid heart rate and other symptoms. Without prompt treatment, the complication caused by malignant hyperthermia can be fatal.

- **Hypertrophy** is increase and growth of muscle cells. Hypertrophy refers to an increase in muscular size achieved through exercise. When you work out, if you want to tone or improve muscle definition, lifting weights is the most common way to increase hypertrophy.

- **Muscle atrophy** refers to loss of muscle tissue. It can occur after long periods of inactivity

- **Hyperplasia** refers to increase in number of cells or fibers.
  (Hyperplasia is increase in number while hypertrophy is increase in size)

- **Muscular dystrophy** is a group of diseases that cause progressive weakness and loss of muscle mass

- **Muscle Twitch:** A single action potential causes a brief contraction followed by relaxation. This response is called muscle twitch.

- **Neuromuscular Junction (NMJ)** is a highly specialized synapse between a motor neuron nerve terminal and its muscle fiber that are responsible for converting electrical impulses generated by the motor neuron into electrical activity in muscle fibers

- **Synaptic Gutter or Trough:** NMJs form an invaginated area or a trough on the muscle cell membrane called synaptic gutter

- **Synaptic vesicles:** In neuron, synaptic vesicles store various neurotransmitters that are released at the synapse

- **Subneural cleft:** At the bottom of the gutter are numerous smaller folds of the muscle membrane called subneural clefts, which greatly increase the surface area at which the synaptic transmitter can act.

- **End plate potential:** End plate potentials are the voltages which cause depolarization of skeletal muscle fibers caused by neurotransmitters binding to post synaptic membrane in the neuromuscular junction

- **Muscle spasm:** A muscle spasm is a sudden, involuntary movement in one or more muscles

- **Excitation-contraction coupling** describes the rapid communication between electrical events occurring in the plasma membrane of skeletal muscle fibers and Ca^{+2} ion release from SR, which leads to contraction

- **Latch mechanism:** By latch mechanism myosin cross-bridges remain attached to actin for some time after the cytoplasmic Ca^{+2} ion concentration falls. This produces sustained contraction with little expenditure of energy, which is especially important in vascular smooth muscle.

- **Latent period (in smooth muscle contraction):** The time between a stimulus to a nerve and the contraction of a muscle

- **Myosin phosphatase:** It is an enzyme that dephosphorylate the regulatory light chain of myosin. This dephosphorylation reaction occurs in smooth muscle tissue and initiates the relaxation process of muscle cells.

- **Axonal varicosities:** small, bead-like swellings that appear along the length of neuronal axons, which are parts of neurons that transmit electrical and chemical signals to neighbouring nerve cells.

- **Slow waves –** Waves of partial depolarization of smooth muscle that sweep along the digestive tube for long distances

- Sources of energy for muscle contraction
  1. Phosphocreatine
  2. Glycolysis
  3. Oxidative metabolism (95%)

- **Isometric Contraction –** When muscle does not shorten during contraction
  Isotonic Contraction – When muscle shortens but the tension on muscle remains constant throughout the contraction

- **Myesthenia Gravis** is an autoimmune disease in which antibodies are developed that block or destroy their own acetylcholine receptors at the post synaptic neuromuscular junction.
  It causes muscle weakness because of the inability of neuromuscular junctions to transmit enough signals from the nerve fiber to the muscle fiber.

- In most people with myasthenia gravis, the immune system blocks or damages acetylcholine receptors. The acetylcholine cannot attach to the receptors and so muscle is less able to tighten.

Neostigmine works by slowing the breakdown of acetylcholine when it is released from the nerve endings

- The importance of **stress-relaxation** or **reverse stress-relaxation** is that except for short periods, they allow hollow organs to maintain about the same amount of pressure inside its lumen despite sustained large changes in volume.

- Some of the unitary smooth muscles are self-excitatory. This feature is most likely due to slow waves

- Excitation-contraction coupling in skeletal muscles is initiated when calcium binds to troponin. Excitation-contraction coupling in smooth muscles is initiated when calcium binds to calmodulin.

- Factors causing vasodilation:
  1. Lack of oxygen
  2. Excess carbondioxide
  3. Increased hydrogen ion concentration

- Nernst potential for K^+ (-96) is nearest to resting membrane potential
- Nernst Potential for

Na^+	+60
Ca^{+2}	+137
K^+	-96
Cl^-	-64
Mg^{+2}	+9

- The A band of the sarcomere doesnot change in length during muscle contraction

- Action potential causes increased calcium ion permeability of presynaptic terminal cell membrane

- Choline formed from the breakdown of acetylcholine in the synaptic cleft is absorbed by the presynaptic terminal membrane

- Phosphate is released when myosin heads attach to actin filaments

- The actin-myosin bond is broken by attachment of ATP

- During muscle contraction, myosin binding sites are uncovered by the movement of troposmyosin

- Energy produced when ATP is converted into ADP and phosphate is stored in myosin heads

- Action potentials enter muscle cells at the T-tubules

- An action potential for a muscle cell is propagated along the sarcolemma

- Cross bridges form between binding sites on actin myofilaments and myosin heads

- Endomysium separates individual muscle fibers

- A bundle of muscle fibers is known as fascicle

- A single skeletal muscle fiber contains multiple nuclei
  Smooth muscle cells contain a single nucleus
  Cardiac muscle contains one or two nuclei

- The I-band of a sarcomere is widest when a muscle is relaxed

- In a fully contracted sarcomere, the H zone disappears

- Within the A band, there is a relatively brighter central region, called the **H zone** in which there is no actin/ myosin overlap, when the muscle is in a relaxed state.
  When a muscle contracts, the actin is pulled along myosin towards the center of the sarcomere until until actin and myosin filaments are completely overlapped. The H zone becomes smaller and smaller due to increasing overlap of actin and myosin filaments, and the muscle shortens. When the muscle is fully contracted, the H zone is no longer visible.