PHYSICAL EDUCATION

FUNDAMENTALS OF ANATOMY, PHYSIOLOGY AND KINESIOLOGY IN SPORTS

Anatomy

Anatomy is a branch of biology that studies the human body structure. Anatomy provides us with the details of human structure, its shape, and interrelationships with various parts of the body.

It includes all body parts, starting with your head to your toes. It teaches about how every part of your body works together. You have a brain that tells you what to do, muscles for movement, bones to keep you strong, and many more.

Physiology

Physiology is the science that studies the functions of various organs and systems, their relationship with other organs, and their effects. Physiology is the science of the mechanical, physical, and biochemical functions of human organs and cells.

It encompasses everything from how your muscles contract to your liver's production of bile. It is the study of heart rate, respiratory rate, blood pressure, and more. Physiologists are scientists who study anatomy, bones, muscles, ligaments, organs, joints, circulation systems, etc.

Kinesiology

Kinesiology is the study of human movements and functions, by applying the science of biomechanics, anatomy, physiology, and neuroscience.

It is used to examine, diagnose, and manage injuries of muscles, joints, and bones. Kinesiology is also used in the evaluation of sports performance for purposes of injury prevention or improvement.

Importance of Anatomy and Physiology

- Both are important branches of biology and provide us knowledge of our body.
- Anatomy helps us to understand our by structures properly
- Physiology helps to understand the functioning of various organs and systems with their working
- These subjects help us to understand the role and functioning of various organs
- Good understanding of these subject helps to overcome health problems with their knowledge

- These subjects help the individual to improve the efficiency of various systems
- These subjects help to understand the cause of health problems and guide us to overcome

The function of Skeleton System

Skeletal System:

The skeletal system consists of bones and joints, which provide attachment to the skeletal muscles. Proper functioning of skeletal and muscular systems improves the efficiency of our body.

Functions of the Skeletal System:

Protection: It protects our internal organs from injuries like the skull protects the brain and the ribs protect the heart and lungs.

Movement: This system allows the body to move in many different ways.

Manufacture: Bone marrow, present inside of many bones, produces red blood cells, white blood cells, and platelets.

Store: Bones store calcium, minerals, phosphorus, iron, potassium, which are very important for bodily functions.

Support: Bones and cartilages provide support to our bodies.

Body shape: Skeletal system makes the correct shape for our body.

Act as a lever: Bones acts as a lever that provides movement of muscle.

FUNDAMENTALS

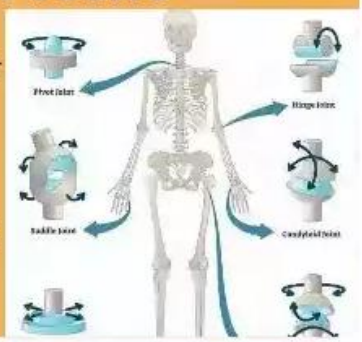
ANATOMY, PHYSIOLOGY, KINESIOLOGY

CLASSIFICATION OF BONES

Long Bone
Short Bones
Flat Bone
Irregular Bone

TYPES OF JOINTS

- Ball and socket
- Hinge joint
- Pivot joint
- Gliding joint
- Sesamoid joint



TYPES OF MUSCLE

Skeletal muscle
Smooth muscle
Cardiac muscle

RESPIRATORY SYSTEM

Process in which exchange of gases takes place in the body

CIRCULATORY SYSTEM

System consists of a heart, blood vessels, arteries, capillaries, veins, and blood

CENTER OF GRAVITY

Middle of the body around which a body can rotate freely in any direction

EQUILIBRIUM

Stable, balanced or unchanged system

Classification of Bones

There are 206 bones present in our body. Bones are the hardest connective tissues forming the skeletal.

Bones protect various organs of our body.

It produces red blood cells and white blood cells, stores many minerals. It also provides structure and support to our body and enables movement.

Bones have different structures and size:

- **Long Bones:** These bones are long and wide. They are found in legs and arms, like the femur and humerous bones.
- **Short Bones:** They are short in size and cube-shaped. They are found in wrist and phalanges.
- **Flat Bones:** Flat Bones have a broad surface, like scapula and sternum, which protects our organs and attachments.
- **Irregular Bones:** These bones have an irregular shape like vertebrae, skull, etc.
- **Sesamoid Bones:** These bones are embedded in tendons. They hold the tendons like patella.
- **Cartilaginous Bones:** These bones are soft and flexible. They are found in ears and nose.

Types of Joints

Joints are the place where two or more bones meet at one point. Joints are three types:

Immovable or Fibrous Joint: These are fixed joints, there are no movements, like the skull joint.

Slightly movable or Cartilaginous Joint: These joints are slightly movable like vertebrae

Freely movable or Synovial Joints: These joints can move to a great extent. These are covered by thin membranes and filled with synovial fluid which acts as a greasing agent.

These joints are of various types

- Ball and socket joint (Shoulder and Hip joint)
- Hinge joint (Elbow joint)
- Pivot joint (Neck joint)
- Gliding joint (Thumb joint)
- Sesamoid joint (ball of the foot behind the big toe)

Properties and Functions of Muscles

Properties of Muscles

- **Contractility:** Every single movement of the body is a result of muscle contraction, where muscle cells get shortened. Muscles can only pull, never push.
- **Excitability:** It is the ability to respond to a stimulus, which is delivered from a motor neuron or a hormone.
- **Extensibility:** It is the ability of a muscle to be stretched, e.g. to flex the elbow, the elbow extensor muscles must extend to allow flexion to occur.
- **Elasticity:** It is the ability to bounce back to the muscle's original length after being stretched.

Functions of Muscles

- **Provides Structure:** Muscles provide the proper shape and structure of individuals. It helps to maintain posture
- **Provide effort:** They worked as effort arm of the lever in body, whereas bone act as Lever
- **External movement:** Muscles provide external movement to an individual by contraction of skeletal muscles
- **Help in fluid movement:** Muscles also provide internal fluid movement by contraction of smooth muscles
- **Forceful actions:** Muscles provide forceful movement of the body as they help in strength, speed and endurance
- **Provide protection:** Skeletal muscles also protect our bones and other internal organs
- **Heart contraction:** Cardiac muscle contracts the heart throughout life.

Respiratory System

Respiration is the process in which the exchange of gases takes place in the body. Oxygen is brought into the body when we Inhale and carbon dioxide is given when we exhale. Oxygen is essential for every cell and tissue in the body.

Parts of the Respiratory System

- Nose and nasal cavity
- Sinuses
- Mouth
- Throat (pharynx)
- Voicebox (larynx)

- Windpipe (trachea)
- Diaphragm
- Lungs
- Bronchial tubes/bronchi
- Bronchioles
- Air sacs (alveoli)
- Capillaries

Respiration is of two types:

- **External Respiration:** Inhalation and exhalation are the processes of external respiration. In this process, we inhale oxygen which goes to different parts of the body, and exhale carbon dioxide which diffuses from the blood.
- **Internal Respiration:** This process of respiration takes place in tissues and cells, where oxygen gets used during energy production.

  The metabolic reaction produces carbon dioxide which is carried away by the blood to the lungs for purification through external respiration

Mechanism of The Respiratory System

When we breathe in, muscles across the ribs contract, it pulls ribs upward and sideward. At the same time, the muscles of the diaphragm contract and flatten.

Thus, the size of the lungs increases, and there is an increase in volume. Due to this process, low pressure develops in the lungs, so air gets inside through the nose.

Breathing out occurs when the muscles of the diaphragm and ribs relax. By this process, space is reduced and there is a decrease in volume of lungs, thus high pressure develops in the lungs so air is pushed out.

Circulatory System

The circulatory system consists of a heart, blood vessels, arteries, capillaries, veins, and blood. The heart acts as a pumping organ and is located slightly on the left side of the chest.

It is approximately a size of a fist. Our Heartbeats are about 72 times per minute at a normal level in an adult. The heart has four chambers. In the upper two parts known as auricles, there is a collection of blood.

In the lower two chambers known as ventricles, the blood is pumped out. This complex organ works with the proper coordination of its valves like tricuspid, bicuspid, aortic, pulmonary valves, etc.

The heart can respond immediately, during a physical workout. Maximum heartbeats go up to 220 beats per minute during a physical workout.

Blood: Blood is a special kind of fluid, which acts as a medium of transporting nutrients and gases from one part of a body to another.

It also acts as a means of communication by conveying chemical messages to various organs and tissues.

Blood consists of Plasma, Red Blood cells, White Blood cells, Leukocytes, Thrombocytes, and Platelets. There are approximately 5 liters of blood present in an adult.

Heart Rate: It is the number of contractions in one minute, which is about 72 times per minute.

Stroke Volume: It is the volume of blood pumped out in one beat, which is about 80 ml/beat in a normal adult.

Cardiac output: It is the amount of blood pumped out in one minute.

Blood Pressure: It is the force exerted by the blood on the walls of blood vessels. It has two types:

Systolic: It is the upper pressure, which is 120mm/Hg in a normal adult.

Diastolic: It is the lower pressure, which is 80mm/Hg in a normal adult.

Equilibrium, Centre of Gravity

Equilibrium: Equilibrium is a condition in which forces cancel one another. It is a condition in which influences are cancelled by others, resulting in a stable, balanced, or unchanged system. Equilibrium provides balance and stability.

It is of two types:

- **Static Equilibrium:** When the body is at rest or motionless
- **Dynamic Equilibrium:** All applied forces acting on the moving body are in balance, resulting in movement with unchanging speed or direction.

Centre of Gravity

The stability of an athlete depends upon the centre of gravity. It is exactly in the middle of the body around which a body can rotate freely in any direction and where the weight of the body is centered.

The Centre of gravity is located at the point along the midline of the body. Lower the CG more is the stability.

Application in sports

- In wrestling, a player who lowers his centre of gravity by expanding his legs gets more stability.
- In weightlifting, players widen their base by keeping feet apart, which provides more stability and balance.
- During landing, the player bends their legs which provides fast control of stability, this process also reduces the chances of injuries from the impact.