

# A Textbook of Physical Education Class 11

## Chapter 7

### FUNDAMENTALS OF ANATOMY AND PHYSIOLOGY IN SPORTS



# DEFINITION AND IMPORTANCE OF ANATOMY AND PHYSIOLOGY IN SPORTS

## **Anatomy**

Anatomy is the study of the structure of living organisms.

## **Physiology**

Physiology is the study of how living systems function.

### **Importance of Anatomy and Physiology**

- Knowledge of Our Body:
- Selection of Sports:
- Prevention of Sports Injuries:
- Augmenting Rehabilitation and First Aid:
- Preparation of Training Programme:
- Understanding the Difference between Male and Female Anatomy:
- Correct Sports Massage Therapy:
- Proper Physical Fitness Development:
- Cultivating a Culture of Knowledge:

# FUNCTIONS OF SKELETAL SYSTEM, CLASSIFICATION OF BONES AND TYPES OF JOINTS

## The Skeletal System

The skeletal system is a combination of all the bones in the body together with the structures that support them. The adult human body has 206 bones of various shapes and sizes.

## Functions of the Skeletal System

The functions of the skeletal system are:

- |                          |                     |
|--------------------------|---------------------|
| 1. Locomotion:           | 2. Support:         |
| 3. Protection:           | 4. Calcium Storage: |
| 5. Acting as Levers:     |                     |
| 6. Endocrine Regulation: |                     |

## Classification of Bones

Bones can be classified as follows on the basis of their shape and formation:

- |                     |                    |
|---------------------|--------------------|
| 1. Long Bones:      | 2. Short Bones:    |
| 3. Flat Bones:      | 4. Sesamoid Bones: |
| 5. Irregular Bones: |                    |

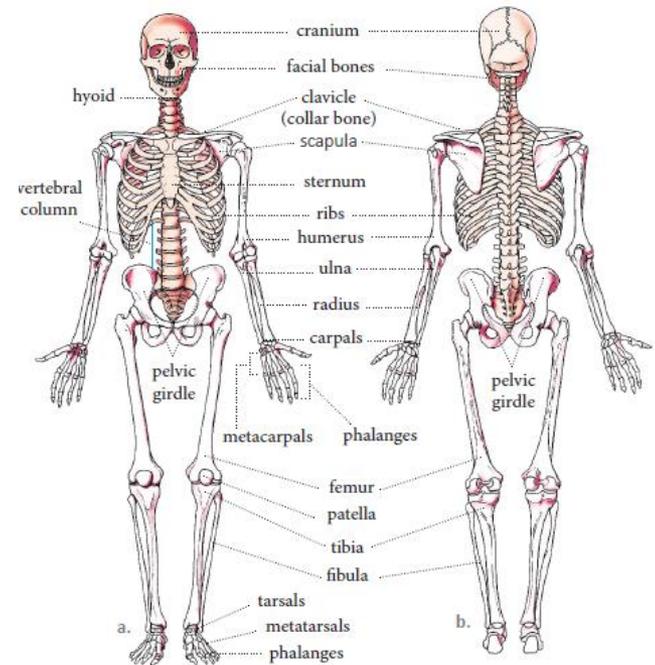


Figure 7.1 The human skeleton  
a. anterior view b. posterior view

## JOINTS AND TYPES OF JOINTS

Joints are the points where bones intersect. They hold the skeleton together and help it to carry out movements. According to their range of motion, joints can be classified into three groups:

**A. Immovable Joints (also known as synarthrosis):**

**B. Slightly Movable Joints (also known as amphiarthrosis):**

They are further divided into two categories:

1. Symphysis:                      2. Synchondrosis:

**C. Freely Movable Joints (also known as diarthrosis):**

Synovial joints are further classified as:

- Gliding Joints:
- Hinge Joints:
- Condyloid Joints:
- Saddle Joints:
- Ball and Socket Joints:
- Pivot Joints:

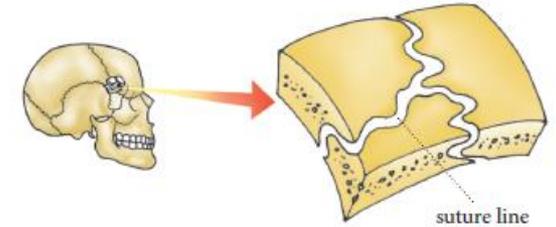


Figure 7.2 Fibrous joint (suture)

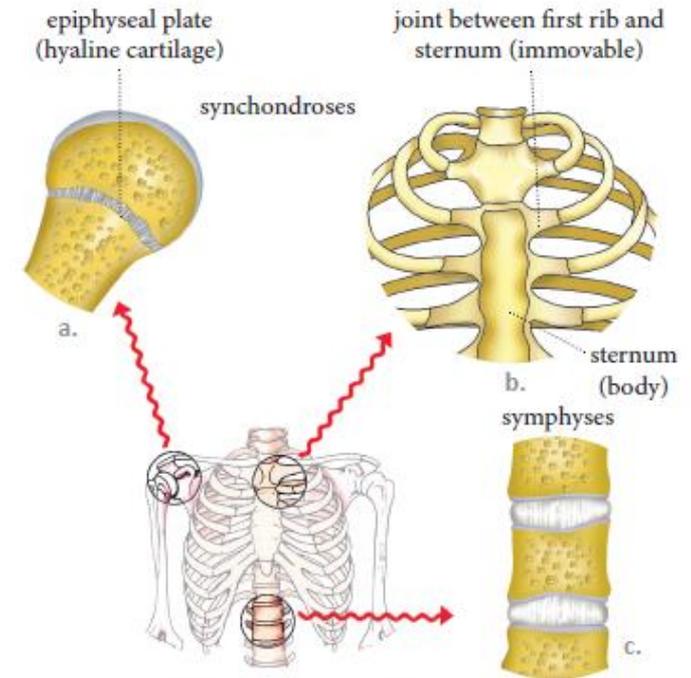


Figure 7.3 Cartilaginous joints

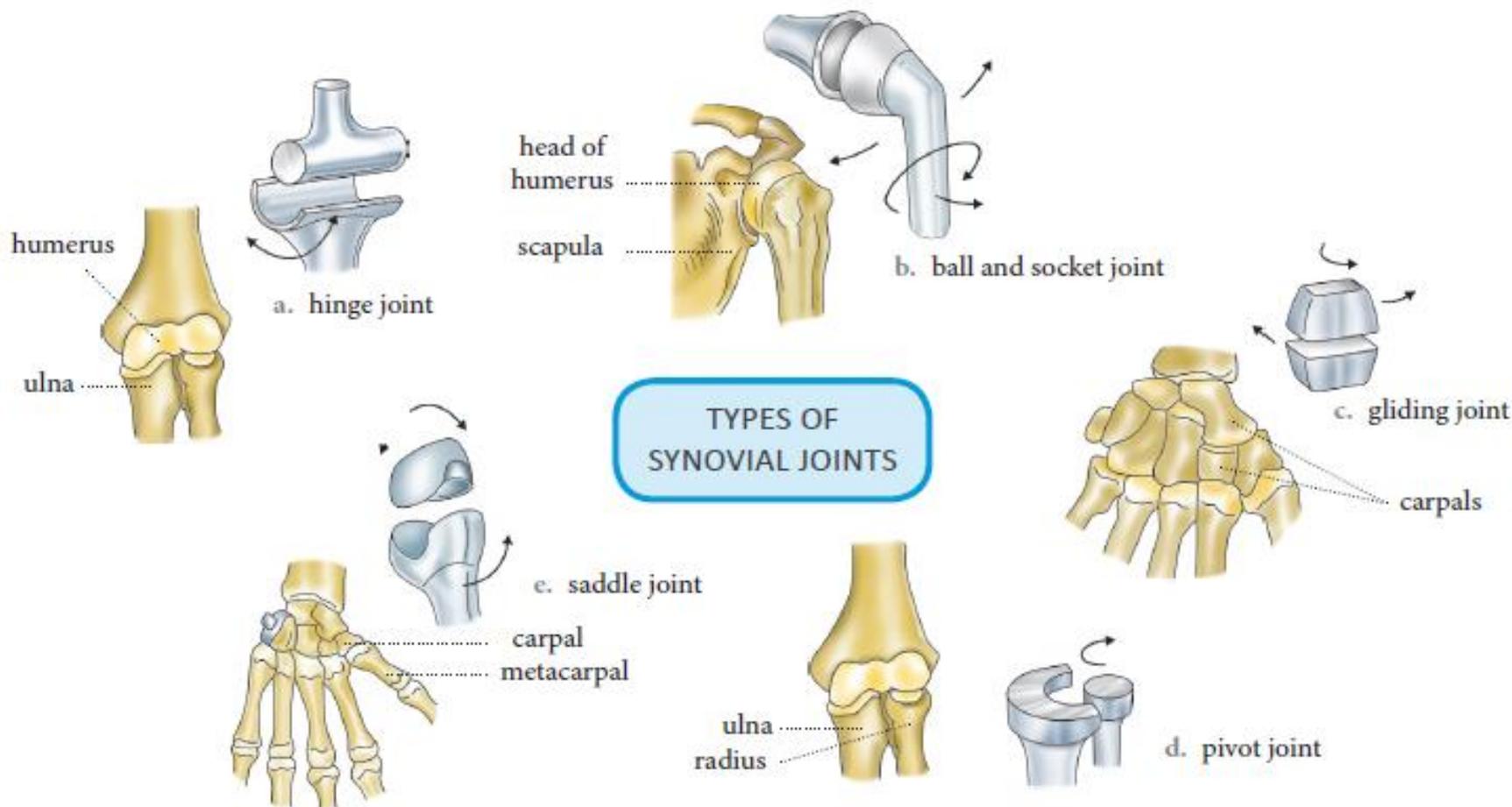


Figure 7.5 Types of synovial joints

# FUNCTION AND STRUCTURE OF CIRCULATORY SYSTEM AND HEART

## Meaning of Circulatory System

The circulatory system is a complex and vital network of organs and vessels that work together to transport blood, nutrients, hormones, oxygen, antibodies and lymph throughout the body. By continuously supplying these substances and removing waste products such as carbon dioxide, it maintains homeostasis (the stable state of normal body temperature and pH balance) and fights diseases

The circulatory system may be broken down into the following components:

- Heart
- The three vessels: arteries, veins and capillaries
- Lymphatic System

## The Heart

The heart is a hollow four-chambered muscular organ responsible for the pumping of blood.

Shape, Size and Weight:

Location:

Structure:

Function

The function of the heart is composed of three types of circulation:

1. Pulmonary Circulation:
2. Systemic Circulation:
3. Coronary Circulation:

### Blood Vessels

#### Arteries

Arteries make-up one of the three vessels through which blood is carried throughout the body. They transport oxygenated blood from the heart to the body. Each artery has three layers:

1. Tunica Intima:
2. Tunica Media:
3. Tunica Adventitia:

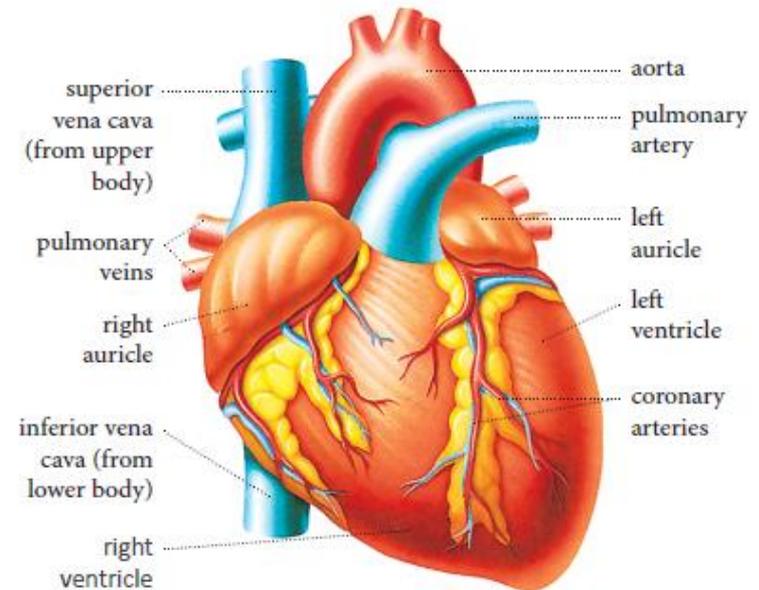


Figure 7.6 The external view of human heart

Arteries do not have a uniform size and structure. They may be divided into three categories:

1. Conducting Arteries:
2. Muscular Arteries:
3. Arterioles:

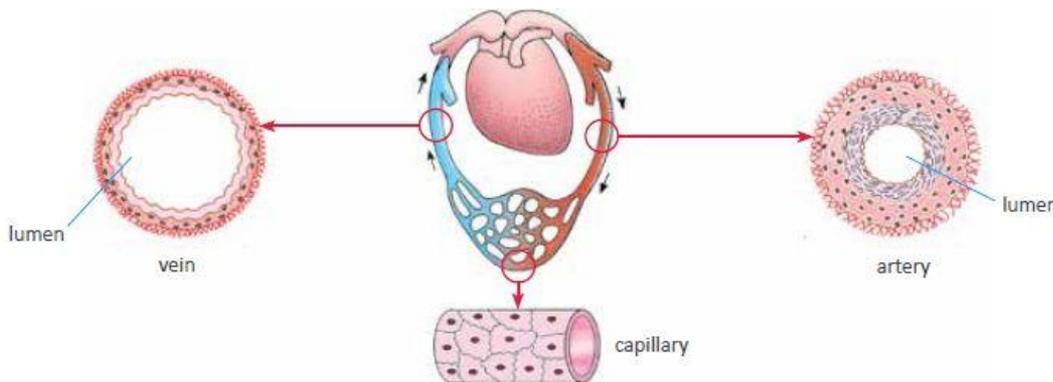
## Veins

Veins are different from arteries in many ways. They perform the opposite function – with the exception of pulmonary veins. Veins transport deoxygenated blood to the heart from the rest of the body.

## Capillaries

Capillaries are the smallest vessels with diameters ranging from 8 to 10 micron and are made of tunica intima only. Capillaries can be classified into three types based on the structure of their endothelial cells:

1. Continuous Capillaries:
2. Fenestrated Capillaries:
3. Sinusoidal Capillaries:



**Figure 7.7** Diagrammatic relationship between arteries, veins and capillaries.

## The Lymphatic System

It is an open subsystem, the function of which contributes to the efficient running of the cardiovascular part of circulation and to the strength of the immune system in general.

The lymphatic system primarily transports 'lymph', an interstitial fluid containing leftover WBCs and other materials.

## Functions of the Circulatory System

The circulatory system performs five important functions:

1. Transportation of Oxygen, Essential Nutrients and Hormones:
2. Stabilisation of pH Balance:
3. Maintenance of Body Temperature:
4. Removal of Waste Products:
5. Boosting the Immune System:

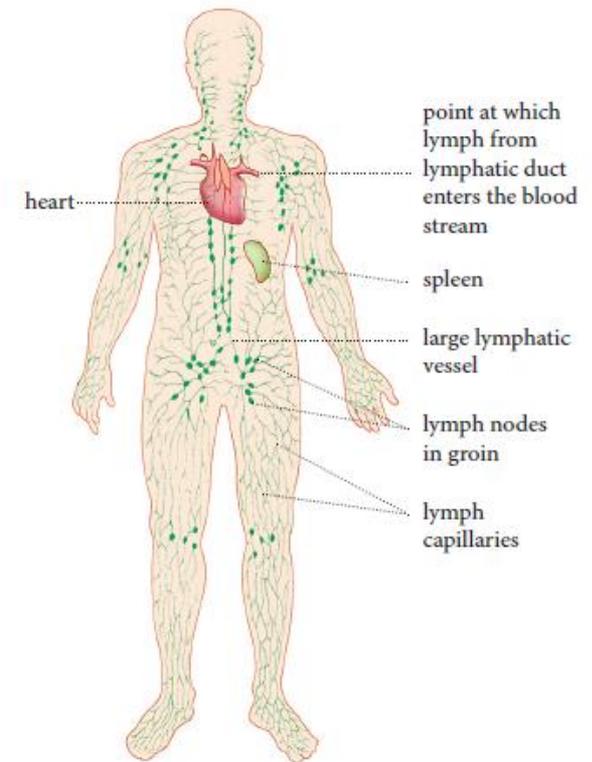


Figure 7.8 The lymphatic system

# FUNCTION AND STRUCTURE OF RESPIRATORY SYSTEM

## Respiration

Respiration is the chemical process of converting oxygen and glucose into  $\text{CO}_2$ , water and energy and then eliminating the  $\text{CO}_2$  and excess water through exhalation.

## Structure of Respiratory System

- |            |          |            |
|------------|----------|------------|
| The Nose:  | Pharynx: | Larynx:    |
| Trachea:   | Bronchi: | Diaphragm: |
| The Lungs: |          |            |

## Mechanism of Respiration

It can be divided into two stages:

1. Inspiration or Inhalation:
2. Expiration or Exhalation:

## Types of Respiration

The two types of respiration are:

1. External Respiration:
2. Internal Respiration:

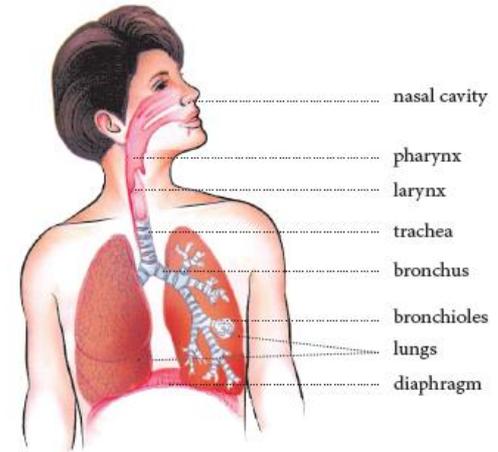


Figure 7.9 The respiratory system

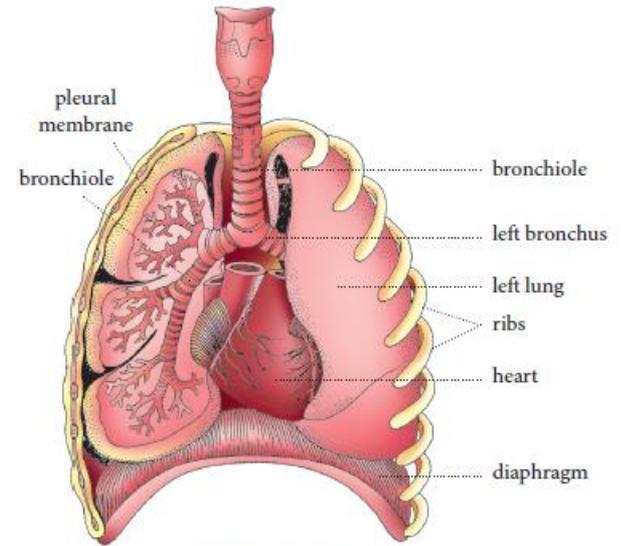
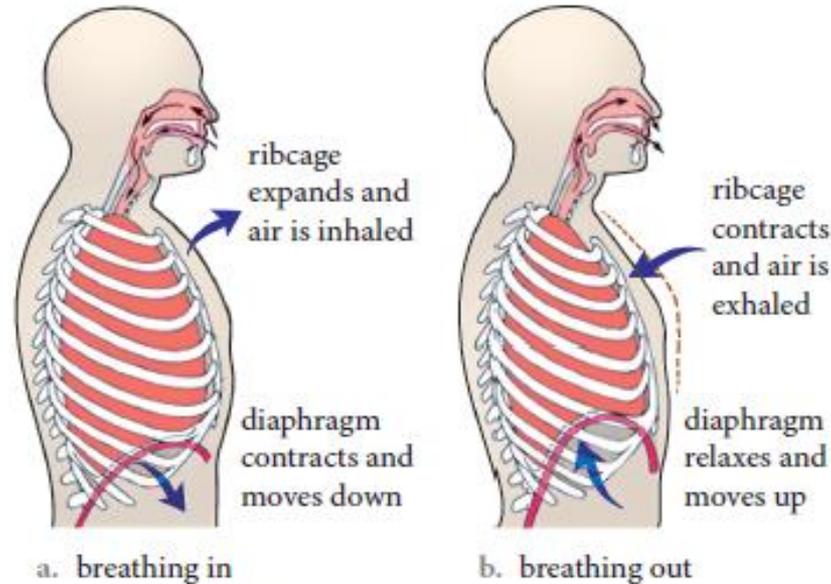


Figure 7.10 The lungs



**Figure 7.11** Mechanism of breathing

## Functions of Respiration

The main functions of respiration are:

- to implement inhalation and exhalation and thus obtain oxygen and eliminate carbon dioxide and excess water from the body
- to produce energy inside the body using oxygen
- to produce sound through the vibration of the vocal chords
- to enable olfaction, the detection of smell.

## SUMMARY

1. Anatomy is the study of the structure of living organisms. It is derived from two Greek words: '*ana*' for 'up', and '*tomia*' for 'cutting'.
2. Physiology is the study of how living systems function. It is derived from Latin '*physiologia*', which means 'study of nature'.
3. In sports, it is crucial to learn how our circulatory system, respiratory system, nervous system, muscles, bones and metabolism work and what type of chemical changes occur inside our body during exercise. Training methods are planned accordingly to fully utilise the athletes' potential without ruining their health.
4. The skeletal system is a combination of all the bones in the body together with the structures that support them. The adult human body has 206 bones of various shapes and sizes.
5. Joints are the points where bones intersect. They hold the skeleton together and help it to carry out movements.
6. Joints can be classified into three groups: immovable joints, slightly movable joints and freely movable joints.
7. Up to 60% of the body's total volume of blood is found in the veins at any point of time.
8. There are around 40 billion capillaries in our body, though they carry only 5% of the total volume of blood.

## SUMMARY

- 9.** Capillaries deliver blood to the tissues and have thin enough walls to allow interchange of substances between cells and the blood.
- 10.** More than 5 litres of blood travels through 96,560 kilometres of blood vessels per minute at rest. When the heart fails, the entire body of the organism is fatally affected.
- 11.** Arteries make up one of the three vessels through which blood is carried throughout the body. They transport oxygenated blood from the heart to the body.
- 12.** Veins, with the exception of pulmonary veins, transport deoxygenated blood to the heart from the rest of the body.
- 13.** Respiration is the chemical process of converting oxygen and glucose into  $\text{CO}_2$ , water and energy, and then eliminating the  $\text{CO}_2$  and excess water through exhalation.
- 14.** The mechanism of respiration is basically breathing which is divided into two stages: inspiration or inhalation and expiration or exhalation.