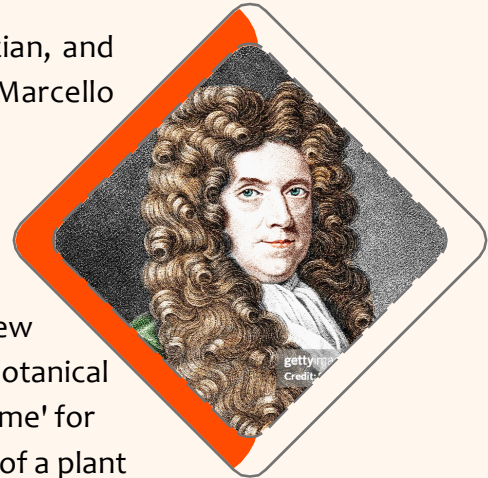
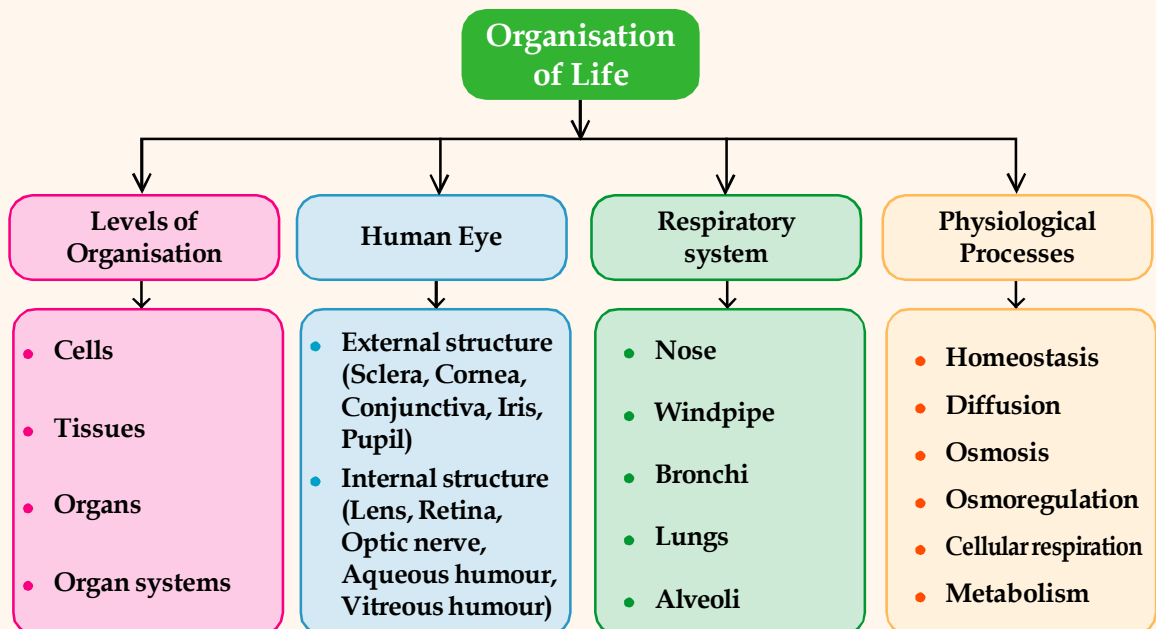


ORGANISATION IN LIVING BEINGS

Nehemiah Grew was an English botanist, physician, and microscopist. Along with the Italian microscopist Marcello Malpighi, he is considered one of the founders of plant anatomy. Grew's first book on plant anatomy, *The Anatomy of Vegetables Begun*, was presented to the Royal Society of London at the same time as Malpighi's manuscript on the subject. In his work, Grew noted the existence of cells and introduced several botanical terms, including 'radicle' for the embryonic root, 'plume' for what is now known as the plumule (the primary bud of a plant embryo), and 'parenchyma' for unspecialized plant cells.



CONCEPT MAP



CONCEPT 1.1

Introduction:

There are millions of different things in this world around us. Some of them are living and some are not. People, cats, mice, insects and trees, are living things, while rocks, water, chair and table are not living and are called non-living. Living things exist along with non-living objects on this earth. However, living things show certain characteristics that distinguish them from non-living things.

These characteristics include cellular organisation, nutrition, respiration, growth, excretion, reproduction, movement and response to stimuli. In addition to the cellular organisation, the living things exhibit unique **organisation** which allows them to coordinate the different function of life.

What does this 'organisation' mean?

The term **organisation** denotes the manner in which smaller units or components of any structure are aggregated into higher or bigger units. Each unit of aggregation represents the **level**. There can be different levels or organisation, as discussed below. At each level, there are interactions between the units. The main function of organisation is to help the living thing to perform different functions, and thus sustain life.

Levels of Organisation in the Living:

There are two broad levels of organisation - one below the level of the organism (the individual plant or animal) and the other above the level of the organism. These two levels constitute the "**lower**" levels and "**higher**" levels of organisation respectively.

Lower Levels of Organisation:

Each living organism is made up of parts, subparts and so on. For example, in flowering plants, there are roots, stems, branches, leaves, flowers and fruits. These parts have further subparts. Likewise in animals also, there are parts such as head, neck, abdomen, hands, legs, feet, eyes, and so on.

All these parts represent lower levels of organisation.

Lower levels of organisation are of two types -

1. Molecular level:

All organisms are made up of cells. The cells are made up of smaller parts called **organelles**. The organelles in turn are made up of various **molecules**. The molecules are made up of **atoms** of various elements. Six of these elements (carbon, hydrogen, nitrogen, oxygen, sulphur and so on). These molecules have further given rise to large molecules and compounds like carbohydrates, proteins, fats and nucleic acids (DNA - deoxyribonucleic acid, RNA -ribonucleic acid). The living substance called **protoplasm**, which makes up cells, is made of all these compounds.

DNA is an important compound, responsible for the transfer of characters from parents to children. It is known as the molecule of life.

Thus, at the molecular level, following organisation occurs:

Atoms → Molecules → Compounds → Organelles → Cells.

2. Cellular level (Cells and Tissues):

A **cell** is the lowest level of cellular organisation. It is the smallest living unit and is capable of performing all the functions of life. In unicellular organisms like **Amoeba, Paramecium** (also written as Paramecium) and bacteria, all the functions are carried out by the single cell. But it is not so in a multicellular organism.

In a multicellular organism, although each cell can carry out the important functions of life, it is not capable of existence on its own. A muscle cell cannot obtain its own food or oxygen. Other specialized cells in the body collect food or carry oxygen.

All the cells do not perform all the jobs. Different tasks or functions like ingestion of food, digestion, respiration, excretion and reproduction are divided among groups of cells. For example, nerve cells are very long, and this helps them to conduct messages from the one part of the body to another. Similarly, in plants, xylem elements are long and tubular and are specialised for movement of water from the roots to the stem and leaves.

It would be clear from the above account that the body of a multicellular organism is highly organised. It shows various levels of organisation, starting from the cells.

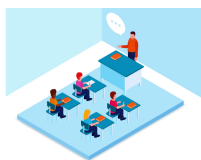
Cells that are alike in size and shape team up. They work together to do special jobs. These cell “teams” are called **tissues**. Thus, cells combine to form tissues.

“A group of similar cells that work together to do the same job is called a tissue”. In other words, a tissue is a group of cells similar in structure and function.

Tissues in plants - Epidermal tissue, vascular tissue and ground tissue.

Each of these tissues is meant for a different function. For example, epidermis (epidermal tissue) which is the outermost layer of tissue provides protection to the plant body. The ground tissue represented by cortex lies inner to epidermis. Its conduction of water and food materials. All these tissues can be observed by taking a section of the root or stem.

Tissues in animals - Epithelial tissue, connective tissue, nervous tissue, and muscular tissue. As in plants, different tissues in animals also perform different functions. For example, nervous tissue helps in the conduction of messages from one part of the body to another. Epithelial tissue is a protective tissue. Skin is an epithelial tissue. Connective tissue consisting of cartilages and bones provides support to the body.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.1

1. **What distinguishes living things from non-living things?**
 - (A) Cellular organization
 - (B) Movement
 - (C) Reproduction
 - (D) Response to stimuli
2. **What is the primary function of organization in living things?**
 - (A) To sustain life
 - (B) To differentiate between cells and tissues
 - (C) To form molecules and compounds
 - (D) To regulate growth
3. **Which of the following is a lower level of organization in living organisms?**
 - (A) Organs
 - (B) Tissues
 - (C) Cells
 - (D) Molecules
4. **What is the correct sequence of organization at the molecular level?**
 - (A) A t o m s → O r g a n e l l e s → M o l e c u l e s → C o m p o u n d s → C e l l s
 - (B) A t o m s → C o m p o u n d s → M o l e c u l e s → O r g a n e l l e s → C e l l s
 - (C) A t o m s → M o l e c u l e s → C o m p o u n d s → O r g a n e l l e s → C e l l s
 - (D) A t o m s → M o l e c u l e s → O r g a n e l l e s → C o m p o u n d s → C e l l s
5. **Which of the following is the smallest living unit capable of performing all life functions?**
 - (A) Organ
 - (B) Organism
 - (C) Cell
 - (D) Tissue
6. **In multicellular organisms, which type of cells carry out specific functions?**
 - (A) Nerve cells
 - (B) Epithelial cells
 - (C) Stem cells
 - (D) Prokaryotic cells
7. **What are tissues composed of?**
 - (A) Different types of cells
 - (B) Only one type of cell
 - (C) Organs
 - (D) Molecules and compounds
8. **Which tissue in plants provides protection to the plant body?**
 - (A) Vascular tissue
 - (B) Ground tissue
 - (C) Epidermal tissue
 - (D) Xylem tissue
9. **What is the primary function of nervous tissue in animals?**
 - (A) Conduction of messages
 - (B) Providing support
 - (C) Protection
 - (D) Movement
10. **What tissue in animals consists of cartilages and bones?**
 - (A) Nervous tissue
 - (B) Muscular tissue
 - (C) Epithelial tissue
 - (D) Connective tissue

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

1 A B C D	2 A B C D	3 A B C D	4 A B C D	5 A B C D
6 A B C D	7 A B C D	8 A B C D	9 A B C D	10 A B C D

CONCEPT 1.2

Organs:

Tissues combine to form organs. An organ is made of different kinds of tissues. Your stomach is an organ. It is made up of different tissues like nerve tissue, blood tissue, fat tissue and muscle tissue.

Your stomach, mouth, food pipe, and small intestine are all organs. These are organs of digestion. An organ performs a specific function. Similarly, your heart is an organ. The heart pumps blood. It is made mostly of muscle tissue, with some blood tissue and fat tissue. These tissues work together to allow the heart to pump blood. Your lungs and windpipe are organs used for breathing.

Likewise, your kidneys are the organs of excretion. You also possess organs for sensing what is happening around you. The ear is sense organ. Your eyes tongue, skin and nose are sense organs too.

Largest organ in the body is your skin. It covers and protects your body. It helps you to get rid of three waste material - salts, water and heat.

Organs may be **external** or **internal**. The organs described above like the stomach, heart, kidneys, intestine are internal organs. External organs for example, include ear, eye, arms, legs hands and feet.

Similarly, in plants, roots, stems, leaves and flowers are organs. These organs perform different jobs and are composed of different tissues like the epidermal tissue, vascular tissue (xylem and phloem), and the ground tissue as mentioned earlier.

Organ System:

Organs do important jobs. But they do not work alone. Usually, several organs team up and work together to carry out a certain life function. A group of organs working together is called an **organ system**.

Your digestive system is an organ system. Can you recall some of the organs of the digestive system? These are the mouth, the food pipe, the stomach, and the intestines. Each organ has a special job to do. Together, they digest your food.

There are several organ systems in your body. Can you name a few of these organ systems besides the digestive system?

There are some organs that are parts of more than one system.

Organisation in Living Beings - IX

For example:

- (a) The liver is a part of the digestive system. The liver is also a part of the excretory system, which gets rid of wastes.
- (b) The large intestine is a part of the digestive system. But it is also a part of the excretory system.

In plants, there are two organ systems - the **root system** and the **shoot system**. Each of these systems has several organs. For example, the shoot system has stem, branches, leaves, flowers and fruits. The root system has roots and root branches.

Organism:

The organ systems collectively form an organism. The whole organism is a product of all the systems working together in uniform with each other. Each organism, thus, possesses a well organised structure consisting of smaller parts. The cell is the smallest unit or level of cellular organisation.

Molecular and cellular levels of organisation are, thus, represented as follows:
Atoms → Molecules and compounds → Organelles → Cells → Tissues → Organs → Organ systems → Organism

Higher Levels of Organisation:

Higher levels of organisation beginning from the organism, in the order of increasing complexity, are the following:

- (i) Population, (ii) Biotic community, (iii) Ecosystem, and (iv) Biosphere.

(i) Population:

An organism or an individual does not exist in isolation. Rather, it lives in association with other individuals of its own kind, i.e. species. **All the individuals of a single species existing in a give locality or area constitute a population.** A population is, thus, the next higher level of organisation above the individual level.

For example, we belong to a human species called **Homo sapiens**. The different individuals occurring in a particular area represent population of **Homo sapiens**. Likewise, there exist populations of different species of plants and animals.

Individuals of populations of one species can breed among themselves only. They do not breed with individuals of other species.

IX - Organisation in Living Beings

Thus, a frog breeds with frog only and a cat with another cat. This is true in case of plants also.

The members of a population compete with each other for same resources - food, space, light and water.

(ii) Biotic Community:

The populations of different species occurring in a locality constitute the next higher level of organisation called the **community or biotic community**. For example, in a wheat field, you find along with wheat plants, other plants called weeds with grow in the whet field. In addition, different kinds of insects, worms, birds and mammals (like rat) are found in the field. The populations of all these different species found in the wheat field or any crop field constitute a biotic community. Members of different populations do not have similar requirements of food and shelter, though they live in the small area. Community, thus, is a higher level of organisation above the population.

(iii) Ecosystem:

The biotic community in an area interacts with the non-living physical environment, and the two (i.e., the biotic community and the abiotic environment) together constitute the next higher level of organisation, termed the **ecosystem**. **Examples:** Forests, crop fields, deserts, ponds and rivers are all examples of ecosystems.

There are two main components of an ecosystem - **non-living (abiotic)** and **living (biotic)** components. **Abiotic components**, or non-living components, include (i) physical environment (like soil, water, air and minerals), and (ii) climatic factors (light, temperature, wind and rain)

Biotic components, or **living components**, consist of (i) **Autotrophs** or **producers** (green plants) (ii) **Heterotrophs** or **consumers**.

Different types of heterotrophs are herbivores and carnivores. **Decomposers** (saprophyte) like bacteria and fungi play an important role in the recycling of minerals. The different living organisms in an ecosystem are interconnected through the food chains starting from the consumers.

(iv) Biosphere:

The various ecosystems found in all the geographical regions of the world form the next level of organisation is called the biosphere.

Biosphere is the highest level of organisation in the living world. Biosphere is that part of universe that supports life in air, soil and water.

Organisation in Living Beings - IX

Thus, **all living organisms inhabiting soil, air and water constitute biosphere.**

Biosphere consists of four components, of which three are non-living, These are:

1. **Hydrosphere** (water bodies)
2. **Lithosphere** (land or soil)
3. **Atmosphere** (air)
4. **Living organisms** (plants and animals)

The different levels of organisation found in the biosphere up to the individual level are as follows:

- i) **Protozoa** - Single-cell animal.
- ii) **Sponges** - Loose aggregation of cells without tissue formation.
- iii) **Coelenterate** - Two-layer tissue-level organisation.
- iv) **Platyhelminthes** - Three-layer arrangement of cell having separate head, organ for attachment and well-developed reproductive system.
- v) **Nemathelminthes** - Well-developed exoskeleton, muscular alimentary, circulatory, excretory, locomotory, respiratory and excretory systems.
- vi) **Annelida** - Well-developed exoskeleton, muscular alimentary, circulatory, excretory, locomotory, respiratory and excretory systems.
- vii) **Arthropods** - Integumentary system with a hard exoskeleton and well developed muscular and other systems.
- viii) **Molluscs** - Integumentary system with a hard exoskeleton, specialised locomotory system and varied type of respiratory system.
- ix) **Echinodermata** - Unique system called water vascular system, all other systems are presents.
- x) **Chordata** - All ten systems are present, Human beings are noted for their erect posture. Free four limbs and well-developed brain.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.2

1. What distinguishes an organ from a tissue?
 - (A) Size
 - (B) Function
 - (C) Composition
 - (D) Complexity
2. Which of the following is NOT an organ of digestion?
 - (A) Stomach
 - (B) Kidneys
 - (C) Small intestine
 - (D) Food pipe
3. What is the primary function of the heart?
 - (A) Digestion
 - (B) Excretion
 - (C) Pumping blood
 - (D) Breathing
4. What is the largest organ in the human body?
 - (A) Heart
 - (B) Brain
 - (C) Liver
 - (D) Skin
5. Which of the following is NOT an external organ in humans?
 - (A) Ear
 - (B) Skin
 - (C) Stomach
 - (D) Arms
6. What are organs composed of?
 - (A) Atoms
 - (B) Cells
 - (C) Tissues
 - (D) Molecules
7. Which organ system is responsible for digestion?
 - (A) Respiratory system
 - (B) Nervous system
 - (C) Digestive system
 - (D) Circulatory system
8. Which organ is part of both the digestive and excretory systems?
 - (A) Liver
 - (B) Stomach
 - (C) Small intestine
 - (D) Large intestine
9. In plants, what are the two organ systems?
 - (A) Root and leaf systems
 - (B) Stem and leaf systems
 - (C) Root and shoot systems
 - (D) Stem and flower systems
10. What is the highest level of organization in the living world?
 - (A) Organism
 - (B) Population
 - (C) Ecosystem
 - (D) Biosphere

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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| 6 A B C D | 7 A B C D | 8 A B C D | 9 A B C D | 10 A B C D |

CONCEPT 1.3**Animal Tissue:**

A group of cells similar in structure, function, and origin is called tissues. In animals, the structure of a tissue depends on its function. An animal body is made of four different types of tissues. They have been classified based on the type of cell, function, and location in the body. They include:

- | | |
|-----------------------------|-----------------------------|
| 1. Epithelial tissue | 2. Connective tissue |
| 3. Muscular tissue | 4. Nervous tissue |

The tissues differ in the amount and structure of inter cellular substance or matrix. They also differ in function. The epithelial tissue performs protection, excretion, secretion, sensation and absorption. The connective tissue is the supporting and binding tissue. Muscular tissue aids in contraction and movement of the body. Nervous tissue helps in coordination of different organs. The four types of tissues present in the animals are present in different organs and they are specific in structure and their functions.

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1. Epithelial Tissue:

All layers and organs in the body are lined by a group of tissues called epithelial tissues which are commonly referred to as epithelium. They cover the surface of all internal as well as external organs. Epithelial tissue is highly permeable. Thus, it plays a significant role in the exchange of substances across the cells and helps in maintaining the osmoregulation. Depending on the number of layers of cells it is composed of epithelium has been divided into simple epithelium and compound epithelium. The main functions of epithelial tissue are protection, secretion, absorption, and sensation.

Simple Epithelial Tissue:

This type of epithelium is composed of a single layer of cells which mainly make up the linings of ducts (vessels), tubes and other cavities in the body. Based on the structure of the cell, the simple epithelial tissue is classified into three types viz.

Squamous epithelium:

It is a simple single-layered epithelium.

Structurally, squamous epithelium is made up of flat cells and tile like with irregular boundaries.

It forms linings of blood vessels mesothelium of body cavities of lungs and alveoli etc.

Cuboidal epithelium:

The tissue is made of single layer of cube-shaped cells.

Proximal and distal convoluted tubules of nephron with centrally located spherical nuclei.

Columnar epithelium:

It is composed of single layer tall and slender, column-shaped

It forms the lining of stomach and intestine.

In some organs, cuboidal and columnar epithelial have cilia present on the outer surface which is called ciliated epithelium. It helps in the directional movement of materials along the hollow organs like the respiratory tract. The cuboidal or columnar epithelia which are specialized in secretions are called glandular epithelium which includes the exocrine and endocrine glands.

Compound Epithelial Tissue:

The compound epithelium is a multilayered (two or more layers of cells) tissue. The key function of compound epithelium is protection and has a limited role in secretion. Skin is a compound epithelium which functions as a barrier against chemical and mechanical stress.

2. Connective Tissue:

As their name suggests, they connect and support the different tissues, organs, and parts of the body. Among the animal tissues, connective tissues are the most abundant ones in the body. The connective tissue cells are freely arranged in a matrix and are widely distributed in the body. Different types of connective tissues include areolar tissue, adipose tissue (fat), blood, bone, and cartilage. Except for blood, all other cells secrete collagen (elastin) which offers elasticity and flexibility to the tissues.

Areolar Connective Tissue:

It is found underneath the skin, also around nerves and blood vessels.

It is composed of fibroblasts, macrophages and plasma cells.

It provides support and repair tissues.

Adipose Tissue:

It is present in skin (subcutaneous fat) and organs (visceral fat).

It is composed of fat globules and is characterized by fat storage

It provides insulation due to the fat present.

Areolar tissue and adipose tissue are indeed types of loose connective tissue.

In both, cells and fibres are loosely scattered in a semi-fluid matrix, which is characteristic of loose connective tissues.

Bone:

Bone is a hard connective tissue which forms the framework of the body.

It has a rigid matrix rich in calcium and collagen fibres.

Functions include protection, support, facilitates movements and serves as a site for blood cell production.

Cartilage: Cartilage is made of chondrocytes with dense, flexible intercellular materials. In the majority of vertebrates, cartilages in embryos get replaced by bones on maturity. They are present at the tips of external ears, bronchi, vertebral column, etc.

Blood: Blood is the only fluid connective tissue composed of blood cells (RBC, WBC, and platelets) and plasma.

Functions: Transportation, defence, blood clotting and helps in homeostasis. Blood, bone, and cartilage are specialized connective tissues.

3. **Muscular Tissue:** There are 3 types of muscle tissue:

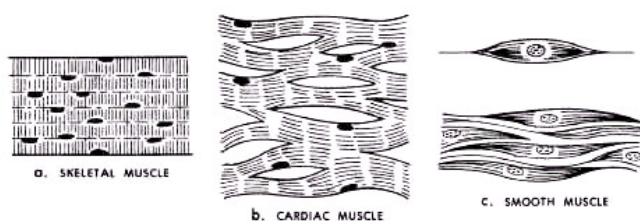
Skeletal muscle tissue,
Cardiac muscle tissue, and
Smooth muscle tissue.

The structure of these muscle tissues can be described from the level of detail of the muscle fibres

(muscle cells) through all the other muscle structures and parts of structures that bind muscle cells together enabling them to perform their functions.

The functions of muscle tissues depend on the type of muscle tissues and their locations in the body.

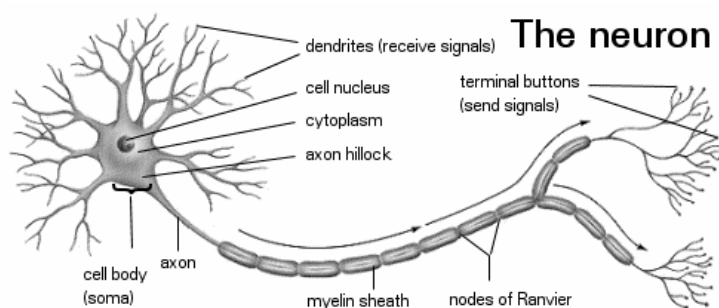
The cytoplasm of muscle fibres contains several myofibrils. Each myofibril has myosin and actin myofilaments.

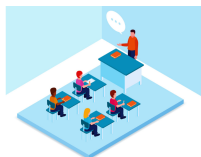


4. **Nervous Tissue:**

Nervous tissue or nerve tissue is the main tissue component of the two parts of the nervous system, the brain and spinal cord of the central nervous system (CNS), and the branching peripheral nerves of the peripheral nervous system (PNS), which regulates and controls bodily functions and activity. Nervous tissue is made up of different types of nerve cells, all of which have an axon, the long stem-like part of the cell that sends action potential signals to the next cell. Bundles of axons make up the nerves.

Functions of the nervous system are sensory input, integration, control of muscles and glands, homeostasis, and mental activity.





CLASSROOM DISCUSSION QUESTIONS

CDQ
1.3

1. **What is the primary function of epithelial tissue?**
 - (A) Contraction
 - (B) Protection
 - (C) Storage
 - (D) Coordination
2. **Which type of epithelial tissue is composed of cube-shaped cells?**
 - (A) Squamous epithelium
 - (B) Cuboidal epithelium
 - (C) Columnar epithelium
 - (D) Ciliated epithelium
3. **What is the main function of compound epithelial tissue?**
 - (A) Absorption
 - (B) Secretion
 - (C) Contraction
 - (D) Protection
4. **What is the primary function of connective tissue?**
 - (A) Contraction
 - (B) Protection
 - (C) Support
 - (D) Coordination
5. **Where is adipose tissue primarily found?**
 - (A) Underneath the skin
 - (B) In the blood vessels
 - (C) In the respiratory tract
 - (D) In the stomach lining
6. **Which connective tissue forms the framework of the body?**
 - (A) Areolar tissue
 - (B) Adipose tissue
 - (C) Bone
 - (D) Cartilage
7. **What is the main function of bone tissue?**
 - (A) Fat storage
 - (B) Blood cell production
 - (C) Insulation
 - (D) Protection
8. **Which muscle tissue is found in the heart?**
 - (A) Skeletal muscle tissue
 - (B) Cardiac muscle tissue
 - (C) Smooth muscle tissue
 - (D) Nervous tissue
9. **What is the function of nervous tissue?**
 - (A) Contraction
 - (B) Support
 - (C) Integration
 - (D) Secretion
10. **Where is nervous tissue primarily located in the body?**
 - (A) Brain and spinal cord
 - (B) Skin
 - (C) Stomach
 - (D) Blood vessels

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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CONCEPT 1.4

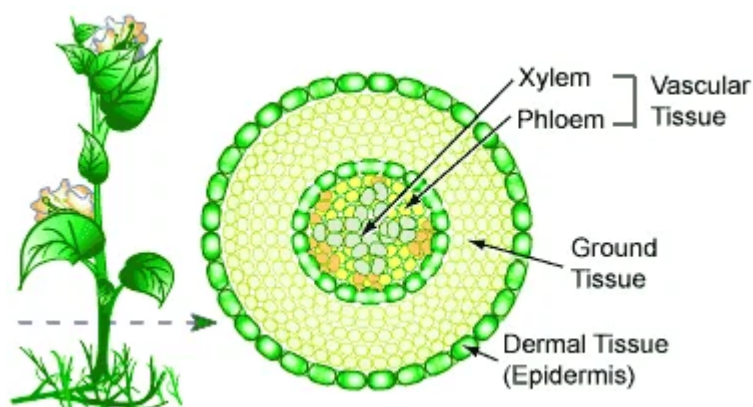
Plant Tissues:

A single cell which may be the fertilised egg or the zygote, from where the life of an organism starts. This single cell undergoes repeated mitotic division to form a multi-cellular embryo and finally the organism gradually differentiates. The stages of formation of a multi-cellular organism are as follow:

Cells → Tissue → Tissue system → Organ → Organ system → Body

But in the unicellular organism all physiological functions are carried out by a single cell, so this organisation is not found. In higher plants, tissue systems are of three types. Those are:

1) Epidermal Tissue, 2) Ground Tissue and 3) Vascular Tissue



Classification of plant tissue: -

The plant tissue can be classified into three categories on the basis of the divisional power.

- 1. Meristematic tissue:** Growth in plants is largely restricted to specialised regions of active cell division called meristems. (meristos - divided)

The meristems which occur at the tips of roots and shoots.

- 2. Permanent tissue:** The cells of the permanent tissues do not generally divide further permanent tissues having all cells similar in structure and function are called simple tissue.

Permanent tissues having many different types of cells are called complex tissues.

- 3. Simple tissue:** Simple tissue is made of only one type of cells:

1. Parenchyma

2. Collenchyma

3. Sclerenchyma

Parenchyma: Parenchyma forms the major component within organs. They may be spherical, oval, round, polygonal or elongated in shape.

Functions like photosynthesis, storage, secretion.

Collenchyma: Collenchyma layers below the epidermis in most of the dicotyledonous plants.

Cells be oval, spherical or polygonal and often contain chloroplasts.

They provide mechanical support to the growing parts of the plant.

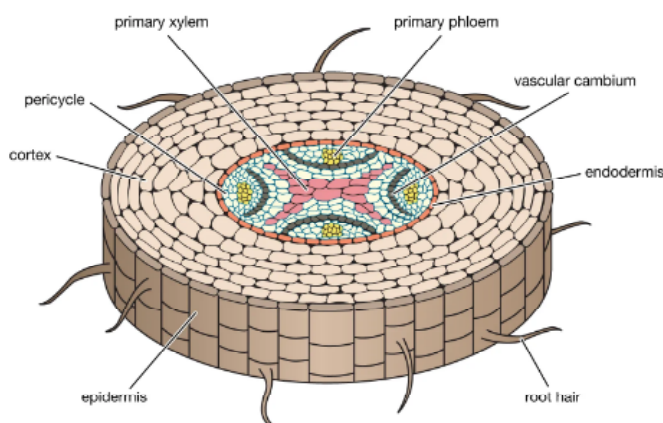
Sclerenchyma: Long, narrow cells which thick and lignified cell walls having a few or numerous pits.

Sclerenchyma may be either fibres or sclereids.

Provides mechanical support to organs.

What is the Vascular Tissue?

The tissue responsible for the conduction of food and water is called Vascular Tissue. The xylem and phloem are the two major components of vascular tissues.



The permanent tissue with heterogeneous elements is known as complex tissue. This plant tissue is mainly of two types, i.e., xylem and phloem. Both of them constitute the vascular bundle. Xylem tissue is composed of four major elements. These are the tracheids, vessels, xylem parenchyma, and xylem fibres. One of them that are the xylem parenchyma is only the living tissue. Likewise, the phloem elements include sieve cells, sieve tubes, companion cells, phloem-parenchyma and phloem fibres. Sieve cells are common in gymnosperms and pteridophytes (transport of nutrients and sugars), but sieve tube is common in angiosperms (flowering plants).

In plant tissues, the xylem conducts water and minerals from the roots to the leaves in the upward direction through the transpiration stream. The phloem, on the other hand, transports the prepared food from the leaves in upward, downward, and lateral directions. Sieve elements are living but lack a nucleus, while phloem parenchyma and companion cells are living. Phloem fibres, however, are dead elements.

What is secondary growth?

The cambium or lateral meristem is a strip of procambium situated in between xylem and phloem in the vascular bundles of dicots and gymnosperms, which remains meristematic even after primary growth is over. Cambium can be of three types:

i) Fascicular cambium: The cambium present in between the xylem and phloem within the vascular bundles is called fascicular cambium.

ii) Inter-fascicular cambium: The cambium that develops between two vascular bundles in the medullary rays is called the inter-fascicular cambium. It joins with the fascicular cambium to form the cambial ring, which cuts off secondary xylem towards the centre and secondary phloem towards the periphery.

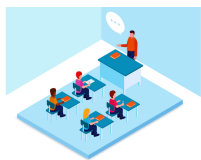
iii) Cork cambium: They are formed from cortical cells, epidermis layers get broken need to be replaced to provide new protective cell layers is called the phellogen, which forms the bark or periderm.

The increase in thickness or girth due to the activity of the cambium and cork cambium is known as secondary growth.

- 1) **Secondary growth in stem:** On the basis of the activities of cambium and cork-cambium, secondary growth in stem can be discussed under the following heads:

Activity of cambium: The vascular cambium between the xylem and phloem is called intrafascicular or fascicular cambium, which is primary in origin. During secondary growth, the parenchymatous cells of the medullary rays between the vascular bundles become meristematic and form a strip of cambium called the interfascicular cambium, which is secondary in origin. Both interfascicular and intrafascicular cambium join together to form the cambium ring, which is partly primary and partly secondary in origin. Through anticlinal divisions, the circumference of the cambium increases. Through periclinal divisions, the cambium produces secondary xylem and phloem tissues on the inner and outer sides, respectively. The amount of secondary xylem produced is 8–10 times greater than that of secondary phloem.

Annual rings: Activity of cambium is not uniform in those plants which grow in the regions where favourable climatic conditions (spring or rainy season) alternate regularly with unfavourable climatic conditions (cold water or dry hot summer). In temperate climates, cambium becomes more active in spring and forms greater number of vessels with wider cavities, while in winter it becomes less active and forms narrower and smaller vessels. The wood formed in the spring is known as spring wood and that formed in the dry summer or cold winter autumn wood or late wood. Both autumn and spring wood constitute a growth or annual ring. In one year only one growth ring is formed. Spring wood is light in colour while autumn wood is dark in colour.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.4

1. **What is the primary function of vascular tissue in plants?**
 - (A) Protection
 - (B) Conduction of food and water
 - (C) Photosynthesis
 - (D) Reproduction
2. **Which type of tissue is responsible for secondary growth in plants?**
 - (A) Meristematic tissue
 - (B) Permanent tissue
 - (C) Vascular tissue
 - (D) Complex tissue
3. **What are the two major components of vascular tissue?**
 - (A) Parenchyma and sclerenchyma
 - (B) Xylem and phloem
 - (C) Epidermis and ground tissue
 - (D) Cambium and cork cambium
4. **What is the primary function of xylem tissue?**
 - (A) Conduction of prepared food
 - (B) Support
 - (C) Conduction of minerals and water
 - (D) Protection
5. **Which type of cambium is formed between two vascular bundles in the medullary rays during secondary growth?**
 - (A) Fascicular cambium
 - (B) Inter-fascicular cambium
 - (C) Cork cambium
 - (D) Vascular cambium
6. **What is the increase in thickness or girth due to the activity of cambium and cork cambium called?**
 - (A) Primary growth
 - (B) Secondary growth
 - (C) Meristematic growth
 - (D) Annual growth
7. **Which activity of cambium results in the formation of secondary xylem and phloem tissues?**
 - (A) Anticlinal division
 - (B) Periclinal division
 - (C) Lateral division
 - (D) Transverse division
8. **In which type of climate do plants form annual rings in their stem?**
 - (A) Uniform climate throughout the year
 - (B) Cold and dry winter climate
 - (C) Hot and humid climate
 - (D) Alternate regular climate patterns
9. **What is the light-colored wood formed during active cambium in spring called?**
 - (A) Spring wood
 - (B) Autumn wood
 - (C) Late wood
 - (D) Growth wood
10. **How many growth rings are typically formed in one year in plants experiencing seasonal climates?**
 - (A) One
 - (B) Two
 - (C) Three
 - (D) Four

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

- | | | | | |
|-----------|-----------|-----------|-----------|------------|
| 1 A B C D | 2 A B C D | 3 A B C D | 4 A B C D | 5 A B C D |
| 6 A B C D | 7 A B C D | 8 A B C D | 9 A B C D | 10 A B C D |

1. Many individual organisms can be organized into the following levels: cells, tissues, organs, and organs systems.
2. An ecosystem consists of all the populations in a given area, together with the non-living environment.
3. The biosphere is the part of Earth where all life exists.
4. The diversity of living things is called biodiversity.
5. Microscopic study of tissues is known as HISTOLOGY.
6. **Animal Tissue:** Animal tissues are classified into four based on the functions they perform.
i) Epithelial ii) Connective iii) Muscular iv) Nervous
7. **Epithelial tissue:** Forms the outer covering of body, lining of organs and their cavities.
8. Epithelium composed of only a single layer of cells is called simple epithelium, while epithelium composed of more than one layer of cells is called stratified.
i) Squamous epithelial cells are round, flat, and have an irregular border; their function is usually to diffuse or filter substances across tissues.
ii) Cuboidal epithelial cells, as wide as they are tall, are cube shaped; they are usually found lining glands where they secrete substances.
iii) Columnar epithelial cells are taller than they are wide and function mostly in absorption, such as in the digestive tract.
iv) Pseudostratified columnar epithelia appear to be stratified because there seems to be more than one row of nuclei, but, in fact, it is a single layer of cells with the nuclei at different levels.
v) Transitional epithelium has the ability to stretch, it usually lines the interior of organs such as the bladder.
9. **Dermal tissue:** A single layer of tissues showing variations in the types of cells gives protection to the plants.
10. **Cuticle:** Waxy, waterproof substance produced by epidermal cells of leaves, shoots, and other above-ground parts of plants, prevents damage and loss of water by evaporation.
11. **Epidermis:** In animals, outer layer of skin that consists mainly of epithelial cells and lacks nerve endings and blood vessels in plants, outer layer of dermal tissue.

ADVANCED WORKSHEET



Analytical Approach Type (A.A.T)

1. The lowest level of cellular organisation is a:

- (A) Cell
- (B) Organism
- (C) Tissue
- (D) Organelle

2. A group of similar cells which perform a particular function is called a:

- (A) Organism
- (B) Tissue
- (C) Organelle
- (D) Organs

3. Two organ systems in plants are:

- (A) Roots and stem
- (B) Root system and shoot system
- (C) Stem and branches
- (D) All the above

4. A level of organisation above the population is:

- (A) Organism
- (B) Ecosystem
- (C) Community
- (D) Biosphere

5. Biosphere consists of:

- (A) Atmosphere, lithosphere and hydrosphere
- (B) Atmosphere and hydrosphere
- (C) Ecosystem only
- (D) Abiotic components

6. Biotic community consists of:

- (A) Only animals
- (B) All organisms
- (C) Only plants
- (D) Organisms and the environment

7. Trachea is a part of:

- (A) Digestive system
- (B) Excretory system
- (C) Respiratory system
- (D) Circulatory system

8. Bones and cartilages are a part of:

- (A) Skeletal system
- (B) Respiratory system
- (C) Muscular system
- (D) Excretory system

9. The lowest level of organisation is:

- (A) Cells
- (B) Biosphere
- (C) Atoms
- (D) Molecules

10. The basic unit of a all living things are:
(A) Cells (B) Tissues
(C) Organs (D) Organisms
11. Which one of the following hierarchy is correct?
(A) Atoms → Cells → Systems → Organs
(B) Tissues → Cells → Systems → Organs
(C) Cells → Tissues → Organs → System
(D) Atoms → Cells → Systems → Tissues
12. Which one of the following is not an organ?
(A) Heart (B) Lung
(C) Kidney (D) Muscles
13. Which of these explains a community?
(A) A group of organisms found in several habitats
(B) A group of populations found in several habitats
(C) A group of many populations of different species living in the same habitat
(D) A group of animals intersecting with non-living things
14. Which of these is a producer?
(A) Plants (B) Animals
(C) Fungi (D) Bacteria
15. _____ is an example of tissue found in animals.
(A) Conducting tissue
(B) Ground tissue
(C) Epithelial tissue
(D) None of these
16. Biotic along with abiotic components form an:
(A) Organism
(B) Ecosystem
(C) Organ
(D) Organisation
17. _____ is an animal organ that pumps the blood throughout the body.
(A) Heart (B) Ear
(C) Stomata (D) Lungs
18. A group of the species living in a specific geographical area at a given time forms a:
(A) Cell
(B) Biosphere
(C) Population
(D) Community
19. Organisms in a community are _____ for their food and energy requirements.
(A) Independent
(B) Interdependent
(C) Dependent
(D) None of these
20. _____ help/helps in regulation of body temperature.
(A) Heart (B) Skin
(C) Bones (D) Ovaries
21. Blood cells are produced by:
(A) Bone marrow
(B) Heart
(C) Lungs
(D) Blood vessels

22. The _____ system provides movement to the body.
- (A) Reproductive
 - (B) Nervous
 - (C) Circulatory
 - (D) Skeletal
23. _____ is a part of the nervous system.
- (A) Spinal cord
 - (B) Skin
 - (C) Heart
 - (D) Liver
24. The respiratory system helps in:
- (A) Photosynthesis
 - (B) Oxidation
 - (C) Energy production
 - (D) Digestion
25. Excretory organs in humans are _____.
- (A) Lungs
 - (B) Kidneys
 - (C) Skin
 - (D) All of these
26. The process of producing young ones of its own kind is called _____.
- (A) Photosynthesis
 - (B) Digestion
 - (C) Reproduction
 - (D) Excretion
27. Which of the following is a protective tissue?
- (A) Muscular tissue
 - (B) Connective tissue
 - (C) Epithelial tissue
 - (D) Nervous tissue
28. The tissue which forms the internal lining of organs is:
- (A) Nervous tissue
 - (B) Epithelial tissue
 - (C) Connective tissue
 - (D) A muscle
29. Nervous tissue consists of:
- (A) Nerve cells
 - (B) Tendons
 - (C) Cyton
 - (D) Lymph
30. Short branching structures arising from the cell body of a neuron are called:
- (A) Axons
 - (B) Cyton
 - (C) Dendrites
 - (D) Lymph
31. The muscles which take part in breathing movements are:
- (A) Involuntary muscles
 - (B) Cardiac muscles
 - (C) Voluntary muscles
 - (D) All of these
32. Muscles found in heart are:
- (A) Voluntary muscles
 - (B) Cardiac muscles
 - (C) Involuntary muscles
 - (D) All of these
33. Which type of tissue form the thin surface for the gas exchange in the lungs?
- (A) Epithelial
 - (B) Connective
 - (C) Nervous
 - (D) Muscle

34. The epithelium, which lines the inner surface of stomach of man, is made of _____.

- (A) Squamous epithelium
- (B) Pseudostratified epithelium
- (C) Columnar epithelium
- (D) Stratified epithelium

35. Which one of the following epithelial cells repairs the injured skin?

- (A) Columnar
- (B) Sensory
- (C) Squamous
- (D) Cuboidal

36. Inner surface of intestine is lined by:

- (A) Muscles only
- (B) Epithelial tissue only
- (C) Several types of tissues
- (D) Epithelial and muscular both types of tissues



Analytical Approach Type (A.A.T)

37. Nervous system consists of ____.

- i) Brain ii) Spinal cord
- iii) Nerves iv) Sense organs

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (iii) & (iv)
- (D) All of these

38. Which of the following are the components of 'Biosphere' ?

- i) Hydrosphere
- ii) Lithosphere
- iii) Atmosphere
- iv) Flora & Fauna

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (iii) & (iv)
- (D) All of these

39. Smooth muscles occur in ____.

- i) Vein
- ii) Artery
- iii) Uterus

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (i) & (iii)
- (D) All of these

40. Epithelial tissue performs the following functions:

- i) Sensation
- ii) Secretion
- iii) Absorption

- (A) (i) & (ii)
- (B) (ii) & (iii)
- (C) (i) & (iii)
- (D) All of these



Matrix Matching Type (M.M.T.)

SET-I

Column - I

- 41. Fat storing
- 42. Osteoblasts
- 43. Fibroblasts
- 44. Cartilage

Column - II

- (A) Bone tissue
- (B) Areolar tissue
- (C) Shark
- (D) Adipose tissue
- (E) Ear pinna

SET-II

Column - I

- 45. Fascicular cambium
- 46. Inter-fascicular cambium
- 47. Phellogen
- 48. Cambial ring

Column - II

- (A) Originates from medullary ray cells
- (B) Present inside vascular bundles
- (C) Replaces broken epidermis during secondary growth
- (D) Formed by joining fascicular and inter-fascicular cambium

Assertion Reason Type (A.R.T.)

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

49. **Assertion (A):** Phloem fibres are the only dead elements in the phloem.

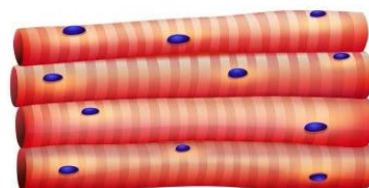
Reason (R): Sieve tubes, phloem parenchyma, and companion cells are all living.

50. **Assertion (A):** Annual rings are formed due to uniform activity of cambium throughout the year.

Reason (R): In temperate regions, cambium activity varies with changing seasons.

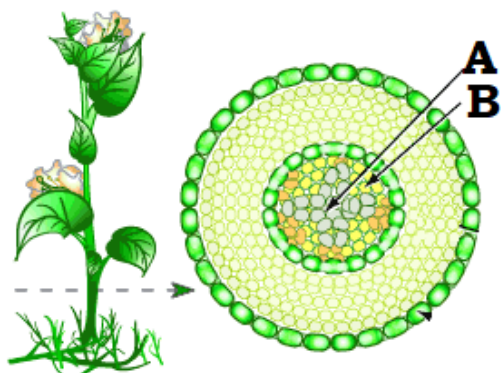
Figure Based (F.B.)

51. Identify the given diagram.



- (A) Cardiac muscle
- (B) Skeletal muscle
- (C) Smooth muscle
- (D) None of the above

52. Identify A and B in the given diagram.



- (A) A - Xylem; B-Phloem
- (B) A - Phloem; B-Xylem
- (C) A - Ground tissue; B-Xylem
- (D) A - Phloem; B-Dermal tissue

Previous Questions (P.Q.)

53. Transitional epithelium is found in _____. [AFMC 1997]

- (A) Larynx
- (B) Vein
- (C) Kidney
- (D) Ureter & Renal pelvis

54. Difference between bone and cartilage is of _____. [CPMT 2002]

- (A) Collagen
- (B) Blood vessels
- (C) Lymphatic vessels
- (D) Harversian canals

55. Fibres associated with phloem are _____. [JKCMEE 2004]

- (A) Hard fibres
- (B) Wood fibres
- (C) Surface fibres
- (D) Bast fibres

56. Which one has perforated wall _____. [AIEEE 2004]

- (A) Tracheid
- (B) Vessel
- (C) Fibre
- (D) Sclereid

57. Specialised epidermal cells surrounding the guard cells are called:

- (A) Complementary cells
- (B) Subsidiary cells
- (C) Bulliform cells
- (D) Lenticels

58. Cortex is the region found between: [NEET 2016]

- (A) Endodermis and pith
- (B) Endodermis and vascular bundle
- (C) Epidermis and stele
- (D) Pericycle and endodermis

59. Which of the following is made up of dead cells?

[NEET- 2017]

- (A) Xylem parenchyma
- (B) Collenchyma
- (C) Phellem
- (D) Phloem

60. The vascular cambium normally gives rise to ____.

[NEET- 2017]

- (A) Phelloderm
- (B) Primary phloem
- (C) Secondary xylem
- (D) Periderm

61. A simple tissue with both mechanical and physiological functions in young dicotyledonous plant is ____.

[EAMCET 2002]

- (A) Meristematic tissue
- (B) Parenchyma
- (C) Sclerenchyma
- (D) Collenchyma

62. Dividing cells not yet committed to become specific cell type are:

- (A) Epidermal cells
- (B) Ground cells
- (C) Periderm cells
- (D) Meristem cells

63. Intercalary meristem is derivative of ____.

[KCET 2008]

- (A) Promeristem
- (B) Primary meristem
- (C) Lateral meristem
- (D) Secondary meristem

64. Living part of xylem is ____.

[RPMT 2005]

- (A) Xylem tracheids
- (B) Xylem vessels
- (C) Parenchyma
- (D) None of these

65. Smooth muscles are:

[NEET - 2016]

- (A) Involuntary, fusiform, non-striated
- (B) Voluntary, multinucleated, cylindrical
- (C) Involuntary, cylindrical, striated
- (D) Voluntary, uninucleate, spindle shaped

66. Choose the CORRECT pair:

[NEET - 2014]

- (A) Tendon - Specialised connective tissue
- (B) Adipose tissue - Dense connective tissue
- (C) Areolar tissue - Loose connective tissue
- (D) Cartilage - Loose connective tissue

67. The kind of epithelium which forms the inner walls of blood vessels is:

[NEET - 2010]

- (A) Cuboidal epithelium
- (B) Columnar epithelium
- (C) Ciliated columnar epithelium
- (D) Squamous epithelium

68. The epithelial tissue present on the inner surface of bronchioles and fallopian tube is:

[NEET - 2009]

- (A) Cuboidal epithelium
- (B) Glandular epithelium
- (C) Ciliated epithelium
- (D) Squamous epithelium

69. The cell junctions called tight, adhering and gap junctions are found in:

[NEET - 2009]

- (A) Muscular tissue
- (B) Connective tissue
- (C) Epithelial tissue
- (D) Neural tissue

70. Areolar connective tissue joins:

[NEET - 2006]

- (A) Fat body with muscles
- (B) Integument with muscles
- (C) Bones with muscles
- (D) Bones with bones