SECOND TERM NOTES

SUBJECT: BIOLOGY
CLASS: SS 1

SCHEME OF WORK

WEEK TOPIC

1. Tissue and Supporting System
2. Tissue and Supporting System (cont'd)
3. Nutrition in mammals
4. Nutrition in animals cont.
5. Basic ecological concepts
6. Basic ecological concept cont.
7. Continuation of basic ecological concept
8. Function in ecosystem
9. Energy transformation in nature
10. Relevance of biology to agriculture in nature
11. Revision
12. Examination

Week 1 & 2

INTRODUCTION

To carry out life processes, all organisms (plants and animals) need tissues. Tissues are group of similar cells that carry out specific functions.
Skeleton is the bony framework of the body which provides support, shape and protection to the soft tissues and organs in animals. It forms the central core of human body and it is covered by muscles and blood vessels and skin.

FORMS OF SKELETAL MATERIALS

There are 3 forms of skeletal materials found in animals. These are

1. Chitin
2. Cartilage
3. Bones

1.CHITIN

It is a tough non-living material present in arthropods (invertebrates). It acts as a hard-outer covering to the animal and is made up of series of plates covering or surrounding organisms. Chitin is very tough, light and flexible. However, it can be strengthened by impregnation with 'tanned' proteins and particularly in the aquatic crustaceans like crabs, by calcium carbonate.

2.CARTILAGE

This is a tissue present in skeleton of complex vertebrates. Cartilage consists of a hard matrix penetrated by numerous connective tissue fibres. The matrix is secreted by living cells called **chondroblasts**. These later become enclosed in spaces (lacunae) scattered throughout the matrix. In this condition the cells are termed **chondrocytes**. It acts as a shock absorber in between bones during movement because it is tough and flexible with a great tensile strength. It is found predominantly in mammals and cartilaginous fishes e.g. shark.

TYPES OF CARTILAGE

Cartilages are of three main types in mammals and they are

HYALINE CARTILAGE

This contains a dense meshwork is the most common type and can be found on surface of moveable joint, trachea and bronchi (for ease of respiration) and also in protruding parts of the nose.

WHITE FIBROUS CARTILAGE

Tougher than the hyaline cartilage and can be found in the intervertebral disc of vertebral column.

YELLOW ELASTIC CARTILAGE
Found in the external ear (pinna) and epiglottis (*cartilaginous flap covering the trachea active during food swallowing).

3.BONE
This is the major component of the skeletal system and it consists of living cells (osteocytes), protein fibers (collagen), and minerals such as calcium carbonate and calcium phosphate. These minerals (the non- living constituents) make up two-third of a mass of bone. Hence, bone is strong and very rigid unlike
cartilage. Bones are highly vascularized.

The skeleton of a young vertebrate embryo is made up of cartilage. As the embryo grows bone cells (osteocyte) replace cartilage cells. Hence, the cartilage tissue becomes hardened into bone through the addition of minerals in a process called **OSSIFICATION**

Differences Between Bones and Cartilage

	Bone	Cartilage
1	Bones produce red and white blood cells	Cartilages do not
2	Made up of both living cells and dead cells	Made up of mainly living cells.
3	Bones are often rigid	Cartilage are often flexible
4	They are made up mainly of mineral substance such as calcium	Mineral substance are absent
5	Can never be replaced by cartilage	Can be replaced by bones
6	Flexible only in young ones	Cartilage both in young ones and adult is flexible.

TYPES OF SKELETON
The three main types of skeleton in animals are

1. **Hydrostatic skeleton:** This type is present in soft bodied animals e.g. earthworm, sea anemones etc**.** Such animals use pressure to support themselves**.** They also have a muscular body wall which is filled with fluid. The fluid presses against the muscular wall causing them to contract and exerting force against the fluid.

2. **Exoskeleton:** This is the outer skeleton present in arthropods. It is secreted by the cells covering the body of the animals and the main component is chitin (non-Living substance). Exoskeleton also supports animals against gravity and enables them to move about. Animals with these skeleton types periodically shed the old skeleton; grow rapidly in size when the new exoskeleton is still soft and extensible. The shedding process is called **MOULTING or ECDYSIS**.

3. **Endoskeleton:** This is an internal skeleton present in all vertebrates. Endoskeleton of vertebrates are composed mainly of bones and the bones grow steadily as the animal grows (hence no need for moulting). Bones of many sizes and shapes make up the endoskeleton of vertebrates. These bones are attached together as moveable joints by tough flexible fibers called **ligaments** hence the skeleton is flexible. Muscles are also attached to the bones usually by **tendons** to provide posture and bring about body movement.

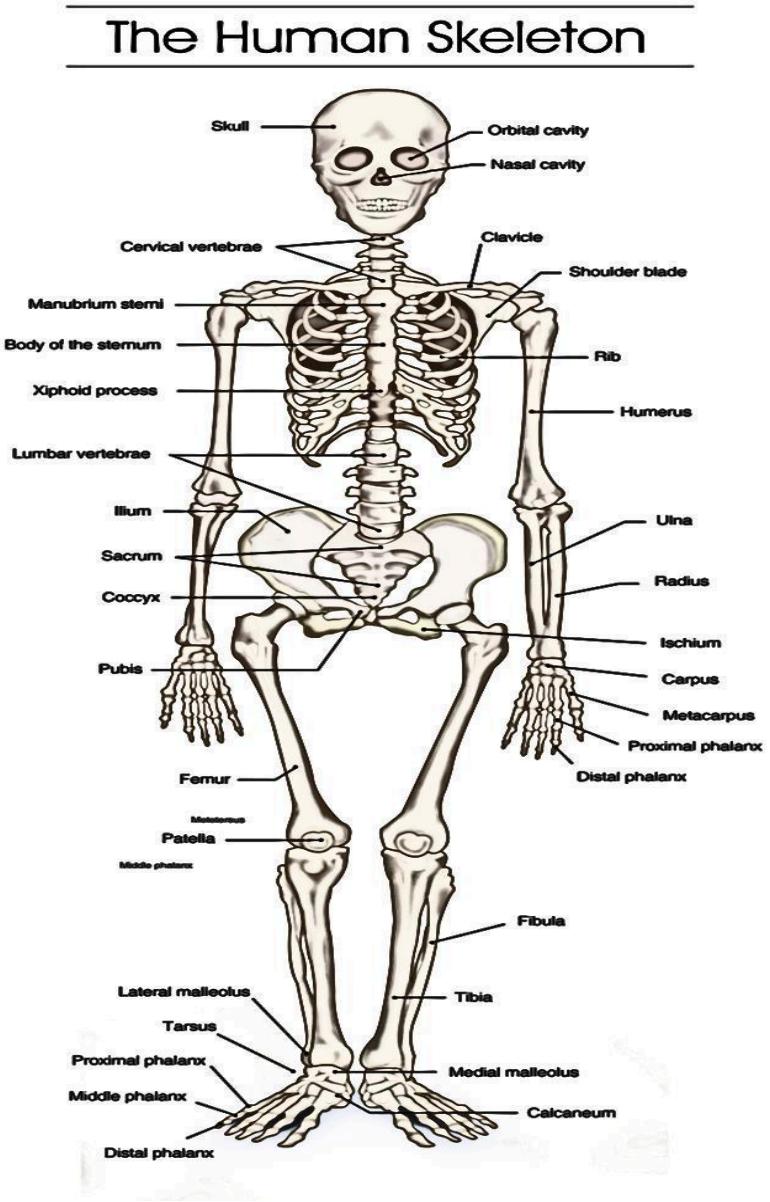
FUNCTION OF SKELETON

- It supports the body of organisms.
- Skeleton acts as the framework of the body
- Protection of delicate organs e.g. heart, brain, etc.
- Used for locomotion through the limbs in action.
- Important component of respiration e.g. breathing involve active movement of the ribs.
- Production of blood via bone marrows.

BONES OF THE MAMMALIAN SKELETON

The skeleton of vertebrate such as fish, frog, lizard, bird and man consist of bones and cartilages. It can be classified into two.

1. **AXIAL SKELETON-** which consists of the skull, ribs, sternum and the vertebral column.
2. **APPENDICULAR SKELETON** - it is made up of limb girdles (pectoral and pelvic girdles), and the limbs (the fore and hind limbs).



AXIAL SKELETON

The Skull

The Skull is made up of flat bones joined together by suture joint which has three parts: Cranium (brain-box), facial skeleton and the jaws; including maxilla (upper) and mandible.

Functions

- It protects the brain.
- Also protects the olfactory organ, eyes, middle and inner ear.
- Gives shape to the head.
- Bears the teeth.

The vertebral column

It forms the backbone, protecting the spinal cord. It is made up of 5 groups of bones called the vertebrate each of which is built on a similar basic pattern. The vertebrates are held together with strong ligament and comprehensible cartilage pads called intervertebral discs.

Types of Vertebrae and Location

Vertebrae	Location	Rat	Rabbit	Cat	Cow	Humans
Cervical	Neck	7	7	7	7	7
Thoracic	Chest	13	12-13	13	13	12
Lumber	Upper trunk	6	6-7	7	6	5
Sacral	Lower trunk	4	4	3	5	5
Caudal	Tail	27-30	16	18-25	18-20	4

A TYPICAL VERTIBRA

A typical vertebra has the following structural features

- **Neural canal** which is for the passage of the spinal cord.
- **Neural spine** which projects upward and backward for the attachment of muscle.
- **Transverse processes** for the attachment of muscles and ligaments.
- **Centrum;** a solid bony pieces below the neural canal
- **Zygapophyses** are the particular surfaces for joining together successive vertebrates.

This could be pre-zygapophysis (facing inward and upwards) or post-zygapophysis (facing outward and downwards

Cervical Vertebrae

The first cervical vertebra is called the **atlas** while the second is called the **axis.**
The Atlas: It has a large neural canal, flat and broad transverse processes, short neural spine which could be absent at times. It also has a vertebrarterial canal for the passage of blood vessels. Centrum is absent.

Function of Atlas

Permits the nodding of the head.

The Axis

It has a broad and flat Centrum, a large and flat neural spine, reduced transverse processes and a vertebrarterial canal. It articulates with the atlas through odontoid process

Functions

- It permits the turning or twisting of the head.
- Forms pivot joint with the atlas.

Thoracic Vertebra

Have a long and prominent neural spine, a pair of short transverse processes, a large neural
canal and neural arc and large cylindrical centrums. They also have particular surfaces for attachment of the ribs.

Function

- Aids attachment of ribs
- Assist in breathing
- Attachment of muscles at the shoulder and back

Lumbar Vertebrae

Each has large and flat transverse processes, broad and flat neural spine, large and thick centrums and well developed zygapophyses.It has extra paired projections namely

1. anapophysis
2. metapophysis

Functions of Lumbar

- It provides attachment for abdominal muscles
- It bears considerable weight of the body

Sacral Vertebrae

This fuse together to form a singular bony mass called sacrum. Each sacral vertebrae has a narrow neural canal, reduced neural spine and large centrums. The first differs from the remaining four by

1. Having a pair of transverse processes which is large and wing-like while the others are attached to the muscles of the back.
2. Presence of a small neural canal which generally becomes narrower in the lower four vertebrae.

FUNCTION

- Joins the pelvic girdle to provide support,rigidity and strength.

Caudal vertebrae
These are joined together to form a singular bony mass called **coccyx.** Each has no neural spine, no neural canal and no transverse process. It appears as a solid rectangular mass of bone

Functions
- Supports the tail
- Provides attachment for tail muscle

The Appendicular Skeleton
Pectoral girdle: found around the shoulder in man and it consists of two halves which are held
by muscles. Each half is made up of 3 three bones
- Scapula
- Clavicle
- Coracoids

The scapula and coracoids are fixed together as the scapula is flat and triangular with a hollow called **GLENOID CAVITY** at its tip. This cavity articulates or joins with the head of humerus to form the shoulder joint.The clavicle is a small rod of bone attached to a ligament joining the sternum to the scapula

Functions
- The pectoral girdle gives attachment to muscles and ligaments.
- It provides firm support to the fore limbs.

Pelvic girdle: found around the waist in man and it consists of two halves which are joined to each other ventrally and to the sacrum dorsally. Each halve of the pelvic girdle is made up of 3threebones. They are
- Illium
- Ischium
- Pubis

These three bones form a depression (on their outer surface) called ACETABULUM which articulates with the head of the femur to form the hip joint.

LIMBS

The limbs include the fore (upper) and the hind (lower) limbs. In most vertebrates, both limbs have the same basic plan i.e. each limb has a long bone followed by a pair of two long bones next to this is a set of small bones terminating with five digits.

The fore limbs- This is made up of an upper arm bone called **humerus** which joins with two other long bones at its lower end (radius and ulna) to form the elbow joints. Radius and ulna (the ulna is longer) are the bones of the fore arm, next are the wrist bones called **carpals** which are a small bones. These are followed by the digit bones called **metacarpals** which terminate in the **phalanges** (finger bones). In man, each digit has three phalanges except the thumb which has two phalanges.

The hind limbs-This is made up of thigh bones called femur (which is the largest and longest bone in the body). Its round upper end is the end that terminates at two rounded projections called **condyles** which forms the knee joint together with tibia. A small flat bone called **patella** is found in front of the knee joint. Next to the femur are tibia and fibula-Tibia is longer and larger. These are followed by bones of the ankle called **tarsals**. The lower limb terminates as at the digit bone metatarsals and each digit is made up of three phalanges

The ribs

These are long semi circular rods which connects the thoracic vertebrates to the sternum. They are found in the chest region of the body. In man, they are 12 pairs

Function

- They form a cage protecting the lungs and the heart
- They assist in breathing.

A TYPICAL RIB

A typical rib has a head, a neck and a body.The **first seven**ribs are connected directly to the sternum through coastal cartilages. They are therefore called **true ribs**. The **next five** are called **false ribs.** The eighth to tenth ribs have a common articulation to the sternum, each one attached to the coastal cartilage to the one above .The **eleventh and twelfth pairs** of ribs are called **floatingribs** because they have no connection to the sternum.

JOINTS

A joint is the place where two or more bones meet or articulate. The bones meeting at a joint are always held together by strong ligaments which prevents dislocation during movement.

Types of Joints

There are two main types of joints in mammals

1. Immovable joints
2. Movable joints

Immovable joints: These are joints where two or more bones are firmly attached to one another or are firmly fixed by ligaments in such a way that movements of these bones are not possible. This can be found in the skull and pelvic girdles.

Movable joints: these are joints or regions where two or more bones meet in such a way that the bones move over each other, making movements possible.

Types of movable joints

They include;

I. Ball and socket joints: This allow movement in one plane or directions up to 360º. It can be found in the shoulder and hip joints. For instance, the head of the humerus is a ball-like structure which fits into the glenoid cavity of the scapula (pectoral girdles).

II. Hinge joints: This allow movement in one plane up to 180°. They can be found in the elbow and knee joints.

III. Gliding or sliding joints: the gliding joints allow the sliding of bones over one another. Examples are found at the wrist and ankle. They allow the hand and food to be moved up and down or rotated slightly.

IV. Pivot or rotating joints: Pivot joints allows nodding or rotating of one part of the body on another. It is found between the atlas and axis vertebrae.

SUPPORTING TISSUES IN PLANTS

The needs for supporting tisues in plant are for:

1. definite shape;
2. strength;
3. rigidity;
4. resistance against external force such as wind and water.

Types of Supporting Tissues

- Parenchyma tissues
- Collenchyma tissues
- Sclerechyma tissues
- Xylem tissues

- Phloem tissues

Parenchyma Tissues
They are made up of living cells with cellulose and many air spaces within them. This is the most common and abundant plant tissue.

Functions
- It gives firms and turgidity to the stems of hibiscus
- stores food and water
- takes part in food synthesis in leaf mesophyll

Collenchyma Tissues
Made up of living cells which are elongated and thickened at the corners.

Functions
- Provides strength and support in young growing plant.
- Gives flexibility and resilience to plant.

Sclerenchyma Tissues
They are made up of thick cells containing cellulose and ligion. The tissues are rich in fibers.

Functions
- gives flexibility to plant
- provides strength, rigidity, hardness and support to plant

Xylem
Xylem tissues are found in vascular tissues of stems, roots and leaves
Functions
- provides support strength and shape to the plant
- Helps to conduct water and mineral salt from the roots to leaves.

Phloem Tissues
Also located in the vascular bundles of all plants in their roots, stems and leaves

Functions
- Conduction of manufactured food from site of production to site of consumption and storage.
- Assist to provide support to the entire plant.

Reading Assignment

College Biology by Idodo Umeh. Chapter14, page 251-259

WEEKEND ASSIGNMENT

SECTION A

1. ……. is a non living skeletal material
   A. chondroblasts B. osteocyte C. elastic cartilage D. chitin
2. The articulating surface for joining together successive vertebrates is called
   A. neural spine B. zygapophyses C. transverse processes D. neural canal
3. The canal for the passage of blood vessels in vertebrae is called
   A. neural canal B. cervical canal C. vertebraterial canal D. zygaphosis
4. Endo- skeleton is present in the following animals except
   A. dog B. snake C. shark D. lizard
5. The most abundant supporting tissue in plants is
   A. sclerenchyma B. parenchyma C. xylem D. phloem

SECTION B

1. (a) What is ecdysis? (b) Mention two animals in which it occurs
2. Describe the structural features of a typical vertebra
3. Define ossification.
4. What is moulting?
5. State four reasons for presence of supporting tissues in plant
6. List supporting tissues found in plant and state their functions.