PLANT AND ANIMAL TISSUE 6 MARCH 2013

Lesson Description

In this lesson we:

- Discuss important terminology
- Look at the organisation of Life
- Discuss plant tissue and specialised cells
- Discuss animal tissue and specialised cells
- Take a look at a revision question

Key Concepts

Terminology

blood	epidermal	nerve	stem cell
chlorenchyma	epithelium tissue	palisade parencyhma	vascular tissue
companion cell	ground tissue	phloem	xylem
connective tissue	lignin	sclerenchyma	
cuticle	mesophyll	sieve tube	
dermal tissue	muscle	spongy mesophyll	

The Organisation of Life

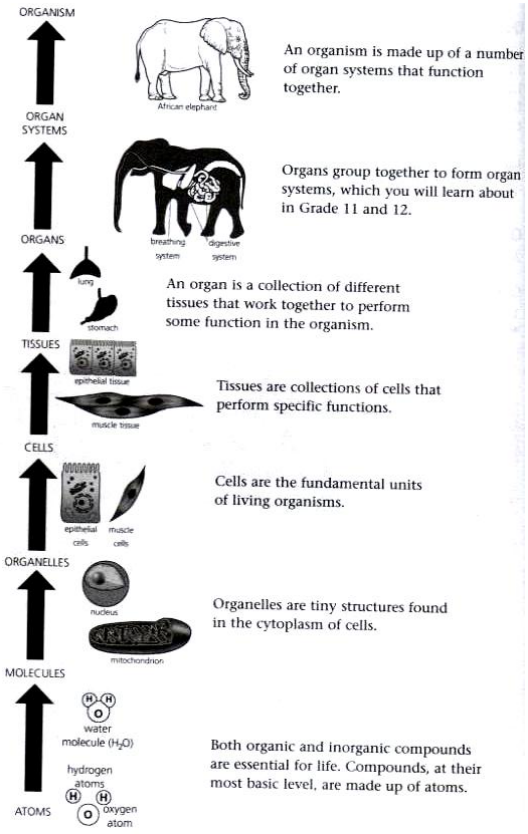


Diagram showing the organisation of Life

Plant Tissue

Plant cells with similar structure and functions form plant tissue.

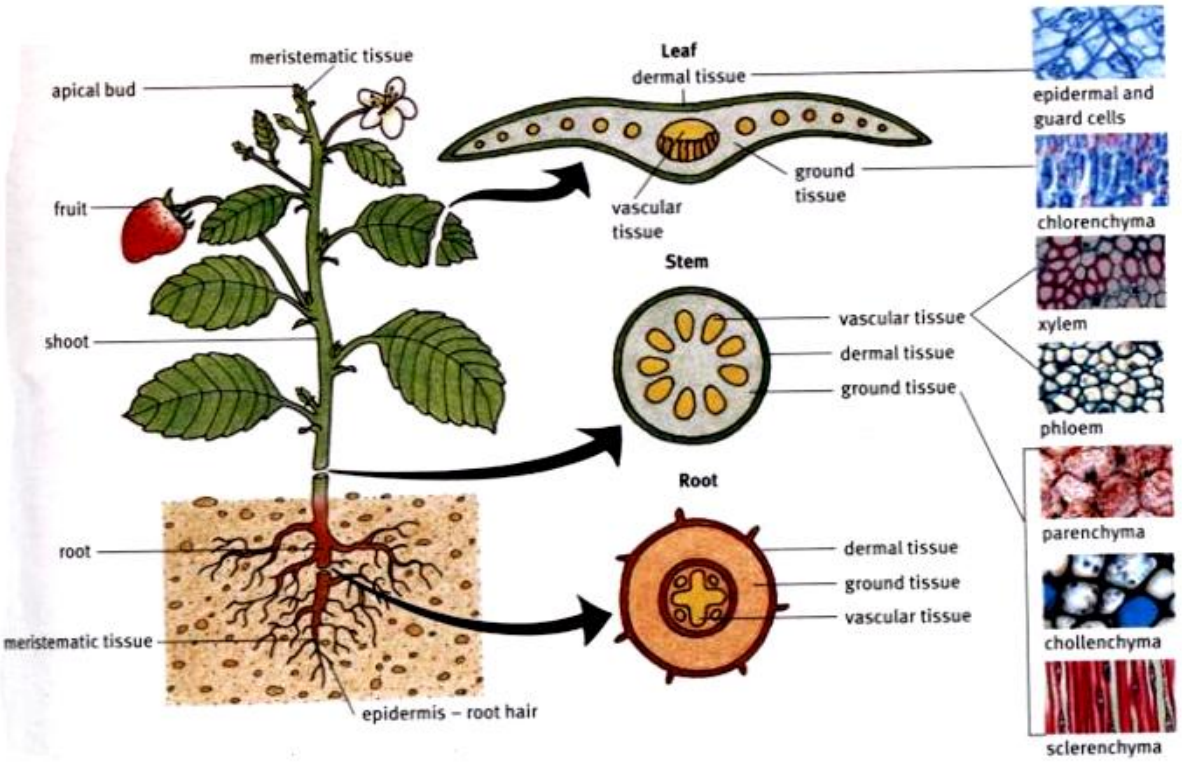
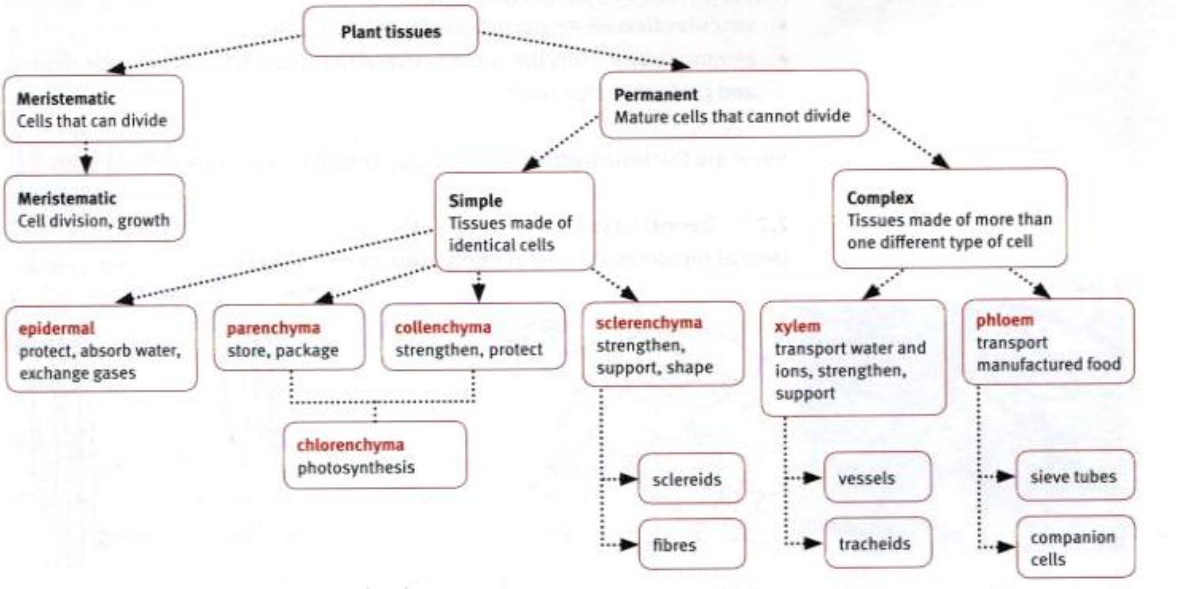


Diagram showing the where different tissue are found in plants

Plant tissue can be divided into two main types:

1. Meristematic tissue
2. Permanent tissue



Meristematic Tissue

Meristematic tissue is actively dividing to produce new cells. Meristematic tissue consists of undifferentiated small cell, with dense cytoplasm and large nuclei. The cells differentiate into new tissue of the plant.

Meristematic tissue is found at the meristems of plants:

- **Apical Meristem**: are located at the growing points at the tips of roots and stems and results in an increase in the length of these structures.

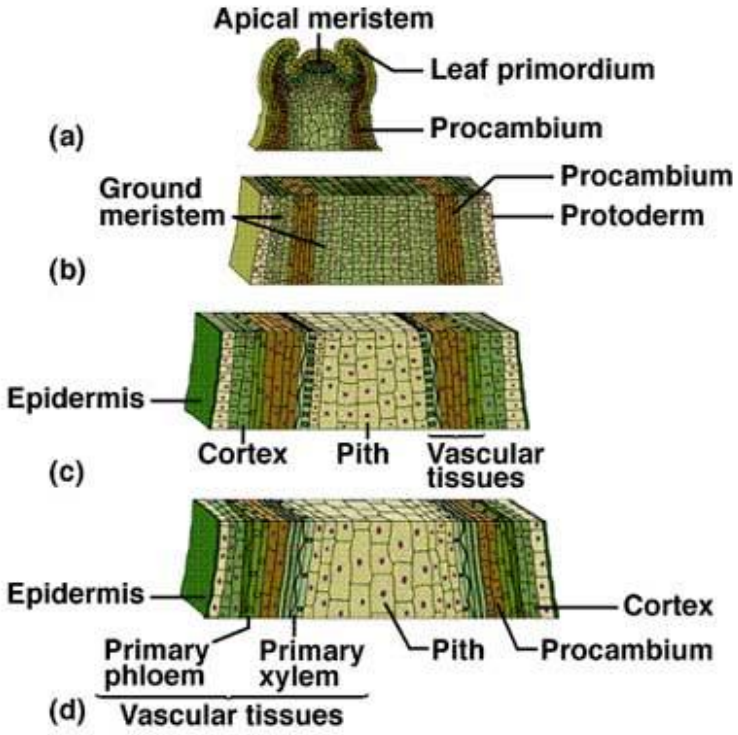


Diagram showing the different types of meristematic tissue

- **Lateral Meristem**: results in the growth in thickness or width of woody roots and stems. This tissue is also called **cambium**; cork cambium divides to form the cork cells that form the outer bark of a woody plant. **Vascular cambium** divides to make xylem and phloem tissue.

Permanent Tissue

Permanent tissue are specialised in function and do not divide constantly. Differentiation of cells begins as soon as cells have been formed by cell division, and results in changes in structure. There are three groups of permanent tissue:

1. Epidermal
2. Vascular tissue
3. Ground

Epidermal Tissue

This is the outermost layer of cells that covers the roots, stems and leaves. Epidermal cells are tightly packed, with no intercellular air spaces. The main function of the epidermal cells is to protect the underlying tissue from injury.

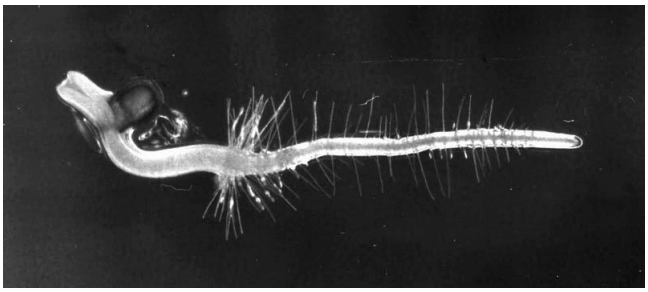
Some epidermal cells are modified to perform a specific function. Specialised epidermal cells of the stem and leaves secrete a waxy layer, called the cuticle, to prevent water loss. Other examples of specialised cells are guard cells and root hair cells.

- Guard Cells

Micrograph of an Guard cell showing

Guard cells are bean- shaped epidermal cells that occur on either side of a stoma- which is the opening that occurs on the surface of a leaf. The guard cells function to open and close the stoma, thus controlling the loss of water by transpiration.

- Hair cells



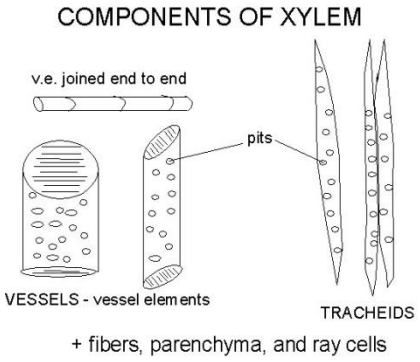
Micrograph of a Guard cell showing

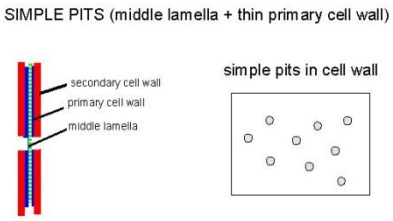
The hair cells of an epidermal root hair cell are formed by an extension of the cell wall. The hair functions to increase the surface area of the root to maximise the uptake of water and nutrients.

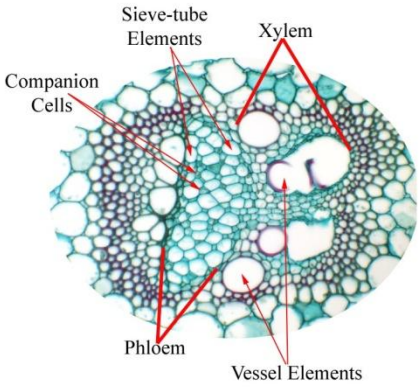
Vascular Tissue

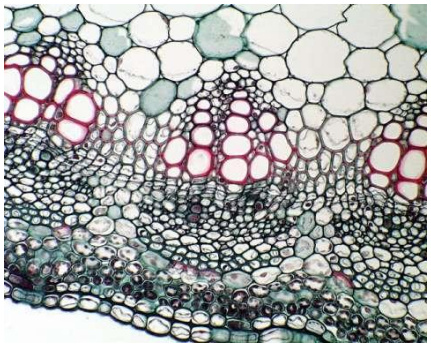
Vascular tissue functions to transport and support.

- **Xylem Tissue:**
  Xylem tissue transport water and mineral salts from the ground water through the roots to the stems and leaves.
  Xylem tissue consists of vessels and tracheids- both cells have cell walls that are strengthened with lignin and both types of cells are dead at maturity.
  Xylem vessels and tracheids do not contain cytoplasm and cross walls are perforated with pits to enable the sideways movement of water.
  Xylem vessels are elongated and hollow and form long tubes that are joined end to end to allow water to flow from one cell to the next.
  Tracheids are long and tapered at the ends. Tracheids function to strengthen the plant.

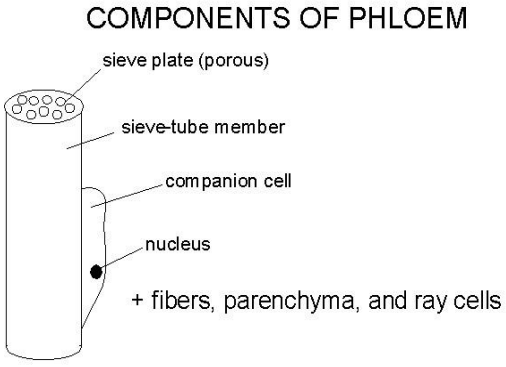


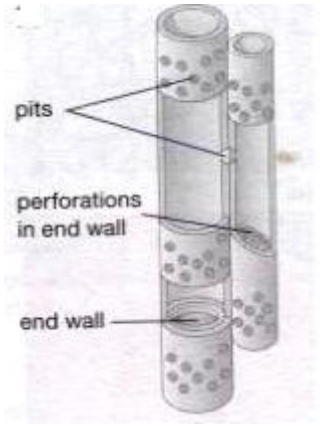






- **Phloem Tissue:**
  Plants have phloem tissue to transport food from the leaves, where photosynthesis takes place, to areas undergoing growth or storage sites.
  Phloem tissue consists of long columns of sieve tubes and companion cells.
  Sieve tubes are elongated, hollow cells. Sieve tubes remain living, although the nuclei in the cells die.
  The end walls (called sieve plates) are perforated and hollow phloem sap to flow from one cell to the next.
  Each sieve tube is found next to a companion cell.
  Companion cells keep the sieve tubes alive by regulating and performing their metabolic activities





Ground Tissue

Ground tissue forms the body of the plant and is responsible for support, storage and photosynthesis. There are three types of ground tissue:

1. Parenchyma
2. Collenchyma
3. Sclerenchyma

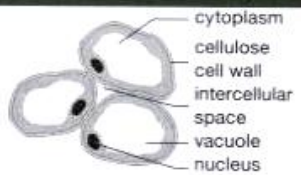
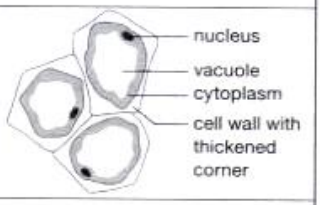
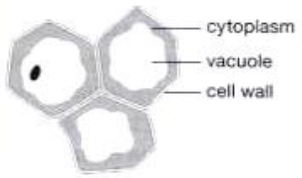
Type of ground tissue	Structure	Function	Illustration
Parenchyma	• Cell walls are thin • Vacuole is usually large • Cells are loosely packed with intercellular air spaces between the cells that allow for the exchange of gases	• Used for storage of water, sugars and starches • Specialised parenchyma are photosynthetic • Used for support • Cells can undergo cell division even when mature	
Collenchyma	• Cell walls are unevenly thickened with cellulose • Cells are packed together tightly with few intercellular air spaces	• Provides mechanical strength and flexibility to stems and leaves • Collenchyma tissue is found just below the epidermis, most commonly in the stem	
Sclerenchyma	• Mature sclerenchyma cells are dead and hollow • Cell walls contain lignin, which make the cells strong • Two forms: sclerids, which are thick-walled, short and pitted, and fibres, which are tapering, elongated cells	• Provides the plant with structure and support • Found in stems • Sclereids are found in seed coats, nut shells and in pears	

Table showing the structure and function of parenchyma, collenchyma and sclerenchyma

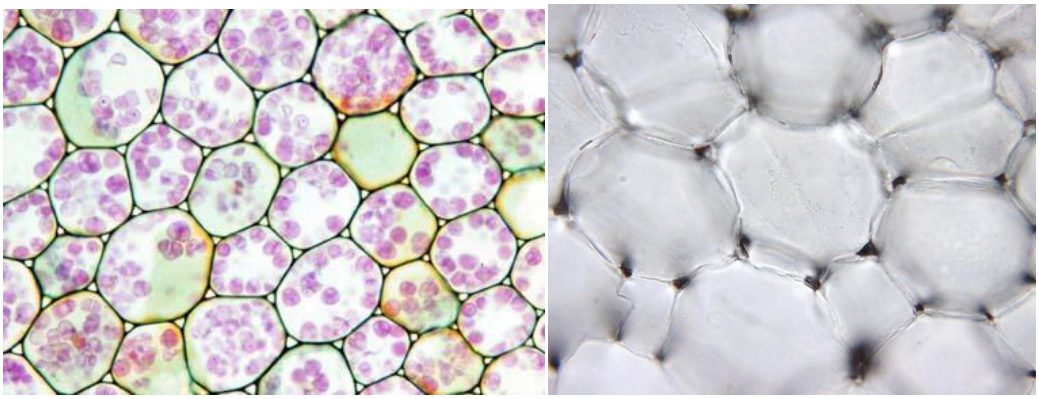


Diagram showing the different types of parenchyma cells

- Parenchyma – thin walled & alive at maturity; often multifaceted.

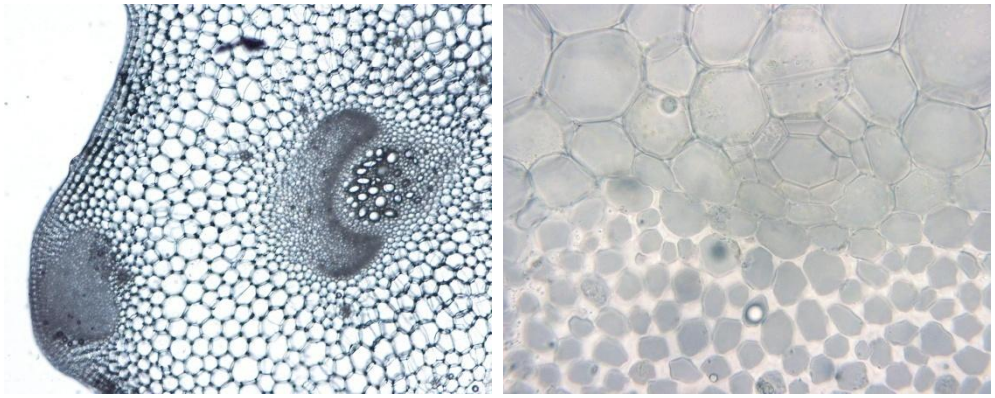
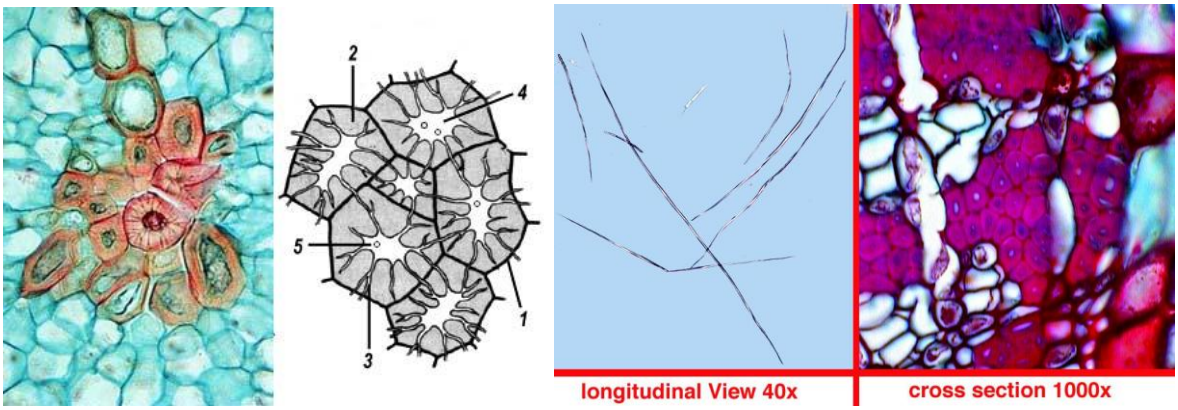


Diagram showing the different types of collenchymas cells

- Collenchyma – thick walled & alive at maturity



Sclerids **Fibers**

Diagram showing the different types of simple tissue – consisting of one cell type

- Sclerenchyma – thick walled and dead at maturity
- Sclerids or stone cells – cells as long as they are wide
- Fibers – cells longer than they are wide

Animal Tissue

Animal cells with the same structure and function are organised into tissues.

Embryonic Tissue

Embryonic tissue can be divided into two kinds of stem cells:

- Embryonic stem cells- tissue in an embryo that produces all other tissue during growth
- Adult stem cells- tissue in adult that produces new tissue cells to replace old and damaged ones.

Structure and Function of Embryonic Tissue	
Structure	**Function**
Embryonic stem cells	Produces cells for specialised tissues
Adult Stem cells	Replaces old and damaged cells and tissues
Large nucleus	
Cellular extensions of cytoplasm	

Animal tissues consist of four major types of permanent tissue:

1. Epithelial tissue
2. Connective tissue
3. Muscle tissue
4. Nerve tissue

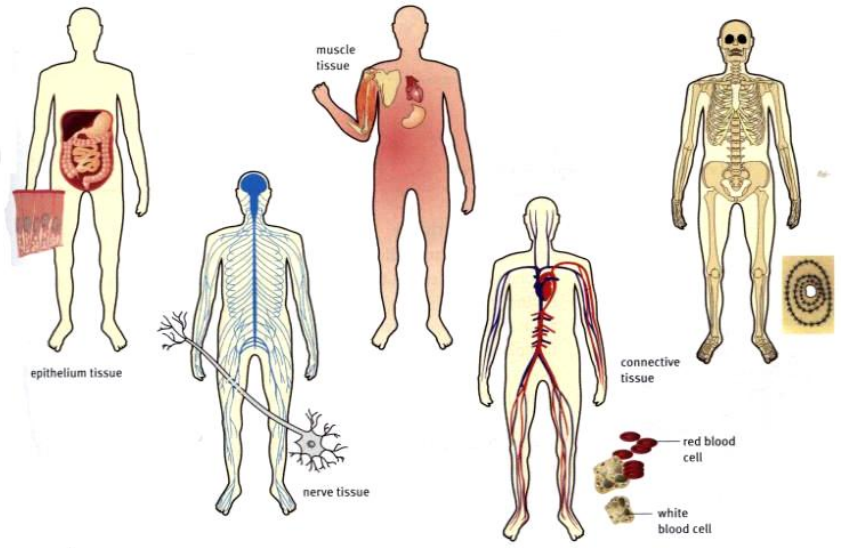
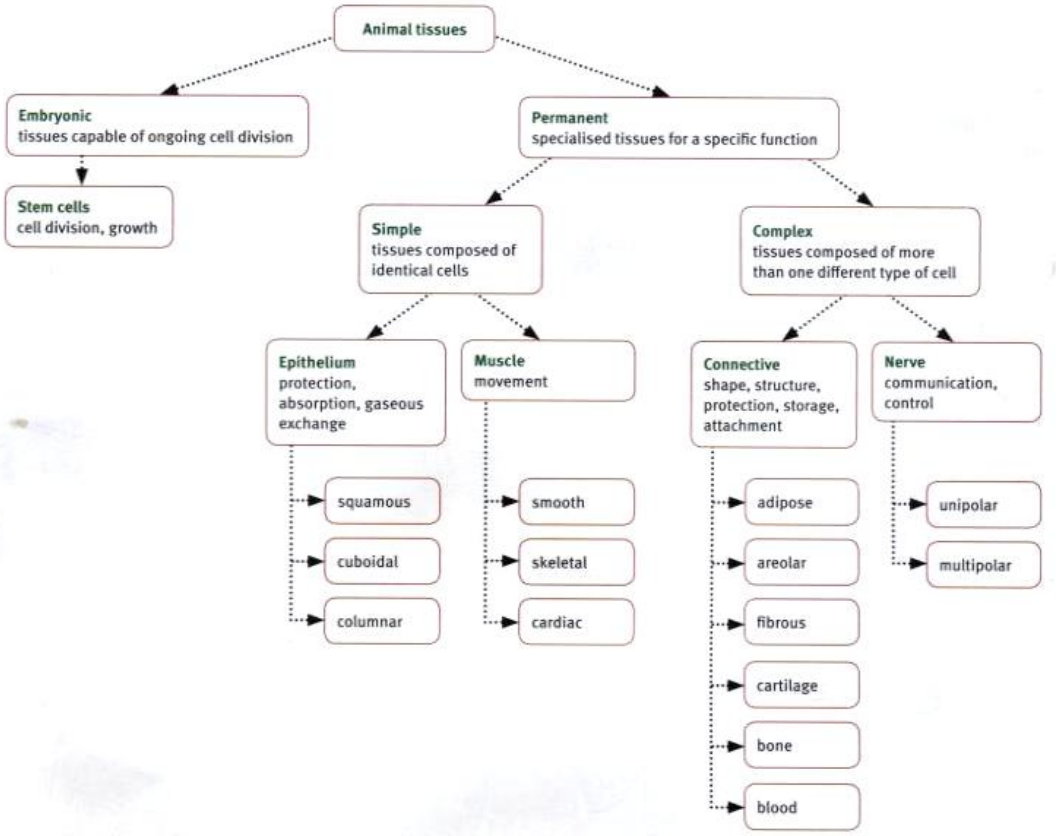


Diagram showing how different types of tissue make up humans



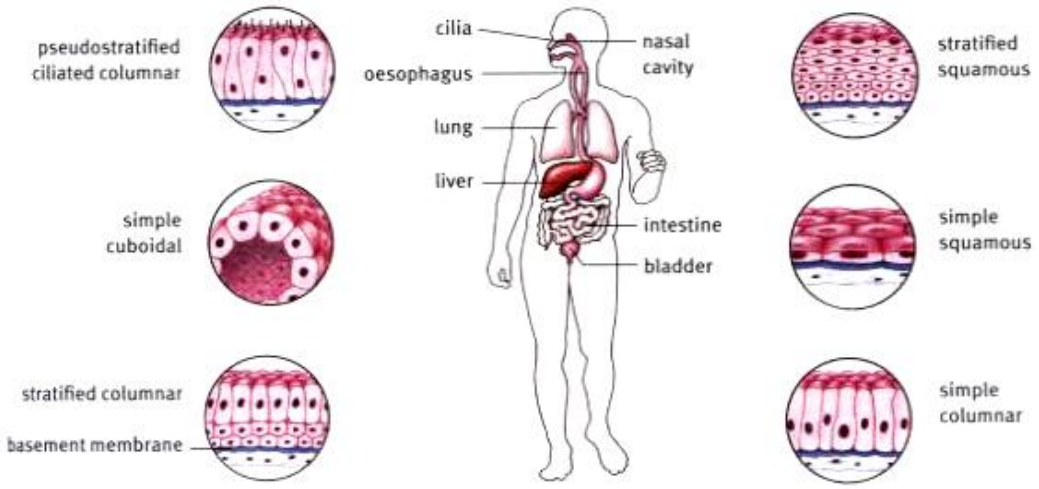
Permanent Tissue

The four groups of permanent tissue have different structures and functions.

These are:

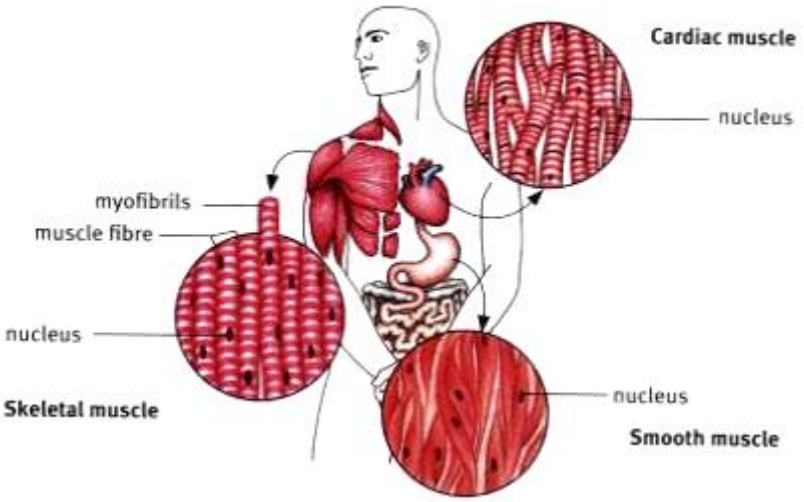
Epithelial tissue: Tissue for covering and lining
Connective tissue: tissue for structure, strength, binding and transport
Muscle tissue: tissue for movement
Nerve tissue: tissue for communication

Epithelial Tissue
Some epithelial tissues are squamous, meaning flat-shaped and some are columnar, meaning tall.
Stratified means "in layers"
Pseudo stratified means it seems to be in layers, but is not (pseudo means false)
Cuboidal means "like a cube"
Ciliated means that they may have tiny hair like outgrowths.



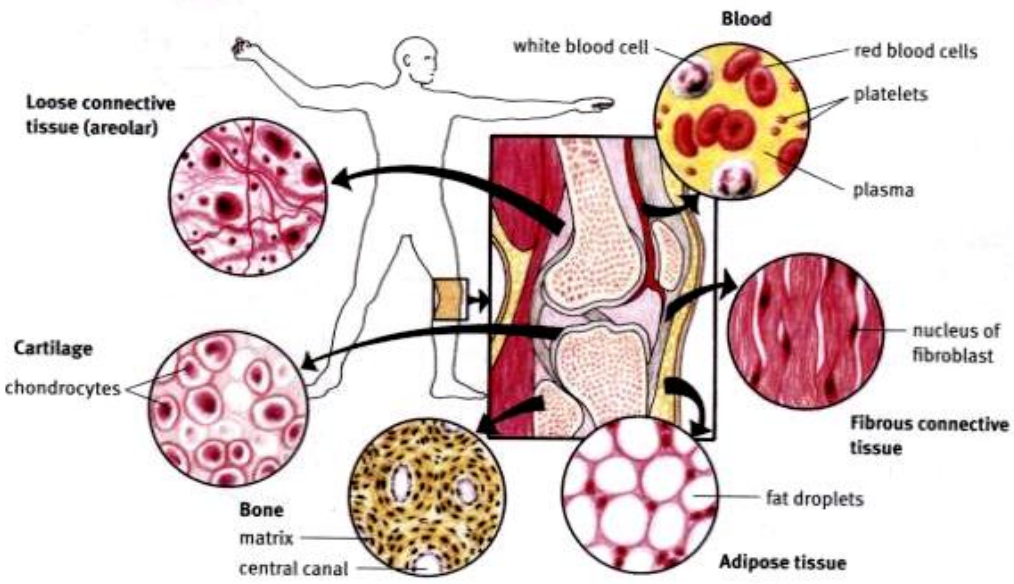
Structure and Function of Epithelial Tissue	
Structure	**Function**
• Has three cell types: - Flat squamous cells - Cuboidal cells - Columnar cells • Found in layers: • Single layers: simple epithelium • Many layers: stratified epithelium • Cells lie on basement layer (membrane) – connects epithelium to other tissues • May contain special cells or structures: goblet cells, cilia (hairs)	• Line body surface inside and outside. • Make up glands that secrete sweat, enzymes, hormones, milk, sebum, oils. • Allow gases, water, nutrients, mineral salts in solution to pass through. • Goblet cells secrete mucus that helps with movement over epithelium layer. • Cilia remove dust particles from internal surfaces.

Muscle Tissue



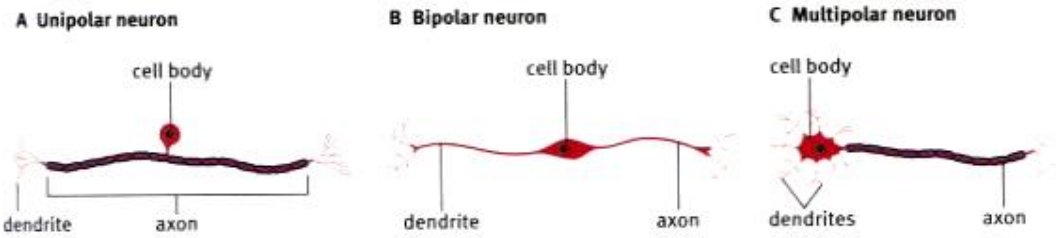
Structure and Function of Muscle Tissue	
Structure	**Function**
• Consists of three tissue types: - Skeletal striated voluntary muscle. - Cardiac striated involuntary muscle. - Smooth, unstriated involuntary muscle. • Made of muscle fibres • Nuclei found on side; may be more than one • Striated muscles has contraction fibrils – myofibrils.	• For voluntary actions: walking, lifting, etc. • For involuntary contracting and relaxing of organs: heart, blood, vessels, bladder, stomach, etc

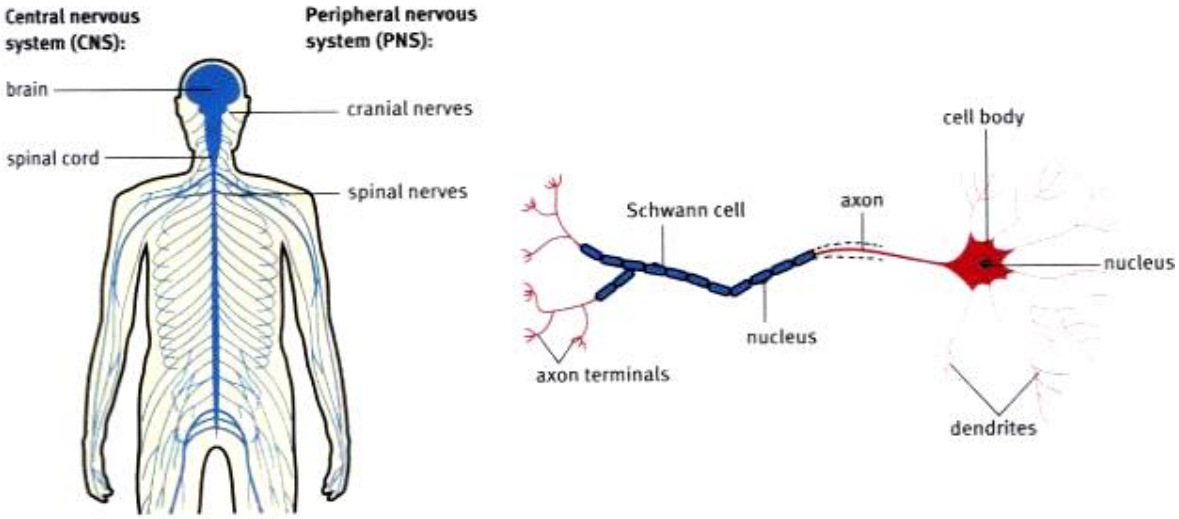
Connective Tissue



Nerve Tissue

- Nerves are made up of cells called neurons.
- Sensory neurons carry impulses from receptors to the central nervous system (CNS)
- Motor neurons carry impulses from the CNS to the muscle cells and glands, which are effectors.
- Axons are covered by Schwann cells with spaces between them called nodes of Ranvier.
- Axons end up in fine extensions called terminal fibres of terminal branches.





Questions

Question 1

Links

- Magnification simulation http://www.cellsalive.com/howbig.htm
- Animal / Plant Cell http://www.cellsalive.com/cells/cell_model.htm
- 3D animation of a cell: http://www.xvivo.net/the-inner-life-of-the-cell/

Reference List

1. Via Afrika Life Sciences; Grade 10 Learner's Book; M. Bowie, A. Johannes, R. Mhlongo, E. Pretorius.
2. Shuters Top Class Life Sciences Grade 10 Learners Book; P. Ayerst, R. Langely, P. Majozi, A. Metherell, D. Smith.