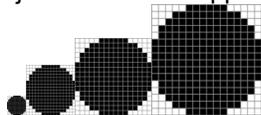


The Microscope

A microscope magnifies (enlarges) the images of small objects. With the aid of a microscope 'invisible' becomes 'visible'.

- when an object is made to appear larger than it's actual size, it is said to be **magnified**..



Early Microscopes ...

- micro-organisms were first discovered by **Anton van Leeuwenhoek**. His hobby of grinding lenses led him to eventually make the first simple microscope to study blood samples, pond water and plaque (which he scraped from his teeth) The organisms he found – that were single cells – he called '**animalcules**'

- **Robert Hooke** was also experimenting with microscopes he had built to look at different things, such as a tiny piece of cork. The small holes that were honeycombed were described as 'little rooms or boxes' and the word **cellulae** was used to name them (Latin form of 'cell').

The Compound Microscope

Microscopes come in many shapes and sizes. Fiber optics is a technology that allows light to travel down a flexible tube. Medical researchers now use fiber optics to create microscopes that can be used to see inside the body and to assist in locating operating regions that help surgeons do their work more effectively.



Identify the parts, function and handling hints of the **Compound Light Microscope**

Technology improvements have led to the development of compound light microscopes (2000X magnification) and electron microscopes (2,000,000X magnification).

There are two types of electron microscopes:

- **TEM** (transmission electron microscope) and
- **SEM** (scanning electron microscope)

The microscope has become a valuable tool for the investigation of the microscopic world

Preparing Slides

Preparing a Wet mount

- Gather all the materials you need (a clean glass slide and cover slip, an eyedropper, tweezers, a small amount of water and your specimen)
- Pick up the slide properly (touching only the edges and ends)
- Use the eyedropper to place one drop of water on the center of the slide and place your specimen (using the tweezers) right side up on the drop.
- Pick up the cover slip (using the tweezers) and lower it slowly over the specimen (try to avoid getting air bubbles).

Preparing and Viewing a Cell Specimen

- Remove a single layer of the specimen (placing it very carefully on the slide and try to avoid getting air bubbles between the specimen and the slide).
- Continue following the procedures for **preparing a wet mount**.

The Cell Is The Basic Unit of Life

A cell is the basic unit of life, because their individual cells carry out all the functions carried out by living things. Two scientists (Matthias Schleiden and Theodore Schwann) who studied cells combined their observations to make a hypothesis ... ***all living things are made up of cells.***

Rudolf Virchow contributed his observation and together the **Cell Theory** was formulated:

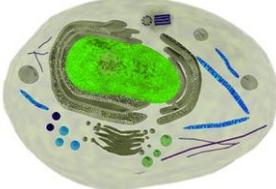
- all living things are composed of one or more cells
- cells are the basic units of structure and function in all organisms

When viewed with a compound light microscope these cell structures become visible to the naked eye. There are certain factors that can affect what you are able to see inside a cell.

These factors are:

- The type of microscope you use
- The power of the lenses
- The quality of the prepared slides

All cells, plant and animal, have structures and each structure performs a specific function in order for the cell to maintain life. The specialized structures inside the cell are called **organelles** and they carry out specific functions.

<p>Cell Structures</p> <p><i>Check out the Virtual Cell Tour</i></p>	Plant Cell	Animal Cell
		
Cell Membrane 'Controlled Gateway'	- surrounds and protects the contents of the cell (looks like a thin line surrounding the cell)	
Cell Wall 'Frame'	- are much thicker and more rigid than membranes, providing support for the plant or fungi (a rigid frame-like covering that surrounds the cell membrane)	
Cytoplasm 'Kitchen'	- distributes materials to different parts of the cell (a liquid inside the cell, which has grainy-looking bits in it)	
Nucleus 'Command Center'	- controls the cell's activities (a fairly large, dark, spherical structure that's usually near the center of the cell)	
Vacuoles 'Storage Rooms'	- is a membrane-bound sac acting as a storage space for surplus food, wastes and other substances the cell is unable to use immediately (clear, liquid-filled spaces in various places within the cytoplasm)	
Chloroplasts 'Solar Panels'	- are the structures in which photosynthesis takes place (greenish structures found only in a plant cell)	
Mitochondria 'Powerhouse'	- chemical reactions occur that convert energy into useable forms (small circular structure with little stringy bits inside)	

Cell Size and Function

To carry out their work, cells need a constant supply of materials, such as oxygen, water and food particles and they also need to get rid of waste products, all these materials must pass through the cell membrane, most cells fall into a very narrow range of size between 10 - 50 micrometers (um)

Cells Work Together

The cells of an organism all work together to help perform the various functions that need to occur if the organism is to live. The specialized cells of the body perform task that enable the organism to survive despite the actions and or habits it is involved in on a daily basis.

Unicellular VS Multi-cellular

Unicellular organisms are identical and can reproduce very large populations very quickly.

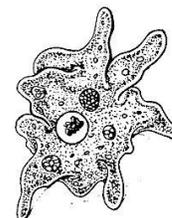
Multi-cellular organisms can:

- live in a wide variety of environments
- grow very large
- obtain their energy from a wide variety of foods
- have complex bodies
- specialize functions and work in harmony with other cells

Common Unicellular Organisms

Amoeba

Amoebas are common unicellular organisms that live in water. They move around using foot-like projections called **pseudopods** (*false feet*). They extend a pseudopod and the cytoplasm fills it. They also use their pseudopods to capture food by surrounding it between two pseudopods and absorbing it.



Paramecium

Paramecium move swiftly through the fresh water where they live. They are covered in hair-like structures called **cilia**, which move back and forth like little oars, moving it through the water. Cilia also help gather food, by channeling the food to an **oral groove**, which is also lined with cilia, sweeping the food into the cytoplasm forming a food vacuole.



Substances Move In and Out of Cells

The Cell Membrane

A cell membrane allows some substances to enter or leave the cell, while stopping other substances. It is a **selectively permeable membrane**. (A **permeable** membrane allows all materials through, while an **impermeable** membrane does not allow anything through)

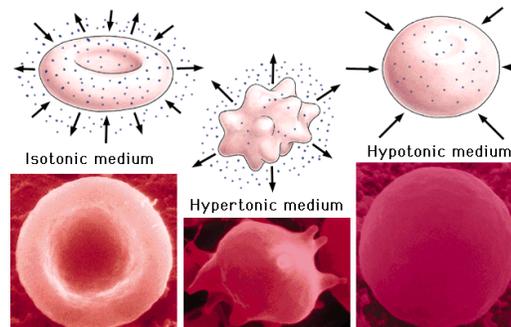
Diffusion

The structure of the cell membrane controls what moves in or out of a cell. Particles - moving in all directions, bumping into each other, eventually spreading out evenly throughout the cell (**diffusion**). Diffusion plays a part in moving substances into and out of a cell. **Concentration** determines the direction that a substance takes through the cell membrane – particles move from higher concentration areas to lower concentration areas (equal concentration allows the movement of particles in and out equally – whereas, a higher concentration of particles on the inside of the cell will move to an area of lower concentration on the outside (so movement will only occur from inside to outside) – until there is a balance.

Osmosis

The **diffusion of water through a selectively permeable membrane** is called **Osmosis**. Water helps to dissolve many of the substances involved in cell processes. When water is lost (moves out of the cell) it leaves behind a high concentration of the dissolved substances – when water moves back into the cell, the substances become more diluted and can be used by the cell for its life functions.

The Effect of Osmosis on Cells



Cells In Multi-cellular Organisms Combine To Form Tissues, Organs and Organ Systems

Cells Reproduce

Cells with the same structure and function form **tissue**

Tissues form **organs**

Organs work together in **organ systems**

Systems work together to form an **organism**

Tissues

Tissues are groups of similar cells that work together, having similar structure and function.

Plants require a large supply of water to make sugars in the process of **photosynthesis**. A group of cells, that perform similar functions, are called **tissue**. The transportation of nutrients is the role of plant tissues.

- **Vascular tissues** connect the roots to the leaves.
- **Phloem Tissue** transports sugars manufactured in the leaves to the rest of the plant.
- **Xylem tissue** conducts water and minerals, absorbed by the root cells, to every cell in the plant.

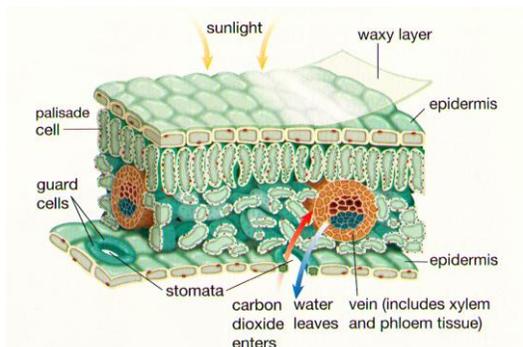
**Xylem and Phloem tissue usually occur together, along the length of plant stems and roots*

From Root to Leaf

The root system contains fine ' **root hairs** '. These hairs are extensions of epidermal cells (which protect the outside of the plant). When the concentration of water is greater on the outside of these ' root hairs ' then water can pass through the membrane by osmosis – which continues from cell to cell, until it reaches the xylem tissue. The tube-shaped xylem cells then move the water by a build up of water pressure in the root hairs (high pressure to low pressure) forcing the water up the xylem tissue, like water up a straw, into the stems and leaves.

Leaves are the plant's food-producing organs (this is where **photosynthesis** takes place).

Photosynthesis takes place in the layer of cells that contain **chloroplasts** (these cells are called **palisade cells**). They are thin, allowing a large amount of light in (large surface area), and enabling the gases (in the air) to diffuse into the leaf cells.



The tiny openings, called **stomata**, allow air to enter the leaf (**supplying oxygen for respiration and carbon dioxide for photosynthesis**). The spaces between leaf cells allow the air to flow and the **guard cells** open and close the stomata.

Transpiration

The loss of water (in a plant) happens through evaporation and is called transpiration. It is not a problem, unless, the plant loses too much water and doesn't replace it by the roots.

The movement of water throughout the plant happens because of the differences in pressure – high pressure in the root hairs to lower pressure in the leaves – (**pushing and pulling water throughout the whole plant**)

Organs

Each organ is made up of several tissues all working together. They are distinct structures in the body that perform particular functions. (**Plants have organs as well – roots, stem and leaves**)

Systems

Organs work together to perform activities that help the organism function as a whole. Plants typically have two systems (**root system and shoot –stems and leaves – system**). A reproductive system (**flowers, fruits and seeds**) is often produced at certain times as well.