#### BIOLOGY 12 - CELL STRUCTURE & FUNCTION: Chapter Notes

#### THE CELL THEORY

- although different living things may be as unlike as a violet and an octopus, they are all built in essentially the same way. The most basic similarity is that all living things are composed of one or more cells. This is known as the Cell Theory.
- our knowledge of cells is built on work done with microscopes
- English scientist Robert Hooke in 1665 first described cells from his observations of cork slices. Hooke first used the word "cell".
- Dutch amateur scientist Antonie van Leeuwenhoek discovered microscopic animals in water
- German scientists Schleiden and Schwann in 1830's were first to say that all organisms are made of one or more cells.
- German biologist Virchow in 1858 stated that all cells come from the division of pre-existing cells.
- Cells are the building blocks of life.

The Cell Theory can be summarized as:

- 1. All living organisms are made up of one or more cells
- 2. The cell is the basic unit of life
- 3. All cells come from the division of pre-existing cells
- cells come in many shapes and sizes, although most are microscopic:
  - most cells are small, about 0.001 cm in length (1/100 of a mm, or 10 μm).
  - the smallest cells of the microorganism mycoplasma are 0.3 µm in size
  - Some cells are large. e.g. some giant algal cells may be several centimeters long. A chicken's egg is a single cell.
  - 40,000 red blood cells would fill the letter "O" on a page of type. You produce about 2.5 million new red blood cells every second! Each square cm of your skin contains about 150,000 skin cells.
  - Human beings are composed of about 50 to 100 trillion cells.
- cells carry on all the processes associated with life, such as reproducing and interacting with the environment.

#### Microscopy

- The study of cell structure includes the fields of CYTOLOGY (for cells) and HISTOLOGY (for tissues), whereas the function of cells is studied in CELL PHYSIOLOGY, BIOCHEMISTRY, and CYTOGENETICS.
- The first instrument used in studying cell structure was the light microscope, which remains an important tool today. The TRANSMISSION ELECTRON MICROSCOPE and the SCANNING ELECTRON MICROSCOPE have vastly increased our knowledge.
- Before an object can be viewed, it is necessary to stain the material and cut it into samples thin enough for a light beam or an electron beam to penetrate them.
- First, the tissue is treated, to "fix" the structures so they will not be altered by the staining and slicing. Usually this is done by using chemicals such as ALCOHOL and FORMALDEHYDE.
- Stains have been developed that react differently with different cell
  structures, depending on their chemical composition or enzymatic
  activity. The use of stains containing <u>radioactive atoms</u>, known as <u>AUTORADIOGRAPHY</u>, often involves
  feeding cells specific compounds with radioactive atoms and then observing the distribution of radioactive
  events on a <u>photographic film</u> emulsion.

#### Relative Powers of Microscopes

- Compound Light Microscope: maximum <u>resolving power</u> = 200 nm (maximum useful magnification = -1000 X)
- Transmission Electron Microscope: maximum resolving power = 0.5 nm nm (maximum useful magnification = >30,000 X)
- Scanning Electron Microscope: Gives vivid 3-D images, but less magnification than transmission EM



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