

## CELL STRUCTURE ANSWERS

1. The characteristics of living things are:
  - \* Specific size and shape (e.g. bacteria are microscopic and tend to be rounded)
  - \* Metabolism (all the cell's processes e.g. plants photosynthesise and also respire)
  - \* Movement in most living things (e.g. bipedal movement in humans)
  - \* Response to stimuli (e.g. plants grow towards light)
  - \* Growth (increase in size of individual cells, and increase in number of cells)
  - \* Reproduction (the production of a new organism)
  - \* Adaptation (ability to undergo modification to be better fitted to surroundings)
2. (a) A cell is the basic unit of all living things. Each cell has genetic material (e.g. DNA), cytoplasm, cell membrane, and other features distinctive to itself.
2. (b) Cells may be prokaryotic or eukaryotic. The eukaryotic cells may be protist, fungus, plant or animal, and so on.
3. (a) Non-cellular material is that material which does not contain cells.
3. (b) Non-cellular material may be gaseous (e.g. air in lungs) or liquid (e.g. urine, plant sap) or solid (e.g. calcified bone).
4. (a) The Cell Theory states that:
  - \* All living things are composed of cells and cell products (e.g. bone, saliva).
  - \* New cells are formed by the division of pre-existing cells.
  - \* There are basic similarities in chemical constituents and metabolism of all cells.
  - \* The activity of an organism is the sum of the activities and interactions of its cells.
4. (b) As the magnification and resolution of microscopes improved throughout history, so did our knowledge of cell components.
4. (c) All microscopes magnify cellular components. Light microscopes and transmission electron microscopes give a two-dimensional image. However, electron microscopes have greater magnification, and the scanning electron microscope can even give a three-dimensional image.

5. *In vivo* comes from the Latin *vivus* meaning alive, and includes experiments that are performed on or in living things (e.g. measuring the heights of growing plants, testing the irritating effect of shampoos on the eyes of mice). *In vitro* comes from the Latin *vitrum* meaning glass, and includes experiments that are done outside of a living organism (e.g. the fertilisation of a sperm and an ovum in a test tube before implanting the zygote back into the mother's womb, chemical tests to determine amounts of protein in different foods).
6. The size of a cell is limited by factors such as availability of nutrients water and gases necessary for the cell's metabolism, the proximity of its surroundings, its ability to extend the cell membrane and cell wall, the ability of the nucleus to control the cell's increased metabolism, and so on.
7. An organelle is an organised cell component with a specific function. Organelles are surrounded by membranes and are found in eukaryotic cells.
8. Two basic cell types are prokaryotes (very small cells which lack internal membranes, noticeably around the nucleus) and eukaryotes (larger and more organised cells which have internal membranes surrounding its cell components which are then called organelles).
9. Plant cells contain chlorophyll in chloroplasts, a cell wall as well as a cell membrane, and larger vacuoles, but plant cells do not contain centrioles. Animal cells lack chlorophyll and a cell wall, but they do have centrioles, and some of the simpler animals have vacuoles. Some single-celled freshwater animals have contractile vacuoles that dispose of excess water back into the surroundings.
10. (a) The functions of the nucleus are to contain genetic material (e.g. DNA), and to control the cell's metabolism.
10. (b) When the nucleus of a cell is extracted by syringe, the cell lives only a short time without its nucleus. Mature red blood cells naturally lose their nuclei, and do not live long in their maturity.
11. (a) Mitochondria - the "powerhouses" where respiration occurs to give the cell a useful form of energy (ATP – adenosine triphosphate).
11. (b) Ribosomes - the "workbenches" where proteins are made.

11. (c) Endoplasmic Reticulum - a system of membranes which help to transport chemicals such as proteins throughout the cell.
11. (d) Golgi Bodies - a system of membranes which help to collect, sort, process and distribute chemicals such as proteins (e.g. hormones) and carbohydrates (e.g. cellulose in cell walls). Golgi Bodies pinch off and form vesicles which break off and carry their contents to other parts of the cell.
12. The prefixes of each come from Latin words - "amyl-" comes from starch, "chrom-" comes from colour, and "elai-" from oil.
13. (a) Since ribosomes help in making proteins such as hormones and enzymes, cells with many ribosomes would be endocrine glands, and glands producing digestive enzymes, for example.
13. (b) Mitochondria are the energy producers for cells, and cells with many mitochondria would be muscle cells as one example.
14. The nucleus contains DNA which makes the RNA that makes the proteins. Since hormones and enzymes are proteins which regulate many processes within individual cells of unicellular and multicellular organisms, the cell would not function very long without its controlling nucleus.
15. Refer to electron micrographs in your textbook.
16. Chromosomes are thicker and more distinct in the nuclei of cells undergoing cell division. Chromatin is the same chromosomes in a thinner and less distinct form in cells that are not dividing at that time.
17. The major structural difference is that eukaryotes have internal components enclosed in membranes and are therefore called organelles, and prokaryotes don't. This means that the nuclei of eukaryotic cells are more distinct. Also eukaryotes are larger than prokaryotes.
18. Prokaryotes and eukaryotes both contain the same types of chemicals needed to carry out their cellular processes. However, eukaryotes are more organised in how they store and sort these chemicals.

19. Cell differentiation is the development of different cells with specific functions in a multicellular organism, from a single cell. For example, each human began as a single-celled zygote, but it developed into a many-celled organism with 230 different cell types such as nerve cells, muscle cells, skin cells, blood cells and so on.

20. Because eukaryotic cells are more specialised than prokaryotic cells, they have the ability to grow larger because more efficient transport of chemicals occurs, there are specialised sites for each cell process, and therefore more chemical activity can occur.

In a similar way, the more efficient interactions that occur between the cells of a multicellular organism means that the organism as a whole is more effective in its surroundings.