





















## 02 – CELLS AS THE BASIS OF LIFE Learning Intentions




I understand that...	I can...	Mastery Check
<b>2.1 – CELL STRUCTURE</b>		
<b>2.1.1</b> The cell theory unifies all living things.		
<b>2.1.2</b> The cell membrane separates the cell from its surroundings and controls the exchange of materials, including nutrients and wastes, between the cell and its environment.	<input checked="" type="checkbox"/> Describe and represent the fluid mosaic model of the cell membrane.	
<b>2.1.3</b> The major types of cell are <ul style="list-style-type: none"> <li>• prokaryotic</li> <li>• eukaryotic.</li> </ul>		
<b>2.1.4</b> Prokaryotic and eukaryotic cells have many features in common, which is a reflection of their common evolutionary past.	<input checked="" type="checkbox"/> Compare prokaryotic and eukaryotic cells with respect to their: <ul style="list-style-type: none"> <li>• size</li> <li>• internal organisation</li> <li>• shape and location of chromosomes.</li> </ul>	
<b>2.1.5</b> Prokaryotes only exist as single cells.		

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<p><b>2.1.6</b> Eukaryotic cells have specialised organelles which facilitate biochemical processes.</p>	<p><input checked="" type="checkbox"/> Represent the structure and describe the function of:</p> <ul style="list-style-type: none"> <li>• nucleus</li> <li>• nucleolus</li> <li>• mitochondrion</li> <li>• chloroplast</li> <li>• vacuole</li> <li>• Golgi body (including vesicles)</li> <li>• endoplasmic reticulum (rough and smooth)</li> <li>• ribosome</li> <li>• lysosome</li> <li>• cytoskeleton.</li> </ul> <p><input checked="" type="checkbox"/> Compare the structures of plant, animal, and fungal cells.</p>	
<b>2.2 – CELLULAR RESPIRATION</b>		
<p><b>2.2.1</b> Cells require inputs of suitable forms of energy, including light energy or chemical energy in complex molecules.</p>	<p><input checked="" type="checkbox"/> Distinguish between autotrophs and heterotrophs.</p>	
<p><b>2.2.2</b> The sun is the main source of energy for life.</p>	<p><input checked="" type="checkbox"/> Recognise that photosynthesis is important in the conversion of light energy into chemical energy, as illustrated by the following equation:</p> $6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ <p style="text-align: center;">carbon dioxide + water <math>\xrightarrow[\text{chlorophyll}]{\text{light}}</math> glucose + oxygen</p>	
<p><b>2.2.3</b> Energy transformations occur within all living cells.</p>	<p><input checked="" type="checkbox"/> Explain how most autotrophs and heterotrophs transform chemical energy for use through aerobic respiration, as illustrated by the following equation:</p>	

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	<p style="text-align: center;"><math>C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O</math></p> <p style="text-align: center;">glucose + oxygen <math>\longrightarrow</math> carbon dioxide + water</p> <p><input checked="" type="checkbox"/> Explain that fermentation is an anaerobic alternative to aerobic respiration:</p> <ul style="list-style-type: none"> <li>• <b>in plants and yeast:</b></li> </ul> <p style="text-align: center;"><math>C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2</math></p> <p style="text-align: center;">glucose <math>\longrightarrow</math> ethanol + carbon dioxide</p> <ul style="list-style-type: none"> <li>• <b>in animals:</b></li> </ul> <p style="text-align: center;"><math>C_6H_{12}O_6 \longrightarrow 2C_3H_6O_3</math></p> <p style="text-align: center;">glucose <math>\longrightarrow</math> lactic acid</p> <p><input checked="" type="checkbox"/> Compare the amount of energy released through aerobic respiration and fermentation.</p> <p><input checked="" type="checkbox"/> Recognise that energy is required to break chemical bonds and energy is released when new bonds are formed.</p> <p><input checked="" type="checkbox"/> Describe the conversion of ATP to ADP and <math>P_i</math>, which releases energy for some metabolic reactions.</p> <p><input checked="" type="checkbox"/> Explain how the conversion of ATP to ADP and <math>P_i</math> releases energy for some metabolic reactions.</p>	
<p><b>2.2.4</b> In order to survive, cells require an input of matter, including gases, simple nutrients, and ions, and the removal of wastes.</p>	<p><input checked="" type="checkbox"/> Compare the inputs and outputs of autotrophs and heterotrophs.</p>	

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<b>2.3 – TRANSPORT ACROSS MEMBRANES</b>		
<p><b>2.3.1</b> Substances move in and out of cells by processes such as:</p> <ul style="list-style-type: none"> <li>• diffusion</li> <li>• facilitated diffusion</li> <li>• osmosis</li> <li>• active transport</li> <li>• endocytosis</li> <li>• exocytosis.</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Explain how the structure of a membrane facilitates different processes of movement through it.</li> <li><input checked="" type="checkbox"/> Explain the roles of transport proteins, including channel proteins (such as aquaporins), and carrier proteins.</li> <li><input checked="" type="checkbox"/> Explain how the exchange of materials across membranes is affected by factors including:               <ul style="list-style-type: none"> <li>• surface-area-to-volume ratio of the cell</li> <li>• concentration gradients</li> <li>• the physical and chemical nature of the materials being exchanged.</li> </ul> </li> </ul>	
<p><b>2.3.2</b> Cell metabolism is critical to the survival of cells.</p>		
<p><b>2.3.3</b> Biochemical processes in the cell are influenced by the nature and arrangement of internal membranes and the presence of specific enzymes.</p>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Explain how the structure of internal membranes of mitochondria and chloroplasts facilitates some biochemical processes.</li> <li><input checked="" type="checkbox"/> Explain that in a metabolic pathway:               <ul style="list-style-type: none"> <li>• there are many regulated steps</li> <li>• each step loses some energy as heat</li> <li>• some steps produce intermediate compounds</li> <li>• specific enzymes are required at each step.</li> </ul> </li> </ul>	
<p><b>2.3.4</b> Biochemical processes in the cell are influenced by environmental factors.</p>		

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<p><b>2.3.5</b> Chemicals can interfere with cell metabolism.</p>	<p><input checked="" type="checkbox"/> Discuss possible benefits and/or harmful effects of chemicals that human beings use.</p>	
<p><b>2.4 – CELL DIVISION</b></p>		
<p><b>2.4.1</b> Cells arise from pre-existing cells, and cell division leads to an increase in cell number.</p>		
<p><b>2.4.2</b> Cell division in somatic cells is different from the cell division that produces gametes from germ-line cells.</p>		
<p><b>2.4.3</b> Continuity of life requires the replication of genetic material and its transfer to the next generation through processes including binary fission, mitosis, meiosis, and fertilisation.</p>	<p><input checked="" type="checkbox"/> Explain why the amount of DNA in a cell doubles before division.</p>	
<p><b>2.4.4</b> The products of binary fission and mitotic division have the same number and type of chromosomes as the parent.</p>	<p><input checked="" type="checkbox"/> Recognise, describe, and represent the process of binary fission in prokaryotic cells.</p> <p><input checked="" type="checkbox"/> Recognise, describe, represent and name the phases of mitosis in eukaryotic cells.</p> <p><input checked="" type="checkbox"/> Compare the products of binary fission and mitotic division.</p>	
<p><b>2.4.5</b> Diploid cells contain pairs of homologous chromosomes. Haploid cells have one chromosome from each homologous pair.</p>	<p><input checked="" type="checkbox"/> Recognise, describe, represent and name the phases of meiosis in eukaryotic cells.</p> <p><input checked="" type="checkbox"/> Explain why the products of meiosis are haploid cells and contain a single set of chromosomes.</p> <p><input checked="" type="checkbox"/> Explain the importance of crossing over and independent assortment in meiosis.</p>	

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	<input checked="" type="checkbox"/> Explain that fertilisation restores the diploid number. Compare the products of mitotic and meiotic cell division.  <input checked="" type="checkbox"/> Compare the sources and degree of genetic variation of the products of asexual and sexual reproduction.	
<b>2.5 – THE CELL CYCLE</b>		
<b>2.5.1</b> Cell division may be regulated by internal and external factors.		
<b>2.5.2</b> The cell produces gene products that regulate the cell cycle.	<input checked="" type="checkbox"/> Describe the stages in the cell cycle (including checkpoints).  <input checked="" type="checkbox"/> Explain that hormones may regulate cell division.	
<b>2.5.3</b> Carcinogens upset the normal controls of cell division by causing mutations in key regulatory genes.		
<b>2.6 – CELL CULTURE</b>		
<b>2.6.1</b> Human beings culture cells for a variety of purposes.	<input checked="" type="checkbox"/> Describe techniques of cell culture, and discuss the applications and limitations of contemporary examples.	