**A-level Biology**



**3.2 Cells**



**Name ……………..…….…………**

| **Lesson Date(s)** | **Topic** | **Learning Outcomes From Specification** | **Key Words & Equations** | **Notes** **(Revision tips, exam technique tips, priorities for revision etc.)** |
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|  | 3.2.1.1Structure of Eukaryotic Cells | The structure of eukaryotic cells, restricted to the structure and function of:cell-surface membranenucleus (containing chromosomes, consisting of protein-bound, linear DNA, and one or more nucleoli)mitochondriachloroplasts (in plants and algae)Golgi apparatus and Golgi vesicleslysosomes (a type of Golgi vesicle that releases lysozymes)ribosomesrough endoplasmic reticulum and smooth endoplasmic reticulumcell wall (in plants, algae and fungi)cell vacuole (in plants).In complex multicellular organisms, eukaryotic cells become specialised for specific functions. Specialised cells are organised into tissues, tissues into organs and organs into systems.Students should be able:apply their knowledge of these features in explaining adaptations of eukaryotic cells. |  |  |
|  | 3.2.1.2Structure of Prokaryotic Cells & Viruses | Prokaryotic cells are much smaller than eukaryotic cells. They also differ from eukaryotic cells in having:cytoplasm that lacks membrane-bound organellessmaller ribosomesno nucleus; instead they have a single circular DNA molecule that is free in the cytoplasm and is not associated with proteinsa cell wall that contains murein, a glycoprotein.In addition, many prokaryotic cells have:one or more plasmidsa capsule surrounding the cellone or more flagella.Details of these structural differences are not required.Viruses are acellular and non-living. The structure of virus particles to include genetic material, capsid and attachment protein. |  |  |
|  | 3.2.1.3Methods of Studying Cells | The principles and limitations of optical microscopes, transmission electron microscopes and scanning electron microscopes.Measuring the size of an object viewed with an optical microscope.The difference between magnification and resolution.Use of the formula: magnification = size of image size of real objectPrinciples of cell fractionation and ultracentrifugation as used to separate cell components.Students should be able to: appreciate that there was a considerable period of time during which the scientific community distinguished between artefacts and cell organelles. |  |  |
|  | 3.2.2Cell Cycle & Mitosis | Within multicellular organisms, not all cells retain the ability to divide.Eukaryotic cells that do retain the ability to divide show a cell cycle.DNA replication occurs during the interphase of the cell cycle.Mitosis is the part of the cell cycle in which a eukaryotic cell divides to produce two daughter cells, each with the identical copies of DNA produced by the parent cell during DNA replication.The behaviour of chromosomes during interphase, prophase, metaphase, anaphase and telophase of mitosis. The role of spindle fibres attached to centromeres in the separation of chromatids.Division of the cytoplasm (cytokinesis) usually occurs, producing two new cells.Meiosis is covered in section 3.4.3Students should be able to:recognise the stages of the cell cycle: interphase, prophase, metaphase, anaphase and telophase (including cytokinesis)explain the appearance of cells in each stage of mitosis.**Required practical 2: Preparation of stained squashes of cells from plant root tips; set-up and use of an optical microscope to identify the stages of mitosis in these stained squashes and calculation of a mitotic index.****Students should measure the apparent size of cells in the root tip and calculate their actual size using the formula:****Actual size = size of image****magnification** |  |  |
|  | 3.2.2Mitosis & Cancer | Mitosis is a controlled process. Uncontrolled cell division can lead to the formation of tumours and of cancers. Many cancer treatments are directed at controlling the rate of cell division. |  |  |
|  | 3.2.2Binary Fission & Viruses | Binary fission in prokaryotic cells involves:replication of the circular DNA and of plasmidsdivision of the cytoplasm to produce two daughter cells, each witha single copy of the circular DNA and a variable number of copies of plasmids.Being non-living, viruses do not undergo cell division. Following injection of their nucleic acid, the infected host cell replicates the virus particles. |  |  |
|  | 3.2.3Membrane Structure | The basic structure of all cell membranes, including cell-surface membranes and the membranes around the cell organelles of eukaryotes, is the same.The arrangement and any movement of phospholipids, proteins, glycoproteins and glycolipids in the fluid-mosaic model of membrane structure. Cholesterol may also be present in cell membranes where it restricts the movement of other molecules making up the membrane. |  |  |
|  | 3.2.3Diffusion & Facilitated Diffusion | Movement across membranes occurs by:simple diffusion (involving limitations imposed by the nature of the phospholipid bilayer)facilitated diffusion (involving the roles of carrier proteins and channel proteins)**Required practical 4: Investigation into the effect of a named variable on the permeability of cell-surface membranes.** |  |  |
|  | 3.2.3Osmosis | Movement across membranes occurs by:osmosis (explained in terms of water potential)**Required practical 3: Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue.** |  |  |
|  | 3.2.3Active Transport & Co-transport | Movement across membranes occurs by:active transport (involving the role of carrier proteins and the importance of the hydrolysis of ATP)co-transport (illustrated by the absorption of sodium ions and glucose by cells lining the mammalian ileum). |  |  |
|  | 3.2.3 Cell Adaptations for Transport Across Membranes | Cells may be adapted for rapid transport across their internal or external membranes by an increase in surface area of, or by an increase in the number of protein channels and carrier molecules in, their membranes.Students should be able to:explain the adaptations of specialised cells in relation to the rate of transport across their internal and external membranesexplain how surface area, number of channel or carrier proteins and differences in gradients of concentration or water potential affect the rate of movement across cell membranes. |  |  |
|  | 3.2.4Antigens | Each type of cell has specific molecules on its surface that identify it. These molecules include proteins and enable the immune system to identify:pathogenscells from other organisms of the same speciesabnormal body cellstoxins.Definition of antigen. The effect of antigen variability on disease and disease prevention. |  |  |
|  | 3.2.4Phagocytes | Phagocytosis of pathogens. The subsequent destruction of ingested pathogens by lysozymes. |  |  |
|  | 3.2.4T Lymphocytes | The response of T lymphocytes to a foreign antigen (the cellular response).The role of antigen-presenting cells in the cellular response.The role of helper T cells (TH cells) in stimulating cytotoxic T cells (TC cells), B cells and phagocytes. The role of other T cells is not required. |  |  |
|  | 3.2.4B Lymphocytes | The response of B lymphocytes to a foreign antigen, clonal selection and the release of monoclonal antibodies (the humoral response).Definition of antibody.Antibody structure.The formation of an antigen-antibody complex, leading to the destruction of the antigen, limited to agglutination and phagocytosis of bacterial cells.The roles of plasma cells and of memory cells in producing primary and secondary immune responses. |  |  |
|  | 3.2.4Vaccines & Immunity | The use of vaccines to provide protection for individuals and populations against disease. The concept of herd immunity.The differences between active and passive immunity. |  |  |
|  | 3.2.4HIV | Structure of the human immunodeficiency virus (HIV) and its replication in helper T cells.How HIV causes the symptoms of AIDS. Why antibiotics are ineffective against viruses. |  |  |
|  | 3.2.4Monoclonal Antibodies & Ethics | The use of monoclonal antibodies in:targeting medication to specific cell types by attaching a therapeutic drug to an antibodymedical diagnosis.Details of the commercial or scientific production of monoclonal antibodies are not required.Ethical issues associated with the use of vaccines and monoclonal antibodies.The use of antibodies in the ELISA test.Students should be able to:discuss ethical issues associated with the use of vaccines and monoclonal antibodiesevaluate methodology, evidence and data relating to the use of vaccines and monoclonal antibodies. |  |  |