|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | The structure of eukaryotic cells specifically the structure and function of – cell-surface membrane. |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – nucleus (containing chromosomes, consisting of protein-bound, linear DNA, and one or more nucleoli). |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – mitochondria. |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – chloroplasts (in plants and algae). |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – Golgi apparatus and Golgi vesicles. |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – lysosomes (a type of Golgi vesicle that releases lysozymes). |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – ribosomes. |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – rough endoplasmic reticulum and smooth endoplasmic reticulum. |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – cell wall (in plants, algae and fungi). |  |  |  |  |  |
|  | The structure of eukaryotic cells specifically the structure and function of – 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. |  |  |  |  |  |
|  | Explaining these adaptations of eukaryotic cells. |  |  |  |  |  |
|  | Prokaryotic cells are much smaller than eukaryotic cells. They also differ form eukaryotic cells in having:* cytoplasm that lacks membrane-bound organelles.
* Smaller ribosomes.
* No nucleus; instead they have a single circular DNA molecule that is free in the cytoplasm and is not associated with proteins.
* A cell wall that contains murein, a glycoprotein.
 |  |  |  |  |  |
|  | In addition, many prokaryotic cells have:* one or more plasmids.
* a capsule surrounding the cell.
* one or more flagella.
 |  |  |  |  |  |
|  | Viruses are acellular and non-living. The structure of virus particles to include genetic material, capsid and attachment protein. |  |  |  |  |  |
|  | 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. |  |  |  |  |  |
|  | Using the formula of magnification. |  |  |  |  |  |
|  | Principles of cell fractionation and ultracentrifugation as used to separate cell components. |  |  |  |  |  |
|  | Appreciate that there was a considerable period of time which the scientific community distinguished between artefacts and cell organelles. |  |  |  |  |  |
|  | 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. |  |  |  |  |  |
|  | Recognise the stages of the cell cycle: interphase, prophase, metaphase and telophase (including cytokinesis). |  |  |  |  |  |
|  | Explain the appearance of cells in each stage of mitosis. |  |  |  |  |  |
|  | 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. |  |  |  |  |  |
|  | Binary fission in prokaryotic cells involves:* Replication of the circular DNA and of plasmids.
* Division of the cytoplasm to produce two daughter cells, each with a 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 replicates the virus particles. |  |  |  |  |  |
|  | Calculate the mitotic index. |  |  |  |  |  |
|  | The basic structure of all cell membranes, including cell-surface membranes and the membranes around the cell organelle 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. |  |  |  |  |  |
|  | Movement across the membranes is caused by:* simple diffusion (involving limitations imposed by the nature of the phospholipid bilayer).
* facilitated diffusion (involving the roles of carrier proteins and channel proteins).
* osmosis (explained in terms of water potential).
* 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).
 |  |  |  |  |  |
|  | 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. |  |  |  |  |  |
|  | The adaptations of specialised cells in relation to the rate of transport across their internal and external membranes. |  |  |  |  |  |
|  | 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. |  |  |  |  |  |
|  | Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of a plant tissue. |  |  |  |  |  |
|  | Each type of cell has specific molecules on its surface that identify it. These molecules include proteins and enable the immune system to identify:* pathogens.
* cells from other organisms of the same species.
* abnormal body cells.
* toxins.
 |  |  |  |  |  |
|  | Definition of antigen. The effect of antigen variability on disease and disease prevention. |  |  |  |  |  |
|  | Phagocytosis of pathogens. The subsequent destruction of ingested pathogens by lysozymes. |  |  |  |  |  |
|  | 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.
 |  |  |  |  |  |
|  | The response of B lymphocytes to a foreign antigen, clonal selection and the release of monoclonal antibodies (the humoral response).* definition of an antibody.
* antibody structure.
* the formation of an antigen-antibody complex, leading to the destruction of the antigen, limited to agglutination and phagocytosis of the bacterial cells.
* The roles of plasma cells and of memory cells in producing primary and secondary immune responses.
 |  |  |  |  |  |
|  | The use of vaccines to provide protection for individuals and populations against disease. The concept of herd immunity. |  |  |  |  |  |
|  | The difference between active and passive immunity. |  |  |  |  |  |
|  | 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. |  |  |  |  |  |
|  | The use of monoclonal antibodies in:* targeting medication to specific cell types by attaching a therapeutic drug to an antibody.
* Medical diagnosis.

(details about the production of monoclonal antibodies is **NOT** required. |  |  |  |  |  |
|  | Ethical issues associated with the use of vaccines and monoclonal antibodies. |  |  |  |  |  |
|  | The use of antibodies in the ELISA test. |  |  |  |  |  |
|  | Evaluate methodology, evidence and data relating to the use of vaccines and monoclonal antibodies. |  |  |  |  |  |