Biology GT Notes

Lipids: A group of naturally occurring molecules that include fats, waxes, steroids, fat-soluble vitamins, monoglycerides, diglycerides, etc. They mainly function for storing energy, signalling and acting as components of cell membranes.

Proteins: Large biomolecules or macromolecules, consisting of one or more long chains of amino acids residues. They perform such functions as catalysing metabolic reactions, DNA replication, responding to stimuli and transporting molecules form one location to another.

Chemical Make-Up of Biomolecules

-Carbohydrates: Carbon, Hydrogen and Oxygen

-Lipids: Carbon, Hydrogen and Oxygen

-Protein: Carbons, Hydrogen, Oxygen and Nitrogen

-Nucleic Acids: Carbon, Hydrogen, Oxygen, Nitrogen and Phosphorous

Control Group: The usual normal state group of an experiment, used for comparisons.

Covalent Bond: Electrons are shared between atoms. Hydrogen always forms these. Usually non-metal bonds.

Ionic Bond: An atom gains an electron while another atom loses an electron. Usually includes metals.

Hydrogen Bond: A bond where one atom is slightly positive while the other is slightly negative.

Polarity: An atom containing both positive and negative charges.

Density of Water: As T -> ∞, D -> 0; As T -> 4, D->∞; As T->-∞, D->0;

Solubility of Water: Water may dissolve all polar substances.

pH: The measurement of the acidity or basicness of a substance; 7 is neutral; <7 is acidic; >7 is basic; every level increase is a magnitude of 10.

Solute: Substance being dissolved.

Solvent: A substance that dissolves another substance or solute.

Solution: The result of one or more substances in combination.

Cohesion: Atoms attracted to atoms of the same type.

Adhesion: Atoms attracted to atoms of a different type.

Surface Tension of Water: Water is normally attracted to itself thus creating surface tension.

Enzymes: Specialized proteins that speed up reactions of processes for example bromelain breaks down proteins.

Phospholipids: Lipid that forms cell membrane.

Monosaccharides: Most basic unit of carbohydrates.

Vitamin K: Helps blood clot quickly.

Vitamin D: Helps form and maintain strong bones.

Vitamin C: Helps heal wounds.

Calcium: Helps maintain strong bones.

Iron: Helps transport oxygen (haemoglobin!).

Sodium: Helps balance water and muscle contraction.

Active Transport: Transport of a solvent form an area of low density to one of high density. Requires energy.

Passive Transport: Transport of a solvent from an area of high density to one of low density. Requires no energy.

Concentration Gradient: The path that substances follow from areas of high to low concentration.

First Law of Thermodynamics: Energy can neither be created nor destroyed.

Second Law of Thermodynamics: Entropy always tends to a maximum.

Third Law of Thermodynamics: Nothing will ever reach absolute 0.

Application of the Second Law of Thermodynamics to Diffusion: Entropy is generally termed as disorder. This is not traditional disorder as we see in everyday life. Suppose you have a rectangular container, a set of atoms are located on the far side of the container, these atoms are near minimum entropy. Now we know that from the third law of thermodynamics nothing can reach absolute 0. Thus, the atoms will move around. They will eventually reach a natural state with all being nearly equally spread out. This natural state is maximum entropy. Thus, entropy illustrates the process of diffusion perfectly. Substances will tend to a state of equilibrium or maximum entropy. To decrease entropy except in the rarest of circumstances more energy is required as is the case with active transport in diffusion.

Cardiovascular/Circulatory System: Circulates blood around the body through the heart, arteries and veins, delivering oxygen and nutrients to organs, cells and carrying their waste products away.

Muscular System: Enables the body to move using muscles.

Digestive System: Mechanical and chemical processes which break down foods and provide nutrients.

Skeletal System: Supports the body and its organs and provides protection to it.

Excretory System: Eliminated waste from the body.

Nervous System: Nerves collect senses, relay to brain which instructs actions.

Endocrine System: Produces and controls hormones.

Respiratory System: Brings air into the body, releases C02.

Immune System: Defends the body against diseases.

Emerging Viruses: Viruses that suddenly appear or are new to researchers.

Reverse Transcriptase: An enzyme that catalyses that conversion of RNA to DNA.

Retroviruses: Viruses that use an RNA->DNA pattern.

Provirus: Like prophage, where DNA is dormant in a cell until catalysed where it produces viruses.

Unicellular: Having one cell.

Multicellular: Having multiple cells.

Homeostasis: Where an organism maintains a constant internal environment.

Stimulus: Something that caused a reaction in an organism.

Viruses: A parasite that consists of nucleic acids contained in a protein capsid or at times a membrane. They reproduce by taking a cell as its host.

Lytic Phases: Phage injects DNA->Phage DNA circulates->Phage DNA inserts into the bacterial chromosome by recombination->Lysogenic bacterium reproduces normally, replicating the prophage of each cell division.

Lytic Cycle: A cycle of viral reproduction which results in the host cell being destroyed.

Lysogenic Cycle: A cycle of viral reproduction which results in DNA being held in prophage form with most of the DNA being inactive. Does not result in the death of the host cell unless an environmental signal causes the switch to lytic cycle. In a few cases the active genes will be harmful.

Animal Viruses: Viruses that affect animals, they have a membranous outer envelope and projecting spikes of glycoprotein which helps them enter and leave the host cell. They tend to have RNA rather than DNA.

Glycoprotein: Protein with attached sugars.

RNA Viruses Reproduction: Glycoprotein Spikes attach to membrane receptors->virus envelope fuses with cell membrane->Protein coated RNA enters cytoplasm->enzymes remove the protein coat->an enzyme form the virus uses the virus’s RNA as a template for making RNA strands->the new strands synthesize new viral proteins and serve as templates for a new viral genome RNA->virus leaves the cell by cloaking itself in plasma membrane thus avoiding lysis.

RNA Viruses Examples: Cold, Measles, MMP, AIDS and Polio

Plant Viruses: Mostly RNA based viruses they must initially pass through a protective layer (cell wall), but may then spread between cells through cytoplasmic connections between adjacent plant cells.

Hereditary: The passing of genetic information between generations.

Metabolism: The collection of all chemical processes that occur in an organism.

DNA Replication: An enzyme called helicase separates DNA into 2 different strands a 3’ and a 5’ lagging strand. The separation results in a replication fork. An enzyme, primase marks a location for replication where DNA polymerase adds nucleotides in the 5’-3’ direction. The other strand is separated into Okazaki fragments which are replicated discontinuously. These are joined together by ligase in the end.

Helicase: Enzyme which separates DNA strands.

Ligase: Enzyme which re-joins DNA strands.

RNA Primase: Primes DNA for replication.

DNA Polymerase: Adds nucleotides in the 5’-3’ direction and runs in the 3’-5’ direction.

Okazaki Fragments: Broken down fragments of DNA.

Cell Cycle: The cell cycle is determined by exterior conditions. It begins with the Growth(G1) phase where the cell grows and develops as well as determines which state to enter and when to enter its synthesis stage. In the synthesis(S) phase the cell replicates its chromosomes. Following the synthesis phase is the Second Growth(G2) phase. During this phase the cell grows, copies organelles and prepares for mitosis. Following the check in the G2 phase for DNA integrity the cell proceeds into the mitosis(M) phase in which the cell divides its nuclei into two separate entities. In the cytokinesis(C) phase the cell divides its cytoplasm resulting in two cells with equivalent DNA forming.

Interphase: The first three stages of cell development where the cell spends most its time and develops as well as prepares for cell replication.

DNA Mutation: DNA mutates in 3 ways during replication, these are insertion, substitution and deletion. Though the polymerase does check DNA for these errors they may still be present and cause a genetic mutation.

mRNA: Otherwise known as messenger RNA this transfers genetic information from the nucleus to the ribosome.

tRNA: Otherwise known as translator RNA this translates mRNA for the ribosome during the process of translation (of course). It attaches to mRNA codons and translates them by codon.

rRNA: Otherwise known as ribosomal RNA this exists in the ribosome and helps put things together.

Central Dogma: The principle that states the direction genetic information may be obtained, it was initially developed by Watson and Crick.

|  |  |  |
| --- | --- | --- |
| General | Special | Unknown |
| DNA->DNA | RNA->DNA | Protein->DNA |
| DNA->RNA | RNA->RNA | Protein->RNA |
| RNA->Protein | DNA->Protein | Protein->Protein |

Mitosis: The process in which cells replicate and produce two identical offspring. It has four phases-prophase, metaphase, anaphase and telophase. In prophase, the cell’s centrioles travel to opposite sides of the cell, the nucleus disappears and the spindles form. In metaphase, the chromosomes split up and the spindles retract towards the opposite ends. In telophase, new nuclei begin to form around the chromosomes to form the daughter cell’s new nuclei.

Meiosis: The process in which cells produce gametes which have genetic variation from the original cell. Produces 4 haploid daughter cells. It contains 8 phases- prophase I, metaphase I, anaphase I, telophase I, prophase II, metaphase II, anaphase II and telophase II. In prophase 1, the tetrads form, the nuclear membrane disintegrates and genetic recombination occurs increasing genetic variation. In metaphase 1, the tetrads attack to spindle fibres at their centromeres and they line up in the middle of the cell. In anaphase 1, tetrads separate and the chromatids move towards the poles. In telophase 1, the nuclear membrane forms around the chromosomes and cytokinesis forms 2 cells. In prophase 2, the spindle begins to form and the nuclear membrane dissolves again. In metaphase 2, the chromatids line up in the middle of the cell and centrioles move towards the poles. In anaphase 2, the centromeres split and move to the opposite ends of the cell. In telophase 2, the nuclei reform and cytokinesis occurs at the same time, ending with 4 haploid cells thus.

Diploid: A cell that contains a full set of chromosomes in the case of humans 46 total.

Haploid: A cell that contains a half set of chromosomes in the case of humans 23.

Somatic Cells: A cell that preforms normal body functions and contains a full diploid set of chromosomes.

Gamete Cell: A cell used for sexual reproduction that contains a haploid set of chromosomes.

Autosomal Traits: Traits determined by chromosomes other than X or Y. These traits are dependent on the alleles given by their parents.

Allele: A variation of a genetic trait. Ex. Tall: Height;

Dominant Allele: An allele that takes precedence over other alleles in its expression.

Recessive Allele: An allele that is only expressed when paired with another recessive allele.

Incomplete Dominance: An allele that can only express itself when paired with itself and will express a third trait if paired with another allele.

Codominance: The expression of two traits simultaneously due to the presence of 2 dominant alleles.

Sex-Linked Traits: Traits determined by either the X or Y chromosome. The vast majority of these are found on the X chromosome.

Punnett Square: A visual representation of the probabilities of inheriting traits.

Pedigree: A visual representation of the genotype or phenotype of a family over multiple generations.