

Edexcel IAL Biology A-level

Topic 4: Plant Structure and Function, Biodiversity and Conservation

Definitions and Concepts

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4.1-4.13: Plant Structure and Function

Amyloplasts: Organelles found in the cytoplasm of plant cells that are used to store amylopectin, a form of starch.

Beta glucose: A structural isomer of glucose that exists in a ring form where the hydroxyl group on carbon-1 lies above the plane of the ring. In cellulose these isomers are held together by 1,4 glycosidic bonds.

Calcium ion: A type of ion that is found in the middle lamella of plant cells. It combines with pectin to form calcium pectate, which holds plant cells together.

Captive breeding programme: Breeding wild animals in a safe environment like a zoo or sanctuary to increase population size.

Cell vacuole: A membrane bound structure found in plant cells that contains cell sap.

Cell wall: A permeable layer that surrounds plant, algae and fungi cells made of polysaccharides which provides strength to the cell.

Cellulose: A polysaccharide made of beta glucose monomers joined by β -1,4 bonds that is used as a structural polysaccharide which provides strength to plant cell walls.

Chloroplast: An organelle found in plants and algae that is the site of photosynthesis.

Cross-linking: A phenomenon which allows chains of beta-glucose monomers in cellulose to be held firmly together through hydrogen bonding between the partially positively charged hydrogen atoms of the hydroxyl (-OH) group and the partially negatively charged oxygen atoms in other areas of the glucose molecules.

Double blind trial: A drug trial is completed where neither the researcher or patient know which drug is a placebo and which is the working drug in order to remove researcher bias.

Magnesium ion: A type of ion with the formula Mg^{2+} which is needed for chlorophyll to function so that plants can carry out photosynthesis.

Microfibrils: Fibrils made of cellulose that largely compose plant cell walls. They are laid down in layers held together by a matrix of hemicelluloses and other short-chain carbohydrates.

Middle lamella: A layer made up of pectins which joins the cell walls of adjacent plant cells together.

Mitochondrion: An organelle found in eukaryotic cells that is the site of aerobic respiration.

Nitrate ion: A type of ion with the formula NO_3^- which is taken up by plants from the soil and is used to make proteins.



Phase 1 clinical trial: A clinical trial where the drug is tested on a small group of healthy volunteers to test for safety and side effects.

Phase 2 clinical trial: A clinical trial where the drug is tested on a small group of patients suffering from the disease to determine how effective the drug is and what the most appropriate dose is.

Phase 3 clinical trial: The final phase in clinical trials where the drug is tested to observe its effects in a much larger group of patients.

Phloem sieve tubes: Living phloem cells joined together to create a long tube for the efficient transport of assimilates.

Phloem: A tissue found in plants which is specialised for the transport of assimilates from their site of production to different parts of the plant where they are needed.

Phosphate ion: A type of ion needed for the phosphate groups in ADP and ATP, which are involved in energy transfer.

Pits: Thin sections of the cell wall that allow for the exchange of water and minerals between adjacent cells.

Placebo: A replica of the drug being tested that is indistinguishable from the real drug yet it exerts no effects on the patient whatsoever.

Plasmodesmata: Cytoplasmic bridges between adjacent plant cells that allow the transport of molecules between the cells.

Polysaccharides: Molecules formed by the condensation of many monosaccharides e.g. glycogen, starch, chitin, cellulose.

Primary cell wall: The primary cell wall is made of cellulose microfibrils oriented in a similar direction.

Reintroduction programmes: Releasing animals from captivity back into the wild in a controlled and safe manner.

Sclerenchyma: Plant tissue made up of cells with thickened cell walls which is used for strength and support.

Secondary cell wall: Made of cellulose microfibrils oriented at different angles to one another, which make the composite material more rigid. Hemicelluloses harden this material further.

Starch: A polysaccharide used for energy storage in plants that is made up of alpha glucose molecules joined together in the forms of amylose and amylopectin.



Tonoplast membrane: The membrane which surrounds the cell vacuole.

Ultrastructure: The architecture of cells and biomaterials that is visible at higher magnifications than found on a standard optical light microscope.

William Withering's digitalis soup: One of the first examples of drug testing where the correct dose of digitalis from the poisonous foxglove plant to treat heart disease was determined by William Withering.

Xylem: A tissue found in plants which is specialised for the transport of water and dissolved minerals up the plant.

4.14: Classification

Classification: A means of organising the variety of life based on relationships between organisms using differences and similarities in phenotypes and in genotypes. †

Domain: The highest taxonomic rank in the classification system which includes 3 groups - Bacteria, Archaea and Eukarya.

Genotype: The genetic makeup of an organism.

Genus: The taxonomic rank below family but above species and always capitalised when written using binomial nomenclature.

Kingdom: The taxonomic rank below Domain which typically has 5 groups - Monera, Eukaryota, Fungi, Protista, Plantae and Animalia.

Phenotype: The observable physical characteristics of an organism which is based on both the genotype and environmental influence.

Phylogeny: The study of evolutionary relationships between organisms.

Species: A group of closely related organisms that are all potentially capable of interbreeding to produce fertile offspring. The lowest taxonomic rank which is below species.

Taxonomic rank: A hierarchy used to group and classify living organisms which typically contains 8 levels - Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species.

Taxonomy: The classification of organisms into groups.

4.15-4.21: Biodiversity and Conservation

Adaptation: The changes organisms undergo to become more suited to their environment.



Anatomical adaptations: Changes to the physical features of an organism that help it cope with factors in its environment.

Behavioural adaptations: The ways in which an organism acts differently to cope with factors in its environment.

Biodiversity: A measure of the variety of life in an area.

Bioindicators/ indicator species: Living organisms such as plants, animals, plankton and microbes that give us an idea of the health of an ecosystem.

Captive breeding programme: Breeding wild animals in a safe environment like a zoo or sanctuary to increase population size.

Conservation: The maintenance of ecosystems and biodiversity by humans in order to preserve the Earth's resources.

Cross-species cloning: Cloning animals using closely related species as surrogate mothers.

Endemism: A species which only exists in a certain area.

Evolution: The change in a population's inherited characteristics over time.

Ex situ conservation: A type of conservation that takes place outside of an organism's natural habitat e.g. zoos, botanic gardens, seed banks.

Gene mutation: A change to at least one nucleotide base in DNA or the arrangement of bases. Gene mutations occur spontaneously during DNA replication and may be beneficial, damaging, or neutral.

Hardy-Weinberg principle: A principle that states that the frequency of alleles in a population will not change over time unless evolutionary factors are present. It can be used to calculate the frequencies of the other two genotypes when given the frequency of one genotype using the equation given below:

$$p^2 + 2pq + q^2 = 1$$

p^2 = Frequency of homozygous dominant

$2pq$ = Frequency of heterozygous

q^2 = Frequency of homozygous recessive



Heterozygosity index (H): A measure of the proportion of a population which is heterozygotic which can be calculated using the following equation:

$$H = \frac{\text{Number of heterozygotes}}{\text{Number of individuals in the population}}$$

In situ conservation: A type of conservation that takes place within an organism's natural habitat e.g. wildlife reserves, marine conservation zones.

Index of diversity (D): A measure of the diversity of a population which takes into account the number and abundance of a species and can be used to compare different habitats. It is calculated using the following equation:

$$D = \frac{N(N - 1)}{\sum n(n - 1)}$$

N = Total number of organisms

n = Total number of organisms of the species of interest

Keystone species: A species which has an unexpectedly large effect on the environment and is crucial for the maintenance of biodiversity.

Mark-release-recapture: A method of estimating the population size of motile organisms. It involves capturing a sample of the population, marking them and releasing them. At a later date, another sample is captured and the number of marked individuals is recorded. The population size can be estimated using the following equation:

$$\text{estimated population size} = \frac{\text{number of individuals in first sample} \times \text{number of individuals in second sample}}{\text{number of marked individuals in second sample}}$$

Natural selection: The phenomenon seen where better adapted organisms are able to survive and reproduce which causes the population to become better adapted over time.

Niche: The position occupied by an organism in its ecosystem.

Physiological adaptations: The internal body changes that an organism undergoes to cope with factors in its environment.

Reintroduction programmes: Releasing animals from captivity back into the wild in a controlled and safe manner.

Reproductive isolation: The inability of some organisms of a species to breed with other members of the same species due to barriers.

Species richness: The number of different species in a habitat.

Definitions denoted with a '+' taken from: [Pearson Edexcel International Advanced Subsidiary/Advanced Level in Biology – Specification – Issue 1 \(September 2017\)](#)

