

Edexcel (B) Biology A-level

Topic 6 - Microbiology and Pathogens

Definitions and Concepts

6.1 - Microbial techniques

Agar cultures - Culturing organisms using a solid agar jelly medium.

Aseptic techniques - Microbiological techniques used which minimise or prevent contamination by microorganisms.

Broth cultures - The culturing of microorganisms using a liquid medium.

Cell counts - A method of measuring the amount of microorganisms in a medium, often carried out using a piece of apparatus known as a hemocytometer.

Death phase - The decrease in the number of bacteria caused by the depletion of nutrients or other unfavourable conditions.

Dilution plating - The process of diluting a sample of microorganisms by a known amount so that the individual cells can be counted.

Growth medium - A sterile liquid or gel which is used to support the growth of microorganisms by providing required nutrients in the correct quantities.

Hemocytometer - A type of microscope slide with a specific size chamber and grid used for counting the amount of cells in a specific volume.

Lag phase - The period of time where microorganisms adjust to a new environment and take up nutrients without significant amounts of division.

Log phase - A period of rapid cell proliferation where the population size increases exponentially.

Microbial turbidity - The cloudiness of a solution which is based on the amount of microorganisms in a solution and can be measured quantitatively to analyse microbial growth.

Selective media - A type of media which contains a specific mix of chemicals to promote the growth of certain microorganisms and inhibit the growth of other unwanted microorganisms.

Stationary phase - The period of time where the population size is constant following the log phase due to limiting factors like a lack of available nutrients.

6.2 - Microbial techniques

Pathogen - A microorganism which causes disease.

Endotoxins - A toxic compound which makes up the outer bacterial cell membrane and is released upon cell death.

Exotoxins - Toxins secreted by bacteria which damage the host.

Mycobacterium tuberculosis - The strain of bacteria which cause the disease tuberculosis by causing destruction of the lung tissue.

Salmonella - A type of gram-negative bacteria which contain endotoxins and can cause infections in the gut and intestinal tract such as gastroenteritis or diseases like typhoid fever.

Staphylococcus - A group of gram-positive bacteria which some members are pathogenic and can cause certain diseases through the secretion of exotoxins.

6.3 Action of antibiotics

Bactericidal antibiotics - A class of antibiotics which kill bacteria.

Bacteriostatic antibiotics - A class of antibiotics which inhibit or hinder the growth and replication of bacteria.

Penicillin - A type of bactericidal antibiotic which was originally extracted from *Penicillium* moulds.

Tetracycline - A type of bacteriostatic antibiotic which inhibits translation in bacteria and is used to treat many different bacterial infections.

6.5 Other pathogenic agents

Influenza - A common viral infection caused by the family of viruses, Orthomyxoviridae. It destroys ciliated epithelial cells in the gaseous exchange system, exposing the airways to secondary infection.

Malaria - A disease caused by a protozoa known as *Plasmodium* which is spread using female *Anopheles* mosquitoes as vectors. It alters and destroys erythrocytes and causes a fever-like illness and often death.

Stem rust - A disease caused by the fungus *Puccinia graminis* which damages cereal crops by depleting available nutrients.

6.6 Other pathogenic agents

Endemic disease - A disease which is common in a certain local geographic area or population.

6.7 Response to infection

Antibody - A protein molecule which binds to an antigen and is produced by B cells in response to an infection.

Antigen - A foreign substance which is capable of triggering an immune response.

Antigen presenting cell - Any type of cell which presents antigens from foreign cells on its surface for detection by T cells.

Artificial adaptive immunity - Immunity that is acquired by exposure to a dead or weakened version of a pathogen in the form of a vaccine.

Artificial passive immunity - Immunity that is gained by the transfer of premade antibodies to an individual through an injection.

B-lymphocyte - A type of lymphocyte which matures in the bone marrow and is involved in humoral immunity through the production of antibodies.

Cell-mediated immune response - The immune response provided by the T-lymphocytes without the use of antibodies.

Clonal expansion - The production of many genetically identical daughter cells through cell division of the activated B or T lymphocyte after clonal selection.

Clonal selection - The process of matching the antigens on an antigen presenting cells with the antigen receptors on B and T lymphocytes.

Cytokines - Protein signalling molecules produced by certain cells such as T-helper cells which regulate the immune response by binding to cellular receptors.

Cytotoxins - Molecules produced by T-killer cells which can kill cells which are virus infected or cancerous.

Herd immunity - A type of disease immunity that occurs when a large proportion of a population are vaccinated against a disease which prevents the spread of the disease to unvaccinated individuals.

Humoral immune response - The immune response which takes place in bodily fluids like the blood through the production of antibodies by plasma cells.

Leukocyte (White blood cell) - A class of cell which makes up part of the immune system and protects the body from disease and infection.

Lymphocytes - A group of leukocytes made in the bone marrow which B-lymphocytes and T-lymphocytes are both part of. They play important roles in the immune system including phagocytosis, antibody production and controlling the immune response.


M E G A
L E C T U R E

Macrophages - Tissue-resident phagocytic leukocytes which play a part in both innate and adaptive immune responses by engulfing and destroying pathogens and debris.

Memory cell - A type of T-lymphocyte or B-lymphocyte which resides in the lymphoid organs and provides long term immunity to a specific pathogen.

Natural adaptive immunity - Immunity that is gained from infection with a live pathogen.

Natural passive immunity - Immunity produced by the transfer of antibodies from a mother to a foetus through the placenta or to a baby through breastfeeding.

Neutrophils - A phagocytic leukocyte which has a multi-lobed nucleus and is one of the first cells to reach the site of an injury.

Plasma cells - A matured and differentiated B-lymphocyte which produces a specific antibody.

Primary immune response - The initial response produced by the immune system when it encounters a pathogen for the first time.

Secondary immune response - The response produced by the immune system to a pathogen which it has encountered previously.

T helper cell - A type of T lymphocyte which regulates the immune response through the release of cytokines.

T killer cell - A type of T lymphocyte which triggers apoptosis in cells which are damaged or infected with viruses.

T-lymphocyte - A class of lymphocyte which matures in the thymus and is involved in cell-mediated immunity through methods like the production of cytokines and cytotoxins.

T memory cell - A type of T lymphocyte with different subtypes found in different parts of the body which is used to provide long term immunity to a pathogen.

Vaccine - The introduction of dead or inactive pathogens to stimulate an immune response and provide long term immunity.