

Unit and Year: B1 - You and your genes YEAR 9

Purpose of Unit:

1. What is the genome and what does it do?
2. How is genetic information inherited?
3. How can and should gene technology be used?

Key Learning/Knowledge:

- To describe the key components of eukaryotic and prokaryotic cells.
- To describe how a microscope can be used to view cells.
- To understand the role of DNA in the production of proteins.
- To explain how mutations can lead to the production of different proteins.
- To show how different genetic traits can be passed down from parents to offspring.
- To suggest the advantages and disadvantages of genetic testing.
- To understand the key steps in the genetic engineering of organisms.

Key Skills:

- To be able to identify eukaryotic and prokaryotic cells.
- PAG 5 - setting up a cell sample on a slide and viewing with a microscope.
- To be able to describe the human genome.
- To be able to distinguish between features due to genetic and environmental factors.
- To be able explain how different genes code for the production of proteins.
- To be able to describe the effect of different mutations on a sequence of DNA and explain the impact of this.
- To be able to use a punnett square in order to show how genetic traits are inherited.
- To be able to use a punnett square in order to show sex determination in humans.
- To be able to describe the different methods of genetic testing and evaluate the use of these methods.
- To be able to describe the role of genetics sequencing in the production of personalised medicine.
- To be able to describe the key steps in the genetic engineering of bacteria and plants.
- To be able to evaluate the use of genetically engineered organisms.

Key Vocabulary and meanings:

Eukaryotic cell - a cell that contains a nucleus (this is where the DNA is stored).

Prokaryotic cell - a cell that does not contain a nucleus (the DNA is free-floating in the cytoplasm).

DNA - a polymer (long chain) of nucleotides, in a double helix shape.

Nucleotide - a compound consisting of a phosphate, a sugar and a base.

Chromosome - a long molecule of DNA with genes at specific regions.

Gene - a short section of DNA that codes for a protein.

Genome - the entire genetic material of an organism.

Allele - different versions of the same gene - alleles can be dominant or recessive.

Dominant allele - only one is needed for the trait to be shown - we represent this as a capital letter.

Recessive allele - both are needed for the trait to be shown - we represent this as a lower case letter.

Homozygous - both alleles in a pair are the same.

Heterozygous - alleles in a pair are different.

Genotype - the combination of alleles in an organism.

Phenotype - the characteristics of an organism, due to its genotype and the environment.

Mutation - a change in the base sequence of a gene, which may result in a different protein produced.

Genome sequencing - a method used to determine the entire genetic makeup of an organism.

Genetic engineering - taking a gene out of one organism and placing into the genome of another.

Links to prior knowledge/learning:

- Builds on 'Reproduction' unit from Year 7.
- Develops Maths skills, calculating the % probability of inheritance, using punnett squares.

Unit and Year: B2 – Keeping Healthy YEAR 9

Purpose of Unit:

1. What are the causes of disease?
2. How do organisms protect themselves against pathogens?
3. How can we prevent the spread of infections?
4. How can we identify the cause of an infection?
5. How can lifestyle, genes and the environment affect health?
6. How can we treat disease?

Key Learning/Knowledge:

- describe common human infections and plant diseases
- explain how communicable diseases are spread in animals and plants
- describe non-specific defence systems of the human body against pathogens
- explain the role of the immune system of the human body in defence against disease
- explain how white blood cells are adapted to their functions in the blood
- explain how the spread of communicable diseases may be prevented in animals and plants
- explain use of vaccines in prevention of disease
- describe ways in which diseases can be detected
- describe ways monoclonal antibodies can be used in diagnostic tests
- describe how interaction of genetic and lifestyle factors can increase or decrease risk of developing non-communicable human diseases
- explain use of medicines, including antibiotics
- evaluate different treatments for cardiovascular disease
- describe the process of discovery and development of potential new medicines

Key Skills:

- investigate microbial growth on various surfaces
- discuss risk & decision making in context of disease prevention
- describe how to use a light microscope PAG1
- describe and explain aseptic techniques PAG7
- calculate cross-sectional areas of clear zones around antibiotic discs on agar jelly using πr^2
- describe how to investigate the effect of exercise on pulse rate and recovery rate PAG6
- discuss correlation, cause & risk
- ethics of using placebos in testing of new medicines

Key Vocabulary and meanings:

Communicable disease - A disease caused by infection with a pathogen; can be passed on

Pathogen - A disease causing organism
Non-specific defences

Immunity - The ability to produce antibodies very quickly against a pathogen to destroy it

Antibodies - Protein molecules made by white blood cells to fight pathogens

Antigens - molecules on the surface of cells and pathogens

Memory cell - White blood cell that stays in blood after an infection & creates immunity

Sterile - Free from bacteria, fungi, protists and viruses that could cause disease

Monoclonal antibody - Antibodies against a specific antigen made in a lab

Coronary heart disease - Fatty deposits cause blood clots in the coronary arteries increasing risk of heart attack

Cardiovascular disease - Non-communicable diseases that affect blood vessels and heart
Risk factors

Peer review - When scientists who are experts in their field critically evaluate another scientist's paper before and after publication

Antibiotic - Substance that kills or stops the growth of bacteria

Antibiotic resistance - Ability of bacteria to survive exposure to antibiotics

Clinical testing - When a new medicine is tested on humans to see if it is safe and works.

Placebo - A substance that looks exactly like a medicine but has no medicine in it.

Blind trial - A trial in which a patient does not know if they are taking a new medicine

Links to prior knowledge/learning:

- Builds on Healthy Living unit from Year 8.
- Develops Maths skills, calculating areas of clear zones around antibiotic discs and analysing data

Unit and Year: B3 – Living Together – Food and Ecosystems YEAR 10

Purpose of Unit:

1. What happens during photosynthesis?
2. How do producers get the substances they need?
3. How are organisms in an ecosystem interdependent?
4. How are populations affected by conditions in an ecosystem?

Key Learning/Knowledge:

- To describe the process and importance of photosynthesis, and **how the rate is limited in plants**.
- To understand the role of enzymes in the process of photosynthesis.
- To consider the different methods by which substances can move in, out and around plants.
- To describe tests for different biological molecules.
- To understand how to use food webs of a given ecosystem.
- To describe the key processes in the carbon and water cycle.
- To explain how chemical substances can have an impact on organisms in a given ecosystem.
- To describe the key equipment needed to investigate populations of organisms in a given ecosystem.

Key Skills:

- To be able to write out the 2 stages of the photosynthesis reaction.
- PAG 5 – investigating photosynthesis rate, using pondweed and a gas syringe.
- To be able to describe how enzymes function.
- PAG 4 – investigating enzyme activity in different concentrations of substrate.
- To be able describe the difference between diffusion, osmosis and active transport.
- PAG 8 – investigating osmosis in cells subject to different concentrations of solution.
- To be able to describe the role of transpiration and translocation in plants.
- PAG 2 – to use different reagents in order to test for the presence of biological molecules.
- To be able to describe the key events in a food web, the carbon cycle and water cycle.
- PAG 3 – investigating animal abundance using Capture Mark Recapture, and plant abundance using quadrats and transects.

Key Vocabulary and meanings:

Photosynthesis – the process in which plants create glucose, using sunlight, water and CO₂.

Enzymes – proteins that help speed up chemical reactions in organisms.

Diffusion – the overall passive movement of chemicals from a high to low concentration.

Osmosis – the overall passive movement of water from a high to low concentration, through a partially permeable membrane.

Active Transport – the overall active movement of chemical from a low to high concentration, requiring energy in the process.

Transpiration – the movement of water in a plant from root and out through the leaf.

Translocation – the movement of glucose in the leaf to all over parts of the plant.

Xylem tissue – a hollow tube made of dead cells that carries water up the stem of a plant.

Phloem tissue – a tube made up of living cells that carries glucose up and down the plant.

Stomata – tiny holes on the underside of the leaf which allow gas exchange to occur.

Community – all the organisms found in a particular habitat.

Ecosystem – all the organisms in the area + the non-living factors in that area.

Biotic – living factors that affect a community.

Abiotic – non-living factors that affect a community.

Bioaccumulation – the increase in concentration of a toxin as you move up through a food chain.

Eutrophication – an increase in nutrients in a body of water, leading to dense plant growth.

Quadrat – a square frame placed on the ground, in order to measure plant species distribution.

Transect – a line (usually a tape measure) placed across a habitat, in order to measure plant species distribution.

Links to prior knowledge/learning:

- Builds on 'Ecology' unit from Year 8.
- Develops Maths skills, calculating the rate of water uptake

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Links to prior knowledge/learning:

- Builds on 'Ecology' unit from Year 8.
- Develops Maths skills, calculating the rate of water uptake and the % energy transferred in a food chain

Unit and Year: B4 Combined – Using food and controlling growth – YEAR 10

Purpose of Unit:

1. What happens during cellular respiration?
2. How do we know about mitochondria and other cell structures?
3. How do organisms grow and develop?
4. Should we use stem cells to treat damage and disease?

Key Learning/Knowledge:

- To describe in detail the processes of aerobic and anaerobic respiration in plant, animal and yeast cells.
- To describe and relate the structure and function of mitochondria to aerobic respiration.
- To describe cellular respiration as an exothermic process.
- To describe how electron microscopy has increased our understanding of sub-cellular structures.
- To describe the roles of interphase and mitosis in the cell cycle.
- To describe cancer as result of cell changes that lead to uncontrollable growth and division.
- To describe the process of meiosis.
- To describe function of stem cells in embryonic and adult animals and meristems plants.
- To describe the importance of cell differentiation in which cells become specialised by switching genes on or off.
- To discuss the potential benefits, risks and ethical issues associated with the use of stem cells in medicine.

Key Skills:

- To be able to compare and contrast aerobic and anaerobic respiration.
- To be able to carry out practical investigations on respiration in yeast, including the construction of graphs.
- To be able to estimate the size of sub-cellular structures and write them in standard form.
- To be able to use a light microscope to observe the stages in mitosis.
- To be able to state the risks and benefits of using stem cells to replace damaged tissues and cells.

Key Vocabulary and meanings:

Respiration – The use of glucose as a source of energy for cells.

Aerobic – In the presence of oxygen.

Anaerobic – Without oxygen being present.

Mitochondria – The sub-cellular structure where aerobic respiration happens in cells.

Electron microscope – A microscope which uses a beam of electrons to view cell structures at a high magnification.

Mitosis – A cell division that results in two identical daughter cells with the same genetic content as the mother cell.

Meiosis – A cell division that results in four cells that each have half the genetic material of the original cell.

Mutation – A change in the base code of an organisms DNA.

Tumour – Cells undergoing uncontrolled growth and division.

Benign – A tumour that does not spread.

Malignant – A tumour that does spread to other parts of the body.

Gamete – A sex cell. E.g. Sperm, ovum, pollen, ovule.

Meristem – Plant cells that are capable of growth and division.

Differentiation – The process in which immature cells become mature cells with specific functions.

Stem cell – A cell that has the ability to develop into different types of cell.

Links to prior knowledge/learning:

- Builds on 'Cells' and 'Ecology' units from KS3.
- Develops Maths skills, calculating magnification using **standard form**.
- Cross curricula link to ethics on the uses of stem cells

Unit and Year: B4 Triple - Using food and controlling growth - YEAR 10

Purpose of Unit:

1. What happens during cellular respiration?
2. How do we know about mitochondria and other cell structures?
3. How do organisms grow and develop?
4. Should we use stem cells to treat damage and disease?

Key Learning/Knowledge:

- To describe in detail the processes of aerobic and anaerobic respiration in plant, animal and yeast cells.
- To describe and relate the structure and function of mitochondria to aerobic respiration.
- To describe respiration as an exothermic process.
- To describe how electron microscopy has increased our understanding of sub-cellular structures.
- To describe the roles of interphase and mitosis in the cell cycle.
- To describe cancer as result of cell changes that lead to uncontrollable growth and division.
- To describe the process of meiosis.
- To describe function of stem cells in embryonic and adult animals and meristems in plants.
- To describe the importance of cell differentiation in which cells become specialised by switching genes on or off.
- To discuss the potential benefits, risks and ethical issues associated with the use of stem cells in medicine.
- To explain how plant hormones are important in the control and coordination of plant growth.
- Describe some of the different ways in which people use plant hormones to control plant growth.

Key Skills:

- To be able to compare and contrast aerobic and anaerobic respiration.
- To be able to carry out practical investigations on respiration in yeast, including the construction of graphs.
- To be able to estimate the size of sub-cellular structures and write them in standard form.
- To be able to use a light microscope to observe the stages in mitosis.
- To be able to order the stages of Meiosis.
- To be able to explain how genes are switched on and off to achieve cell differentiation.
- To be able to state the risks and benefits of using stem cells to replace damaged tissues and cells.
- To be able to describe the role of auxins, gibberellins and ethene in plant growth.

Key Vocabulary and meanings:

Respiration - The use of glucose as a source of energy for cells.

Aerobic - In the presence of oxygen.

Anaerobic - Without oxygen being present.

Mitochondria - The sub-cellular structure where aerobic respiration happens in cells.

Electron microscope - A microscope which uses a beam of electrons to view cell structures at a high magnification.

Mitosis - A cell division that results in two identical daughter cells with the same genetic content as the mother cell.

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Gamete - a sex cell. E.g. Sperm, ovum, pollen, ovule.

Meristem - Plant cells that are capable of growth and division.

Differentiation - The process in which immature cells become mature cells with specific functions.

Stem cell - A cell that has the ability to develop into different types of cell.

Phototropism - Plant growth in response to light.

Gravitropism - Plant growth in response to the Earth's gravitational field.

Auxin - Plant hormone that regulates growth.

Gibberellin - A plant hormone that controls germination and flowering.

Ethene - A plant hormone that controls the ripening of fruit.

Links to prior knowledge/learning:

- Develops Maths skills, calculating magnification using standard form.
- Cross curricula link to ethics on the uses of stem cells

Unit and Year: B5 The Human Body – staying alive (combined)

Purpose of Unit:

1. How do substances get into, out of and around our bodies?
2. How does the nervous system help us to respond to changes?
3. How do hormones control responses in the human body?
4. Why do we need to maintain a constant internal environment?

Key Learning/Knowledge:

- Be able to describe which substances are transported into and out of our cells.
- Be able to describe and explain diffusion, osmosis and active transport.
- Be able to describe the human circulatory system including the structure of the heart, blood vessels and components of the blood.
- Appreciate the relationship between volume and surface area.
- Be able to name the components of the nervous system and explain their functions.
- Be able to identify different types of neurones and explain the structure and function of reflex arcs.
- Describe hormonal control by the endocrine system including the roles of **thyroxine and adrenaline**.
- Explain how homeostasis is maintained using the examples of temperature, ion, urea and water control
- Be able to describe the sequence of events in the menstrual cycle, **including the roles of FSH, LH and oestrogen**.
- **Explain the uses and value of using hormones in conception and contraception.**
- Explain how insulin control blood sugar levels.
- Compare type 1 and type 2 diabetes and explain how they can be treated.

Bold Text - Higher combined only

Key Skills:

- Be able to calculate rations.
- Observe or participate in heart dissection.
- Analyse data and interpret graphs
- Be able to describe and explain feedback loops

Key Vocabulary and meanings:

Diffusion - The movement of molecules from an area of higher concentration to an area of lower concentration

Osmosis - The movement of water molecules from a solution with a high concentration of water molecules to a solution with a lower concentration of water molecules, through a partially permeable membrane.

Active transport - The movement of particles against the concentration gradient. It requires ATP for this energy.

Arteries - blood vessels with thick, muscular walls that carries blood away from the heart.

Veins - blood vessels that contains valves and carries blood to the heart.

Capillaries - blood vessels with walls that are 1 cell thick to allow diffusion of substances in and out.

Neurone - a nerve cell

Reflex arc - A special type of neural circuit that begins with a sensory neuron at a receptor (e.g., a pain receptor in the fingertip) and ends with a motor neuron at an effector (e.g., a skeletal muscle)

Endocrine - The collection of glands that produce hormones.

Homeostasis - The state of steady internal, physical, and chemical conditions maintained in the body.

Menstrual cycle - The monthly cycle of changes in the ovaries and uterus lining.

Diabetes - A disease where the body cannot produce or respond to insulin

Links to prior knowledge/learning:

- Builds learning from Year 7 and 8 biology modules and GCSE module 4

Unit and Year: B5 The Human Body – staying alive (triple)

Purpose of Unit:

1. How do substances get into, out of and around our bodies?
2. How does the nervous system help us to respond to changes?
3. How do hormones control responses in the human body?
4. Why do we need to maintain a constant internal environment?

Key Learning/Knowledge:

- Be able to describe which substances are transported into and out of our cells.
- Be able to describe and explain diffusion, osmosis and active transport.
- Be able to describe the human circulatory system including the structure of the heart, blood vessels and components of the blood.
- Appreciate the relationship between volume and surface area.
- Be able to name the components of the nervous system and explain their functions.
- Be able to identify different types of neurones and explain the structure and function of reflex arcs.
- Describe the structure and function of the brain and explain the difficulties of investigating brain function.
- Describe hormonal control by the endocrine system including the roles of thyroxine and adrenaline.
- Explain how homeostasis is maintained using the examples of temperature, ion, urea and water control
- Be able to describe the sequence of events in the menstrual cycle, including the roles of FSH, LH and oestrogen.
- Explain the uses and value of using hormones in conception and contraception.
- An understanding of how glucagon and insulin control blood sugar levels including diabetes.
- Describe common eye defects and state how they can be treated.

Key Skills:

- Be able to calculate ratios.
- Observe or participate in heart dissection.
- Analyse data and interpret graphs
- Be able to describe and explain feedback loops

Key Vocabulary and meanings:

Diffusion - The movement of molecules from an area of higher concentration to an area of lower concentration

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Reflex arc - A special type of neural circuit that begins with a sensory neuron at a receptor (e.g., a pain receptor in the fingertip) and ends with a motor neuron at an effector (e.g., a skeletal muscle)

Endocrine - The collection of glands that produce hormones.

Homeostasis - The state of steady internal, physical, and chemical conditions maintained in the body.

Menstrual cycle - The monthly cycle of changes in the ovaries and uterus lining.

Diabetes - A disease where the body cannot produce or respond to insulin

Links to prior knowledge/learning:

- Builds learning from Year 7 and 8 biology modules and GCSE module 4

Unit and Year: B6 – Life on Earth – Past, Present and Future YEAR 11 (triple)

Purpose of Unit:

1. How was the theory of evolution developed?
2. How do sexual and asexual reproduction affect evolution?
3. How does DNA help us classify organisms?
4. How is biodiversity threatened and how can we protect it?

Key Learning/Knowledge:

- To describe the key steps in natural selection, in order for evolution to take place.
- To explain the role of isolation in evolution.
- To compare the processes of natural selection and selective breeding.
- To compare sexual and asexual reproduction.
- To understand how organisms can be classified.
- To describe the impact of humans on biodiversity.
- To describe the ways in which sustainability can be achieved.

Key Skills:

- To be able to define what makes an organism a particular species.
- To be able to explain how adaptations benefit organisms in survival.
- To be able to describe the key steps that take place in natural selection, leading to evolution.
- To be able to describe Charles Darwin's role in developing our understanding of evolution.
- To be able to describe the importance of fossils as evidence for evolution.
- To be able to compare the processes of natural selection and selective breeding.
- To be able to describe the advantages and disadvantages of sexual and asexual reproduction in the process of evolution.
- To be able to describe the classification system used to group organisms together.
- To be able to explain the role of electron microscopes and genome sequencing in the re-classification of organisms.
- To be able to define biodiversity and identify its importance to humans.
- To be able to describe how humans have impacted biodiversity across the globe.
- To be able to describe possible sustainable solution on a local and global scale.

Key Vocabulary and meanings:

Species – a group of organisms that can reproduce to make fertile offspring.

Mutation – a change in a gene, which may lead to a different protein produced.

Adaptation – a feature which enables an organism to become better suited to its environment.

Variation – differences between organisms of the same species.

Selective advantage – the adaptation of an organism that enables it to survive and reproduce over other organisms.

Isolation – when organisms are separated by a physical barrier and develop differently over time.

Natural selection – the process by which better adapted organisms survive and reproduce, passing the adaptation to offspring through DNA.

Selective breeding – the process of selecting parents to reproduce, in order to produce offspring with desirable characteristics.

Evolution – the gradual change of an organism over a long period of time, due to natural selection.

Fossil – the preserved remains or imprint of a deceased organism.

Sexual reproduction – the fusion of a male and female gamete to produce a genetically different organism.

Asexual reproduction – the production of organism that is genetically identical to the single parent.

Classification – the organisation of organisms into groups, based on observed and genetic similarities.

Biodiversity – the variety of animal and plant life of earth.

Sustainability – meeting the needs of people today without damaging the earth for future generations.

Links to prior knowledge/learning:

- Builds on 'Ecology' unit from Year 8.

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