# Stuart Bathurst Catholic High School

## Science Department

Long-term sequencing Year 12 A level Biology

As a team we have consistent high expectations based on an ambitious constructed curriculum, designed to build confidence through core substantive knowledge and disciplinary skills. The principles of science of learning and sequencing are weaved throughout with links to prior knowledge to ultimately support knowing and remembering more. We wish to develop enquiring minds of students that question the world around them. They should be able to interpret data and information from a range of sources using mathematical techniques and comprehension skills. They will be able to follow methods to get valid results and analyse the results to reach reasoned conclusions. We expect students to be able to manipulate a range of scientific apparatus and work safely to gather their results. They should be able to gather and record results with a suitable degree of accuracy and precision. When representing results we expect pupils to be able to present their information in an appropriate table or graph.

As a department we are driven by principles of Catholic faith which means we ensure equity of access through our curriculum planning/design and that students are not disadvantaged because of their socio-economic status or SEND/ additional need. Biology students should have an overall appreciation of the key biological process of life and how organisms interact with each other and control their internal environment. In addition they should appreciate the latest scientific developments in the field and develop a love for the subject to encourage them to study it at further education.

To encapsulate an enjoyment of our subject through our teaching with the aim to inspire our pupils to continue their scientific education for future learning or employment. Our curriculum enables all pupils to do be of their best and unlocks opportunity for further education.

**HALF TERM 1:**

**STUDENTS MUST KNOW; (Substantive)**

- Cells
- All Cells have basic features in common.
- Differences between cells are due to the addition of extra features.
- Structure and function of organelles within a cell.
- All cells arise from other cells, by binary fission in prokaryotic cells and by mitosis and meiosis in eukaryotic cells.
- All cells have a cell-surface membrane and, in addition, eukaryotic cells have internal membranes.
- Calculating magnification and describing how we use microscopes to examine cellular structures

- Biological molecules
- Chemical structure and bonds in; carbohydrate, proteins, lipids
- Carbohydrates are commonly used by cells as respiratory substrates. They also form structural components in plasma membranes and cell walls.

**HALF TERM 2:**

**STUDENTS MUST KNOW:**

Cells

- The basic structure of these membranes is the same and enables control of the passage of substances across exchange surfaces by passive or active transport.
- Cell-surface membranes contain embedded proteins. Some of these are involved in cell signalling – communication between cells. Others act as antigens, allowing recognition of 'self' and 'foreign' cells by the immune system.
- Interactions between different types of cell are involved in disease, recovery from disease and prevention of symptoms occurring at a later date if exposed to the same antigen, or antigen-bearing pathogen.

Biological molecules

- Proteins form many cell structures. They are also important as enzymes, chemical messengers and components of the blood.
- Role of water in the body

**HALF TERM 3:**

**STUDENTS MUST KNOW:**

Organism exchange substances with their environment

- The internal environment of a cell or organism is different from its external environment.
- The exchange of substances between the internal and external environments takes place at exchange surfaces.
- To truly enter or leave an organism, most substances must cross cell plasma membranes.
- In large multicellular organisms, the immediate environment of cells is some form of tissue fluid.
- Most cells are too far away from exchange surfaces, and from each other, for simple diffusion alone to maintain the composition of tissue fluid within a suitable metabolic range.

Genetic information variation and relationships between organisms

- A gene is a section of DNA located at a particular site on a DNA molecule, called its locus.
- The base sequence of each gene carries the coded genetic information that determines the sequence of amino acids during protein synthesis.

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| • Lipids have many uses, including the bilayer of plasma membranes, certain hormones and as respiratory substrates.<br>•<br><u>Disciplinary</u><br>• RP - Use of a microscope to observe mitosis in onion tip<br>• RP - Testing for the presence of nutrient including protein, fat, starch and for reducing and non reducing sugar<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes quizzing, questioning, retrieval practice and recall<br>Mid point knowledge check through each unit | • Nucleic acids carry the genetic code for the production of proteins.<br>• The genetic code is common to viruses and to all living organisms, providing evidence for evolution.<br><br><u>Disciplinary</u><br>• RP - Examine transport across plasma membrane of beetroot<br>• RP - Measuring rate of an enzyme controlled reaction<br>• RP - Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue<br>• RP - Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth<br>•<br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes quizzing, questioning, retrieval practice and recall<br>Mid point knowledge check through each unit | • The genetic code used is the same in all organisms, providing indirect evidence for evolution.<br><u>Disciplinary</u><br>• RP - Perform a dissection of heart or locust<br>• RP - Investigation into the effect of a named variable on the permeability of cell-surface membranes<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes quizzing, questioning, retrieval practice and recall<br>Mid point knowledge check through each unit |
| **<u>HALF TERM 4:</u>**<br>**STUDENTS MUST KNOW:**<br><br>• <u>Organism exchange substances with their environment</u><br>• In large organisms, exchange surfaces are associated with mass transport systems that carry substances between the exchange surfaces and the rest of the body and between parts of the body.<br>• Mass transport maintains the final diffusion gradients that bring substances to and from the cell membranes of individual cells. It also helps to maintain the relatively stable environment that is tissue fluid.<br><br>• <u>Genetic information variation and relationships between organisms</u><br>• Biological diversity – biodiversity – is reflected in the vast number of species of organisms, in the variation of individual characteristics within a single species and in the variation of cell types within a single multicellular organism. | **<u>HALF TERM 5:</u>**<br>**STUDENTS MUST KNOW:**<br>**<u>Energy transfers</u>**<br>How photosynthesis occurs by the light & dark reactions<br>• How energy is released in cells by respiration<br>• The structure & function of mitochondria<br>• The stages in aerobic respiration<br>• The stages in anaerobic respiration<br>• Comparison of aerobic & anaerobic respiration<br>• Food chains & energy transfers<br>• Productivity in habitats<br>• Nutrient cycles<br>• The use of natural & artificial fertilisers<br>• The environmental impact of using fertilisers | **<u>HALF TERM 6:</u>**<br>**STUDENTS MUST KNOW:**<br><br>• Outstanding practical and CPAC skills<br><br><u>Mock preparation - Consolidation and revision of paper 1 content</u><br><br>• Students issued with KO/glossaries,<br>• Advice on where to revise included sent out to students/parents.<br>• Preparation lessons on the build up to examinations.<br>• Walkthrough papers<br>• EOTT at the end of every unit. |

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| • Differences between species reflect genetic differences. Differences between individuals within a species could be the result of genetic factors, of environmental factors, or a combination of both.<br>• Genetic diversity within a species can be caused by gene mutation, chromosome mutation or random factors associated with meiosis and fertilisation.<br>• This genetic diversity is acted upon by natural selection, resulting in species becoming better adapted to their environment.<br>• Variation within a species can be measured using differences in the base sequence of DNA or in the amino acid sequence of proteins. Biodiversity within a community can be measured using species richness and an index of diversity.<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes quizzing, questioning, retrieval practice and recall<br>Mid point knowledge check through each unit | **<u>Disciplinary</u>**<br><br>● RP - Use of chromatography to investigate the pigments isolated from leaves of different plants eg leaves from shade-tolerant and shade intolerant plants or leaves of different colours<br>● RP - Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts<br>● RP - Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes quizzing, questioning, retrieval practice and recall<br>Mid point knowledge check through each unit | |
| **Home learning set will consist of a combination of: Seneca and self quizzing. There is a much higher emphasis on use of exam questions and work is set from student workbooks which is printed** | | |

# Stuart Bathurst Catholic High School

**Year 13 A level Biology**

**Long-term sequencing**

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Driven by principles of Catholic faith. To ensure equity of access through our curriculum planning/design and that students are not disadvantaged because of their socio-economic status or SEND/ additional need. To encapsulate an enjoyment of our subject through our teaching with the aim to inspire our pupils to continue their scientific education for future learning or employment. Our curriculum enables all pupils to do and be of their best and unlocks opportunity for further education.

**HALF TERM 1:**
**STUDENTS MUST KNOW: (Substantiative)**

**Energy transfer in and between organisms**

- Life depends on continuous transfers of energy.
- In photosynthesis, light is absorbed by chlorophyll and this is linked to the production of ATP.
- In respiration, various substances are used as respiratory substrates.
- The hydrolysis of these respiratory substrates is linked to the production of ATP. In both respiration and photosynthesis, ATP production occurs when protons diffuse down an electrochemical gradient through molecules of the enzyme ATP synthase, embedded in the membranes of cellular organelles.
- The process of photosynthesis is common in all photoautotrophic organisms and the process of respiration is common in all organisms, providing indirect evidence for evolution

**Organisms respond to changes in their internal environment**

- A stimulus is a change in the internal or external environment.
- A receptor detects a stimulus.

**HALF TERM 2:**
**STUDENTS MUST KNOW: (Substantiative)**

**Energy transfer in and between organisms**

- In communities, the biological molecules produced by photosynthesis are consumed by other organisms, including animals, bacteria and fungi. Some of these are used as respiratory substrates by these consumers.
- Photosynthesis and respiration are not 100% efficient. The transfer of biomass and its stored chemical energy in a community from one organism to a consumer is also not 100% efficient

**Organisms respond to changes in their internal environment**

- Homeostasis and control of blood glucose levels
- Homeostasis and control of water levels
- Sliding filament theory and muscle contraction

Disciplinary

- RP - Production of a dilution series of a glucose solution and use of colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown 'urine' sample

**HALF TERM 3: (Substantiative)**

Genetics populations, evolutions and ecosystem

- All new species arise from an existing species. This results in different species sharing a common ancestry, as represented in phylogenetic classification.
- Common ancestry can explain the similarities between all living organisms, such as common chemistry (eg all proteins made from the same 20 or so amino acids), physiological pathways (eg anaerobic respiration), cell structure, DNA as the genetic material and a 'universal' genetic code.
- The individuals of a species share the same genes but (usually) different combinations of alleles of these genes. An individual inherits alleles from their parent or parents.
- A species exists as one or more populations.
- There is variation in the phenotypes of organisms in a population, due to genetic and environmental factors.
- Two forces affect genetic variation in populations: genetic drift and natural selection. Genetic drift can cause changes in allele frequency in small populations.

- A coordinator formulates a suitable response to a stimulus.
- An effector produces a response.
- Receptors are specific to one type of stimulus. Nerve cells pass electrical impulses along their length.
- A nerve impulse is specific to a target cell only because it releases a chemical messenger directly onto it, producing a response that is usually rapid, short-lived and localised.
- In contrast, mammalian hormones stimulate their target cells via the blood system. They are specific to the tertiary structure of receptors on their target cells and produce responses that are usually slow, long-lasting and widespread.
- Plants control their response using hormone-like growth substances.

<u>Disciplinary</u>

- RP - investigation into the effect of an environmental variable on the movement of an animal using either a choice chamber or a maze

**HOW THIS WILL BE ASSESSED:**

Low stakes quizzing, questioning, retrieval practice and recall

Mid point knowledge check through each unit

End of topic test at the end of every unit.

- RP - Investigation into the effect of a named environmental factor on the distribution of a given species

**HOW THIS WILL BE ASSESSED:**
EOTT at the end of every unit.
LRW which encompass a combination of the units covered so far
Papers are constructed using exampro or in the case of Mock exams the most recent Mock examination which took place to avoid students seeing the paper already.
Staff have undergone AQA training on examination moderation and assessment including of CPAC activities. Blind moderation of Y13 mocks.
Experienced exam markers part of the team and moderation process. Two A level biology teachers to moderate each others work.

**HOW THIS WILL BE ASSESSED:**

Low stakes quizzing, questioning, retrieval practice and recall

Mid point knowledge check through each unit

End of topic test at the end of every unit.

<u>Control of gene expression</u>

- Cells are able to control their metabolic activities by regulating the transcription and translation of their genome. Although the cells within an organism carry the same coded genetic information, they translate only part of it.
- There are many factors that control the expression of genes and, thus, the phenotype of organisms. Some are external, environmental factors, others are internal factors.
- The expression of genes is not as simple as once thought, with epigenetic regulation of transcription being increasingly recognised as important.

**HOW THIS WILL BE ASSESSED:**

Low stakes quizzing, questioning, retrieval practice and recall

Mid point knowledge check through each unit

End of topic test at the end of every unit.

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| **HALF TERM 4:** | **HALF TERM 5:** | **HALF TERM 6:** |
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| **STUDENTS MUST KNOW: (Substantiative)**<br>Genetics populations, evolutions and ecosystem<br>● Genetics populations, evolutions and ecosystem<br>● Natural selection occurs when alleles that enhance the fitness of the individuals that carry them rise in frequency. A change in the allele frequency of a population is evolution. If a population becomes isolated from other populations of the same species, there will be no gene flow between the isolated population and the others. This may lead to the accumulation of genetic differences in the isolated population, compared with the other populations.<br>● These differences may ultimately lead to organisms in the isolated population becoming unable to breed and produce fertile offspring with organisms from the other populations. This reproductive isolation means that a new species has evolved.<br>● Populations of different species live in communities. Competition occurs within and between these populations for the means of survival.<br>● Within a single community, one population is affected by other populations, the biotic factors, in its environment.<br>● Populations within communities are also affected by, and in turn affect, the abiotic (physicochemical) factors in an ecosystem.<br><br>**Control of gene expression**<br>● Humans are learning how to control the expression of genes by altering the epigenome, and how to alter genomes and proteomes of organisms.<br>● This has many medical and technological applications. Consideration of cellular control mechanisms underpins the content of this section. Ways in which organisms and cells control their activities. | **STUDENTS MUST KNOW:**<br>• Biology revision<br>• Statistics in biology<br>• Essay preparation<br><br>**HOW THIS WILL BE ASSESSED:** | EXAM |

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| • Common ailments resulting from a breakdown of these control mechanisms and the use of DNA technology in the diagnosis and treatment of human diseases.<br>• Process of PCR/ gene technology/ invito/invivo/Genetic fingerprinting.<br><br>**HOW THIS WILL BE ASSESSED:**<br><br>Low stakes quizzing, questioning, retrieval practice and recall<br><br>Mid point knowledge check through each unit<br><br>End of topic test at the end of every unit.<br><br>**<u>Statistics in biology</u>**<br>**<u>Essay preparation</u>** | | |
| **Home learning set will consist of a combination of: Seneca and self quizzing. There is a much higher emphasis on use of exam questions and work is set from student workbooks which is printed** | | |