Meden School Curriculum Planning							
Subject	Biology	**Year Group**	13	**Sequence No.**		**Topic**	3.8 Control of Gene Expression

Retrieval	Core Knowledge	Student Thinking
What do teachers need **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'
AQA GCSE Biology B1 Cell Biology AQA GCSE Biology B6 Inheritance, Variation and Evolution AQA A level Biology 3.4 Genetic information, variation (3.4.1 - 4)	**3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins** Gene mutations might arise during DNA replication. They include addition, deletion, substitution, inversion, duplication and translocation of bases. Gene mutations occur spontaneously. The mutation rate is increased by mutagenic agents. Mutations can result in a different amino acid sequence in the encoded polypeptide. • Some gene mutations change only one triplet code. Due to the degenerate nature of the genetic code, not all such mutations result in a change to the encoded amino acid. • Some gene mutations change the nature of all base triplets downstream from the mutation, ie result in a frame shift. Relate the nature of a gene mutation to its effect on the encoded polypeptide. **3.8.2.1 Most of a cell's DNA is not translated** Totipotent cells can divide and produce any type of body cell.	Should everyone be genetically tested to see what onogenes they carry. Ethical debate: "If people know their genetics they can chose a healthier lifestyle" Or "Should people have to life with the knowledge

	During development, totipotent cells translate only part of their DNA, resulting in cell specialisation. Totipotent cells occur only for a limited time in early mammalian embryos. Pluripotent cells are found in embryos; multipotent and unipotent cells are found in mature mammals and can divide to form a limited number of different cell types • Pluripotent stem cells can divide in unlimited numbers and can be used in treating human disorders. • Unipotent cells, exemplified by the formation of cardiomyocytes. Induced pluripotent stem cells (iPS cells) can be produced from adult somatic cells using appropriate protein transcription factors. Evaluate the use of stem cells in treating human disorders. **3.8.2.2 Regulation of transcription and translation** In eukaryotes, transcription of target genes can be stimulated or inhibited when specific transcriptional factors move from the cytoplasm into the nucleus. The role of the steroid hormone, oestrogen, in initiating transcription. Epigenetic control of gene expression in eukaryotes. Epigenetics involves heritable changes in gene function, without changes to the base sequence of DNA. These changes are caused by changes in the environment that inhibit transcription by: • increased methylation of the DNA or • decreased acetylation of associated histones. The relevance of epigenetics on the development and treatment of disease, especially cancer. In eukaryotes and some prokaryotes, translation of the mRNA produced from target genes can be inhibited by RNA interference (RNAi). • Interpret data provided from investigations into gene expression • Evaluate appropriate data for the relative influences of genetic and environmental factors on phenotype. **3.8.2.3 Gene Expression and Cancer** The main characteristics of benign and malignant tumours. The role of the following in the development of tumours: • tumour suppressor genes and oncogenes • abnormal methylation of tumour suppressor genes and oncogenes • increased oestrogen concentrations in the development of some breast cancers.	that they are more likely to develop a certain disease/cancer”

	• evaluate evidence showing correlations between genetic and environmental factors and various forms of cancer • interpret information relating to the way in which an understanding of the roles of oncogenes and tumour suppressor genes could be used in the prevention, treatment and cure of cancer. **3.8.3 Using Genome Projects** Sequencing projects have read the genomes of a wide range of organisms, including humans. Determining the genome of simpler organisms allows the sequences of the proteins that derive from the genetic code (the proteome) of the organism to be determined. This may have many applications, including the identification of potential antigens for use in vaccine production. In more complex organisms, the presence of non-coding DNA and of regulatory genes means that knowledge of the genome cannot easily be translated into the proteome. Sequencing methods are continuously updated and have become automated. **3.8.4.1 Recombinant DNA Technology** Recombinant DNA technology involves the transfer of fragments of DNA from one organism, or species, to another. Since the genetic code is universal, as are transcription and translation mechanisms, the transferred DNA can be translated within cells of the recipient (transgenic) organism. Fragments of DNA can be produced by several methods, including: conversion of mRNA to complementary DNA (cDNA), using reverse transcriptase using restriction enzymes to cut a fragment containing the desired gene from DNA creating the gene in a 'gene machine'. Fragments of DNA can be amplified by *in vitro* and *in vivo* techniques. The principles of the polymerase chain reaction (PCR) as an *in vitro* method to amplify DNA fragments. The culture of transformed host cells as an *in vivo* method to amplify DNA fragments.	Positive Applications of the Genome project include

	The addition of promoter and terminator regions to the fragments of DNA. The use of restriction endonucleases and ligases to insert fragments of DNA into vectors. Transformation of host cells using these vectors. The use of marker genes to detect genetically modified (GM) cells or organisms. (Students will **not** be required to recall specific marker genes in a written paper.) Interpret information relating to the use of recombinant DNA technology evaluate the ethical, financial and social issues associated with the use and ownership of recombinant DNA technology in agriculture, in industry and in medicine balance the humanitarian aspects of recombinant DNA technology with the opposition from environmentalists and anti-globalisation activists relate recombinant DNA technology to gene therapy. **3.8.4.2 Differences in DNA between individuals of the same species can be exploited for identification and diagnosis of heritable conditions** The use of labelled DNA probes and DNA hybridisation to locate specific alleles of genes. The use of labelled DNA probes that can be used to screen patients for heritable conditions, drug responses or health risks. The use of this information in genetic counselling and personalised medicine. Evaluate information relating to screening individuals for genetically determined conditions and drug responses. **3.8.4.3 Genetic Fingerprinting** An organism's genome contains many variable number tandem repeats (VNTRs). The probability of two individuals having the same VNTRs is very low. The technique of genetic fingerprinting in analysing DNA fragments that have been cloned by PCR, and its use in determining genetic relationships and in determining the genetic variability within a population.	<u>Science</u> A database on the human DNA sequence helps to solve some of the basic questions related to gene expression, differentiation and specialization mechanisms, immune processes, among others. <u>Information</u> Demonstrate the predisposition to acquire certain diseases, or the aptitude to perform a certain job. In addition, it allows the elaboration of a genetic identity card for unequivocal identification for various purposes, including judicial ones. <u>Therapy</u> Prevent, diagnose and cure genetic diseases by inserting healthy genes or modifying the

	The use of genetic fingerprinting in the fields of forensic science, medical diagnosis, animal and plant breeding. explain the biological principles that underpin genetic fingerprinting techniques interpret data showing the results of gel electrophoresis to separate DNA fragments explain why scientists might use genetic fingerprinting in the fields of forensic science, medical diagnosis, animal and plant breeding.	expression of harmful genes. Negative applications Eugenics. Selecting individuals on the basis of their genetic information and attempting to modify the genetic heritage of gametes to obtain individuals with predetermined characteristics. Ethical and moral debates needed on all levels of genetic engineering. “Just because we can, should we” “Should scientific research be stopped if there is potential dangers associated with it” “Where should funding be given”

		"Should DNA profiling be allowed" " Should there be a national DNA database"