Year 13 Biology | Term 2

Key Question: How is gene expression controlled?

Topic Overview: In this topic, students will explore that although the cells within an organism carry the same coded genetic information, they translate only part of it. In multicellular organisms, this control of translation enables cells to have specialised functions, forming tissues and organs. Students will develop an understanding of the ways in which organisms and cells control their activities. This should lead to an appreciation of common ailments resulting from a breakdown of these control mechanisms and the use of DNA technology in the diagnosis and treatment of human diseases.

Year 13 Biology | Term 2

Key Question: How does inheritance occur?

Topic Overview: The theory of evolution underpins modern Biology. All new species arise from an existing species. Students will explore how this results in different species sharing a common ancestry, as represented in phylogenetic classification. Students will explore how 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. Students will also explore how populations of different species live in communities.

	Lesson Exploration	Lesson Experience(s)	Key Words
Week 1: Lesson 1	**Are all mutations dangerous?**	Students will experience researching the differences between addition, deletion, substitution, inversion, duplication and translocation of bases and their consequences.	Mutation, codons, frame shift, duplication, inversion, translocation, mutagenic agents, stem cells, embryonic stem cells, umbilical cord, placental stem cells,
Week 1: Lesson 2	**How are genes analysed to treat cystic fibrosis?**	Students will experience using case studies to evaluate the use of stem cells in treating human disorders.	

Week 1: Lesson 3	**How are billions of different cells formed from one cell?**	Students will experience researching how Induced pluripotent stem cells (iPS cells) can be produced from adult somatic cells.	totipotent, omnipotent, pluripotent, unipotent, adrenaline, transcription, epigenome, epigenetics, methylation, acetylation, malignant, benign, oncogenes, oestrogen, proteome, recombinant DNA, gene machine, restriction endonuclease, promoter, terminator, vector, plasmid, antibiotic resistance, replica plating, PCR, DNA probe, genetic fingerprinting
Week 1: Lesson 4	**Why is the work of Lamark being re-evaluated?**	Students will experience interpreting data provided from investigations into gene expression and evaluating the relative influences of genetic and environmental factors on phenotype.	
Week 2: Lesson 1	**What roles do genes play in cancer?**	Students will experience interpreting evidence showing correlations between genetic and environmental factors and various forms of cancer.	
Week 2: Lesson 2	**What are the implications of the human genome projects?**	Students will experience discussing and debating the use of genome projects and exploring how this branch of science could evolve in the future.	
Week 2: Lesson 3	**Where are the gaps in my knowledge?**	Students will experience a range of activities to test and close gaps in current knowledge to prepare for the week 2 assessment	
Week 2: Lesson 4	**Assessment**		
Week 3: Lesson 1	**How do we use jelly in the lab?**	Students will experience interpreting information relating to the use of recombinant DNA technology.	
Week 3: Lesson 2	**How is insulin mass produced?**	Students experience guided activities to evaluate the ethical, financial and social issues associated with the use and ownership of recombinant DNA technology in agriculture, in industry and in medicine.	
Week 3: Lesson 3	**How is a small sample of DNA from a crime scene amplified?**	Students will experience using case studies to explore how DNA technology is used in various fields such as medicine, crime and evolutionary reserach.	
Week 3: Lesson 4	**Why are the social and ethical implications of genetic screening?**	Students will experience researching how to balance the humanitarian aspects of recombinant DNA technology with the opposition from environmentalists and antiglobalisation activists.	
Week 4: Lesson 1	**How can genetic fingerprinting be used to determine paternity?**	Students will experience using gel electrophoresis diagrams to interpret scenarios such as who was the father of the baby, who committed the murder.	

Week 4: Lesson 2	**How are small fragments of DNA produced ?**	Students will experience interpreting information relating to the use of recombinant DNA technology.	
Week 4: Lesson 3	**Where are the gaps in my knowledge?**	Students will experience a range of activities to test and close gaps in current knowledge to prepare for the week 5 assessment	
Week 4: Lesson 4	**Where are the gaps in my knowledge?**	Students will experience a range of activities to test and close gaps in current knowledge to prepare for the week 5 assessment	
Week 5: Lesson 1	**Week 5 assessment**		
Week 5: Lesson 2	**TRY NOW**		
Week 5: Lesson 3	**How do genes interact with each other?**	Students will experience using labelled genetic diagrams to interpret, or predict, the results of epistasis and explain who some genes can determine the fate of others	
Week 5: Lesson 4	**How can chi squared tests be used in population genetics?**	Students will experience using the Chi squared test to investigate the significance of differences between expected and observed phenotypic ratios.	
Week 6: Lesson 1	**What does the distribution of phenotypes in a population tell us?**	Students will experience calculating allele, genotype and phenotype frequencies from appropriate data using the Hardy–Weinberg equation.	
Week 6: Lesson 2	**Why did Darwin's finches have different beaks?**	Students will experience collecting and interpreting data about the frequency of observable phenotypes within a single population.	
Week 6: Lesson 3	**What did Darwin propose? What is the evidence for it?**	Students will experience applying their knowledge of sampling to the concept of genetic drift.	
Week 6: Lesson 4	**How do different forms of selection affect evolution and species population?**	Students will experience drawing and interpreting graphs to represent how different forms of selection affects species population	

Week 7: Lesson 1	**How do new species come about?**	Students will experience using computer programs to model the effects of natural selection and of genetic drift.	
Week 7: Lesson 2	**RP 12 Investigating populations**	Required practical 12: Investigation into the effect of a named environmental factor on the distribution of a given species.	
Week 7: Lesson 3	**How does a barren land become a woodland?**	Students will experience using guided activities to explore primary succession, from colonisation by pioneer species to climax community.	
Week 7: Lesson 4	**What can we do to conserve the habitats?**	Students will experience researching and discussing the need to manage the conflict between human needs and conservation in order to maintain the sustainability of natural resources.	

Literacy Links	**Numeracy Links**
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