**Stage 2 Biology Year Program 3: Topics Integrated**Aligns with Learning and Assessment Plan 3

| **Week** | **Science Understanding** | **Science Inquiry Skills** | **Science as a Human Endeavour** | **Summative Assessment Tasks** |
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| **Term 1** |  |  |  |  |
| 1 | Life on earth, how for how long?  Concept and definition of Evolution  Existing cells are the product of evolution |  |  |  |
| 2-4 | Prokaryotes vs Eukaryotes- compare  Cell Theory  Cell Structure: Cell Membrane- Fluid Mosaic Model  Organelles (structure and function, arrangement of internal membranes)  Compare plant and animal cells | Microscopes  Electron micrographs of organelles  Model of the cell membrane | Discuss developments of different microscope technology and change in understanding. (Influence) |  |
| 5 | Endosymbiotic theory to explain evolution of Eukaryotes  Role of membrane, ribozymes in the first simple cells |  |  |  |
| 6 | DNA: Compare structure in prokaryotes and eukaryotes.  DNA molecule: structure and function  DNA replication | Construct models of DNA  Extract DNA  Use DNA models to simulate DNA replication  Watch animations | Discuss how information from a number of scientists have contributed to the current model of DNA (Communication and Collaboration) |  |
| 7 | DNA mutations- genetic variation, source of new genes, what can increase the mutation rate  Genes: introns and exons |  | How does an understanding of the causes of mutation affect work health and safety? (Influence) |  |
| 8 | Protein synthesis | Model the processes of transcription and translation |  |  |
| 9 | Comparative Genomics: techniques  Species definition(s) | Compare sequences of DNA (and amino acid) | The Power of Comparative Genomics You tube. How can it be applied? (Application) How has the understanding changed since this was produced? (*Limitations*) | Summative SAT 1: Test |
| 10 | Phylogenetic trees: draw and interpret  -more closely related species share more similarity in their DNA sequences | Do practice exercises drawing simple phylogenetic trees | What is the interaction between mathematics and phylogenetic trees?? (*Influence*) NIMBios video | Begin SHE Investigation |
| 11 | Reproductive Isolation: pre and post zygotic |  |  |  |
| **Term 2** |  |  |  |  |
| 1-2 | Sources of variation in sexually reproducing species:  Cell division:, mitosis, meiosis (including crossing over and independent assortment)  Fertilisation | Watch videos to visualize the different processes of cell division  Microscope: Look at prepared slides of onion root tips  Use models to learn the stages of mitosis |  |  |
| 3 | Asexual and Sexual reproduction  Binary fission  Compare mitosis/meiosis  Somatic vs Germ Line cells  Control of cell division- features of and role of hormones  Uncontrolled cell division | Use models to learn the stages of meiosis  Model crossing over and independent assortment | Discuss recent developments and understanding of uncontrolled cell division at its treatment (*Development, Application and Limitation*) |  |
| 4 | Cell culture: applications and limitations/benefits and harmful effects of chemicals. |  | Discuss examples of contemporary uses of cell culture (*Application*) | Summative: SHE Investigation Due |
| 5 | Introduce homeostasis- discuss tolerance limits  Introduce the Nervous System: compare structure and function of neurons, role of receptors, receptor to effector, synapses and neurotransmitters. | Investigation: tolerance limits of organisms- use seedlings to test salinity, pH etc.  Investigate: reflex responses (use online reflex test) | Video: Extreme microbes |  |
| 6 | Compare the nervous and hormonal system and discuss their interdependence.  Stimulus Response Model: reflex arc and negative feedback. |  |  |  |
| 7-8 | Discuss in detail the following homeostatic examples:  Body Temperature (Thyroxine)  Osmoregulation (ADH)  Carbon Dioxide in Blood  Fight or Flight response (adrenaline)  Blood sugar (insulin/glucagon)  Diabetes and hormonal imbalance |  | <http://www.news.com.au/lifestyle/health/health-problems/new-device-for-diabetes-eliminates-the-need-for-painful-finger-pricking/news-story/539d9044155f4866ce7e41b770844001>  Discuss article. (*Collaboration*, *Development*, *Influence*) |  |
| 9 | Proteins: structure (primary, secondary, tertiary, quaternary), structure to function relationship. E.g. enzymes, some hormones etc. | Model folding of a polypeptide |  |  |
| 10 | Enzymes: induced fit, factors, role in cell metabolism  Revisit protein synthesis and consider phenotypic expression and cellular differentiation. | Investigate the effect of a factor on enzyme activity (deconstruct and outcomes uncertain as a focus) | Discuss uses of enzymes in food, cleaning, treatments.  (*Application*) | Summative SAT 2 |
| **Term 3** |  |  |  |  |
| 1 | Gene Expression  Epigenetic changes | Watch video | Explore disease associated with epigenetic changes (*Application and Limitation*) |  |
| 2-3 | Genetic engineering and associated techniques: DNA sequencing, PCR, revisit DNA profiling.  Issues (ethical, economic and cultural) re genetic information collection | Experiment: PCR simulation or visit a lab | Compare traditional selective breeding with cloning (*Application and Limitation*) |  |
| 4 | Tools of genetic engineering: plasmids, bacterial enzymes, gel electrophoresis, bacterial transformation, PCR, probes/restriction enzymes. | Practical: Gel Electrophoresis |  |  |
| 5 | New technologies: CRISPR, benefits and limitations of CRISPR + CAS and other. |  | Consider the ethical considerations of new technologies and gene technology (*Development*) |  |
| 6 | Energy: autotrophs vs heterotrophs, photosynthesis, cellular respiration (compare aerobic/anaerobic etc.)  ATP cycle | Investigation: Practical- use a data logger to measure photosynthesis  Formative Practical Investigation: Design  Factors that affect respiration. |  |  |
| 7 | Obtaining substances for survival: transport processes, revisit cell membrane, factors that affect transport | Investigation: factors that affect diffusion or osmosis |  | Summative SAT 3 |
| 8 | Chance of survival: concept of a gene pool  Natural Selection: role of variation, low genetic diversity, consequences and examples. | Simulation: Pepper Moths | Discuss the work of Darwin and Wallace in the development of the theory of Natural Selection (*Communication*) | Deconstruct and Design, outcome uncertain Investigation: Natural Selection Simulation (Predation) |
| 9 | Speciation: genetic drift, geographical isolation and allopatric speciation  Compare allopatric and sympatric speciation  Convergent evolution  Divergent (adaptive radiation)  Extinction and Human Activity, ethical considerations. | Look at examples for each of these types of speciation. | Discuss extinctions and the roles of humans in preservation of species/habitats.  (*Application and Limitation, Influence*) |  |
| 10 | Succession | Examples of succession- visit a site or look at photographs or watch a video. |  | Summative SAT 4: Non- test SAT- Article and response |
| **Term 4** |  |  |  |  |
| 1-2 | Revision – past exam questions | Deconstructing problems | Responding to SHE questions |  |