**Stage 2 Biology: Program 2: 20-credits**

This teaching program articulates with learning and assessment plan 2.

| **Week** | **Science Understandings** | **SIS** | **SHE** | **Assessment Tasks** |
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| **Term 1**  Week 1 | * Cell Theory * Prokaryotic and Eukaryotic cells –comparison * Eukaryotic cells- internal organisation/organelles * Compare plant and animal cells | * Microscopes * Electron-micrographs of organelles |  |  |
| 2 | * DNA: structure and function, location, prokaryotic vs eukaryotic * DNA replication | * Construct models of DNA * Extract DNA * Use DNA models to simulate DNA replication * Watch animations | Look at the how information from a number of scientists have contributed to the current model of DNA |  |
| 3 | * Genes * Coding and Non-coding DNA- introns and exons * Proteins: * What is a protein? * Polypeptide Folding = functional protein * 3-D shape- importance and how it forms | * Model the folding of a polypeptide |  |  |
| 4. | * Proteins: structure and function (hormones, receptor proteins, antibodies) * Enzymes * Specific * Catalysts * Induced Fit model * Factors that affect enzyme function | * Investigate the effect of a factor on enzyme activity |  |  |
| 5. | * Protein Synthesis | * Model the processes of transcription and translation |  |  |
| 6-7 | * Phenotypic Gene Expression * Cellular differentiation * DNA methylation * Epigenetic modifications can lead to cancer. | Watch video | * Explore diseases associated with epigenetic changes |  |
|  |  |  |  |  |
| 8. | * DNA Mutations (include the science understandings from Topic 4) * DNA sequencing * PCR | * Experiment: PCR (simulation) or visit a lab |  | **Begin: SHE Investigation** |
| 9. | * Biotechnology: genetic engineering |  | * Compare traditional selective breeding with cloning |  |
| 10. | * Transferring DNA * New technologies: such as CRISPR to edit/transfer genes * Benefits and Limitations |  | * Consider the ethical consideration of new technologies and gene technology |  |
| 11. | * Review * Introduce next topic: Cells continued. |  |  | **Summative SAT 1:**  **Test 1** |
| **Term 2**  Week 1 | * Energy and Cells (links to all the processes discussed in Term 1) * Autotrophs and Heterotrophs * Compare these groups * Inputs and Outputs |  |  | **Summative: SHE Investigation Due** |
| 2 | * Photosynthesis * Aerobic Respiration * Anaerobic Respiration | * Investigation: Practical – use a data logger to measure photosynthesis or respiration (anaerobic) |  | **Summative: Practical Investigation:**  **Factors that affect photosynthesis or respiration** |
| 3-4 | * Transport in Cells * Structure and Function of the Cell Membrane * Fluid Mosaic Model * Explain how the membrane facilitates different transport processes * Factors that affect transport | * Model of the cell membrane * Investigation: factors that affect diffusion or osmosis |  |  |
| 5 | * Cell Metabolism |  |  |  |
| 6 | * Cell Division: * Binary Fission: Prokaryotic cells | * Watch videos to visualise the different processes of cell division |  |  |
| 7-8 | * Mitosis: Eukaryotic cells * Cell Cycle * Cell Culture * Carcinogens/Cancer | * Microscopes: prepared slides or onion root tips * Use models to learn the stages of mitosis | * Discuss example of contemporary uses of cell culture |  |
| 9 | * Meiosis: production of gamete cells: Eukaryotic cells | * Use models to learn the stages of meiosis * Model crossing over and independent assortment |  |  |
| 10. | * Review |  |  | **SAT 2: Test 2** |
| **Term 3:**  Week 1 | * Introduction to Homeostasis: tolerance limits * Nervous and Endocrine Systems – compare functions, work together * Composition of the Nervous System * Role of the neurons * Neuron Pathways (synapse, neurotransmitters). | * Investigation: tolerance limits of organisms – use seedlings to test salinity, pH, etc. * Investigate: Reflex responses (use online reflex tests) | * Video: Extreme Microbes |  |
| 2 | * Stimulus Response Model/Negative Feedback   Reflex responses  Composition of Endocrine system in Humans | * Investigate the effect of plant hormones on plant growth |  |  |
| 3-4 | * Hormonal and Nervous system action in body temperature, blood glucose, metabolism, carbon dioxide and osmoregulation |  |  |  |
| 5 | * Role of hormonal imbalances in diabetes |  |  |  |
| 6 | * Introduce: Evolution * The beginning of life on Earth * Prokaryotic cells existed before Eukaryotic cells |  |  | Article for Non-Test SAT given to students |
| 7 | * Species: Definition and limitations of * Reproductive isolating mechanisms * Comparative Genomics and associated techniques * Phylogenetic Tree Diagrams | * Compare sequences of DNA and amino acids * Practical: Gel electrophoresis |  | Non Test: SAT 4  Article Task |
| 8 | * Gene Pools * Natural Selection * Genetic Diversity | * Simulation: Pepper Moths | * Discuss the work of Darwin and Wallace in the development of the theory of Natural Selection. Link to SHE development of models | **Deconstruct and Design Practical Investigation: Natural Selection (predation)** |
| 9 | * Speciation * Allopatric Speciation * Convergent Evolution * Adaptive Radiation * Succession | * Look at examples for each of these types of speciation processes * Examples of succession- video or photographs or schematic |  |  |
| 10 | * The effects of Humans * Maintain biodiversity |  | * Discuss extinctions and the role of humans in preservation of species/habitats | **SAT 3: Test 3** |