**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
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|  |  |  |  |  |
| 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** |