Science Department Programme of Study: A LEVEL BIOLOGY

	Year 12 : Teacher 1	Year 12 Teacher 2	Year 13 Teacher 3	Year 13 Teacher 1	Year 13 Teacher 2
Phase 1	**TRANSPORT IN ANIMALS:** How size affects the need for a circulatory system - How size and level of activity are affected by the type of circulatory system Structure of the human heart - Pressure changes during the cardiac cycle and coordination of the cardiac cycle (+ECG) How to dissect a heart and male annotated drawings- How blood vessels are adapted to their position in the circulatory circuits How exchange at the capillaries is achieved and tissue fluid formed - How oxygen and carbon dioxide are transported	**CELL STRUCTURE** The importance of microscopes, the differences between light and electron, the magnification V's resolution and the mathematical calculations required when using graticules and micrometers. The ultrastructure of the cell, including photomicrographs and how the organelles work together. Prokaryotes are also compared to eukaryotes. **WATER** Concept of monomers and poylmers and the importance of hydrolysis/condensation reactions. Hydrogen bonding in water molecules and the importance to life.	**BIODIVERSITY** Biodiversity refers to the variety and complexity of life. Biodiversity can be considered at a number of levels (diversity within a species which is known as genetic diversity, (b) diversity of species in a habitat – which is important when studying a habitat and (c) diversity of habitats- the range of different habitats found. Maintaining biodiversity is important for many reasons, many of our actions cause loss of biodiversity. Conservation, locally, Nationally and Globally can work *insitu* or exsitu to maintain biodiversity.	**CELLULAR CONTROL** The way in which types if gene mutation can affect protein structure and function; How some mutations are neutral/beneficial; How gene expression is controlled in cells; How certain genes control development of body plans; The importance of mitosis and apoptosis. **PATTERNS OF INHERITANCE (1)-** Environmental and genetic causes of variation; How sexual reproduction can cause variation; Use of genetic diagrams; Using phenotypes to identify linkage and epistasis; Using Chi squared.	**MANIPULATING GENOMES: (to cont phase2)** DNA sequencing and application of DNA sequencing- DNA profiling-Use of PCR and electrophoresis- principles and techniques of genetic engineering-ethical issues relating to genetic manipulation- principles and potential of gene therapy in medicine
Phase 2	**EXCHANGE SURFACES AND BREATHING:** Properties of a good exchange surface – Exchange surfaces in plants, insects, fish and mammals- Breathing in humans and measuring lung volumes (using a spirometer) - Cells and tissues involved in an exchange surface **BIOLOGICAL MEMBRANES: (cont phase3) :** Structures and roles of cell membranes – Diffusion across membranes- Osmosis and practical investigation - How substances cross membranes using active processes- How factors affect membrane structure and permeability and practical investigation	**LIPIDS** Triglycerides, phospholipids and cholesterol: structure, synthesis/breakdown and how the properties of these molecules relate to their function in living organisms. **CARBOHYDRATES** The ring structure and properties of glucose (a and b) and ribose (and deooxyribose), with knowledge of the elements which form them and the synthesis and breakdown reactions. Structure and functions of polysaccharides as energy stores: comparison on glycogen, amylose and amylopectin. Structure and functions of polysaccharides as structural units: cellulose (chitin and peptidogylcan also covered). PAG9 Biological molecules **PROTEINS** The general structure of an amino acid and the synthesis/breakdown of polymers. The 4 levels of protein structure are explored in detail, with chemical bonds included. Differences between the structure/function of globular V's Fibrous proteins. Inorganic ions also covered here.	**COMMUNICABLE DISEASES Cont phase 3)** There is an evolutionary arms race between pathogens and their hosts. We have gained an understanding of organisms which cause us harm. Plants and animals have developed a variety of passive and active defences against pathogenic organisms. In this section we learn about how plants defend themselves passively and actively. And, we learn about immune systems in animals.	**PATTERNS OF INHERITANCE (2)-**The generic basis of continuous and discontinuous variation; Factors affecting evolution; Use of Hardy-Weinberg; Ethical considerations of artificial selection. **COMMUNICATION AND HOMEOSTASIS-** The need for communication systems and homeostasis; Maintenance of a constant internal state by negative feedback; Temperature regulation in ectotherms and endotherms. **EXCRETION AS AN EXAMPLE OF HOMEOSTATIC CONTRO L (to cont in phase3)** - Excretion; structure and function of the liver/ kidneys; Control of water potential in the blood; Treatment of kidney failure.	**CLONING AN BIOTECHNOLOGY (to cont in phase3)** use of natural clones in horticulture- Micropropagation and tissue culture- natural clones in animals and how artificial clones can be produced- uses of microorganisms in biotechnology-how to culture microorganisms using aseptic techniques- the use of immobilised enzymes **PLANT AND ANIMAL RESPONSES: (to cont in phase3)** Range of plant response to their environment- role of hormones in plant responses-how hormones can be used commercially- organisation of the nervous system into somatic and autonomic systems- structure of the brain and the function of parts of the brain- reflex actions- coordinated responses using both neuronal and endocrine systems(including control of the heart rate)- Different types of muscles- Structure and action of skeletal muscle

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Phase 3	**TRANSPORT IN PLANTS:** Distribution of vascular tissue in roots, stem and leaves-How plants take up water and mineral ions and carry them up to the leaves- Mechanism of transpiration and transpiration stream- Translocation of assimilates around the plants- How plants are adapted to the availability in their environments (xerophytes,hydrophytes) **MATHEMATICAL SKILLS :** Scattergrams and correlation- uncertainties- Standard deviation- Student t-test (practical investigation) END OF YEAR EXAM	**ENZYMES** The role of enzymes in catalysing reactions that affect metabolism, and intracellular/extracellular reactions. The need for cofactors, coenzymes and prosthetic groups. Mechanism of enzyme action, effect of temperature, pH and enzyme/substrate concentrations. PAG4 Enzyme Conc. The effects of enzyme inhibitors (competitive and non-competitive) on the rate of enzyme-controlled reactions including poisons and medicinal drugs. END OF YEAR EXAM	**CLASSIFICATION AND EVOLUTION (cont phase 4)** There is a staggering array of different organisms on the planet. The range of diverse forms in different habitats has caught the attention for biologists for many years. In particular the adaptation of those organisms to their habitat is striking. The mechanism involves the selection of the most well adapted from a variety of different forms. The wide diversity of habitats gives rise to a very wide variety of organisms that can exploit those habitats. All organisms share a common ancestor and this allows them to be classified. Classification is an attempt to place this wide variety of organisms into groups. The early systems of classification used observable features. Now more advanced techniques such at DNA sequencing has led to the reconfiguration of classification systems. END OF YEAR EXAM	**NEURONAL COMMUNICATION**- The role of sensory receptors; Structure and function of neurones; Generation and transmission of action potentials; Structure and roles of synapses. **HORMONAL COMMUNCATION- T**he structure and function of the adrenal glands; Functions of hormones secreted by adrenal glands; The histology of the pancreas and how insulin if secreted; the regulation of blood glucose concentration; Diabetes and its treatment. **RESPIRATION**-Why organisms need to respire; Where in cells the different stages of respiration take place; An outline of events of each stage of respiration; The importance of coenzymes NAD and FAD and coenzyme A; Chemiosmosis theory; Anaerobic respiration' The relative values of different respiratory substances and respiratory quotients; How factors that affect respiration rates can be investigated experimentally **STUDY LEAVE**	**Revision** **STUDY LEAVE**
Phase 4	**ECOSYSTEMS:** factors affecting ecosystems- transfer of biomass and manipulating transfer of biomass-Carbon and nitrogen cycle- Succession- Techniques to study ecosystems- **PHOTOSYNTHESIS**: Interrelationship between photosynthesis and respiration- structure of chloroplasts and sites of the different stages of photosynthesis- Importance of photosynthetic pigments -separation of the pigments using thin layer chromatography- Light dependent and light independent stages of photosynthesis- Practical investigations into factors that affect photosynthesis	**NUCLEIC ACIDS** Structure of nucleotides, ADP, ATP, DNA, and the synthesis/breakdown of macromolecules. Practical investigation of DNA extraction. Semi-conservative replication is investigated along with the nature of the genetic code and detailed description of transcription and translation. MRNA, tRNA and rRNA all covered. **CELL DIVISION** The cell cycle stages and regulation points. The main stages of mitosis and the significance in living organisms. PAG1 Microscopes. The main stages of meiosis and the significance in living organisms, with modelling. Differentiation of cell types from stem cells, including blood cell derivation. How animal cells build into tissues, organs and organ systems. How plants are made from differentiated cells specific to their function and how they build into tissues. Features and differentiation of stem cells and potential uses in medicine and research. PAG10 RasMol.	**POPULATION AND SUSTAINABILITY**: factors affecting population size and how populations interact- Preservation and conservation- Sustainable management of ecosystems- balancing the needs for humans with conservation of species- how humans affect their environment and how to control their effects	**STUDY LEAVE**	**STUDY LEAVE**