WFA Progression Map - planning for knowledge/skills etc to build & accumulate sequentially over time

WESTON FAVELL ACADEMY

Key: ***Bold** writing shows development or progression from previous year. *<u>Underline</u> shows cross-over of key concepts with other end-points

Faculty: Science		**Subject: Biology**	
End points	**Year 11**	**Year 12**	**Year 13**
Understanding of core concepts of "the cell"	•stem cells in animals and meristems in plants •enzymes •factors affecting the rate of enzymatic reactions •carbohydrates, proteins, nucleic acids and lipids as key biological molecules	Biology is the study of living organisms. Every living organism is made up of one or more cells, therefore understanding the structure and function of the cell is a fundamental concept in the study of biology. The cells of all living organisms are composed of biological molecules. Proteins, carbohydrates and lipids are three of the key groups of biological macromolecules that are essential for life. A study of the structure of these macromolecules allows a better understanding of their functions in living organisms. Nucleic acids are essential to heredity in living organisms. Understanding the structure of nucleotides and nucleic acids allows an understanding of their roles in the storage and use of genetic information and cell metabolism. Metabolism in living organisms relies upon enzyme controlled reactions. Knowledge of how enzymes function and the factors that affect enzyme action has improved our understanding of biological processes and increased our use of enzymes in industry. Membranes are fundamental to the cell theory. The structure of the plasma membrane allows cells to communicate with each other. Understanding this ability to communicate is important as scientists increasingly make use of membrane-bound receptors as sites for the action of medicinal drugs.	

		During the cell cycle, genetic information is copied and passed to daughter cells. Microscopes can be used to view the different stages of the cycle. In multicellular organisms, stem cells are modified to produce many different types of specialised cell. Understanding how stem cells can be modified has huge potential in medicine. To understand how a whole organism functions, it is essential to appreciate the importance of cooperation between cells, tissues, organs and organ systems.	
	NC/Spec coverage	**NC/Spec coverage** **H420 MODULE 2 Foundations in Biology** ***2.1.1 Cell Structure*** ***2.1.2 Biological molecules*** ***2.1.3 Nucleotides and nucleic acids*** ***2.1.4 Enzymes*** ***2.1.5 Biological membranes*** ***2.1.6 Cell division, cell diversity and cellular organisation***	**NC/Spec coverage**

Appreciation of the function of multicellular organisms	•the need for transport systems in multicellular organisms, including plants •the relationship between the structure and functions of the human circulatory system •nervous coordination and control in humans •the structure and function of the human nervous system •the structure and function in a reflex arc •hormonal coordination and control in humans •hormones in human reproduction, hormonal and non-hormonal methods of contraception •homeostasis	As animals become larger and more active, ventilation and gas exchange systems become essential to supply oxygen to, and remove carbon dioxide from, their bodies. Ventilation and gas exchange systems in mammals, bony fish and insects are used as examples of the properties and functions of exchange surfaces in animals. As animals become larger and more active, transport systems become essential to supply nutrients to, and remove waste from, individual cells. Controlling the supply of nutrients and removal of waste requires the coordinated activity of the heart and circulatory system. As plants become larger and more complex, transport systems become essential to supply nutrients to, and remove waste from, individual cells. The supply of nutrients from the soil relies upon the flow of water through a vascular system, as does the movement of the products of photosynthesis.	Organisms use both chemical and electrical systems to monitor and respond to any deviation from the body's steady state. The kidneys, liver and lungs are all involved in the removal of toxic products of metabolism from the blood and therefore contribute to homeostasis. The kidneys play a major role in the control of the water potential of the blood. The liver also metabolises some toxins that are ingested. The stimulation of sensory receptors leads to the generation of an action potential in a neurone. Transmission between neurones takes place at synapses. The ways in which specific hormones bring about their effects are used to exemplify endocrine communication and control. Treatment of diabetes is used as an example of the use of medical technology in overcoming defects in hormonal control systems. Plant responses to environmental changes are coordinated by hormones, some of which are important commercially. In animals, responding to changes in the environment is a complex and continuous process, involving nervous, hormonal and muscular coordination. Photosynthesis is the process whereby light from the Sun is harvested and used to drive the production of chemicals, including ATP, and used to synthesise large organic molecules from inorganic molecules Respiration is the process whereby energy stored in complex organic molecules is transferred to ATP. ATP

			provides the immediate source of energy for biological processes.
	NC/Spec coverage	**NC/Spec coverage** **H420 MODULE 3 Exchange and Transport** **3.1.1 Exchange Surfaces** **3.1.2 Transport in animals** **3.1.3 Transport in plants**	**NC/Spec coverage** **H420 MODULE 5 Communication, homeostasis and energy** **5.1.1 Communication and homeostasis** **5.1.2 Excretion as an example of homeostatic control** **5.1.3 Neuronal communication** **5.1.4 Hormonal communication** **5.1.5 Plant and animal responses** **5.2.1 Photosynthesis** **5.2.2 Respiration**

Understanding of how organisms interact with each other and with their environment	• the genome as the entire genetic material of an organism •how the genome and environment influence the development of the phenotype of an organism •the potential impact of genomics on medicine •most phenotypic features being the result of multiple, rather than single genes •single gene inheritance and single gene crosses with dominant and recessive phenotypes •sex determination in humans •genetic variation in populations of a species •the process of natural selection leading to evolution •the evidence for evolution •developments in biology affecting classification •selective breeding of plants and animals in agriculture •the uses of modern biotechnology including gene technology •some practical and ethical considerations of modern biotechnology	Organisms are surrounded by pathogens and have evolved defences against them. Medical intervention can be used to support these natural defences. The mammalian immune system is introduced. Biodiversity refers to the variety and complexity of life. It is an important indicator in the study of habitats. Maintaining biodiversity is important for many reasons. Actions to maintain biodiversity must be taken at local, national and global levels. Evolution has generated a very wide variety of organisms. The fact that all organisms share a common ancestry allows them to be classified. Classification is an attempt to impose a hierarchy on the complex and dynamic variety of life on Earth. Classification systems have changed and will continue to change as our knowledge of the biology of organisms develops.	The way in which cells control metabolic reactions determines how organisms, grow, develop and function. Isolating mechanisms can lead to the accumulation of different genetic information in populations, potentially leading to new species. Over a prolonged period of time, organisms have changed and some have become extinct. The theory of evolution explains these changes. Humans use artificial selection to produce similar changes in plants and animals Genome sequencing gives information about the location of genes and provides evidence for the evolutionary links between organisms. Genetic engineering involves the manipulation of naturally occurring processes and enzymes. The capacity to manipulate genes has many potential benefits, but the implications of genetic techniques are subject to much public debate Farmers and growers exploit “natural” vegetative propagation in the production of uniform crops. Artificial clones of plants and animals can now be produced. Biotechnology is the industrial use of living organisms (or parts of living organisms) to produce food, drugs or other product. Organisms do not live in isolation but engage in complex interactions, not just with other organisms but also with their environment. The efficiency of biomass transfer limits the number of organisms that can exist in a particular ecosystem. Ecosystems are dynamic and tend towards some form of climax community There are many factors that determine the size of a population. For economic, social and ethical reasons

			ecosystems may need to be carefully managed. To support an increasing human population, we need to use biological resources in a sustainable way.
	NC/Spec coverage	**NC/Spec coverage** **H420 MODULE 4 Biodiversity, evolution and disease** **4.1.1 Communicable disease, disease prevention and the immune system** **4.2.1 Biodiversity** **4.2.2 Classification and Evolution**	**NC/Spec coverage** **H420 MODULE 6 Genetics, evolution and ecosystems** 6.1.1 Cellular control 6.1.2 Patterns of inheritance 6.1.3 Manipulating genomes 6.1.4 Cloning and biotechnology 6.3.1 Ecosystems 6.3.2 Populations and sustainability

Understanding of how to structure scientific investigations	•explaining every day and technological applications of science •appreciating the power and limitations of science •recognizing the importance of peer review of results •using scientific theories and explanations to develop hypotheses •make predictions using scientific knowledge and understanding •select, plan and carry out the most appropriate types of scientific enquiries to test predictions •applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate both for fieldwork and for experiments •consider the accuracy of measurements •be aware of health and safety considerations •present reasoned explanations in relation to predictions and hypotheses •evaluate data showing awareness of potential sources of random and systematic error •carry out and represent mathematical and statistical analysis •represent distributions of results and making estimations of uncertainty •communicate the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations	**Practical skills delivered throughout the course across the two years. Only formally assessed at the end of Y13 and via the PAGs (practical assessed grades)**
	NC/Spec coverage	**NC/Spec coverage** **Module 1 Development of practical skills in biology** **1.1.1 Planning 1.1.2 Implementing 1.1.3 Analysis 1.1.4 Evaluation**

Having a good grasp of numerical, analytical and literacy skills in order to communicate scientific ideas effectively	•developing their use of scientific nomenclature • understanding how scientific quantities are determined •using IUPAC chemical nomenclature unless inappropriate •interconverting units •using an appropriate number of significant figures in calculations	**Partially met through the practical skills delivered throughout the course across the two years. Only formally assessed at the end of Y13 and via the PAGs (practical assessed grades)** **Also seen via the integrated mathematical skills**	
	NC/Spec coverage	**NC/Spec coverage**	**NC/Spec coverage**