CURIOSITY COMPASSION COURAGE

Curriculum overview

Subject	Biology	Year group	12
Vision statement:	At Landau Forte our curriculum exists to ensure all students regardless of background and ability have the opportunity to unlock their potential. We are committed to students being challenged from their previous key stage learning experiences. Our broad and balanced curriculum is ambitious, coherently planned and sequenced, and will provide the platform for preparing students with the foundations for examination success. Our Curriculum Intent has been informed by a wide variety of researchers and is steeped in evidence based research. Christine Counsell summarises the aspiration of our curriculum to empower all learners creating a pathway to success in university, their career and life: *'A curriculum exists to change the pupil, to give the pupil new power. One acid test for a curriculum is whether it enables even lower attaining or disadvantaged pupils to clamber into the discourse and practices of educated people, so that they gain powers of the powerful.'* As well as excellent academic success we aim to ensure our students leave us as polite and well-rounded young adults. Our new core values of Compassion, Courage and Curiosity are currently being embedded throughout our curriculum offer to ensure we continue to meet our social, emotional, spiritual and moral obligations.		
Curriculum intent:	*In line with the Academy's vision to enhance students' understanding of the world by ensuring an educational journey guided with care and compassion the Science department at Landau Forte Academy QEMS aim to deliver a curriculum that not only develops students' knowledge and understanding of the subject but inspires them to succeed far beyond their education at the academy.* *The science curriculum aims to be;* ○ *Aspirational* ○ *Ambitious* ○ *Coherent both in planning and sequence* ○ *Adapted successfully to suit all needs and abilities* ○ *Broad - covering not only aspects of the subject but how this can be taken into the outside world* *In delivering the knowledge based curriculum students will be able to not only achieve the best they can academically but also link theory to reason, understand why they learn about specific concepts, grasp how this fits into the world of careers and ultimately develop the skills and reasoning needed to become well rounded individuals. The curriculum aims to give students a range of opportunities within the classroom and beyond allowing them to become confident and articulate in their scientific ideas. Consistently high expectations of both students and teaching staff ensures that every individual in Science has access to the highest quality of teaching and learning possible and working with key stakeholders ensures that our students have every opportunity to achieve.*		
Threshold Concepts (TCs):	1. *Biological Molecules, molecules of life including water, ATP, carbohydrates, lipids and proteins* 2. *Cell structure and division, cell membranes and the immune system* 3. *Exchange and transport systems* 4. *DNA, RNA and protein synthesis with links to diversity, selection and classification*		

	5. *Energy transfer in organisms, respiration, photosynthesis and nutrient cycles*
KS4 specification summary:	The KS4 science curriculum ensure students have the knowledge to enable them to develop curiosity about the natural world, insight into working scientifically, and appreciation of the relevance of science to their everyday lives. This allows students to not only develop scientific knowledge and conceptual understanding through the specific disciplines of biology but also develop understanding of the nature, processes and methods of science, through different types of scientific enquiry that help them to answer scientific questions about the world around them. Students are helped to understand how, through the ideas of biology, the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas which are of universal application, and which can be illustrated in the separate topics set out below. These ideas include: • life processes depend on molecules whose structure is related to their function • the fundamental units of living organisms are cells, which may be part of highly adapted structures including tissues, organs and organ systems, enabling life processes to be performed more effectively • living organisms may form populations of single species, communities of many species and ecosystems, interacting with each other, with the environment and with humans in many different ways • living organisms are interdependent and show adaptations to their environment • life on Earth is dependent on photosynthesis in which green plants and algae trap light from the Sun to fix carbon dioxide and combine it with hydrogen from water to make organic compounds and oxygen • organic compounds are used as fuels in cellular respiration to allow the other chemical reactions necessary for life • the chemicals in ecosystems are continually cycling through the natural world • the characteristics of a living organism are influenced by its genome and its interaction with the environment • evolution occurs by the process of natural selection and accounts both for biodiversity and how organisms are all related to varying degrees. Students have been taught about: Cell biology Transport systems Health, disease and the development of medicines Coordination and control Photosynthesis Ecosystems Evolution, inheritance and variation

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Learner skills:	Critical thinking  	Organisation  	Collaboration  	Adaptability  	Oracy  	Self-quizzing 
	Term 1 Aug-Oct	Term 2 Nov-Dec	Term 3 Jan-Feb	Term 4 Mar-Apr	Term 5 Apr-May	Term 6 Jun-Jul
The Big Question	**What is required for cells and organisms to function?**					
Big picture questions:	**What biological molecules are required for a cell to function?**	**Are all cells different?**	**How do organisms exchange substances with their environment?**	**What causes biodiversity?**	**How do molecules link with cells then link with systems?**	**How is energy transferred between plants and animals?**
Content (Linked to TCs):	Section A • Molecules of life • Sugars (monosaccharides, disaccharides) • Polysaccharides • Lipids • Proteins • Enzymes • Factors affecting enzyme activity	Section A • Eukaryotic cells and organelles • Prokaryotic cells and viruses • Analysing cell components • Cell division – mitosis • Investigating mitosis Section B • Cell membranes	Section A • Size and surface area • Gas exchange • Gas exchange in humans • Effects of lung disease • Dissecting gas exchange systems Section B • Digestion and absorption	Section A • DNA • Genes and chromosomes • RNA and protein synthesis • Transcription and translation • The genetic code and nucleic acids Section B • Meiosis and genetic variation	**Complete topic 4 and review of topics 1-4**	Section A • Photosynthesis, respiration and energy • Photosynthesis and the light dependent reaction • Photosynthesis and the light independent reaction

	• Enzyme controlled reactions Section B • DNA and RNA • DNA replication • ATP • Water • Inorganic ions	• Diffusion • Osmosis • Active transport Section C • Antigens • The immune response • Immunity and vaccines • Antigenic variation • Antibodies in medicine • HIV and viruses	• Haemoglobin • Circulatory system • The heart • Cardiovascular disease • Transport in plants – xylem • Transport in plants – phloem	• Mutations • Genetic diversity • Natural selection • The effects of selection • Investigating selection Section C • Classification • Classification using courtship behaviour • Classification using DNA or Proteins • Using gene technologies to assess genetic diversity • Investigating variation • Biodiversity • Agriculture and biodiversity		• Limiting factors in photosynthesis • Aerobic and anaerobic respiration • Mitochondrial reactions Section B • Energy transfer in ecosystems • Farming practices and production • Nutrient cycles in natural ecosystems • Fertilisers and eutrophication
Key vocabulary:	Protein, peptide bond, monosaccharide, disaccharide, polysaccharides, glyosidic bond, ester bond, phosphodiester bond, DNA polymerase, condensation reaction and hydrolysis.	Prokaryote, eukaryote, prophase, metaphase, anaphase, telophase, diffusion, osmosis, active transport, T lymphocytes, B-lymphocytes, vaccine, immunity.	Amylase, lipase, endopeptidases, exopeptidases, dipeptidases, Haemoglobin, mass transport, arteries, arterioles, capillaries	Exons, introns, mRNA, tRNA mutation, allele, natural selection, Biodiversity, phylogenetic, biodiversity		NADP, ATP, glycolysis, NAD, chemiosomotic, krebs cycle, gross primary productivity, net primary production, gross primary production and biomass.

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Assessment:	**Retrieval quizzes every lesson** **Section tests** **Key Learning Task**	**Retrieval quizzes every lesson** **Section tests** **Key Learning Task**	**Retrieval quizzes every lesson** **Section tests** **Key Learning Task**	**Retrieval quizzes every lesson** **Section tests** **Key Learning Task**		**PPE paper 1 Biology** **Retrieval quizzes every lesson** **Section tests** **Key Learning Task**
Key/Historical misconceptions in this unit:	• "Ions are polar" - Ions are charged hence they cannot pass through the hydrophobic inside of the Cell Surface Membrane. • "Fatty acid/ hydrocarbon tails interact with hydrophobic bonds" – Fatty acid/ hydrocarbon tails interact with hydrophobic interactions. • "Hydrolysis and Condensation both produce water as a	• Prokaryotes contain organelles because they are living organisms - they have no internal membrane-bound organelles within their cytoplasm. • "Exocytosis is the same as active transport" - Exocytosis is a type of bulk transport requiring vesicles, while active transport uses carrier proteins.	• Confusion between the functions of xylem and phloem – xylem transports water and minerals, phloem transports organic solutes.	• "Translation comes before Transcription" – Transcription is then followed by Translation • "Uracil is a base contained in DNA" – Uracil is only found in RNA • Species coexist in ecosystems because of their compatible needs and behaviours; they need to get along. - Within an ecosystem, species compete for resources and feed on one another. Species live in the same ecosystem because of similar adaptations and environmental needs. • Confusion between species diversity and richness – observing a higher number of species in an area does not mean		• Students may not realize that plant cells have mitochondria and chloroplasts that plants do not obtain ATP solely from photosynthesis, and that respiration and photosynthesis can occur simultaneously. • The light independent part of photosynthesis is not reliant on the light dependent part – light independent part of photosynthesis requires the products of the

	product." – Hydrolysis uses water to break a bond, condensation reactions produce water as a result of the making of a bond.			it is more diverse. It rather means that it is more 'species rich' • Most variation is either genetic or environmental – most variation is multifactorial.		light-dependent reactions to function. • Mitochondria carry out respiration" - Mitochondria carry out aerobic respiration
Sequencing:	In the first year of A level Biology, students will firstly learn about the different biological molecules (e.g. proteins) which are the building blocks for the different structures in cells. This will provide students with key knowledge to aid their understanding of the different structures in cells and to the different types of cells (e.g. immune cells). Having studied the structure of cells, the next logical step is study the biological process that are essential for the whole organism. Therefore, students develop an understanding about the processes (e.g. gas exchange) which enable organisms to exchange substances with their environment. Having learnt about some of the biological processes which are essential for all organisms to exist, students will next explore the biological processes, which lead to the rich diversity in plants and animals. The A level Biology course will then explore energy transfer between plants and animals by studying the process of photosynthesis which provides glucose which allows animals and plants to respire thus gaining energy. Throughout the course, students will be developing their critical thinking, experimental skill and evaluative techniques during the completion of required practicals					