Share Multi Academy Trust

Curriculum Planning Template

Subject: Biology Year:9 Ability: All

Topic	Cell Structure	Cell Transport	Principles of Organisation	Cell Division
Topic overview Students will learn…	In this section students will learn that cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism.	In this section we will learn about how substances move into and out of cells in different living organisms. These processes will include diffusion, osmosis and active transport. Students will learn how to apply these cell transport processes to unfamiliar contexts and be able to interpret data linked to scientific investigations.	In this section students will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. Students will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis (linked to Year 8).	To enable students to deepen their understanding of genes, they will learn how cell division occurs including the importance of this in growth and repair in all living organisms.
What Golden Knowledge will pupils learn and remember?	Students will describe the function of the main organelles and then link this to the scale of a cell and the order of size of the organelles. Students will explain the need for differentiation in a multicellular organism and link this to describe the differences between differentiation in plants and in animals. Students will then build upon this by; Explaining how specialised cells are adapted for their function and define the term 'stem cell'. This will help students to describe where stem cells can be found in animals and plants in order to then; Describe in simple terms how nerve cells genetically identical to a patient could be obtained. Describe how stem cells could be used to help treat some medical conditions and then apply this to describe stem cells in plants and their uses for humans. Identify plant, animal and bacterial cells and classify them as eukaryotic or prokaryotic cells building on previous knowledge from KS3. Label diagrams of bacterial cells in order to then; Students will describe the differences between eukaryotic and prokaryotic cells in terms of structure and size. Use this to then link cells with microscopes and why microscopes are used;	Students will define the term 'diffusion' and then; build upon previous knowledge to be able to explain how temperature, concentration gradient and surface area affect the rate of diffusion. This will enable students to give examples of substances that diffuse into and out of cells. This will then lead to students building on their knowledge using examples such as; how the small intestine and lungs in mammals, and roots and leaves in plants, are adapted for exchange of substances. The previous knowledge then allows students to describe and explain how an exchange surface is made more effective.	To build upon student's knowledge of cells, explain the terms cell, tissue, organ, organ system and organism, and be able to give examples of each. Linking back to microscopes and their uses, have an understanding of the size and scale of cells, tissues, organs, organ systems and organisms. To build upon knowledge of eukaryote and prokaryote cells, describe the main systems in the human body and their functions. This will then link to describing the functions of the digestive system to digest and absorb foods. In order to understand this, students need to identify the positions of the main organs on a diagram of the digestive system. Students will know that food molecules must be small and soluble in order to be absorbed into the blood which then links to the functions of the organs in the digestive system. Students will use this knowledge to explain how the small intestine is adapted for its function by building on knowledge of specialised cells. Students will define the terms 'catalyst' and 'enzyme' and use them to describe the properties of enzymes. This will enable students to explain why enzymes are specific and are denatured by high temperatures and extremes of pH linking to knowledge of kinetic energy and bonds in Chemistry. Students will use the lock and key theory and collision theory to explain enzyme action which then links to explaining why foods need to be digested into small, soluble molecules. Students will use this knowledge to then describe the three types of enzymes involved in digestion, including the names of the substrates, products and where the enzymes are produced. Explain how bile helps in the digestion of fats and link this to the food tests practical. Building upon knowledge learnt at KS3, describe the functions of the heart and circulatory system and build upon this knowledge by being able to describe and label a diagram of the heart showing four chambers, vena cava, pulmonary artery, pulmonary vein and aorta. Students will describe the flow of blood from the body, through the heart and lungs and back to the body and link this to red blood cells learnt in the previous topic.	Know that bacteria multiply by simple cell division and how that links to reproduction and DNA. Students can then describe what a chromosome is and where chromosomes are found in the cell. Students will describe simply how and why body cells divide by in order to be able to; Draw simple diagrams to describe mitosis and the cell cycle. Students will learn about heredity as the process by which genetic information is transmitted from one generation to the next and A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA Model. Students will learn the

	Students will describe the differences in magnification and resolution of light and electron microscopes and use this to therefore; Students will explain how electron microscopy has increased understanding of organelles and why this knowledge is useful.	Define the term 'osmosis' which builds upon diffusion and links to; defining the term active transport. Be able to apply these methods of transport across cells to different biological contexts. This can only be done if the components before are taught sequentially in this order.	Use this knowledge to explain how the heart is adapted for its function which will allow students to explain how the blood vessels are adapted. Linking to last half term, students will describe problems associated with the heart and explain how they can be treated. Describe the heart as a double pump and explain why this is efficient; linking from the organ systems unit in KS3. Build upon this knowledge to describe the function of the pacemaker cells and coronary arteries. Linking to the respiratory system learnt at KS3, label the main structures in the gas exchange system. This will then enable students to explain how the alveoli are adapted for efficient gas exchange and link this to how the small intestine is adapted in a similar way. Students will describe the four main components of blood and how they are adapted to their function and link this to the specialised cells topic. Linking to the heart and lungs, explain how diet, stress and life situations can affect physical and mental health. Use this knowledge to then give examples of non-communicable diseases. Students will link this to then describe the effects of diet, smoking, alcohol and exercise on health. Students will also learn about the effects of recreational drugs (including substance misuse) on behaviour, health and life processes (linked to Year 8 digestion). Build on this knowledge to explain how and why the Government encourages people to lead a healthy lifestyle. Give risk factors associated with cardiovascular disease, Type 2 diabetes, lung diseases and cancers and link this to the skills for life programme. Students will describe some causes of cancer and then build on this to describe the difference between benign and malignant tumours and link this to the cell cycle and mitosis in the cells topic. Students will label the main organs of a plant and describe their functions to then show the links between animals and plants to then identify the tissues in a leaf and describe their functions. Students will relate the structure of each tissue to its function in photosynthesis and sign post this as a topic covered in Year 10. Build upon plant cells learnt last topic to describe the organs that make up the plant transport system. Students will then be able to deepen this knowledge by learning the adaptations of leaves for photosynthesis (link back to Photosynthesis Year 8) Further develop knowledge to then describe the role of xylem, phloem and root hair cells and explain how they are adapted for their functions and link this to define the terms 'transpiration' and 'translocation' Students will explain why there are more stomata on the lower surface of a leaf and link this to describe the role of stomata and guard cells to control water loss and gas exchange.	basics of variation between species and between individuals of the same species and how that means some organisms compete more successfully, which can drive natural selection (Link back to Variation in Year 7 and Evolution and Inheritance from Year 8).
What prior knowledge should pupils already know?	Students will have learnt the basics of cells and their structure, they will know how to use a microscope and what microscopes are used for, they will have knowledge of different organ systems in both plants and animals. Students will have learnt about different specialised cells and how they are adapted. That cells are the basic unit of all forms of life and the structural differences between types of cells and how this enables them to perform specific functions within the organism. Students will know that these differences in cells are controlled by genes in the nucleus and that for an organism to grow, cells must divide by mitosis producing two new identical cells. Students will have learnt about stem cells and their uses and how this phenomenon has led to the development of stem cell technology.	Students will already know the structure of different types of cells and the role of the cell membrane. They will also have an understanding of the principles of cell organisation and how cells work together as tissues and tissues form organs and organ systems.	Students will have learnt about different specialised cells and how they are adapted. They have a basic knowledge of the digestive and respiratory systems and structure of heart and lungs such as we breathe in oxygen and breathe out carbon dioxide.	Students will know the structure of a cell, how cells differentiate into specialised cells and how different cells are adapted to their function. Students will also be aware of the different structures within cells, where chromosomes are found and the function of the nucleus.

What skills will pupils learn and apply? (disciplinary knowledge)	Prepare slides of plant and animal cells and describe the procedure which can then be used in Year 12 to examine root tips and mitosis as part of students' 5 year learning journey. Correctly use a microscope to observe cells under different magnifications – a skill which can be transferred to future topics and supports mathematical ability such as rearranging equations and converting units. Evaluate risks and benefits, as well as the social and ethical issues concerning the use of stem cells from embryos in medical research and treatments which can be transferred to a range of other subjects and scientific concepts. Calculate the magnification of a light microscope – mathematical skills to transfer to all topics in all Sciences. Carry out calculations using the formula: real size=(image size)/magnification Rearrange the equation to calculate image size or magnification. Convert values for the units: cm, mm, µm and nm. All of these skills can be used in Maths, Science and other mathematical based subjects and contexts.	Apply knowledge of osmosis to unfamiliar situations and make predictions. This skill can then be transferred to all application questions across Science and cross curriculum. Analyse graphs and data to explain what is happening in terms of diffusion, osmosis and active transport. Be able to calculate surface area to volume ratios and how that affects diffusion rate.	Interpret graphs to determine the optimum temperature or pH for an enzyme. Graph skills can be used in every Science topic and in other subjects using data. Carry out other enzyme-controlled investigations as appropriate which will also be valuable throughout their GCSE course and A Level Biology to form part of their learning journey. Calculate the rate of enzyme-controlled reactions, a mathematical skill which can be transferred to Chemistry and Maths. Carry out practicals to investigate the food groups in a range of different food types and be able to apply this to unfamiliar contexts. Interpret the results from enzyme-controlled reactions – interpretation, a skill needed in all subjects. Evaluate the use of drugs, mechanical devices and transplants to treat heart problems, including religious and ethical concerns. Evaluating skills can be used in all subjects and it is a higher-level skill which inter leaves throughout the Biology curriculum up to KS5 and beyond. Calculate stomatal density; another mathematical skill which can be transferred to Physics and Maths.	Calculations involving number of cells after a certain amount of time in cell division. Calculate the number of bacteria in a population after a given time, when given the mean division time. This can then be transferred to Chemistry and Physics topics where the mean needs to be calculated during practicals. This also links to Maths and other subjects involving data analysis.
Key vocabulary students will know and learn	Eukaryote Cell Prokaryote Cell Microscope Mitochondria Ribosomes Cell differentiation Stem Cell	Osmosis Active Transport Diffusion Concentration Gradient	Tissue Enzyme Organ Digestion Alveoli Heart Blood Transpiration Translocation	Mitosis Chromosomes DNA Division Growth Repair Binary Fission
How will pupil understanding be checked &/or assessed?	Each school in the Trust follows the same assessment cycle process. All students will complete an informal key piece assessment every half term (at least) which take a variety of formats to assess golden knowledge learnt over the previous lessons. The key piece assessments are either retrieval-based questions to help students retrieve their prior golden knowledge, scientific literacy questions where students have to practice applying their golden knowledge to exam style questions in different contexts or exam style questions using a variety of command words such as describe, explain and evaluate. Students will then complete a short improvement activity based on gaps identified in the informal key piece and teachers will check these to ensure gaps have closed. In addition to these informal key piece assessments, all students complete a formal assessment at least every term which synoptically assess their retention and application of key golden knowledge learnt in Biology, Chemistry and Physics. Teachers will then use the Science Trust QLA tracker to identify gaps in knowledge; reteach accordingly and then students will complete a range of improvement style activities to close those gaps which are then checked by the teacher either through live marking or collection of books. Further details of the Science SHARE Assessment and Feedback policy can be found here: Q of E			
Resources available	Each school has their own shared area for each year group in each key stage. Lessons are planned to follow the SHARE Science lesson structure guidance document which can be found here: SCIENCE SHARE MAT lesson structure guidance.docx In summary: 1. First 5/Do Now to retrieve prior learning needed for the foundations of new learning. 2. I do/explicit instruction/guided explanation/teacher input through expert curriculum delivery. 3. We do/modelling where appropriate to show students how to remember and apply the key golden knowledge to different contexts. 4. You do/Independent practice to retrieve and practice applying the key golden knowledge to a variety of contexts. 5. Final 5 to retrieve key golden knowledge learnt in the lesson. All schools have these SHARE Science curriculum plans, delivery plans which sit underneath these to guide staff on when to deliver each section of the curriculum and then schemes of learning and lesson resource folders to adapt in order to meet the unique needs of the students and classes they teach. All shared resources which are common across all schools can be found in the SHARE Science folder here:			

	Home (click on the documents tab at the top of the page) All QA including lesson visits, work scrutiny and student voice will prioritise the SHARE Science Q of E Non-Negotiables Checklist which can be found here: SCIENCE SHARE MAT Non negotiables Q of E QA check list.docx All lesson resources are focussed on retrieval (through the Retrieve to Remember strategy) and practice, and this is built into these curriculum plan through effective sequencing of golden knowledge components. There are also KS3 and KS4 Golden Knowledge booklets for staff which outline the key golden knowledge linked to the exam specifications and National Curriculum at KS3 and KS4. These can be found here: Golden Knowledge If staff can't get access to any of the folders above, please request access through joanna.richards@sharemat.co.uk			
Notes Why this topic is important…	Cells is the most crucial topic in Biology and students start learning cells from Key Stage 3. Throughout their 5-year learning journey at Shelley, cells are constantly built upon and revisited through structure and sequencing. Knowledge of cells is built up to Year 13 and beyond.	For students to understand the next topic about photosynthesis, it is important that students understand the structure of a plant cell, plant tissues such as xylem and phloem and then plant diseases and how they can affect plants and their growth. This then leads perfectly into the Bioenergetics topic. Students need a fundamental understanding of how substances move into and out of cells in order to gain a full understanding of respiration and photosynthesis in different contexts.	Principles of organisation builds upon the cells topic clearly and fluently to link knowledge and skills to those previously learnt. Again, this topic is a crucial part of Biology from KS3 to A-Level as it outlines the fundamentals of life on earth. More complex concepts can't be taught without the knowledge of cells and how they are organised in animals and plants.	In order for students to understand how living organisms grow and repair themselves, it is vital for them to understand the cell cycle and cell division. This also provides a fundamental understanding needed to explore the genetics and inheritance unit.