

Subject: Biology Year:10 Ability: All

| Topic | Infection and Response | Bioenergetics | Homeostasis |
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| Topic overview Students will learn... | In this section, students will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Students will then explore what happens once the pathogen is inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. This section will continue to explore what happens once the pathogen is inside the body and how our immune system is triggered through white blood cells and antibodies. Students will also learn about vaccines and how this can lead to herd immunity. | The next section will explore how plants harness the Sun’s energy in photosynthesis in order to make food. This process releases oxygen which has built up over millions of years in the Earth’s atmosphere to enable respiration for all living organisms. Students will then look into how both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. | This section will explore how cells require a constant temperature and pH as well as a constant supply of dissolved food and water. We will explore the structure and function of the nervous system and the hormonal system and how they bring about changes. Students will explore the homeostasis topic by looking at hormones involved in puberty, the menstrual cycle and the components of the endocrine system. Triple students will continue to explore homeostasis and how water is controlled in the body including kidney failure and treatment. |
| What Golden Knowledge will pupils learn and remember? | Linking to KS3, students will define the term pathogen and state the four main groups of pathogen. Use this knowledge to then explain how pathogens can be spread to plants or animals and cause infection. Link this knowledge to then describe the main differences between bacteria and viruses. Explain how the spread of disease can be reduced or prevented and link this to Covid and the pandemic. Students will describe the symptoms, mode of transmission, prevention and treatment for measles, HIV and AIDS, salmonella and gonorrhoea and link this back to Covid and how diseases can be spread. Build upon this knowledge to describe athlete’s foot as a fungal disease. Describe colds and flu as viral diseases and link back to KS3. Describe the life cycle of the malarial protist and then link this to the symptoms, mode of transmission, prevention and treatment for malaria. To build upon communicable diseases learnt in Year 9, describe the body’s first line defences by building on knowledge from KS3 also. Explain how microbes make us feel ill and how viruses damage cells and link this back to the cells topic (prokaryotes). Explain how the immune system defends against disease and link this to cell organisation and the components of the blood. Describe what white blood cells do by building on knowledge from the previous topic. | Building on knowledge of plant disease, students will be able to learn the word and symbol equation for photosynthesis and link these processes to their structure and plant disease. This will enable students to explain why photosynthesis is important for the survival of other organisms. Use experiments such as the pond weed RP to show that plants produce oxygen in the light to link these ideas together. This knowledge will then enable students to state factors that can limit the rate of photosynthesis. Students can use this knowledge to explain how conditions in greenhouses can be controlled to optimise the growth of plants. Link this knowledge to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses. Students need to list ways in which glucose is used by a plant in order to describe functions of fats, oils, cellulose, starch and proteins in a plant. This links to Biology at KS5 as part of the 5 year learning journey. This will then link to how plants obtain nitrate ions and what they are needed for. Students need to state that all animals and plants produce carbon dioxide and water all the time as a by-product of aerobic respiration, building on knowledge from KS3. Students’ knowledge of photosynthesis then enables students to write the word equation for aerobic respiration. Learning the word equation will enable students to define the term ‘aerobic’. Build upon this to describe what organisms need energy for. Linking back to the cells topic, state the site of aerobic respiration and be able to give examples of cells that contain a lot of mitochondria such as small intestine. | Students need to explain what homeostasis is and why it is important in order to describe examples of conditions that need to be controlled. Students’ knowledge of homeostasis will then enable them to describe the roles of the nervous system and the endocrine system. Students will then link this knowledge to explain how the nervous system is adapted for its functions. Once students have learnt the basics of hormonal and nervous systems, they will then build upon this knowledge to explain the role of chemicals at synapses. Students will link the nervous system and how it works to describe and use different methods to measure reaction time. Students will explain the importance of reflex actions and give examples to then describe the differences between voluntary and reflex actions. Students will then build upon this knowledge in order to describe the stages of a reflex action. Triple scientists will identify the cerebral cortex, cerebellum and medulla and describe the function of each in order to describe the techniques used to map areas of the brain to their functions. Students will then use this knowledge to evaluate the benefits and risks of procedures carried out on the brain and nervous system. Triple students will link prior knowledge to label a diagram of the eye and describe the function of each structure. This will then enable them to define the term ‘accommodation’ and describe how the eye changes to focus on near and distant objects. Triple students will use their knowledge of homeostasis to describe different methods to measure body temperature and explain how body temperature is monitored and controlled. Students will link their knowledge of the hormonal system in order to describe the endocrine system and the organs in the endocrine system. Once students have learnt this, they can then compare the actions of the nervous and endocrine systems. This will enable students to then learn how blood glucose concentration is monitored and controlled. This will then help students to explain when insulin is |

Students will explain why antibodies are specific for one pathogen/ antigen and therefore describe what a vaccine contains and how vaccines prevent disease.

This content may continue into Year 10 dependent on curriculum time in each school within the MAT. Explain the idea of 'herd immunity' and link this to what students already know following the Covid 19 pandemic and vaccination.

Year 10 Triple scientists will then learn about monoclonal antibodies and their potential uses which linked to immunity

Students will build upon knowledge of bacterial cells and diseases to explain how antibiotics treat only bacterial diseases and how this has saved lives.

Describe the problems associated with antibiotic resistance and link this to evaluation skills using graphs.

Explain the difficulty in developing drugs that kill viruses without damaging body tissues by building on knowledge of cells from the previous topics and KS3.

Use this prior knowledge to give examples of painkillers and other medicines used to treat symptoms.

Build upon knowledge of antibiotics to describe Fleming's discovery and explain its importance.

Students will state which drugs come from plants and microorganisms and link this back to the cells topic.

Students will build upon knowledge of drugs to explain why drugs need to be tested before they can be prescribed.

This then links to describe the main steps in the development and testing of a new drug and reasons for the different stages in drug testing.

Explain the terms placebo and double-blind trial to develop knowledge further.

Build upon diseases in animals to link this to plants.

Year 10 Triple students can then learn about antibiotic resistance and aseptic techniques through practical which links clearly to drugs and their development.

Students will describe the symptoms and effects of Tobacco mosaic virus and its effects. Students will then be able to describe the symptoms and effects of Rose black spot fungal infection which then leads to explain how aphids affect plant growth. All building upon knowledge over time in a logical sequence.

Year 10 triple Students will describe visual indications of plant disease and methods that gardeners and scientists can use to identify the disease-causing pathogen.

This knowledge can then be linked to define the term 'anaerobic'. This will enable students to explain why anaerobic respiration is less efficient than aerobic respiration.

Students will link this to the word equation for anaerobic respiration in animal cells and then develop this further to write the word and symbol equation for anaerobic respiration in yeast cells and ensure students know that this is called fermentation.

Use the word fermentation to explain why yeast is used to make bread and alcoholic drinks.

Link the concept of respiration to describe and explain the changes that occur in the body during exercise including the effects of long periods of vigorous exercise on the body.

This will enable students to define the term 'oxygen debt'.

Link this knowledge to explain what happens to lactic acid once exercise stops.

Build upon this knowledge to define the term 'metabolism' and give some examples including;

Naming some chemicals formed from glucose molecules and describing lipid formation from a molecule of glycerol and three molecules of fatty acids.

This will enable students to apply their knowledge to other molecules such as the use of glucose and nitrate ions to form amino acids, which form proteins.

This then links to the formation of urea which leads into KS5 structure and function of the kidney.

produced and how it helps to control blood glucose levels and describe that glycogen as a stored carbohydrate.

Students will then be able to explain when glucagon is produced by the pancreas and its effect on blood glucose levels. This will enable them to explain how insulin and glucagon work together to control blood glucose levels. Explain the cause, effects, treatment and problems associated with Type 1 and 2 diabetes.

Students will now learn about the secondary sexual characteristics of boys and girls and use this knowledge in order to explain the cause of these changes in boys and girls and their relevance in reproduction.

Students will use their knowledge of hormones in order to describe the menstrual cycle and fertility. Building on this knowledge, students will then learn that oestrogen is secreted by the ovaries and that It inhibits production of FSH and stimulates release of LH. This will then link their knowledge to describe that progesterone is secreted by the empty follicle in the ovary after ovulation and how it inhibits FSH and LH production and maintains the lining of the uterus during the second half of the cycle.

Students will then use their knowledge on the menstrual cycle to explain the interaction between these hormones which will help students to describe hormonal and non-hormonal methods of contraception.

This knowledge will then help students understand the use of fertility drugs in women with low FSH levels. Students will then describe where and when adrenaline is released and its target organs and the effects of adrenaline on the body.

Students will apply this knowledge to different hormones such as where thyroxine is produced and its effects on the body and how its release is stimulated by thyroid stimulating hormone and the levels of these two hormones are controlled by a negative feedback system.

Triple students will build upon this knowledge further to describe how plant shoots and roots respond to light and gravity and explain the role of auxin in plant responses in terms of unequal distribution in shoots and roots. This then links to the functions of gibberellins and ethene in plants.

Students will then be able to describe how auxins are used as weed killers and rooting powders, and to promote growth in tissue culture.

Students will then link this knowledge to the use of ethene to control the ripening of fruit during storage and transport. This then will help students describe the use of gibberellins to end seed dormancy, promote flowering and to increase fruit size.

Triple students will use their homeostasis knowledge to describe where water, ions and urea are lost from the body which will help them to explain why there is no control over water, ion and urea loss by the lungs and skin. Students will then link this to how the body responds to different temperature and osmotic challenges in terms of sweat and urine release. This will enable students to describe how amino acids are de-aminated in the liver to form ammonia, which is converted to urea for excretion.

This then links to the site of production and target organs for ADH and the effects of ADH on kidney tubules including how ADH controls the concentration of the blood using a negative feedback mechanism. This knowledge will then enable students to describe the advantages and disadvantages of a kidney transplant,

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| | | | why dialysis fluid contains sugar and ions at the same concentration as normal blood, but no urea. |
| What prior knowledge should pupils already know? | Students will have already learnt how the body defends against pathogens and how certain factors can then lead to disease. Students will also have a greater knowledge of disease transmission and prevention following covid. (although, teachers should be aware of misconceptions leading from covid) | Students will already know about mitochondria, the structure of plant and animal cells, the structure of plant tissue and photosynthesis. Students will already know about respiration and photosynthesis and the importance of controlling these processes which links to homeostasis in animals and plants. Students will have learnt about plant diseases and defences and this links sequentially to the photosynthesis element of the bioenergetics topic. Students will have learnt about photosynthesis and Respiration in Year 8 so this is building upon prior knowledge and skills. Students will have also learnt the structure of a plant, how translocation and transpiration occur and how this links to respiration and photosynthesis. | Students will already know about the structure of nerve cells and how they are adapted to their function. Students will have an understanding of the blood and the fact that plasma carries hormones to target organs. Students will have a basic understanding of puberty and reproduction from KS2 and Year 7. This also links to PSHE where students will learn about development and reproductive processes. Students will have an understanding of the importance of glucose and what glucose is needed for. |
| What skills will pupils learn and apply? (disciplinary knowledge) | Evaluation skills using graphs. Data analysis questions. Aseptic techniques for Year 10 Triple Scientists. Interpret data about painkillers and other medicines. This can be transferred to any interpreting graph/data question across all 3 Sciences and across other subjects. | Investigate the need for light, carbon dioxide and chlorophyll to make glucose by changing independent variables which can then be transferred to KS5 and other Sciences. Test to see if a leaf contains starch using practical equipment safely which can then be transferred to all Science practicals undertaken at KS4 and KS5. Interpret results and relate to photosynthesis equation and link this to balancing equations in Chemistry. Interpret data showing how factors affect the rate of photosynthesis. This data interpretation can then applied to Biology, Chemistry and KS5 questions linked to photosynthesis and respiration. Carry out an investigation, collect, present and analyse the results using scientific skills to help prepare students for lab skills carried out at KS5 and in Chemistry and Physics. Calculate the rate using numerical information or graphs which can then be transferred to calculating rates in other Sciences and later in KS5 e.g. the rate of an enzyme controlled reaction in KS5. Interpret graphs to decide which factor is limiting the rate which will enable students to develop this skill further at KS5 in the topic about respiration and photosynthesis (Energy Transfers) Evaluate the benefits of artificially manipulating the environment in which plants are grown to develop students' evaluation skills across all subjects. Interpret data from yeast investigation and use this interpretation skill to analyse data across all Science subjects leading into KS5.. Design and carry out an investigation about the effects of exercise on the body and make cross curricular links with PE. Present and interpret data about heart rate, breathing rate and breath volume and again link this to PE. Interpret data relating to the effects of exercise on the body, eg spirometer tracings and this skill is then transferred to Biology in KS5. | Make a plan to investigate a factor on human reaction time and then use this to carry out an investigation to measure reaction time Interpret glucose tolerance test results which helps students to evaluate modern methods of treating diabetes. Compare the causes, and treatments of Type 1 and Type 2 diabetes Evaluate the use of different contraceptive methods. Students can then use a model, eg a flow diagram to explain the process of In Vitro Fertilisation (IVF). This will help students to evaluate the use of fertility treatments. Triple students will then use their planning skills to plan and carry out an investigation into the effect of light on plant shoots. Observe, present and analyse the results in a later lesson. Students can then build upon these skills to interpret results of plant hormone experiments using secondary sources. Triple students will use evaluation skills to discuss the use of kidney transplants and dialysis to treat kidney failure |
| Key vocabulary student will know and learn | Communicable disease Virus Bacteria Fungi Protist Vector | Photosynthesis Endothermic Chlorophyll Chloroplast Glucose Respiration | Homeostasis Endocrine Reflex Neurone Hormone Glands |

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| | Transmission Hybridoma | Exothermic | Glucagon Glycogen Diabetes |
| 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 | <p>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</p> <p>In summary:</p> <ol style="list-style-type: none"> 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. <p>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)</p> <p>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</p> <p>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.</p> <p>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</p> <p>If staff can't get access to any of the folders above, please request access through joanna.richards@sharemat.co.uk</p> | | |
| Notes Why this topic is important... | <p>Infection and Response builds on the cells and cell organisation topic to further deepen understanding about cells, tissues and organs. It clearly links how cells can be used to defend against disease, how plants are used in medicine and how antibiotics treat animals. It shows how these 3 concepts are clearly linked together and builds on previous knowledge learnt during KS3. This then continues throughout KS4 and into KS5. Without learning cells, students can't understand cell organisation and then can't use this knowledge to understand disease.</p> | <p>This topic brings us to the end of paper 1. Students need a basic knowledge of topic 1 in order to access the knowledge and skills covered in paper 2. In order to develop students' knowledge of respiration, students need to learn about photosynthesis in plants which provides a clear link to the process of respiration. Respiration is the core process to enable the survival of living organisms and therefore it is a crucial part of the curriculum. Students cover the basic reactants and products of both processes at KS3 and this is developed both at KS4 and KS5. Now that students have got the core fundamentals of biology such as cells, respiration, photosynthesis and defending against disease, students can then move forward into the Homeostasis topic to look further into body systems and how body systems are controlled. Students can't access topics such as Homeostasis without having an understand of specialised cells for example.</p> | <p>This topic starts paper 2 and is one of the most challenging topics with a lot of new concepts. This topic links together how living organisms control their internal environment so draws together everything learnt in cells, organisation, infection and response and photosynthesis and respiration. Students must understand the basics of homeostasis before they can move on to the second part of homeostasis and understanding the roles of specific hormones and their uses. The second part of this topic is important so students understand sexual development, contraception and fertility. Triple students can't move on to controlling water levels until they understand the process of negative feedback and how hormones work together to rest the imbalance of certain conditions. Much of the triple additional content for paper 2 falls into the Homeostasis topic as it covers so many fundamental core processes needed in the human body.</p> |