Science Faculty Rationale

Our vision is to support young people to become independent and enthusiastic scientists.
We aim to instil our students to be confident, resilient, problem solvers who are scientifically literate and numerate.

National Curriculum Aims

The national curriculum for biology aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding through the specific discipline of biology.
- develop understanding of the nature, processes and methods of biology through different types of biological enquiries that help them to answer scientific questions about the world around them
- are equipped with the biological knowledge required to understand the uses and implications of biology, today and for the future.

Biology Triple SoL Rationale

Topic	Required practical skills	Rationale
1. Culturing microorganisms **Y9** **Autumn term 1**	**RP2 Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition.** Record length and area. Measure and observe bacterial growth. Safe and ethical use of bacteria. Hypotheses, planning, accuracy, risk assessment, calculate cross sectional area πr^2	Culturing microorganisms is to be taught at the same time as the combined science classes are learning about bacterial cell structure. This complements the teaching of prokaryotes. Bacteria have been introduced at KS3 as part of the importance of bacteria in digestion and as part of the immune system. Antibiotics are not studied until later in the combined course as part of topic 3, infection and response, but the concept that antibiotics kill bacterial pathogens is simple enough to grasp at this point in the course. Links to antibiotic resistance bacteria. Population growth curves are important to understand for the population topics at KS5.
2. Biological maths **Y9** **Autumn term 2**	Magnification Percentage change Area, volume, SA:V Standard form Pie chart calculations Calculating rates	Since the mathematical content has increased to 15% of every exam paper we believe that students benefit from studying biological maths skills as a separate topic. It also gives time for more of the content of combined science topics to have been covered so the triple lessons can build on from combined science teaching.
3. Decay **Y9** **Spring term 1 & 2**	**RP10 Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH changes.** Safe use of microorganisms. Measure **anaerobic** decay. Measure rate of decay by pH change. Evaluate method and identify possible improvements. Graphs. Calculate **rate change**.	Whilst decay is covered towards the end of the specification in the Ecology topic it builds on the knowledge acquired from bacterial growth since microorganisms cause decay. Students are expected to explain the factors that affect the rate of decay. Calculating rates in the biological maths topic can be practised here. Optimising conditions of aerobic decay to make compost is studied and then extended into anaerobic decay and biogas generators. Decay then links to the carbon cycle and food chains in the Ecology topic as they help to recycle nutrients back into the soil and respire to release carbon dioxide back into the atmosphere. Linked to nutrient cycles in KS5.
4. Biomass, food & Biotechnology **Y9** **Summer term 1 & 2**	Constructing pyramids of biomass from appropriate data. Calculate the efficiency of biomass transfer between trophic levels. Interpret population and food production statistics to evaluate food security. Evaluate the advantages and disadvantages of modern farming techniques.	Biomass, food and biotechnology are part of the ecology topic along with decay. Trophic levels in an ecosystem builds on simple food chains from KS2 (repeated at KS3 as a simple concept and also covered in KS4 in combined science in the final topic of study). Decomposers recapped here from decay. Pyramids of biomass are introduced, which builds on from food chains. Food chains developed to explain the energy transfer between each trophic level and losses in energy explained. Food security, farming techniques and sustainable fisheries can be taught as stand-alone topics, which do not rely on prior knowledge from the KS4 combined science specification. Role of biotechnology completes the food production topic which is why it is taught here. It links to genetic engineering which is taught later on in the course. However, the extra detail needed for the triple students the means that it must be taught to include the extra detail initially to avoid confusion. The simple method

		taught in combined science can act as revision of the basic points later on in the course. Genetic engineering is a key concept which is developed at KS5 during recombinant DNA technology.
5. Monoclonal antibodies and plant disease **Y10** **Autumn term 1**	Appreciate the power of monoclonal antibodies and consider any ethical issues. Evaluate the advantages and disadvantages of monoclonal antibodies.	This is to be taught alongside or slightly after Infection and response at the start of Y10. There is a planned antibodies lesson at the start of this topic to recap antibodies structure and function before moving on to monoclonal antibodies. Plant disease is also covered to complete the teaching of infectious diseases.
6. The brain **Y10** **Autumn term 2**	Evaluate the benefits and risks of procedures carried out in the brain.	The brain can be taught as a stand-alone topic. It is being taught alongside the nervous system in combined science.
7. The eye **Y10** **Autumn term 2**		The eye can be taught as a stand-alone topic. The foundation of knowledge on stimuli and senses from KS3 enables this. It is being taught alongside the nervous system in combined science.
8. Homeostasis **Y10** **Spring term 1 & 2**	Evaluate the advantages and disadvantages of treating organ failure by mechanical device or transplant.	The control of body temperature and maintaining water and nitrogen balance in the body are being taught here to be close to the teaching of homeostasis in the combined specification. It can be taught without being taught the combined specification if the teaching isn't perfectly aligned.
9. Plant hormones **Y10** **Summer term 1 & 2**	**RP8 Investigate the effect of light or gravity on the growth of newly germinated seeds.** Planning Record length and time Observations of biological specimens to produce labelled scientific drawings. Suggest improvements and further investigations.	In the plant hormones topic there is a wonderful opportunity and plenty of time to plan the final required practical. This is intended to be taught alongside hormones in the combined specification however, It can be taught without the combined specification element if the teaching isn't perfectly aligned. The concept of plants needing light for photosynthesis is required which is taught in photosynthesis in topic 4 Bioenergetics. Links to biodiversity due to how the everyday use of hormones as weedkillers can affect biodiversity.
10. DNA & protein synthesis **Y11** **Autumn term 1**	Interpret a diagram of DNA structure but will not be required to reproduce it. Modelling insertions and deletions in chromosomes to illustrate mutations.	DNA structure is taught in a lot more detail in this topic and complements the teaching of the topic inheritance, variation and evolution that is to be taught at the beginning of Y11. Protein synthesis links to KS5.
11. Reproduction **Y11** **Autumn term 2**	Historical developments of our understanding of the causes and prevention of malaria.	Reproduction is taught after DNA and protein synthesis to align with the combined syllabus teaching of reproduction as this topic on the triple specification relies on the knowledge of sexual and asexual reproduction to discuss the advantages and disadvantages of each methods. Asexual reproduction links back to mitotic cell division. Some organisms can reproduce by both methods.
12. Cloning **Y11** **Spring term 1**	Explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections.	There are links with advantages and disadvantages of sexual and asexual reproduction and selective breeding which is why this topic is the penultimate topic in the SOL. Cloning also relies on the knowledge of tissues from the organisation topic, cell division in cell biology and DNA and reproduction.
13. Theory of evolution **Y11** **Spring term 2**	Students should appreciate that the theory of evolution by natural selection developed over time and from information gathered by many scientists.	The development of understanding genetics and evolution is the concept for the final topic. In this topic the idea of how life began and evolved to what it is today brings together all the living organisms in the world. Biology is the study of life. Our understanding of evolution has changed over time with new scientific discoveries such as the discovery of DNA supporting past evidence to form theories today.