OCR Biology A A-Level 2 year Long Term Plan

Assessment Objectives

AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures

AO2: Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:

a. in a theoretical context
b. in a practical context
c. when handling qualitative data
d. when handling quantitative data

AO3: Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to:

a. make judgements and reach conclusions
b. develop and refine practical design and procedures

Year 12 - Scientific skills

1. Working scientifically: skills identified and developed through teaching and learning

i. independent thinking
ii. use of scientific methods and practices
iii. numeracy in a practical context
iv. instruments and equipment
v. research and referencing

2. **Practical techniques to be developed through the delivery of core practicals (CPAC skills additionally assessed)**

i. use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)
ii. use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer
iii. use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions
iv. use of light microscope at high power and low power, including use of a graticule
v. produce scientific drawing from observation with annotations
vi. use qualitative reagents to identify biological molecules
vii. separate biological compounds using thin layer/paper chromatography or electrophoresis
viii. safely and ethically use organisms to measure: - plant or animal responses - physiological functions
ix. use microbiological aseptic techniques, including the use of agar plates and broth
x. safely use instruments for dissection of an animal organ, or plant organ
xi. use sampling techniques in fieldwork
xii. use ICT such as computer modelling, or data logger to collect data, or use software to process data.

3. Mathematical skills identified and developed through teaching and learning

i. arithmetic and numerical computation - Recognise and make use of appropriate units, expressions in decimal and standard form, ratios, fractions and percentages and estimations.
ii. handling data - Use an appropriate number of significant figures, find arithmetic means, construct and interpret frequency tables, diagrams, bar charts

and histograms. Understand; simple probability, sampling as applied to scientific data, the terms mean, median and mode. Use a scatter diagram. Make order of magnitude calculations. Select and use a statistical test. Understand measures of dispersion, including standard deviation and range. Identify uncertainties.

iii. algebra - Understand and use the symbols =, <, <<, >>, >, ∝, ~. Change the subject of an equation, substitute numerical values into algebraic equations, solve algebraic equations.

iv. graphs - Translate information between graphical, numerical and algebraic forms. Plot two variables from experimental or other data. Understand that y = mx + c represents a linear relationship. Calculate rate of change from a graph showing a linear relationship. Draw and use the slope of a tangent to a curve as a measure of rate of change

v. geometry and trigonometry - Calculate the circumferences, surface areas and volumes of regular shapes.

4. <u>Transferable learning skills (developed throughout)</u>

i. structure independent study time between lessons to complete teacher set consolidation tasks and pre reading to deadline.

ii. build the habit of returning to prior learning to consolidate, deepen the understanding and reapplying it in familiar contexts.

iii. to establish note taking and retrieval revision habits outside of the classroom.

iv. self mark work, in green pen, adding modelled solutions where needed both in class and independently using mark schemes.

v. use teacher provided feedback to identify gaps in knowledge and target those areas in private study.

<u>Year 13 - Scientific skills</u>

1. <u>Working scientifically: skills identified and developed through teaching and learning</u>

i. independent thinking

ii. use and application of scientific methods and practices

iii. numeracy and the application of mathematical concepts in a practical context

iv. instruments and equipment

v. research and referencing

2. **<u>Practical techniques to be developed through the delivery of core practicals</u>**

i. use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)

ii. use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer

iii. use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions

iv. use of light microscope at high power and low power, including use of a graticule

v. produce scientific drawing from observation with annotations

vi. use qualitative reagents to identify biological molecules

vii. separate biological compounds using thin layer/paper chromatography or electrophoresis

viii. safely and ethically use organisms to measure: - plant or animal responses - physiological functions

ix. use microbiological aseptic techniques, including the use of agar plates and broth

x. safely use instruments for dissection of an animal organ, or plant organ

xi. use sampling techniques in fieldwork

xii. use ICT such as computer modelling, or data logger to collect data, or use software to process data.

3. <u>Mathematical skills identified and developed through teaching and learning</u>

i. arithmetic and numerical computation - Recognise and make use of appropriate units, expressions in decimal and standard form, ratios, fractions and percentages and estimations. Use calculators to find and use power, exponential and logarithmic functions.
ii. handling data - Use an appropriate number of significant figures, find arithmetic means, construct and interpret frequency tables, diagrams, bar charts and histograms. Understand; simple probability, sampling as applied to scientific data, the terms mean, median and mode. Use a scatter diagram. Make order of magnitude calculations. Select and use a statistical test. Understand measures of dispersion, including standard deviation and range. Identify uncertainties.
iii. algebra - Understand and use the symbols =, <, <<, >>, >, ∝, ~. Change the subject of an equation, substitute numerical values into algebraic equations, solve algebraic equations. Use logarithms in relation to quantities that range over several orders of magnitude.
iv. graphs - Translate information between graphical, numerical and algebraic forms. Plot two variables from experimental or other data. Understand that y = mx + c represents a linear relationship. Calculate rate of change from a graph showing a linear relationship. Draw and use the slope of a tangent to a curve as a measure of rate of change. Determine the intercept of a graph.
v. geometry and trigonometry - Calculate the circumferences, surface areas and volumes of regular shapes.

4. Transferable learning skills (developed throughout)

i. structure independent study time between lessons to complete teacher set and personalised consolidation tasks as well as pre reading to deadline.
ii. refine the habit of returning to prior learning to consolidate, deepen the understanding and reapplying it in complex and less familiar contexts.
iii. to further develop note taking and retrieval revision habits outside of the classroom. Developing the ability to apply appropriate spacing techniques to maximise the benefit from revision time.
iv. self mark work, in green pen, adding modelled solutions where needed both in class and independently using mark schemes.
v. develop as a self aware learner, able to identify gaps in knowledge and target those areas in private study.

Rationale for the sequencing of content and skills across the course

At Lipson we follow the OCR Biology A course. The course is content-led, allowing for an inclusive approach to developing the knowledge, skills and understanding required to be successful at this level and aids students who progress to undergraduate level, regardless of their choice of subject. The Biology course has been carefully sequenced to allow a natural transition from GCSE to A level, particularly focussing on linking together different areas of the topic and is designed to enable two teachers to teach different topics simultaneously. This aids memory retention and understanding through spacing out knowledge acquisition, retrieval and memory retention.

In Year 12, both teachers start with topics that are fundamental to understanding biological concepts; cells and the chemistry of life. These are sensible starting points as they reflect and develop on previous knowledge from GCSE whilst also developing a strong basis on which to build future learning. They also provide opportunities to develop both practical and mathematical skills with the first two core practicals covered both being variations on GCSE required practicals, allowing for retrieval and transfer of practical skills from the previous year. This easing into the A level course provides students with the confidence and knowledge required to be successful in future topics.

Throughout the rest of year 12 the sequence is well structured and coherent to help students manage with the increased knowledge demand of the topics. For example, understanding the biochemistry involved with respiration and photosynthesis, requires a good understanding of biological molecules and transport across membranes.

Most of the core practicals are taught in Year 12 as they help to develop a skill set that is beneficial in Year 13. Problem-solving and organisation skills are essential for success as the level of demand increases later in the course. Chapters 10 and 11 are taught in Year 12, as the two are very closely linked - both focus on ecology. Teaching the two in Year 12 allows students to complete the ecology core practicals in the summer months of Year 12, a necessary prerequisite for biological sampling techniques that are better learnt outside.

Ultimately, the course is designed to enthuse students and develop not just a passion for biology but young adults with the ability to succeed at undergraduate level. Transferable skills are equally as important as academic understanding and students develop their cognitive, interpersonal and intrapersonal skills throughout the course, enabling them to meet the demands of further and higher education. The coherent mapping of content alongside disciplinary skills helps to develop young scientists equipped with a comprehensive set of skills to ensure future success, particularly in the biological sciences.

A Level Y12 LTP

Teacher 1: Three hours per week

Term 1 **Module 2 Foundations in biology** **Chapters 2, 5, 6**	**Term 2** **Module 3 Exchange and transport** **Chapter 9**	**Term 3** **Module 4 Biodiversity, evolution and disease** **Chapters 10 and 11**
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. 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	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. Content: ● vascular tissue ● transpiration ● plant adaptations	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. Content:

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. <u>Content:</u> ● Microscopy ● Cell ultrastructure ● Plasma membrane structure and function ● Transport across membranes ● The cell cycle ● Meiosis ● Stem cell applications		● classification ● phylogeny ● evolution ● adaptations ● biodiversity ● sampling ● statistical analysis ● conservation
Skills covered: **1i-v,** **2i-2vi, 2viii, 2xii** **3i-3iii**	**Skills covered:** **1i-v,** **2i-2v, 2viii, 2x** **3i-v**	**Skills covered:** **1i-v,** **2i-2iii, 2vii, 2viii, 2xii** **3iv**

Teacher 2: Two hours per week

Term 1 **Module 2 Foundations in Biology** **Chapters 3 and 4**	**Term 2** **Module 3 Exchange and transport** **Chapters 7 and 8**	**Term 3** **Module 4 biodiversity, evolution and disease** **Chapter 12**
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. Metabolism in living organisms relies upon enzyme	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.	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. <u>Content:</u>

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. <u>Content:</u> • water • carbohydrates • lipids • proteins • nucleic acids • DNA • enzyme action • inhibitors • cofactors	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. <u>Content:</u> • exchange surfaces • ventilation • spirometry • transport systems • blood vessels • the heart	• pathogens • diseases • transmission • non-specific defence • specific immunity • prevention and treatment
Skills covered: **1i-v,** **2i-2vi, 2viii, 2x, 3i-iv**	**Skills covered:** **1i-v,** **3ii**	**Skills covered:** **1i-v,** **2i, 2v, 2viii, 2xi, 2xii, 3i-3ii**

A Level Y13 LTP

Teacher 1: Three hours per week

Term 1 **Module 5 communication, homeostasis and energy** **Chapters 13-14-15** Organisms use both chemical and electrical systems to monitor and respond to any deviation from the body's steady state. 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. Type 1 diabetes is used	**Term 2** **Module 5 communication, homeostasis and energy** **Chapters 16, 17, 18** 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.	**Term 3** **Revision, review and exam preparation** This term will be dedicated to revision for all modules in preparation for the final examination period. Each teacher will set specific revision tasks based on the topics they have taught throughout the course. Revision will be in a variety of forms including: • Revisiting maths skills throughout the topic content • Key words and a focus on use of correct spelling and vocabulary

as an example to demonstrate how medical technology is used to regulate the hormonal control systems. <u>Content:</u> ● coordination ● neurones ● action potentials ● the brain ● reflexes ● hormones ● blood glucose control ● heart rate ● homeostasis ● thermoregulation ● kidney function	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. <u>Content:</u> ● plant hormones ● tropisms ● ATP ● photosynthesis ● aerobic respiration ● anaerobic respiration	● Exam skills analysis to pinpoint areas of weakness in question interpretation and technique ● Personal identification of specific topic areas in need of further review ● Practice exam papers and peer marking to familiarise with mark schemes ● Formal practice papers in exam conditions to prepare for the time constraints and question planning
Skills covered: **1i-v,** **2i, 2iii, 2viii, 2ix** **3i-iv**	**Skills covered:** **1i-v,** **2i, 2iii, 2vi, 2viii, 2ix** **3i-ii, 3iv**	

Teacher 2: Two hours per week

<u>Term 1</u> **<u>Module 6, genetics evolution and ecosystems</u>** **<u>Chapters 19, 20, 21</u>** Some of the practical techniques used to manipulate DNA such as sequencing and amplification are considered and their therapeutic medical use. The use of microorganisms in biotechnology is also covered. Both of these have associated ethical considerations and it is important that learners	**<u>Term 2</u>** **<u>Module 6, genetics evolution and ecosystems</u>** **<u>Chapters 22,23,24</u>** 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.	**<u>Term 3</u>** **<u>Revision, review and exam preparation</u>** This term will be dedicated to revision for all modules in preparation for the final examination period. Each teacher will set specific revision tasks based on the topics they have taught throughout the course. Revision will be in a variety of forms including: ● Revisiting maths skills throughout the topic

develop a balanced understanding of such issues. 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. <u>Content:</u> ● mutations ● control of gene expression ● variation and inheritance ● evolution ● speciation ● DNA profiling ● DNA sequencing ● genetic engineering	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. <u>Content:</u> ● cloning ● microorganisms and biotechnology ● culturing microorganisms ● ecosystems ● succession ● measuring distribution ● populations ● competition ● ecosystem management.	content ● Key words and a focus on use of correct spelling and vocabulary ● Exam skills analysis to pinpoint areas of weakness in question interpretation and technique ● Personal identification of specific topic areas in need of further review ● Practice exam papers and peer marking to familiarise with mark schemes ● Formal practice papers in exam conditions to prepare for the time constraints and question planning
Skills covered: **1i-v,** **3i**	**Skills covered:** **1i-v,** **3i-ii**	