

| BIOLOGY LEARNING PATHWAY                              |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
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| SUBSTANSIVE KNOWLEDGE: 3 BIOLOGICAL CONCEPTS          | Year 7                                                                                                                                                                                                                                                                                                       | Year 8                                                                                                                                                                                                      | Year 9 Autumn                                                                                                                                                                                                                                                            | Y9 Spring                                                                                                                                                                                             | Y9 Summer                                                                                                                                                                                              | Year 10 Autumn                                                                                                                                                                                                                 | Year 10 Spring                                                                                                                                                                                                                 | Year 10 Summer                                                                                                                                                                                                                 | Year 11 Autumn                                                                                       | Year 11 Spring                                                                                                                                                                                                                 | Year 12 Autumn                                                                                                                                                                                                                                                                                                                                                                  | Year 12 Spring                                                                                                                                                                                                                                                                                                                                                                                                                                 | Year 12 Summer                                                                                                 | Year 13 Autumn                                                                                                                                                                                                                                                                | Year 13 Spring                                                                                                                                          |
| Assessments                                           | End of Each Topic and School Exam in Summer term                                                                                                                                                                                                                                                             | End of Each Topic and School Exam in Summer term                                                                                                                                                            | Autumn 2                                                                                                                                                                                                                                                                 | February                                                                                                                                                                                              | School Exam                                                                                                                                                                                            | Autumn 1, Autumn 2                                                                                                                                                                                                             | February                                                                                                                                                                                                                       | School Exam: Paper 1                                                                                                                                                                                                           | Autumn 1, Mock Exam Paper 1                                                                          | Spring 1, Practice Mock Paper 2                                                                                                                                                                                                | 3 module tests, November formal assessment                                                                                                                                                                                                                                                                                                                                      | Module tests                                                                                                                                                                                                                                                                                                                                                                                                                                   | School Exam - AS Paper 1 and AS Paper 2                                                                        | Module tests, November Formal Assessment                                                                                                                                                                                                                                      | Module Tests, Practice Mock Papers                                                                                                                      |
| Cells and cellular processes                          | B1.1 Cell structure                                                                                                                                                                                                                                                                                          | B2.1 Health and lifestyle                                                                                                                                                                                   | T1: Eukaryotic and prokaryotic cells                                                                                                                                                                                                                                     | T2: Cell division and growth                                                                                                                                                                          | T3: DNA and genes                                                                                                                                                                                      | T3: Protein synthesis (B)                                                                                                                                                                                                      | T6: Photosynthesis                                                                                                                                                                                                             |                                                                                                                                                                                                                                | T8: Cellular respiration                                                                             | T7: Thyroxine, the kidney (B)                                                                                                                                                                                                  | 2.1.1 Cell structure                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                | 6.1.1 Cellular control                                                                                                                                                                                                                                                        |                                                                                                                                                         |
|                                                       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             | T1: Transporting substances                                                                                                                                                                                                                                              |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                | 2.1.3 Nucleotides and nucleic acids                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                | 5.2.1 Photosynthesis                                                                                                                                                                                                                                                          | 5.2.2 Respiration                                                                                                                                       |
|                                                       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                | 2.1.5 Biological membranes                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
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| Biological systems for life                           | B1.2 Body systems                                                                                                                                                                                                                                                                                            | B2.3 Adaptations and inheritance                                                                                                                                                                            | T1: Digestion and enzymes                                                                                                                                                                                                                                                | T2: Nervous system                                                                                                                                                                                    | T2: The Brain and eye (Sep Sci biology students only)                                                                                                                                                  | T5: Health and disease (non-communicable)                                                                                                                                                                                      | T5: Health and disease (communicable)                                                                                                                                                                                          | T9: Ecosystems                                                                                                                                                                                                                 | T8: Transport and exchange                                                                           | T7: Hormones and homeostasis                                                                                                                                                                                                   | 2.1.2 Biological molecules                                                                                                                                                                                                                                                                                                                                                      | 3.1.1 Exchange surfaces                                                                                                                                                                                                                                                                                                                                                                                                                        | 5.1.1 Communication and homeostasis                                                                            | 5.1.2 Excretion as an example of homeostatic control                                                                                                                                                                                                                          |                                                                                                                                                         |
|                                                       | B1.3 Reproduction                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       | T1: Calorimetry and food tests (Sep Sci biology students only)                                                                                                                                         |                                                                                                                                                                                                                                | T5: Virus lifecycle, plant diseases, monoclonal antibodies, plant diseases (B)                                                                                                                                                 |                                                                                                                                                                                                                                |                                                                                                      | T7: Thyroxine, kidneys (B)                                                                                                                                                                                                     | 2.1.4 Enzymes                                                                                                                                                                                                                                                                                                                                                                   | 3.1.2 Transport in animals                                                                                                                                                                                                                                                                                                                                                                                                                     | 5.1.3 Neuronal communication                                                                                   | 5.1.4 Hormonal communication                                                                                                                                                                                                                                                  |                                                                                                                                                         |
|                                                       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                 | 3.1.3 Transport in plants                                                                                                                                                                                                                                                                                                                                                                                                                      | 5.1.5 Animal responses                                                                                         |                                                                                                                                                                                                                                                                               | 5.1.5 Plant responses                                                                                                                                   |
|                                                       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                | 4.1.1 Communicable diseases, disease prevention and the immune system                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
| Organisms and their interactions with the environment |                                                                                                                                                                                                                                                                                                              | B2.2 Ecosystem processes                                                                                                                                                                                    |                                                                                                                                                                                                                                                                          | T2: Nervous system                                                                                                                                                                                    | T3: Inheritance and variation                                                                                                                                                                          | T4: Natural selection and genetic modification                                                                                                                                                                                 |                                                                                                                                                                                                                                | T9: Ecosystems                                                                                                                                                                                                                 |                                                                                                      |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                 | 4.2.1 Biodiversity                                                                                                                                                                                                                                                                                                                                                                                                                             | 6.3.1 Ecosystems                                                                                               | 6.1.2 Patterns of inheritance                                                                                                                                                                                                                                                 | 6.2.1 Cloning and biotechnology                                                                                                                         |
|                                                       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                | T9: Energy transfer, pollution decomposition (B)                                                                                                                                                                               |                                                                                                      |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                 | 4.2.1 Classification and evolution                                                                                                                                                                                                                                                                                                                                                                                                             | 6.3.2 Populations and sustainability                                                                           | 6.1.3 Manipulating genomes                                                                                                                                                                                                                                                    |                                                                                                                                                         |
| Chemistry linked to bio                               | Combustion, acids, word equations, symbol equations, diffusion                                                                                                                                                                                                                                               | Filtration, chromatography, polymers, testing for carbon dioxide, carbon cycle, rock cycle, fossils, endo/exothermic reactions                                                                              | Filtration and chromatography, rates of reaction and diffusion, concentration                                                                                                                                                                                            | Neurotransmitters                                                                                                                                                                                     | H bonds / intermolecular forces, colour changes, combustion quantitative v qualitative data                                                                                                            | Rate of reaction inc catalysts                                                                                                                                                                                                 | Reversible reactions, equilibrium                                                                                                                                                                                              | Fertilisers, eutrophication, carbon and nitrogen cycles, global warming                                                                                                                                                        | Rate of reaction inc catalysts, alcohols, carboxylic acids, polymers, fermentation, SA:V ratio       |                                                                                                                                                                                                                                | Enthalpy, condensation and hydrolysis, bonds, rates of reaction                                                                                                                                                                                                                                                                                                                 | Organic chemistry, rates of reaction                                                                                                                                                                                                                                                                                                                                                                                                           | Neurotransmitters, ions, carbon and nitrogen cycles, fertilisers                                               | Biochemistry, catalysis, chromatography, electrophoresis                                                                                                                                                                                                                      | Biochemistry, catalysis                                                                                                                                 |
| Physics linked to bio                                 | Energy                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                             | Standard form, converting units , mean, range, plotting and interpreting graphs, rearranging formulae, light vs electron wavelengths                                                                                                                                     | Nervous system & electricity, energy transfers                                                                                                                                                        | The eye and light, medical imaging                                                                                                                                                                     |                                                                                                                                                                                                                                | Light wavelengths                                                                                                                                                                                                              | Energy transfer, Sankey diagrams                                                                                                                                                                                               | Energy transfers                                                                                     | Energy transfers                                                                                                                                                                                                               | Pressure (water potential)                                                                                                                                                                                                                                                                                                                                                      | Countercurrent flow and energy transfer, hydrostatic & oncotic pressure                                                                                                                                                                                                                                                                                                                                                                        | Energy transfer, electrical circuits                                                                           | Electromagnetic spectrum, electrical gradients                                                                                                                                                                                                                                | Electrical circuits (plant responses)                                                                                                                   |
| Math skills                                           | Interpret data, graphs, process collected data, drawing graphs/tables                                                                                                                                                                                                                                        | Interpreting data, graphs - bar/line/histogram, mean, range, mode, median, freq tables, units and equations                                                                                                 | Standard form, converting units (microscopy), rearranging formulae (magnification), rates of reaction (enzymes), mean, range, plotting and interpreting graphs                                                                                                           | % change, plotting graphs, interpreting graphs/data, percentile charts                                                                                                                                | Interpret/process data, probability, ratios, %, mean, mode, median, range, frequency tables, histograms, continuous/discontinuous data, energy in food calcs                                           | probability, ratios, %, mean, mode, median, range, frequency tables                                                                                                                                                            | Area of clear zones, inverse square law, potometer calcs, tangents and rates, correlations, rate calcs, % change, means, fractions, %, BMI/waist:hip calcs                                                                     | Means, fractions, %, rate calcs, correlations, SA:V ratio, correlations, interpret graphs, % change, interpreting kite diagrams, energy transfer, Sankey diagrams ,                                                            | SA:V ratio, correlations, interpret graphs, % change, means, fractions, %, standard form, Fick's law | Rate calcs, interpret graphs/charts/tables                                                                                                                                                                                     | AIM calculations, convert units, sig figs, Rf calculations, y = mx + c, calculate percentage error, calculate mean, range, standard deviation, SA and vol of regular cubes/cuboid, determine y intercept of a graph                                                                                                                                                             | Calculate SA and vol of a sphere and cylinder, SA:vol ratio, rate calculations, interpret oxygen dissociation curves, Understand and use the symbols: =, <, =, », >, <, ~, identify correlations in graphs, calculate probability, plot histogram, bar charts and frequency density, draw and use the slope of a tangent to a curve to measure rate of antibody production, compare means, medians and modes, select and use statistical tests | Use logarithms in relation to quantities that range over several orders of magnitude                           | Plot/interpret line graphs to show change in blood glucose over time (2 data sets for diabetic vs non-diabetic), determine the intercept of a graph, e.g. compensation point, Understand the symbol $\propto$ (light intensity $\propto 1/d^2$ ), represent phenotypic ratios | Use calculators to use power, exponential and log functions, , express/interpret logarithmic data, calculate percentage yield, calculate area of circle |
| Practical skills                                      | Prepare onion/cheek cells, diffusion using teabags/potassium permanganate, lung volume, chicken leg demo, forces hinge prac, muscle fatigue prac, flower dissection, mass on time taken for seeds to fall                                                                                                    | Biological molecules food tests, effect of pH on enzyme activity, designing experiments - variables, stomata under microscope, starch leaf test, effects of exercise on breathing/heart rate, reaction time | Prepare onion/cheek cells, Biological molecules food tests, pH and enzyme activity                                                                                                                                                                                       | Osmosis in plant cells, diffusion in model cells, reaction times                                                                                                                                      | Designing experiments, DNA extraction                                                                                                                                                                  | Calorimetry, biological molecules food tests                                                                                                                                                                                   | Aseptic technique, light intensity prac, use of potometer, stomata under microscope, leaf starch test,                                                                                                                         | Systematic and random sampling, quantitative and qualitative soil testing, use of indicator species                                                                                                                            |                                                                                                      | Respiration prac, heart dissection, kidney dissection                                                                                                                                                                          | PAG9 DNA replication, PAG6 Chromatography, PAG5 Colorimetry, PAG4 Enzyme, PAG1 Mitosis, PAG8 Beetroot membrane                                                                                                                                                                                                                                                                  | PAG2 Gas exchange in fish, PAG7 Aseptic technique, PAG3 Species diversity/abundance                                                                                                                                                                                                                                                                                                                                                            | Use logarithms in relation to quantities that range over several orders of magnitude.                          | PAG11 plant/animal responses, PAG1 histology of pancreas/kidney                                                                                                                                                                                                               | PAG12 research - photosynthesis, PAG7 tissue culture, PAG10 yoghurt pH                                                                                  |
| Disciplinary knowledge                                |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             | Interpret biological drawings, recall procedures for preparing wetmount slides/technique, interpret micrographs, safety procedures, identify variables, process data and draw conclusions, assess repeatability/reproducibility, random/systematic errors and food tests | Knowledge of apparatus, procedures and measurements taken, identify variables, assess repeatability/reproducibility, random/systematic errors, accuracy/precision, interpret data to make predictions | Knowledge of apparatus, procedures and measurements taken, identify variables, assess repeatability/reproducibility , random/systematic errors, accuracy/precision, interpret data to make predictions | Knowledge of apparatus, procedures and measurements taken, identify variables, assess repeatability/reproducibility, random/systematic errors, accuracy/precision, interpret data to make predictions, health and safety risks | Knowledge of apparatus, procedures and measurements taken, identify variables, assess repeatability/reproducibility, random/systematic errors, accuracy/precision, interpret data to make predictions, health and safety risks | Knowledge of apparatus, procedures and measurements taken, identify variables, assess repeatability/reproducibility, random/systematic errors, accuracy/precision, interpret data to make predictions, health and safety risks |                                                                                                      | Knowledge of apparatus, procedures and measurements taken, identify variables, assess repeatability/reproducibility, random/systematic errors, accuracy/precision, interpret data to make predictions, health and safety risks | All PAGs focus on students using equipment and chemicals safely, handling equipment with dexterity & utilising independently. Students complete the practical in line when content is taught and complete follow up interpretation results that get them to draw conclusions and complete additional questions that clearly link the disciplinary knowledge to the substantive. |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
| Personal development                                  |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
| British values                                        | British values are covered during practical work individually or with peers, discussing ethical issues regarding science and religion, ethical debates to build democratic skill, laws introduced in the UK that may not be the same in other countries, respect for different cultural views and practises. |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                |                                                                                                      |                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
| CIEAG/careers                                         | 2 lessons on E&D during summer term                                                                                                                                                                                                                                                                          | 2 lessons on E&D during summer term, role of scientists and importance in communication                                                                                                                     | Dietician, Lab technicians                                                                                                                                                                                                                                               | Neurosurgeon, Dietician, Healthcare professionals using percentile charts to monitor growth of children                                                                                               | Botanist                                                                                                                                                                                               | Neurosurgeon, optometry, food scientist                                                                                                                                                                                        | Athletes, botanist, food scientist                                                                                                                                                                                             | Environmental officer, conservationist, park rangers, zoo staff                                                                                                                                                                | Environmental officer, conservationist, park rangers, zoo staff                                      | Healthcare professionals                                                                                                                                                                                                       | Lecturer, healthcare professional                                                                                                                                                                                                                                                                                                                                               | health care professionals, epidemiologist, zoologist                                                                                                                                                                                                                                                                                                                                                                                           | Botanist, conservationist, international and national bodies reviewing conservation, health care professionals | Forensics, botanist, health care professionals                                                                                                                                                                                                                                | food industry, farming, health care professional                                                                                                        |

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| SMSC                   | History of microscope, sickle cell anaemia to RBC function, importance of photosynthetic organisms, function of organs and consequences of defects, human gas exchange system diseases, joint replacements, puberty, IVF, surrogacy, artificial insemination, stages in pregnancy, stages of menstrual cycle | marketing on 'healthy' foods, consequences of imbalanced diet and deficiency diseases, crohns disease, effects of drugs on individuals, family and community, effect of alcohol, drugs, smoking on foetus, consequences of using illegal drugs, deficiency diseases in plants, effects of bioaccumulation, effect of invasive species, predator-prey relationships, inherited vs environmental variation, DNA discovery, natural selection, extinction reasons, | Ethical issues associated with using embryos in stem cell research, coeliac disease and absorption of nutrients, cystic fibrosis and enzymes, ectopic pregnancies, group work during practicals | Smoking alveoli effects of diffusion, multiple sclerosis and Schwann cells, innate reflexes, group work during practicals | E&D Rosalind Franklin, bereavement/miscarriage, genetic disorders                     | Brain related health, medical imaging, reference to down syndrome extra chromosome, extinction of animals, group work during practicals, bereavement/miscarriage | Risk factors for developing NCD, wider effects of NCD on individuals, families and communities. Effects of selective breeding on genetic variation and species - health issues, group work during practicals, ethics of testing on living organisms | Effects of farming on biodiversity, group work during practicals, ethics of testing on living organisms | Effects of farming on biodiversity   | Puberty, Menstrual cycle, IVF          |  | Evolution, genetic disease prevalence in some communities,                                                                                        | Environmentally sensitive ecosystems, endemic species, recycling within ecosystems, succession, genetic diseases | advancement in PCR technology, genetic diseases, hormonal regulation | the use of GMO organisms, ethics of cloning, |
| Extra curricula        | half termly themed clubs                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | British science week, Guest speaker (psychiatry - entry to medicine), science clinic                                                                                                            |                                                                                                                           |                                                                                       |                                                                                                                                                                  |                                                                                                                                                                                                                                                     |                                                                                                         |                                      |                                        |  | UoB lectures, field course, British science week, Guest speaker (psychiatry - entry to medicine) university essay writing entries, Biology clinic |                                                                                                                  |                                                                      |                                              |
| Cultural capital       | Stem cell breakthrough news, different examples of diffusion, exchange surface in fish, Why farmers need bees near fields, impact of Varroa mites may have on our food production, IVF, Relationships and puberty                                                                                            | plumpy nut to treat malnutrition, mass use of DDT insecticide and effect on wildlife, heart rate and exercise, diet and digestion, drug and alcohol use, healthy eating and deficiency diseases, natural selection and conflict with religion                                                                                                                                                                                                                   | Stem cell ethical scenarios students debate for and against, diet and digestion                                                                                                                 | Reflexes and reaction time                                                                                                | genetics discoveries (Mendel, Darwin) and conflict with religious leaders of the time | Genetic engineering for and against, natural selection and conflict with religion, genetics discovery Mendel and conflict with religion                          | Personal hygiene and preventing spread of diseases, healthy lifestyles, genetic engineering for and against, vaccination and MMR controversy                                                                                                        | Farming effects on the environment                                                                      | Farming effects on the environment   | Menstrual cycle and hormones, diabetes |  | Personal hygiene and preventing spread of diseases, vaccinations and MMR controversy, field work                                                  |                                                                                                                  | epigenetics                                                          | Genetic engineering, epigenetics, cloning    |
| Equality and Diversity | 2 lessons on E&D during summer term                                                                                                                                                                                                                                                                          | Rosalind Franklin scientific discovery, 2 lessons on E&D during summer term                                                                                                                                                                                                                                                                                                                                                                                     | Stem cell debates regarding genetic diseases                                                                                                                                                    |                                                                                                                           | E&D Rosalind Franklin, disability                                                     |                                                                                                                                                                  |                                                                                                                                                                                                                                                     | Sustainable use of limited resources                                                                    | Sustainable use of limited resources |                                        |  |                                                                                                                                                   |                                                                                                                  |                                                                      | GMO debate, gene therapy debate              |