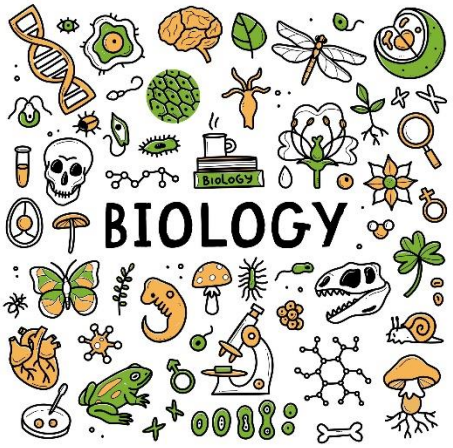

Index

Biology

The area of Biological Science saw some of the most exciting development of the 20th Century and promises continuing advances in the 21st Century. An understanding of the way humans interact with their environment has become essential for the long-term survival of the human species. At the same time, medical advances provide a greater insight into the functions of the human body. From the secrets of the Genetic Code that underlies the essence of life as we know it, to the structure of biological molecules that build cells, from the detailed biochemical pathways that are photosynthesis, to the adaptations of cereal crops that enable growth in extreme environments, this course provides an expanse of knowledge to provide an insight into the Science of Life.

Biology is a challenging subject that requires a lot of factual recall, detailed interpretation of a wide range on scenarios, mathematical processes and extensive background reading. Although you will need to apply yourself rigorously in order to keep on top of the work, the

transferable skills developed throughout the course should provide you with a fine standing for University life or the workplace.

Biology is important for a wide range of disciplines, complementing Geography, Psychology, Chemistry, Physics, Health and Social Care and Applied Science at both A level and Degree level.

The following list provides only an indication of the many vocations you may pursue following your education:

Marine Biology, Biochemistry, Forensics, Brewing; Teaching; Microbiology, Psychology, Pharmacology, Veterinary Science, Medicine, Dentistry, Food Science, Horticulture, Agriculture, Conservation, Cytology, Botany, Microbiology, Forensic Science, Stem Cell Research, Pharmacology!

General Information

- The A level Biology course you will study is Edexcel Level 3 Advanced GCE in Biology B (9B10)
- Your teachers will be Mrs J Nichols and Ms M Cousins.

Course Specification

First year: ***GCE A level Biology will consist of 7 taught lessons per fortnight plus one designated independent study lesson.***

During this year we will cover:

Topic 1: Biological molecules

Topic 2: Cells, Viruses and reproduction of Living Things

Topic 3: Classification and Biodiversity

Topic 4: Exchange and Transport

Topic 10: Ecosystems (start of the topic)

Second year: ***GCE A level Biology will also consist of 7 taught lessons per fortnight plus one designated independent study lesson.***

During this year we will cover:

Topic 5: Energy for Biological Processes

Topic 6: Microbiology and Pathogens

Topic 7: Modern Genetics

Topic 8: Origins of Genetic Variation

Topic 9: Control Systems

Topic 10: Ecosystems

Science practical Endorsement: during the two years, you will also complete a minimum of 12 practical activities and be assessed by their teachers against Common Practical Assessment Criteria issued by Edexcel.

Expectations of the Course

Homework and Independent Learning

Advanced Level Biology students will be expected to complete a minimum of six hours independent learning per week. This will be a combination of structured exam-style questions, research, writing up of practical work, essays and data analysis. Deadlines will be set when the task is issued; students are expected to meet all deadlines.

In addition, **we expect you to:-**

- Be fully prepared for lessons
- Be committed to the subject, be focused and determined to achieve your potential
- Actively participate in lessons including contributing to class discussion and practical work, make comprehensive notes and work as a co-operative team member
- Complete homework to A level standard indicating progress in the subject
- Read additional background material to ensure your understanding of topics covered and to broaden your general knowledge of the subject
- Take part in all educational visits, which are an integral part of the course
- Attend all lessons except in the case of illness or school-based activities
- Discuss any subject related concerns with your biology teachers

In return, you can expect

- Thoroughly planned lessons with clear learning outcomes
- An up-to date knowledge of the subject and of examination requirements
- Regular feedback on your progress
- Regular review of your biology folder and practical portfolio
- Assessment guidance

- Help with subject specific problems outside of normal lesson time

Compulsory educational visits:

- Year 1 Biodiversity practical day at a field centre
- Year 1 Research trip
- Year 2 Research trip

Extension activities:

There may be opportunities throughout the course to attend enrichment visits/lectures and to participate in events such as the Biology Olympiad. Participation in these activities is highly recommended.

Year 1

Topic Outline:

In the first year you will study:

- The cell - is the fundamental unit of all living things; the organisation of cells into tissues, organs and organ systems. The use of microscopes, the importance of staining specimens and the reasons why the electron microscope is so important in biology
- The structure and function of cell organelles and that the cell surface membrane allows cells to communicate with each other
- Cell division, cell diversity, cellular organisation and the cell cycle
- The process of sexual reproduction in mammals and plants
- How the gas exchange surface in the lungs is used to exemplify the properties and functions of exchange surfaces in living things
- How as animals become larger and more active, transport systems become essential to supply nutrients to and remove waste from individual cells
- How as plants become larger and more complex, transport systems become essential to supply nutrients to and remove waste from individual cells.
- Proteins, carbohydrates and lipids, three of the key groups of macromolecules essential for life.
- How the structure of the chemicals of life relates to their function.
- The structure of proteins and understand their role in the storage of genetic information and the functioning of the cell. The way that

- How DNA codes for proteins is central to our understanding of how cells and organisms function. The way in which cells control chemical reactions determines the ways in which organisms grow, develop and function
- The structure and function of DNA, mRNA and tRNA.
- How cell function relies upon enzyme-controlled reactions. How enzymes work and develop an understanding of the action of metabolic poisons and some drugs.
- The importance of water and how its structure is significant to living organisms.
- Biodiversity as an important indicator in the study of habitats and that variation; adaptation and selection are major components of evolution
- Maintaining biodiversity and the reasons why it is important. Also an understanding of why and how actions to maintain biodiversity must be taken at local, national and global levels.
- Classification as an attempt to impose a hierarchy on the complex and dynamic variety of life on Earth; DNA sequencing, electrophoresis and bioinformatics can be used to distinguish between species and determine evolutionary relationships.
- Variation generated by meiosis and mutation provides the raw material for natural selection. Isolating mechanisms can lead to new species

Year 2

Topic Outline:

In the second year you will study:

- Respiration - the process whereby energy stored in complex organic molecules is transferred to ATP. ATP provides the immediate source of energy for biological processes.
- The different stages of aerobic respiration, anaerobic respiration in animals and plants
- Photosynthesis - the process whereby light from the sun is transformed into chemical energy and used to synthesise large organic molecules from inorganic substances. Photosynthesis forms the basis of most food chains.
- Structure and function of chloroplasts, light dependent and independent stages and factors that limit the rate of photosynthesis.
- Why plants have a variety of photosynthetic pigments.
- Basic aseptic techniques and the principles involved in culturing organisms.
- Bacteria as agents of infection, the spread of antibiotic resistance in bacteria and the transmission of disease and modes of infection by pathogenic organisms.
- Responses to infection including the primary and secondary responses of human immune system.

- An understanding of gene sequencing and an overview of modern genetics including gene technology and the different types of stem cells.
- The process of genetic modification, and the public debate about the widespread use of GM crops.
- The origins of genetic variation and how genetic information is transferred, gene pools can change as a result of selection pressures and how the Hardy-Weinberg equation can be used to monitor changes in gene frequency
- Homeostasis- the maintenance of a state of dynamic equilibrium
- How organisms use chemical and electrical systems to monitor and respond to any deviation from the body's steady state
- How in receptors, the energy of a stimulus is transferred into energy in an action potential in a neurone. Transmission between neurones takes place at synapses.
- How the effects of drugs can be caused by their influence on synaptic transmission
- The structure of the human eye
- The principles of mammalian hormone production by endocrine glands, their mode of action involving receptors on target cells.
- How chemical control in plants is brought about by plant growth substances.
- The structure and function of the mammalian nervous system, including the structure and function of the central nervous system and the organisation of the peripheral nervous system.
- How heart rate is controlled in mammals
- Osmoregulation -the kidneys, liver and lungs are all involved in the removal of toxic products of metabolism from blood
- Temperature regulation in endotherms and ectotherms.
- Ecosystems- the variety and range of ecosystems, key terminology, ecological techniques, energy transfer between trophic levels and the importance of nutrient recycling by microorganisms
- How ecosystems develop over time and the effects of biotic and abiotic factors.
- Data relating to human influences on ecosystems including climate change and unsustainable exploitation of resource depletion.
- The role of scientific journals, peer review and scientific conferences to validate evidence for the climate change debate.

Assessment Structure

Regular assessment of exam-style questions will occur throughout the two-year course. You will be given individual feedback on how you are progressing and how you can improve your

performance. This will be in addition to final examinations, which will be taken at the end of the course.

Assessment summary		
Paper 1: Advanced Biochemistry, Microbiology and Genetics 9B10/01	Questions from topics 1-7 (90 marks) 1 hour 45 minutes	30% of total qualification
Paper 2: Advanced Physiology, Evolution and Ecology 9B10/02	Questions from topics 1-4 and topics 8-10 (90 marks) 1 hour 45 minutes	30% of total qualification
Paper 3: General and Practical Principles in Biology 9B10/03	Questions from all topics 1-10 (120 marks) 2 hours 30 minutes	40% of total qualification

Science Practical Endorsement

The assessment of practical skills is a compulsory requirement of the course for the study of A level biology. A minimum of 12 practical activities will be carried out by all students during the two year course. Your practical skills will be assessed throughout the two years.

You will be assessed on practical skills including (but not limited to):

- Demonstration of skilful and safe practical techniques using suitable qualitative and quantitative methods
- Making and recording valid observations
- Making and recording accurate measurements to an appropriate degree of precision
- Processing results quantitatively. Interpreting the results to reach valid conclusions
- Using scientific knowledge and understanding to suggest explanations for trends and patterns in data
- Identifying and explaining the main limitations of the data collection strategy. Suggesting and justifying reasons for changes to the experiment that will improve the quality of data
- Commenting on the reliability of the data collected; discussing the validity of the conclusions

You will be also learn how to produce a scientific report for each of your practicals. The format of these reports is as follows:

Title: Insert your title

Introduction: In your own words. What is the practical about? You need to do background research and use scientific citations in your introduction. The whole introduction needs to be relevant to your investigation.

Hypothesis: Write your hypothesis and null hypothesis based on your research in your introduction. You will be taught how to do this.

Equipment: Develop based on method.

Risk Assessment: Use the table given to you by your teachers, fill it in using research and common sense.

Method: Needs to be very specific and well referenced (scientific references only!) It needs to be a step-by-step set of instructions.

Data: Everything you do during the actual practical. Drawings/calculations etc.

Analysis: Analyse your data with appropriate statistics. Use graphs/charts/images if appropriate.

Conclusion: Detailed section about what conclusions you can draw from your data. Use scientific references to support or challenge your data. Include limitations.

Reference list/bibliography: At the end of your report you have a reference list which has the full Harvard style referencing. This is to complement your in-text citations. You will be given a guide for how to include references.

Presentation of Raw Data

Assessment of raw data is a very important aspect of this course.

- Draw a table for your data before beginning the investigation. Label each column appropriately, including units in the headings
- Separate units from the column heading using a slash or solidus
- With compound units, use negative indices. For example, metres per second is written as ms^{-1} and grams per cubic centimetre as gcm^{-3}
- The first column must contain the independent variable
- Only include numbers in the body of the table
- Make all measurements to an appropriate level of accuracy
- Be consistent with the number of decimal places (or significant figures) for your data

Example

Temperature / °C	Amount of gas produced / ml		
	1	2	3
10.1	2.0	1.9	1.9
20.0	4.0	4.0	3.8
30.4	6.9	6.9	7.0
40.2	10.0	9.8	9.9

Mathematical Skills

Analysis of data requires some degree of mathematical ability in the following areas:

- Graphs
- Histograms
- Pie charts
- Scatter graphs
- Mean and Mode
- Standard deviation
- Probability
- Statistics

Instructions will be given in these techniques.

Candidates are permitted to use calculators in all written papers.

Graphs

Graphs to be assessed must be drawn by hand, and the type of graph must be selected by the candidate. A graph could be a line graph, bar chart or histogram as appropriate. As with tables, there are important points that must be followed:

- Plot the independent variable on the x-axis and the dependent variable on the y-axis
- Choose a suitable scale that utilises as much of the graph paper as possible, enabling all points to fit on the graph. The scale must also enable points to be plotted accurately and for any pattern or trend to be clearly visible
- Plot individual points either as a small dot with a circle around it or as a cross
- Only draw a curve of best fit if intermediate values can be predicted with confidence, otherwise, join points with straight lines
- Do not extrapolate lines past the points plotted

- Label axes, including units. As with tables, separate units from the axis label using a slash or solidus

Resources

The Biology Department will loan a standard A level textbook to all students for use in school. The text used for AS/A level is Edexcel Biology B (books 1 and 2) published by Pearson ISBN 978-1-14479-7654-7

Suggested Books to Purchase

Maths Skills for A Level Biology, for example by James Penny, Philip Leftwich

In the Department

A range of additional books are available to borrow from the Biology Department.

The Internet

Current A-level students have found the Internet to be an invaluable source of information, especially when researching topics which are rapidly changing, such as gene technology.

Good Revision websites:

Cognito: https://cognitoedu.org/home

Khan Academy: http://www.khanacademy.org/#biology

Save my exams: https://www.savemyexams.com/login/

Biology mad: www.biologymad.com. Although written for the AQA specification, a lot of the information will be relevant to the Edexcel specification we will be following.

Membership of The Institute of Biology is a good way to keep up to date with the ever-changing world of Biology; further information may be found on www.iob.org.

Essential equipment

- A4 ring-binder(s)
- Dividers for each topic/teacher
- A4 paper
- Pens, pencils, ruler, eraser
- Calculator

Additional Information

We recommend that you include in your background reading articles from the New Scientist, Nature and Biological Sciences Review publications. If at all possible, it would be very useful to subscribe to Biological Sciences Review. This is a biology journal aimed at A level students; it targets the topics that we will study in class, as well as providing useful advice and tips on exam technique from A level examiners.

Student subscription is available at a discount; details can be found at https://www.hoddereducation.co.uk/biologicalsciencesreview. Subscription to this journal is also an excellent way to keep up to date with new developments and research in Biological science. We also recommend reading scientific papers and journals; the department subscribes to the Institute of Microbiology and receives regular newsletters, these are available in SC3.

Biology Transition Work - IMPORTANT

As you prepare for your A Level course, you will find it helpful to begin reading around some of the topics that appear in the course. You have two tasks to complete over the summer.

1. *Create a model of either a plant or an animal cell.*
    - *Cannot be digital (No powerpoint/word creations)*
    - *Must be clearly labelled*
    - *Must have details about the **function** of all the organelles also (in more detail than GCSE!)*
    - *Minimum organelles to be included (IF RELEVANT to your chosen cell): Nucleus, cytoplasm, cell surface membrane, vacuole(s), rough endoplasmic reticulum, mitochondria, smooth endoplasmic reticulum,*
    - *Some ideas (but you can be creative) are:*
        i. *Clay model*
        ii. *Using foam and craft materials*
        iii. *A Cake*
        iv. *Shrinky dinks*
        v. *Lego*
        vi. *Playdoh*
2. *Read (at least) 1 book about science. This can be of your choosing. You will need to*

- *Give a brief written summary*
- *Write a reflection. What did this book make you think about/consider (maybe it didn't!)? Were you glad to have read it or disappointed?*

Although it can be any book about science here are a few recommendations:

a. A Sting in the Tale by Dave Goulson: This book is all about bees but most of it connects to A-Level biology with bees as the example.
b. A life on our planet by David Attenborough: His latest book and it is wonderful. You will learn a lot about ecology and begin to understand a concept we call 'shifting baseline'.
c. The immortal life of Henrietta Lacks by Rebecca Skoot: Really interesting about everything we know about STEM cells
d. A short history of nearly everything: Bill Bryson: Just what it says, really science based.
e. What do you care what other people think? Richard Feynman. An edited collections of reminiscences by the Nobel Prize-winning physicist.