# *PLANNING SUPPORT BOOKLET*

**J257, J260**

**For first teaching in 2016**

This support material booklet is designed to accompany the OCR GCSE (9–1) in Biology B and Combined Science B (Twenty First Century).

***DISCLAIMER***

This resource was designed using the most up to date information from the specification at the time it was published. Specifications are updated over time, which means there may be contradictions between the resource and the specification, therefore please use the information on the latest specification at all times.If you do notice a discrepancy please contact us on the following email address: [resources.feedback@ocr.org.uk](mailto:resources.feedback@ocr.org.uk)

# Introduction

This support material is designed to accompany the OCR GCSE (9-1) specification for first teaching from September 2016 for:

* [Biology B (Twenty First Century Science – J257)](http://www.ocr.org.uk/Images/234595-specification-accredited-gcse-twenty-first-century-science-suite-biology-b-j257.pdf)
* [Combined Science B (Twenty First Century Science – J260)](http://www.ocr.org.uk/Images/234597-specification-accredited-gcse-twenty-first-century-science-suite-combined-science-b-j260.pdf)

The Planning Guidance table on the following pages sets out *suggested* teaching times for the topics within the specification. Note that we always recommend that individual centres plan their schemes of work according to their individual needs. Actual teaching times for topics will depend on the amount of practical work done within each topic and the emphasis placed on development of practical skills in various areas, as well as use of contexts, case studies and other work to support depth of understanding and application of knowledge and understanding. It will also depend on the level of prior knowledge and understanding that learners bring to the course.

The table follows the order of the topics in the specification. It is not implied that centres teach the specification topics in the order shown, centres are free to teach the specification in the order that suits them.

## Delivery guides

Delivery guides are individual teacher guides available from the GCSE Biology B and Combined Science B qualification pages.

* <http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-biology-b-j257-from-2016/>
* http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-combined-science-b-j260-from-2016/

These Delivery guides provide further guidance and suggestions for teaching of individual topics, including links to a range of activities that may be used and guidance on resolving common misconceptions.

## Ideas about Science (B7) and Practical Work (B8)

Specification Chapter B7 (Ideas about Science) and Chapter B8 (Practical skills) are not included explicitly in the Planning Guidance table. The expectation is that these ideas and practical skills are developed throughout the course and in support of conceptual understanding.

Links to B7 learning outcomes and suggestions where the PAG techniques can be included are found throughout the table. This is by no means an exhaustive list of potential practical activities.

| Chapter | Estimated teaching hours **Separate / Combined** | Comments and PAG opportunities |
| --- | --- | --- |
| **Chapter 1: You and Your Genes** | | |
| 1.1 What is the genome and what does it do? | 7 / 4 | PAG1 Describe how to use a light microscope to observe a variety of plant and animal cells |
| 1.2 How is genetic information inherited? | 4 / 3 |  |
| 1.3 How can and should genetic information be used? | 5 / 5 |  |
|  | **Total 16 / 12** |  |
| **Chapter 2: Keeping Healthy** | | |
| 2.1 What are the causes of disease? | 5 / 5 |  |
| 2.2 How do organisms protect themselves against pathogens? | 6 / 5 |  |
| 2.3 How can we prevent the spread of infections? | 3 / 3 |  |
| 2.4 How can we identify the cause of an infection? | 5 / 0 | PAG1 Describe how to use a light microscope to observe microorganisms  PAG7 Describe and explain the aseptic techniques used in culturing microorganisms |
| 2.5 How can lifestyle, genes and the environment affect health? | 4 / 3 | PAG6 Describe how to practically investigate the effect of exercise on pulse rate and recovery rate |
| 2.6 How can we treat disease? | 3 / 2 | PAG7 Calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 |
|  | **Total 26 / 18** |  |
| **Chapter 3 Living Together – Food and Ecosystems** | | |
| 3.1 What happens during photosynthesis? | 10 / 9 | PAG5 Describe practical investigations into the requirements and products of photosynthesis  PAG4 Describe practical investigations into the effect of substrate concentration, temperature and pH on the rate of enzyme controlled reactions |
| 3.2 How do producers get the substances they need? | 8 / 7 | PAG8 Describe practical investigations into the processes of diffusion and osmosis  PAG1 Describe how to use a light microscope to observe the structure of the xylem and phloem  PAG6 Describe how to use a simple potometer |
| 3.3 How are organisms in an ecosystem interdependent? | 7 / 4 | PAG2 Describe the use of qualitative tests for biological molecules |
| 3.4 How are populations affected by conditions in an ecosystem? | 3 / 3 | PAG3 Describe how to carry out a field investigation into the distribution and abundance of organisms in an ecosystem |
|  | **Total 28 / 23** |  |
| **Chapter 4 Using Food and Controlling Growth** | | |
| 4.1 What happens during cellular respiration? | 3 / 3 | PAG5 Describe practical investigations into the effect of different substrates on the rate of respiration in yeast |
| 4.2 How do we know about mitochondria and other cell structures? | 1 / 1 |  |
| 4.3 How do organisms grow and develop? | 5 / 5 | PAG1 Describe how to use a light microscope to observe stages of mitosis |
| 4.4 How is plant growth controlled? | 3 / 0 | PAG6 Describe practical investigations into the role of auxin in phototropism |
| 4.5 Should stem cells be used to treat damage and disease? | 1 / 1 |  |
|  | **Total 13 / 10** |  |
| **Chapter 5 The Human Body – Staying Alive** | | |
| 5.1 How do substances get into, out of and around our bodies? | 7 / 6 |  |
| 5.2 How does the nervous system help us respond to changes? | 5 / 2 | PAG6 Describe practical investigations into reflex actions |
| 5.3 How do hormones control responses in the human body? | 2 / 2 |  |
| 5.4 Why do we need to maintain a constant internal environment? | 5 / 1 | PAG6 Describe practical investigations into temperature control in the body |
| 5.5 What role do hormones play in human reproduction? | 5 / 5 |  |
| 5.6 What can happen when organs and control systems stop working? | 7 / 2 | PAG6 Describe practical investigations into the response of the pupil in different light conditions |
|  | **Total 31 / 18** |  |
| **Chapter 6 Life on Earth – Past and Present** | | |
| 6.1 How was the theory of evolution developed? | 8 / 5 |  |
| 6.2 How do sexual and asexual reproduction affect evolution? | 1 / 0 |  |
| 6.3 How does our understanding of biology help us classify the diversity of organisms on Earth? | 1 / 1 |  |
| 6.4 How is biodiversity threatened and how can we protect it? | 8 / 3 |  |
|  | **Total 18 / 9** |  |

**Total teaching hours = 132 / 90 hours**

# Outline Scheme of Work: B1 You and Your Genes

## Suggested teaching time for chapter: 16/12 hours

|  |  |
| --- | --- |
| **Additional remote learning opportunities**  ***As a response to the Covid-19 outbreak, additional online learning opportunities were identified for each topic in June 2020.*** | |
| **Statement** | **Teaching activities** |
| B1.1.1 a & b | This [video](https://www.youtube.com/watch?v=v2lHztS4sMU) can be used as a nice introduction to cell level systems, or be given to students as home learning to watch ready for the lesson. An alternative is this [video from the Amoeba sisters](https://www.youtube.com/watch?v=Pxujitlv8wc) which compares eukaryotic cells with prokaryotic cells.  Here is a [virtual practical](https://ocr.org.uk/rpgbiol1) using onion cells and cheek cells, which can be used to demonstrate the skills for PAG 7. It is also accompanied by quiz questions students can work through. |
| B1.1.2, B1.1.3 & B1.1.7 | This BBC Bitesize [daily interactive remote lesson](https://www.youtube.com/watch?v=gpKjp51miwA) contains two videos and two practise activities to reinforce leaning from the videos.  Here is a [virtual practical](https://ocr.org.uk/rpgbiol2) about extracting DNA from split peas. It has an interactive experiment, as well as a video and quiz questions. It can be used to demonstrate the skills for PAG2. |
| **B.1.1.8 & B1.1.9** | This [video from Amoeba sisters](https://www.youtube.com/watch?v=oefAI2x2CQM) could be used with students to demonstrate protein synthesis. They could be given questions after watching the video to check understanding. This [cut and stick activity](https://www.tes.com/teaching-resource/sb3d-protein-synthesis-11815617) could be shared with students who can virtually cut and stick the images. |
| B1.2.2 | This [interactive resource](https://www.abpischools.org.uk/topic/genes-and-inheritance) has information pages, glossaries, animations and questions that students can work through. |
| B1.2.3 & B1.2.6 | This [powerpoint](https://www.tes.com/teaching-resource/punnett-square-7161572" \t "_blank) has examples of punnett squares, that include answers and shows the chance of certain traits based on the punnett square. This second [resource pack](https://www.tes.com/teaching-resource/punnett-squares-and-pedigree-analysis-12174963) has a powerpoint, worksheet and exam question that students can work through. It also includes the answers for students to check their work. |
| B1.2.7 | This [TED talk](https://www.youtube.com/watch?v=Mehz7tCxjSE) discusses the work of Mendel and how it has led to our understanding of genetics. |

### B1.1 What is the genome and what does it do?

**Notes:**

* Statements in bold are for higher tier learners only.
* A reference to PAG indicates an opportunity to cover some skills from one of the Practical Activity Groups – see Chapter 8: Practical Skills of the Biology B specification for more information.
* A reference prefixed with “M” indicates an opportunity to cover some of the mathematical skills required for this qualification – see Appendix 5d of the Biology B specification for more information.

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | B1.1.1 a) explain how the nucleus and genetic material of eukaryotic cells (plants and animals) and the genetic material, including plasmids, of prokaryotic cells are related to cell functions  b) describe how to use a light microscope to observe a variety of plant and animal cells  *PAG1* | Recap Key Stage 3 knowledge and understanding using Activity 1 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf).  Use an animation such as the ones from [here](http://www.cellsalive.com/cells/cell_model.htm) to point out the nucleus in both plant and animal cells.  Can also use an animation such as the one [here](http://www.cellsalive.com/cells/bactcell.htm) to show a plasmid in a bacterial cell.  Look at pre-prepared slides of animal and plant cells down a light microscope using Activity 1 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) as a guide. Focus on the nucleus as suggested.  Other possible activities from the You and Your Genes Delivery Guide are Activities 9, 10, 11 and 12 found [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf). | From the Key Stage 3 Programme of Study:   * cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope. * functions of cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondrion and chloroplast. * similarities and differences between animal and plant cells.   Limit the function of a plasmid to it being a small loop of genetic material which can move between bacterial cells allowing it to be useful in genetic engineering.  Looking at animal and plant cells using a light microscope and doing scientific drawings from them allows skills from *PAG1* to be covered (see p. 68 of the specification).  IaS2.2 Use SI units (mm, μm)  OUP GCSE Biology textbook pages 5, 280–1 |
| 2 & 3 | B1.1.2 describe the genome as the entire genetic material of an organism  B1.1.3 describe DNA as a polymer made up of nucleotides, forming two strands in a double helix  B1.1.7 describe DNA as a polymer made from four different nucleotides, each nucleotide consisting of a common sugar and phosphate group with one of four different bases attached to the sugar  *(separate science only)* | Use Activity 2 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) to illustrate that the genome is the entire genetic material of an organism and link this to the very visual practical activity.  Introduce the structure of DNA by describing the role of modelling used by Watson and Crick in their determination of the structure. Show this video about [base pairing](https://www.dnalc.org/resources/3d/25-basepairing.html).  Use Activity 3 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) to continue with the development of the understanding of the structure of DNA.  Learners could make a model of DNA. There are many options, some have a different focus and use various raw materials.  One example is found in the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) in Activity 6.  Other examples include the ones [here](http://www.yourgenome.org/activities/origami-dna), [here](https://www.tes.com/teaching-resource/dna-structure-sweet-model-6113201) and [here](http://learn.genetics.utah.edu/content/molecules/builddna/).  Activity 8 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) can be used as a way of assessing learner’s grasp of the unfamiliar terminology covered in this part of the course. | From the Key Stage 3 Programme of Study:   * a simple model of chromosomes, genes and DNA in heredity, including the part played by Crick, Watson, Wilkins and Franklin in the development of the DNA model.   IaS3.4 Use a variety of models  OUP GCSE Biology textbook pages 6, 9 |
| 4 & 5 | B1.1.6 explain the importance of amino acids in the synthesis of proteins, including the genome as instructions for the polymerisation of amino acids to make proteins  **B1.1.8 explain simply how the sequence of bases in DNA codes for the proteins made in protein synthesis, including the idea that each set of three nucleotides is the code for an amino acid**  **B1.1.9 recall a simple description of protein synthesis, in which:**   * **a copy of a gene is made from messenger RNA (mRNA)** * **the mRNA travels to a ribosome in the cytoplasm** * **the ribosome joins amino acids together in an order determined by the mRNA**   *(separate science only)* | Learners need to have a good idea of what the code on the DNA is used for. There are many activities available to assist in the delivery of this concept.  Activities 4, 5, 7 and 14 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) are all activities to present ideas about the code on DNA.  There are many simple animations and videos that can be shown such as the examples [here](https://www.youtube.com/watch?v=2zAGAmTkZNY) and [here](https://www.youtube.com/watch?v=NJxobgkPEAo).  Activity 13 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) is a reviewing task of the structure of DNA that can linked to the previous lessons.  Learner Resource 3 / Teacher Resource 2 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) are linked to Activity 5 and involve the construction of a flowchart summarising the coding for proteins. | OUP GCSE Biology textbook pages 7–8, 10–11 |
| 6 | B1.1.4 describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism, including the idea that most characteristics depend on instructions in the genome and are modified by interaction of the organism with its environment  B1.1.5 explain the terms chromosome, gene, allele, variant, genotype and phenotype | Once learners are aware of the contribution of the genome to the phenotype, they need to have an understanding that the environment plays a significant role.  Consider presenting learners with a series of pictures, possibly of celebrities, showing related people e.g. father / son, siblings, mother / daughter, identical twins. Learners could consider the differences in their characteristics – physical and others – and then discuss the contributions that genes and the environment play.  In order for learners to grasp the difficult terminology associated with this topic, it is necessary to explain inheritance and how characteristics are passed from one generation to another. The relationship between the terms ‘chromosome’, ‘gene’ and ‘allele’ is perhaps best tackled using an example and diagrams.  Information about the interaction of genes and the environment can be found [here](http://www.bbc.co.uk/education/guides/zhp4jxs/revision). | OUP GCSE Biology textbook page 4 |
| 7 | **B1.1.10 recall that all genetic variants arise from mutations**  *(separate science only)*  **B1.1.11 describe how genetic variants in coding DNA may influence phenotype by altering the activity of a protein**  *(separate science only)*  **B1.1.12 describe how genetic variants in non-coding DNA may influence phenotype by altering how genes are expressed**  *(separate science only)* | Learner Resource 2 / Teacher Resource 1 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) are linked to Activity 4 and provide a connection between the genetic code and mutations and provide a comprehensive explanation and exercise looking at these ideas.  Information about mutations can be found [here](http://www.bbc.co.uk/education/guides/zhp4jxs/revision/3).  [This](https://www.youtube.com/watch?v=GieZ3pk9YVo) is quite a simple and amusing video about mutations. | OUP GCSE Biology textbook pages 12–13 |

### B1.2 How is genetic information inherited?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 & 2 | B1.2.1 explain the terms gamete, homozygous, heterozygous, dominant and recessive  B1.2.2 explain single gene inheritance, including dominant and recessive alleles and use of genetic diagrams  B1.2.4 use direct proportions and simple ratios in genetic crosses]  M1c  B1.2.5 use the concept of probability in predicting the outcome of genetic crosses  M2e | Why do some people with brown eyes have children with blue eyes? Why do some people who are health have children with genetic disorders? Recap on the idea that each person has two alleles, one from each parent. Each allele controls a characteristic.  Alleles can be dominant or recessive. For dominant alleles you only need one copy of that allele to have that characteristic. For recessive alleles you need to have two copies of that allele to have that characteristic.  Work through an example genetic cross (Punnett square) diagram use an example like wet or dry ear wax (the dominant variant causes wet ear wax and the recessive variant causes dry ear wax) to show how parents can pass on recessive characteristics.  Learners at both tiers should use the terms homozygous and heterozygous.  These ideas could be linked to genetic disorders e.g. cystic fibrosis.  Activity 1 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) can be used to cover the content in these assessable learning outcomes.  Learner resource 4 / Teacher resource 3 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) summarise the key terminology met so far in this section and B1.1.  Activity 4 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) helps to address common misconceptions and support learning of the concepts in this topic. | From the Key Stage 3 Programme of Study:   * heredity as the process by which genetic information is transmitted from one generation to another.   IaS3.4 Use a variety of models  IaS2.11 Draw reasoned conclusions  OUP GCSE Biology textbook pages 14–16 |
| 3 | B1.2.3 predict the results of single gene crosses  B1.2.4 use direct proportions and simple ratios in genetic crosses  M1c  B1.2.5 use the concept of probability in predicting the outcome of genetic crosses  M2e  B1.2.6 recall that most phenotypic features are the result of multiple genes rather than single gene inheritance  B1.2.8 describe sex determination in humans | Activities 5, 7, 9 and 10 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) are designed to support the delivery of these concepts.  There are many examples of supporting activities for this part of specification content including these simple [Genetic Practice Problems](http://www.biologycorner.com/worksheets/genetics_practice.html).  Activity 6 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) can be used to consolidate knowledge of genetics.  Activity 3 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) can be used to consider the inheritance of sex chromosomes | The mathematical element to these concepts may be challenging to some learners so time should be taken to address these.  IaS3.4 Use a variety of models  OUP GCSE Biology textbook page 16–20 |
| 4 | B1.2.7 describe the development of our understanding of genetics including the work of Mendel **and the modern-day use of genome sequencing**  *(separate science only)* | A video about [Gregor Mendel](https://www.youtube.com/watch?v=6NvESo3mG90) and his experiments could be watched.  Activity 8 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) is intended as a method of considering the work of Gregor Mendel.  Information about genome sequencing can be found [here](https://www.bbc.co.uk/bitesize/guides/zmyk6v4/revision/1). | IaS3.2 Development of scientific methods and theories over time  OUP GCSE Biology textbook page 18 |

### B1.3 How can and should genetic information be used?

| Lesson | Statements | Teaching activities | Notes |
| --- | --- | --- | --- |
| 1 | B1.3.1 discuss the potential importance for medicine of our increasing understanding of the human genome, including the discovery of alleles associated with diseases and the genetic testing of individuals to inform family planning and healthcare | A video such as the one [here](http://www.bbc.co.uk/news/health-22686245) could be watched as a stimulus to a discussion about genetic testing and what genetic testing / screening could be used for. This [longer video](https://www.stem.org.uk/resources/elibrary/resource/26083/genes-and-disease) could also be used – it is very interesting and introduces some topics for discussion.  Learners could discuss what would be the advantages and disadvantages for the following people of being genetically tested:   * Testing someone to see it they will have side effects from a drug. * Testing someone to see if they have a gene which will cause heart disease. * Testing a young person to see if they have the gene for a disease such as Huntington’s (but have yet to show symptoms). * Testing a person to see if they have one recessive allele for a disease such as cystic fibrosis. * Testing an unborn child to see if they have two recessive alleles for a disease such as cystic fibrosis.   Discuss different viewpoints, the person tested, their family, their children, their employer, their insurance company.  What are the options if genetic testing reveals a genetic disease in an unborn child? | IaS3.2 Development of scientific methods and theories over time  IaS4.1 Examples of applications of science that have made a positive difference  IaS4.5 Involvement of ethical issues  OUP GCSE Biology textbook pages 21–26 |
| 2 & 3 | B1.3.2 describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics  **B1.3.3 describe the main steps in the process of genetic engineering including:**   * **isolating and replicating the required gene(s)** * **putting the gene(s) into a vector (e.g. a plasmid)** * **using the vector to insert the gene(s) into cells** * **selecting modified cells** | Learners need to have an overall idea of the process of genetic engineering and the uses of it.  [This video](https://www.youtube.com/watch?v=H7FdzpE2GIE) is a good description of genetic engineering at the right level.  Activities 1, 2, 4 and 5 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) can be used to support the delivery of these ideas.  A summary of the process of genetic engineering can be found [here.](http://www.bbc.co.uk/education/guides/zx6g87h/revision)  [This](http://www.educationquizzes.com/gcse/biology/unit-1-genetic-engineering/) is a multiple choice quiz about genetic engineering that could be used as consolidation of learning. | IaS4.1 Examples of applications of science that have made a positive difference  IaS4.5 Involvement of ethical issues  OUP GCSE Biology textbook pages 27–9 |
| 4 & 5 | B1.3.4.explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology in modern agriculture and medicine | Activities 2, 3 and 6 from the You and Your Genes Delivery Guide [here](http://www.ocr.org.uk/Images/221465-you-and-your-genes-delivery-guide.pdf) can be used to help learners to see all of the various points of view associated with these ideas.  An article such as the one [here](http://news.bbc.co.uk/1/hi/scotland/highlands_and_islands/8516598.stm) about the sequencing of the genome of the ancient giant European wild cattle could be used along with the 5 W framework (who, what, when, where, why) as a way to improve learners’ abilities to extract and summarise information and consider some of the issues surrounding technological advances such as gene sequencing. | IaS4.1 Examples of applications of science that have made a positive difference  IaS4.2 Risks from scientific advances  IaS4.5 Involvement of ethical issues  OUP GCSE Biology textbook pages 27–9 |

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