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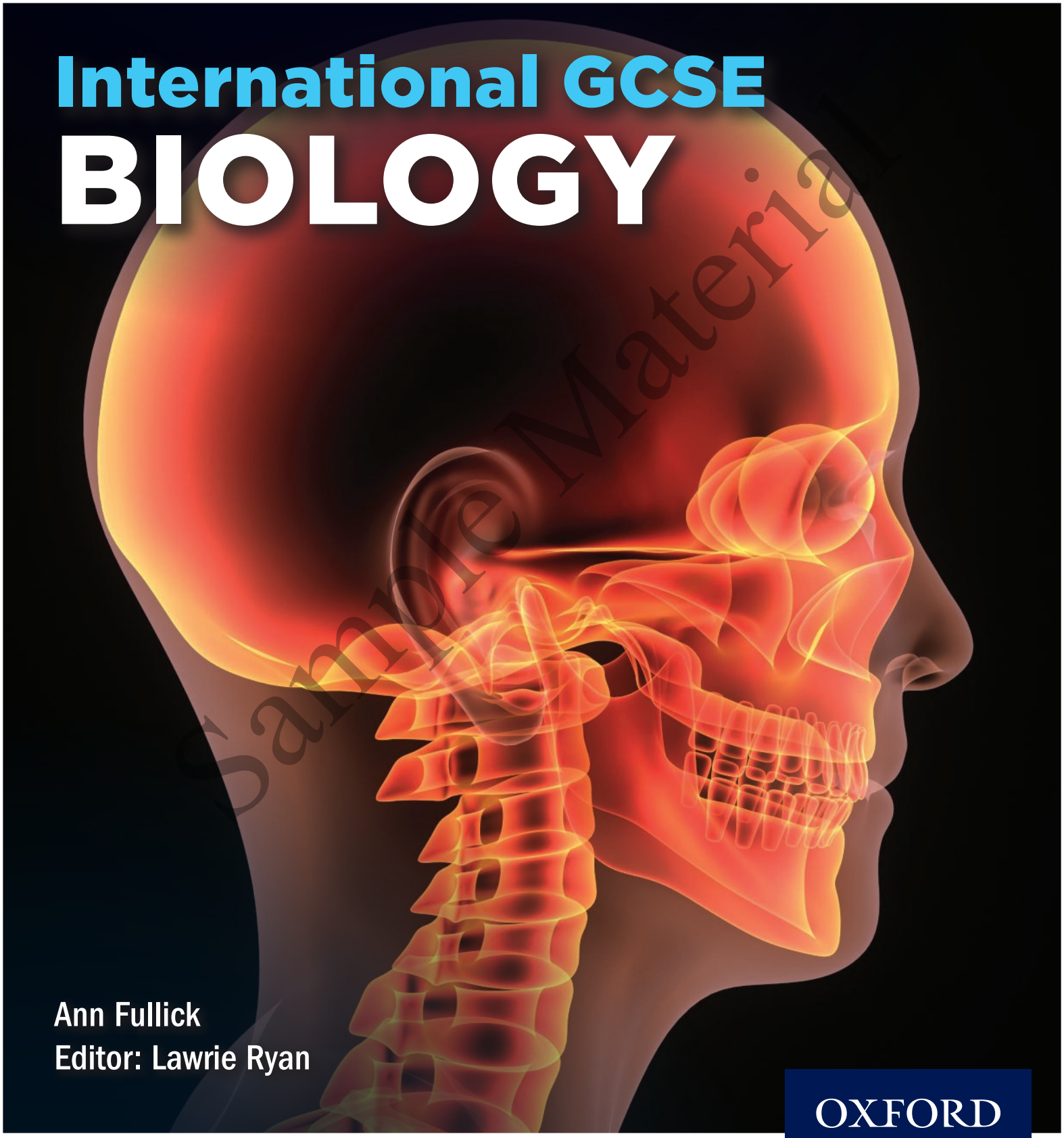

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Contents

How to use this book

This book has been written for you by experienced teachers and subject experts. It covers what you need to know for your exams and is packed full of features to help you achieve the very best that you can.

Figure 1 *Many diagrams are as important for you to learn as the text, so make sure you revise them carefully*

Key words are highlighted in the text. You can look them up in the glossary at the back of the book if you are not sure what they mean.

Required practical

This feature helps you to become familiar with key practicals. It may be a simple introduction, a reminder, or the basis for a practical in the classroom.

Summary questions

These questions give you the chance to test whether you have learnt and understood everything in the topic. If you get any wrong, go back and have another look. They are designed to be increasingly challenging.

And at the end of each chapter you will find …

Chapter summary questions

These will test you on what you have learnt throughout the whole chapter, helping you to work out what you have understood and where you need to go back and revise.

Practice questions

These questions are examples of the types of questions that you will answer in your actual exam, so you can get lots of practice during your course.

Key points

At the end of the topic are the important points that you must remember. They can be used to help with revision and summarising your knowledge.

Learning objectives

Each topic begins with key statements that you should know by the end of the lesson.

Study tip

These hints give you important advice on things to remember and what to watch out for.

Did you know … ?

There are lots of interesting and often strange facts about science. This feature tells you about many of them.

links

Links will tell you where you can find more information about what you are learning and how different topics link up.

Practical skills

During this course, you will develop your understanding of the scientific process and the skills associated with scientific enquiry. Practical work is an important part of the course as it develops these skills and in addition it reinforces concepts and knowledge developed during the course.
As part of this course, you are expected to undertake practical work in many topics and must carry out the five required practicals listed below:

Required practicals

1 Investigating the effect of different concentrations of solutions separated by a partially permeable membrane.
2 Investigating how variables effect the rate of photosynthesis.
3 Investigating how different temperatures and pH affect the rate of digestion.
4 Investigating the effects of exercise on the human body.
5 Investigating the effect of disinfectants and antibiotics on uncontaminated cultures of microorganisms.

In Paper 2, you will be assessed on aspects of the practical skills listed below, and may be required to read and interpret information from scales given in diagrams and charts, present data in appropriate formats, design investigations, and evaluate information that is presented to you.

Designing a practical procedure

- Design a practical procedure to answer a question, solve a problem, or test a hypothesis.
- Comment on/evaluate plans for practical procedures.
- Select suitable apparatus for carrying out experiments accurately and safely.

Control

- Appreciate that, unless certain variables are controlled, experimental results may not be valid.
- Recognise the need to choose appropriate sample sizes, and study control groups where necessary.

Risk assessment

- Identify possible hazards in practical situations, the risks associated with these hazards, and methods of minimising the risks.

Collecting data

- Make and record observations and measurements with appropriate precision and record data collected in an appropriate format (such as a table, chart, or graph).

Analysing data

- Recognise and identify the cause of anomalous results and suggest what should be done about them.
- Appreciate when it is appropriate to calculate a mean, calculate a mean from a set of at least three results, and recognise when it is appropriate to ignore anomalous results in calculating a mean.
- Recognise and identify the causes of random errors and systematic errors.
- Recognise patterns in data, form hypotheses, and deduce relationships.
- Use and interpret tabular and graphical representations of data.

Making conclusions

- Draw conclusions that are consistent with the evidence obtained and support them with scientific explanations.

Evaluation

- Evaluate data, considering its repeatability, reproducibility, and validity in presenting and justifying conclusions.
- Evaluate methods of data collection and appreciate that the evidence obtained may not allow a conclusion to be made with confidence.
- Suggest ways of improving an investigation or practical procedure to obtain extra evidence to allow a conclusion to be made.

1.1 Animal and plant cells

Learning objectives

After this topic, you should know:

- the main parts of animal and human cells
- the similarities and differences between plant and animal cells.

Earth is covered with a great variety of living things. However, they all have one thing in common – they are all made up of cells. Most cells are very small and you can only see them using a microscope. Eggs are the biggest animal cells. Unfertilised ostrich eggs are the biggest of all – they have a mass of around 1.3 kg and you certainly don't need a microscope to see them! The **light microscopes** in schools may magnify things several hundred times. Scientists have found out even more about cells using **electron microscopes**. These can magnify objects more than a hundred thousand times.

Most of the organisms you see around you are **eukaryotes**. This includes all animals and plants. Many microorganisms are **prokaryotes**. You will compare **eukaryotic cells** and **prokaryotic cells** on page 5.

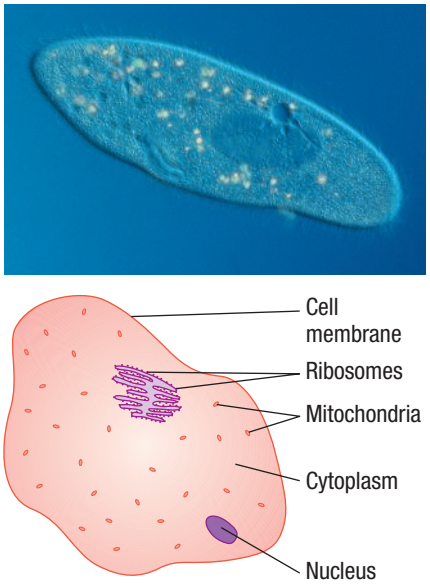

Figure 1 *Diagrams of cells are much easier to understand than the real thing seen under a microscope. The top picture shows an animal cell magnified ×2000 times under an electron microscope. Below it is the way that a model animal cell is drawn to show the main features common to most living cells, including those in humans*

Animal cells – structure and function

All eukaryotic cells have some features in common. You can see these clearly in animal cells. Human cells have the same features as other animal cells, and so do the cells of most other living things.

- The **nucleus** – controls all the activities of the cell. It contains the **genes** on the **chromosomes** that carry the instructions for making the proteins needed to build new cells or new organisms.
- The **cytoplasm** – a liquid gel in which most of the chemical reactions needed for life take place, for example, the first stages of respiration.
- The **cell membrane** – controls the passage of substances such as glucose and mineral **ions** into the cell. It also controls the movement of substances such as urea or hormones out of the cell.
- The **mitochondria** – structures in the cytoplasm where oxygen is used and where most of the energy is released during respiration.
- **Ribosomes** – where **protein synthesis** takes place, making all the proteins needed in the cell.

Plant cells – structure and function

Plants are very different organisms from animals. They make their own food by photosynthesis. They stay in one place, and do not move their whole bodies about from one place to another.

Plant cells have all the features of a typical animal cell, but they also contain features that are needed for their very different way of life. **Algae** are simple aquatic organisms. They also make their own food and have many similar features to plant cells. For centuries they were classified as plants, but now they are part of a different kingdom.

Figure 2 *Algal cells contain a nucleus and chloroplasts so they can photosynthesise*

All plant and **algal cells** have:

- a **cell wall** made of **cellulose** that strengthens the cell and gives it support.

Many (but not all) plant cells also have these other features:

- **Chloroplasts** are found in all the green parts of the plant. They are green because they contain the green substance **chlorophyll**. Chlorophyll absorbs light energy to make food by photosynthesis. Root cells do not have chloroplasts because they are underground and do not photosynthesise.
- A **permanent vacuole** is a space in the cytoplasm filled with cell sap. This is important for keeping the cells rigid to support the plant.

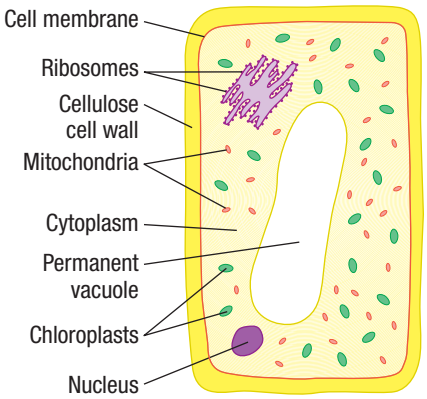

Figure 3 *A plant cell has many features in common with an animal cell, as well as other features that are unique to plants*

Practical

Looking at cells

Set up a microscope to look at plant cells, for example, from onions, *Elodea,* and/or algal cells. You should see the cell wall, the cytoplasm, and sometimes a vacuole. You will see chloroplasts in the *Elodea* and the algae, but not in the onion cells because they do not photosynthesise.

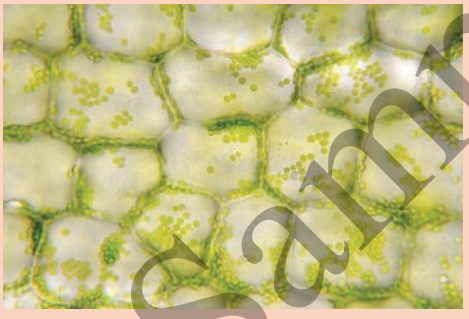

Figure 4 *Some of the common features of plant cells show up well under a light microscope. Here, the features are magnified ×40*

Summary questions

1 **a** List the main structures you would expect to find in an animal cell.
b You would find all the things that are present in animal cells in a plant cell or algal cell, too. There are three extra features that may be found in plant cells but not in animal cells. What are they?
c What are the main functions of these three extra structures?

2 Why are the nucleus and the mitochondria so important in all cells?

3 Chloroplasts are found in many plant cells but not in all of them. Give an example of plant cells without chloroplasts, and explain why they have none.

Study tip

Remember that not all plant cells have chloroplasts.

Don't confuse chloroplasts and chlorophyll.

links

For more information on photosynthesis, look at 9.1 Photosynthesis.

Did you know ... ?

The best light microscopes magnify cells ×2000. To give an idea of scale, this would make an average person about 3.5 km tall. An electron microscope magnifies cells ×2 000 000, making an average person around 3500 km tall!

Study tip

Learn all the parts of cells and their functions. This will help you answer many different questions on the biology papers, not just the ones on cell structure.

Key points

- **Most human cells are similar to most other animal cells and contain features common to all cells – a nucleus, cytoplasm, cell membrane, mitochondria, and ribosomes.**
- **Plant and algal cells contain all the structures seen in animal cells as well as a cellulose cell wall. Many plant cells also contain chloroplasts and a permanent vacuole filled with sap.**

Practice questions

1 Figure 1 shows a typical plant, animal, and bacterial cell.

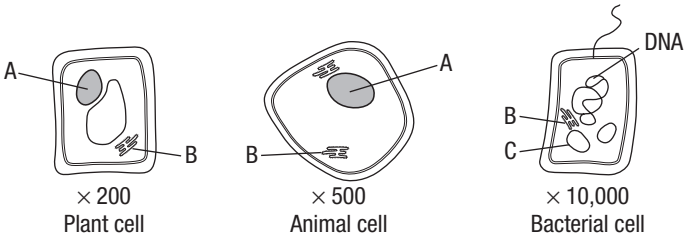

Figure 1

a Name the structures A, B, and C. (4)

b Describe the function of the nucleus in cells. (2)

c Which parts of a bacterial cell carry out the same function as the nucleus does in plant and animal cells? (2)

d Calculate the length of each cell in µm (1 µm = 0.001 mm).
Use the formula:
length on diagram = real length × magnification
i Plant cell .....
ii Animal cell .....
iii Bacterial cell ..... (3)

e Ribosomes make protein molecules for the cell.
Suggest two possible uses for these protein molecules. (2)

f Suggest why there are no mitochondria in bacterial cells. (1)

2 The two plant cells in Figure 2 are very different because they have been specialised to carry out different functions.

Figure 2

a Describe the function of each cell. (5)

b *In this question you will be assessed on using good English, organising information clearly, and using specialist terms where appropriate.*
Compare and contrast the structures of these two cells in relation to their function. (6)

3 The plant in pot A has been adequately watered and is healthy. The plant in pot B has not been given enough water and is wilting.

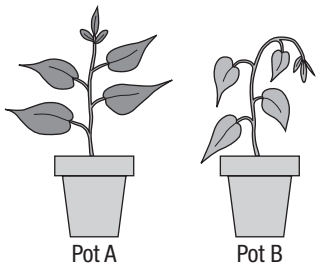

Figure 3

a Draw and label a stem cell from each plant.
Use the correct term to describe the state of each cell. (4)

b Explain in detail why the plant in pot A remains upright whilst the plant in pot B does not. (3)

4 Some scientists wish to grow mouse skin cells in tissue culture. They know that the tissue culture liquid must have the same concentration of salts and sugars as the cytoplasm of the cell.

They made solutions at four different concentrations and added some mouse skin cells.

After 24 hours they removed some cells and observed them under a microscope.

The following table shows the results.

Test number	1	2	3	4	Control
Concentration of salts in mol/dm^3	0.24	0.26	0.28	0.30	Fresh cell from mouse
Appearance of cells					

a Name the term that describes a solution that has the same concentration as the contents of the cells. (1)

b Which concentration of salts is suitable for the tissue culture liquid? (1)

c *In this question you will be assessed on using good English, organising information clearly, and using specialist terms where appropriate.*
The concentration in test 1 is not suitable as it has damaged the cells.
Explain why the solution in test 1 has damaged the cells. (6)