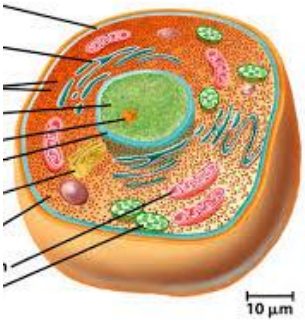
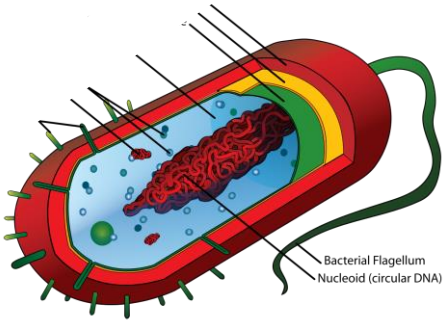
PiXL Gateway: Masterclass - Biology

Contents:

I. **Cells and Cell Ultrastructure**
II. **Cell Division and Reproduction**
    a. **Mitosis**
    b. **Evolution**
III. **Maths for A Level Biology**
    a. **Required Mathematical Skills**
    b. **Statistics in Biology**
IV. **Checklist of Skills and Basic Knowledge**

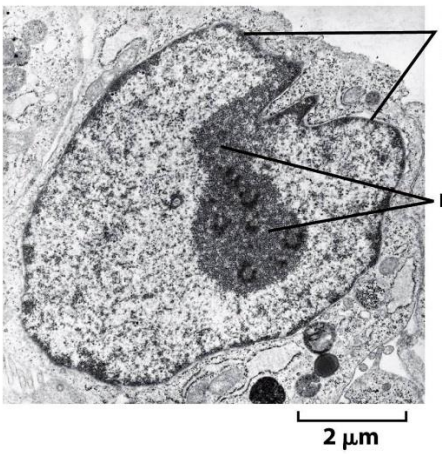
Cells and Cell Ultrastructure





Cell organelles.

For each image, identify the organelle(s) shown, describe the key characteristics that have lead you to make this decision and explain the function of the organelle(s).



Name of organelle: _____

Key features: _____

_____

_____

_____

Function: _____

_____

_____

Name of organelle: _____

Key features: _____

_____

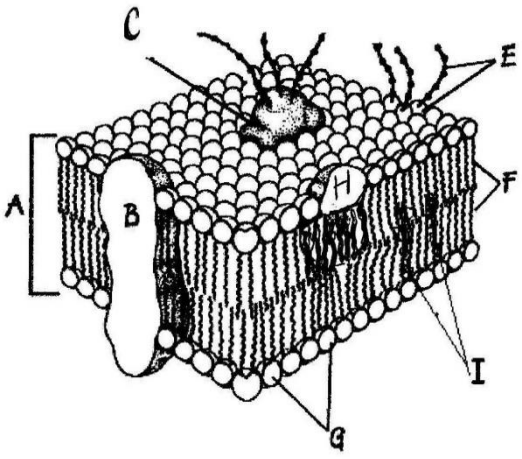
_____

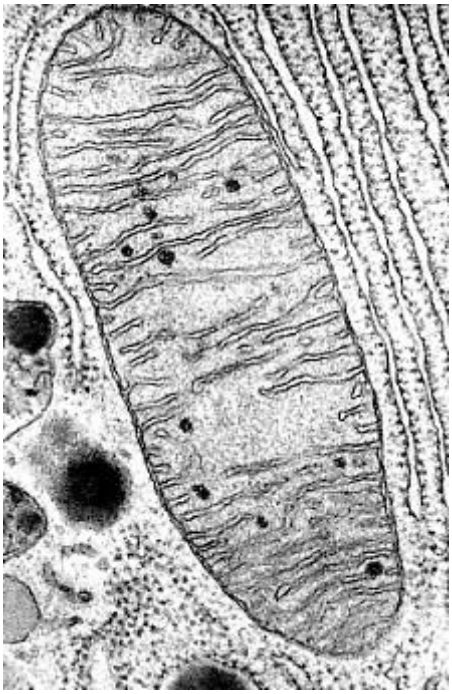
_____

Function: _____

_____

_____





Name of organelle: _____

Key features: _____

_____

_____

_____

Function: _____

_____

_____

Name of organelle: _____

Key features: _____

_____

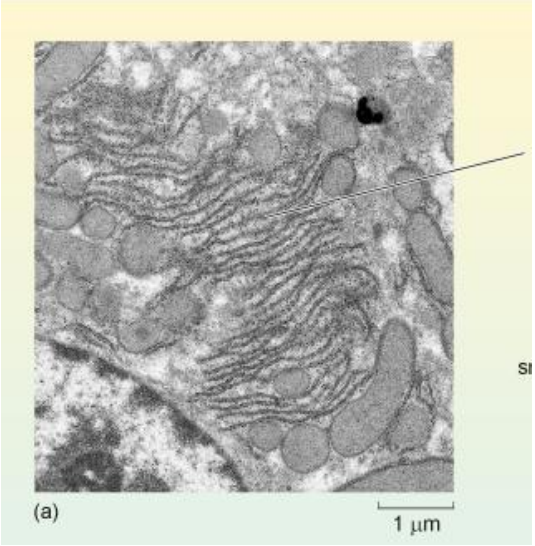
_____

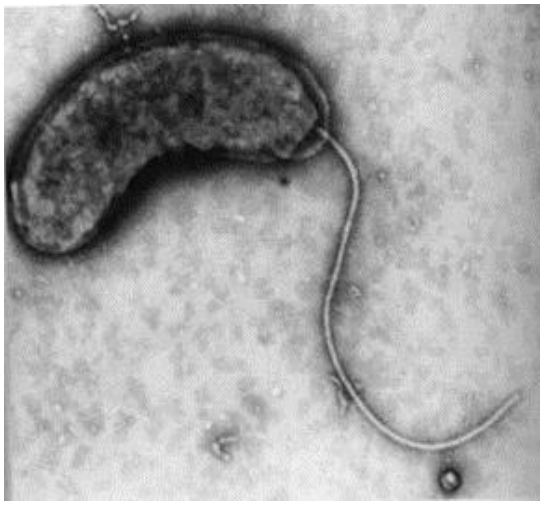
_____

Function: _____

_____

_____





Name of organelle: _____

Key features: _____

_____

_____

_____

Function: _____

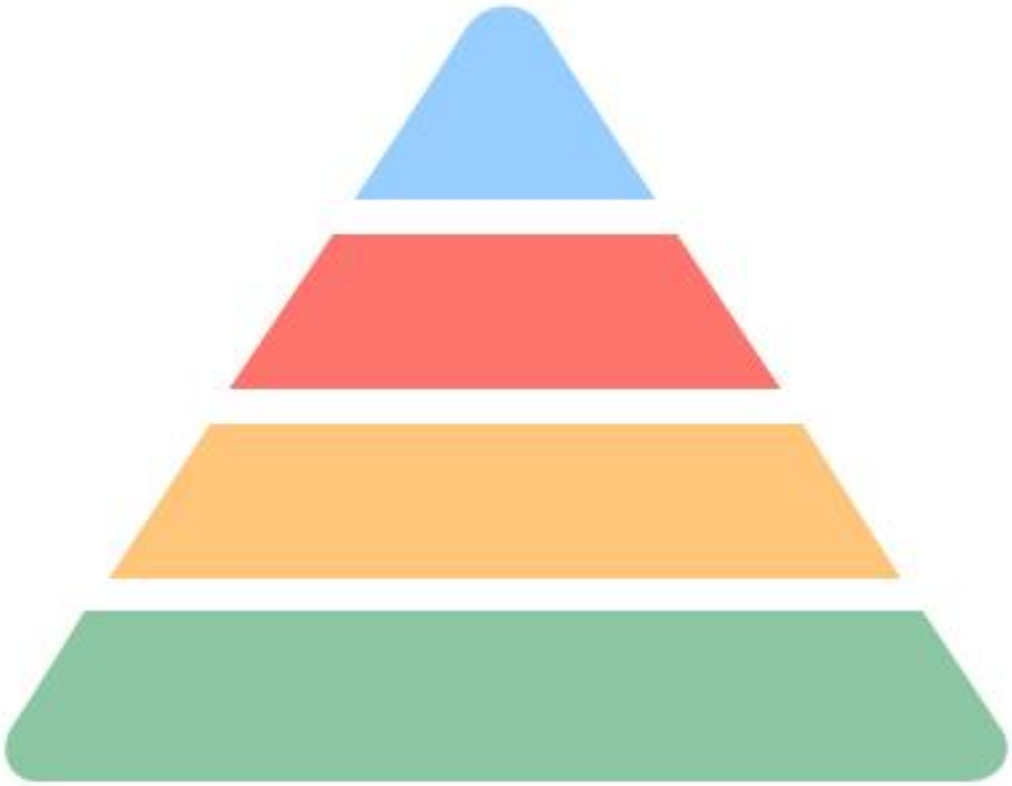
_____

_____

Going Deeper

You will need to be able to use your knowledge of these structures to explain further concepts in AS and A2 Biology. The cell membrane is used to explain osmosis, diffusion and active transport. Mitochondria are essential in respiration. Chloroplasts are the site of photosynthesis. Ribosomes are where the DNA code is finally converted into new protein.

Based on your learning , decide which is the most important organelle within a cell. The most important goes at the top of the pyramid and the least important at the bottom. Make sure you justify WHY you think it the most/least important.



_____

_____

_____

_____

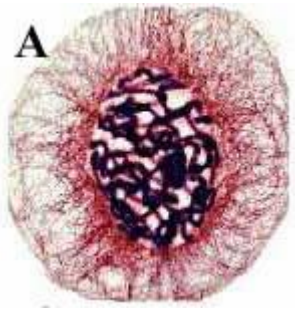
_____

_____

_____

_____

Cell Division and Reproduction - Mitosis



Stage of mitosis: _____

Key features: _____

_____

_____

_____

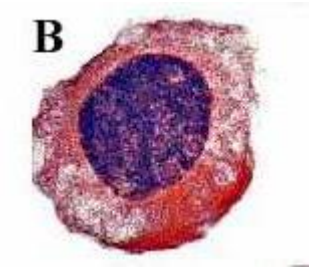
Stage of mitosis: _____

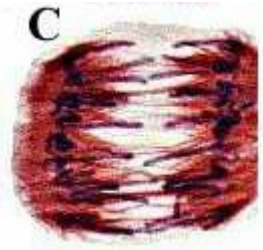
Key features: _____

_____

_____

_____





Stage of mitosis: _____

Key features: _____

_____

_____

_____

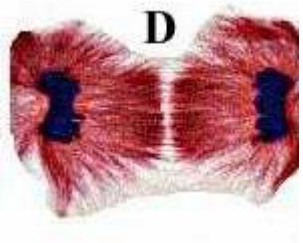
Stage of mitosis: _____

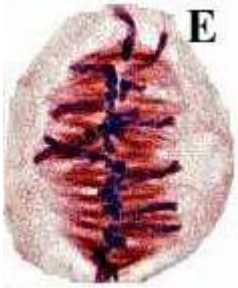
Key features: _____

_____

_____

_____





Stage of mitosis: _____

Key features: _____

_____

_____

_____

Going Deeper

Detailed knowledge of the contents of the nucleus is required to explain inheritance at A2 as well as explaining how DNA is converted into protein. Understanding the structure and function of genes, chromosomes and DNA, including alleles, is used to explain characteristics and applying this to meiosis and reproduction helps us to understand how traits are passed between generations.

Mutations occur at random in DNA. These may be advantageous or may cause diseases such as cancer. Knowledge of mutagens and the different types of mutations helps us to identify the cause or risks of disease occurring.

Cell Reproduction – Evolution by Natural Selection

Rat snakes live all over the eastern half of the United States.

The colouration of rat snakes has changed according to the location of their habitat. They can be found with yellow, black, orange and green colourations.

Use your knowledge of evolution by natural selection to explain how this change takes place over generations. Remember to use the keywords included in the lesson.

Antibiotic Resistance in Bacterial Populations

One of the greatest threats to global health is the increasing number of strains of bacteria that are demonstrating resistance to antibiotics. As bacteria grow and reproduce, mutations can occur in the genes. Some of these mutations may be advantageous to the bacteria and may confer resistance to antibiotics.

Populations of bacteria that are resistant will survive and reproduce in far greater numbers than those that are not resistant and hence the population will become more resistant.

A growing number of infections are now becoming harder to treat as antibiotics are becoming less effective. Pneumonia, tuberculosis, salmonellosis and gonorrhoea are common examples of these new 'superbugs'.

Antibiotic resistance will occur via natural selection within these populations of bacteria, however this rate of change is increased by the overuse and misuse of antibiotics.

For a long time antibiotics have been routinely included in animal feeds and administered to humans regardless of whether they have a bacterial infection. In addition, some people fail to complete their course of treatment with antibiotics once their symptoms reduce. All these scenarios have provided the opportunity for resistant traits to develop and for the frequency of the resistant gene to increase within the overall bacterial population.

Mutations in the genes of bacteria can be inherited as bacteria undergo binary fission. In addition to this, populations of bacteria can share their plasmids within a generation in a process known as horizontal transmission. This increases the rate at which the resistant gene becomes present in the population.

Where antibiotics are now unable to treat diseases, patients must be prescribed more expensive medicines, are likely to be unwell for longer and may spend greater time in hospital and may be unable to work. Routine medical procedures such as organ transplants and caesarean sections become much riskier if antibiotics aren't available to treat and prevent infections.

Take a section of the text and do the following:

1) Prioritise: Underline the three most important sentences here. Rank 1-3, briefly explain number 1. Cross out the least important sentence
2) Reduce: Reduce the key information into 12 words
3) Transform: Transform this information into 4 pictures or images (no words allowed)
4) Categorise: Sort this information into three categories. Highlight and think of a suitable title for each category.
5) Extend: Write down three questions you'd like to ask an expert in this subject.

Maths for A Level Biology

You must be able to demonstrate the following mathematical skills.

If you can confidently demonstrate a skill, place a tick in the box.

- ☐ use appropriate units
- ☐ use decimals and standard form
- ☐ use ratios, fractions and percentages
- ☐ estimate results
- ☐ use calculators to find and use power
- ☐ use appropriate significant figures
- ☐ understand mean, median and mode
- ☐ construct and interpret graphs
- ☐ understand probability
- ☐ understand sampling
- ☐ select and use statistical tests
- ☐ understand standard deviation
- ☐ identify uncertainties
- ☐ change the subject of an equation
- ☐ substitute values into algebraic equations
- ☐ solve algebraic equations
- ☐ use logarithms
- ☐ understand that y=mx+c represents a linear relationship
- ☐ determine the intercept of a graph
- ☐ calculate rate of change from a linear graph
- ☐ draw and use tangents to calculate rate
- ☐ calculate circumference, areas and volume

From your list above, identify the next steps in your learning.

Use the following pages to research and make notes on how to demonstrate these skills.

Use your text books, class notes and recommended reading to help you to complete this.

Topic:

Key equations/units:

Key facts:

Key applications:

Worked example:

Topic:

Key equations/units:

Key facts:

Key applications:

Worked example:

Topic:

Key equations/units:

Key facts:

Key applications:

Worked example:

Statistics in Biology

For each of the following statistical tests:

1. Describe the type of data/experiment that would be analysed with this test
2. Research the equation used
3. Define each component of the equation

Student's t-test

Spearman rank/Correlation coefficient

Chi-squared

Standard deviation

Going Deeper

You will be required to analyse graphs and tables of data from secondary sources in your exam. These might be related to your required practical work. When presented with data you should always read in detail before attempting any questions. Look for trends and anomalies, statistical tests that have been conducted and anything that the data **does not** tell you. A common question in exams is "To what extent does the data support the hypothesis?".Be prepared to critique the data identifying strengths and weaknesses.

Checklist of Skills and Basic Knowledge

Basic Cell Knowledge	
	I can identify pro- and eukaryotes
	I can describe the difference between pro- and eukaryotes
	I can explain the function of all the common organelles in pro- and eukaryotes
	I can suggest the possible consequences to a cell of an organelle failing to function normally
Basic Cell Division	
	I can identify the stages of mitosis
	I can identify the stages of mitosis using both diagrams and light microscopy
	I can describe the outcomes of mitosis
	I can compare and contrast mitosis and binary fission
	I can describe and explain how meiosis produces genetically unique cells
Basic Maths Knowledge and Skills	
	I can identify the correct units in a calculation
	I can convert and use standard form
	I can give my answer to an appropriate number of significant figures
	I can change the subject of an equation
	I can calculate circumference, area and volume of common shapes