Tauheedul Girls

OCR A level Biology

Induction booklet

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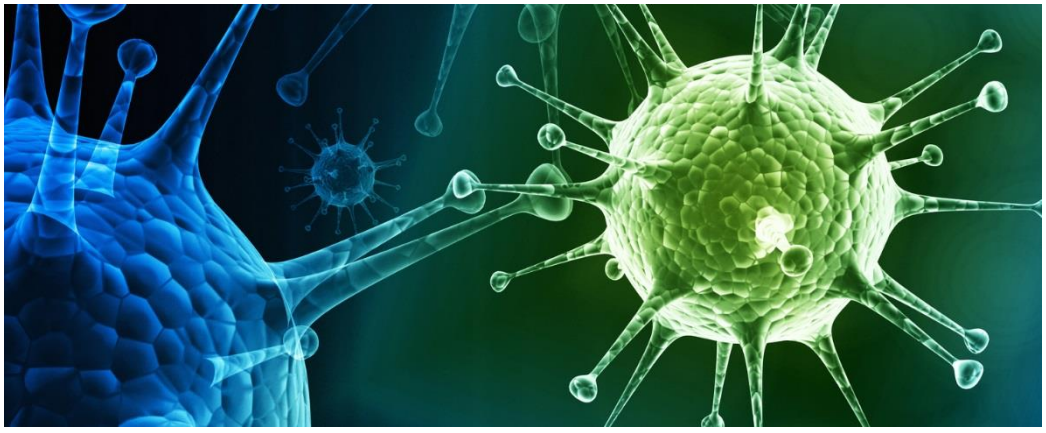

Ever wondered how your heart beats? Or how you breathe in and out? Or maybe why polar bears can survive in the Arctic? Pursue biology and discover why! Biologists study life processes and decode the mysteries of life. The knowledge and skills developed in biology unlock many career pathways as people will always require healthy food, novel medicines, clean water, sensibly-produced crops, and fuel that is carbon neutral. Without a work force well trained in the biological sciences, none of this will happen.

Skills you will develop:

Problem solving, analytical, thinking outside the box, communication, evaluative, planning, investigative, maths, design, practical and many more!

Where will AS and A-level Biology take you?

Agriculture, Anatomy / Physiology, Bioinformatics / Biotechnology, Botany, Biochemistry, Cell Biology, Optometry, Conservation, Dentistry, Ecology, Epidemiology Environmental Scientists, Forensic Science Genetics, Marine Science, Medicine, Medical Therapist, Microbiology Natural Resources, Neuroscience, Pharmacology, Radiography, Toxicology, Veterinary Medicine, Surgeon and Zoology

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The modules you will study:

Module 1: Development of practical skills in biology

Module 2: Foundations in biology

Module 3: Exchange and transport

Module 4: Biodiversity, evolution and disease

Module 5: Communication, homeostasis and energy

Module 6: Genetics, evolution and ecosystems

Papers you will sit at the end of the second year:

Paper 1: Biological processes, Modules 1, 2, 3 & 5 (includes practical skills) 37% of A level
Written paper 2 hours 15 minutes
100 marks
(Section A multiple choice questions, 15 marks. Section B short structured questions, problem solving, calculations, practical and extended response questions, 85 marks)

Paper 2: Biological diversity, Modules 1, 2, 4 & 6 (includes practical skills) 37% of A level
Written paper 2 hours 15 minutes
100 marks
(Section A multiple choice questions, 15 marks. Section B short structured questions, problem solving, calculations, practical and extended response questions, 85 marks)

Paper 3: Unified Biology, Modules 1-6 (includes practical skills) 26% of A level
Written paper 1 hour 30 minutes
70 marks
(short structured questions, problem solving, calculations, practical and extended response questions)

Module 2: Foundations in biology

Chapter 2- Basic components of living organisms

Activity 1

Microscopes are the reason for our fascinating knowledge on biological processes.

You task is to research the differences between the following including how they work:

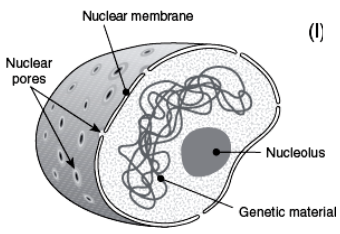
- Light microscope
- Electron microscope
- Scanning confocal microscope

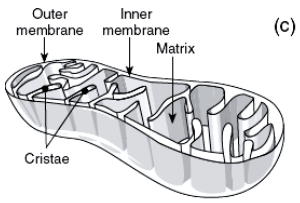
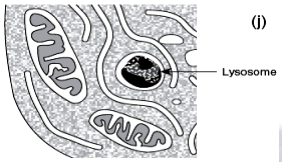
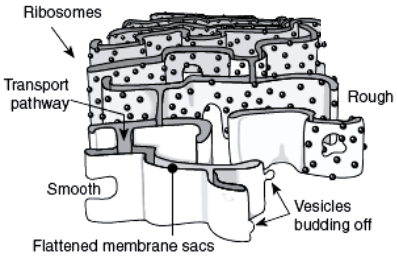
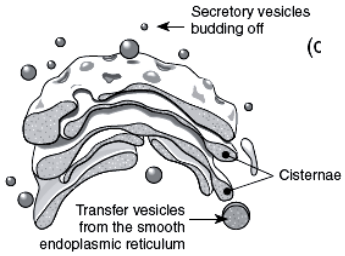
Aiming for an A (you should all be!) please ensure you also include the advantages and disadvantages for each. Do all 3 on separate A4 sheet.

Activity 2

Organelles and their roles

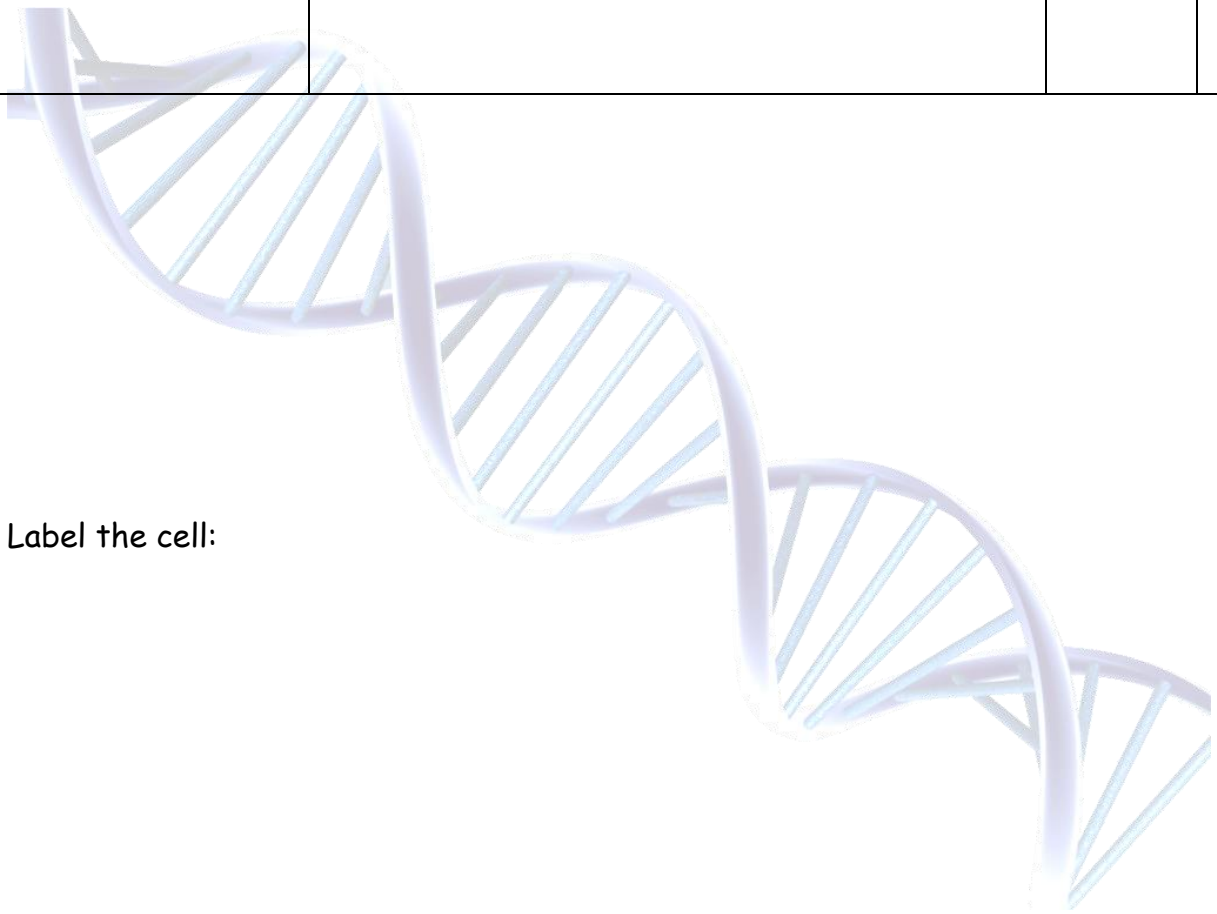
Research information on the different organelles and make sure you learn them so you can be tested when you come back ☺

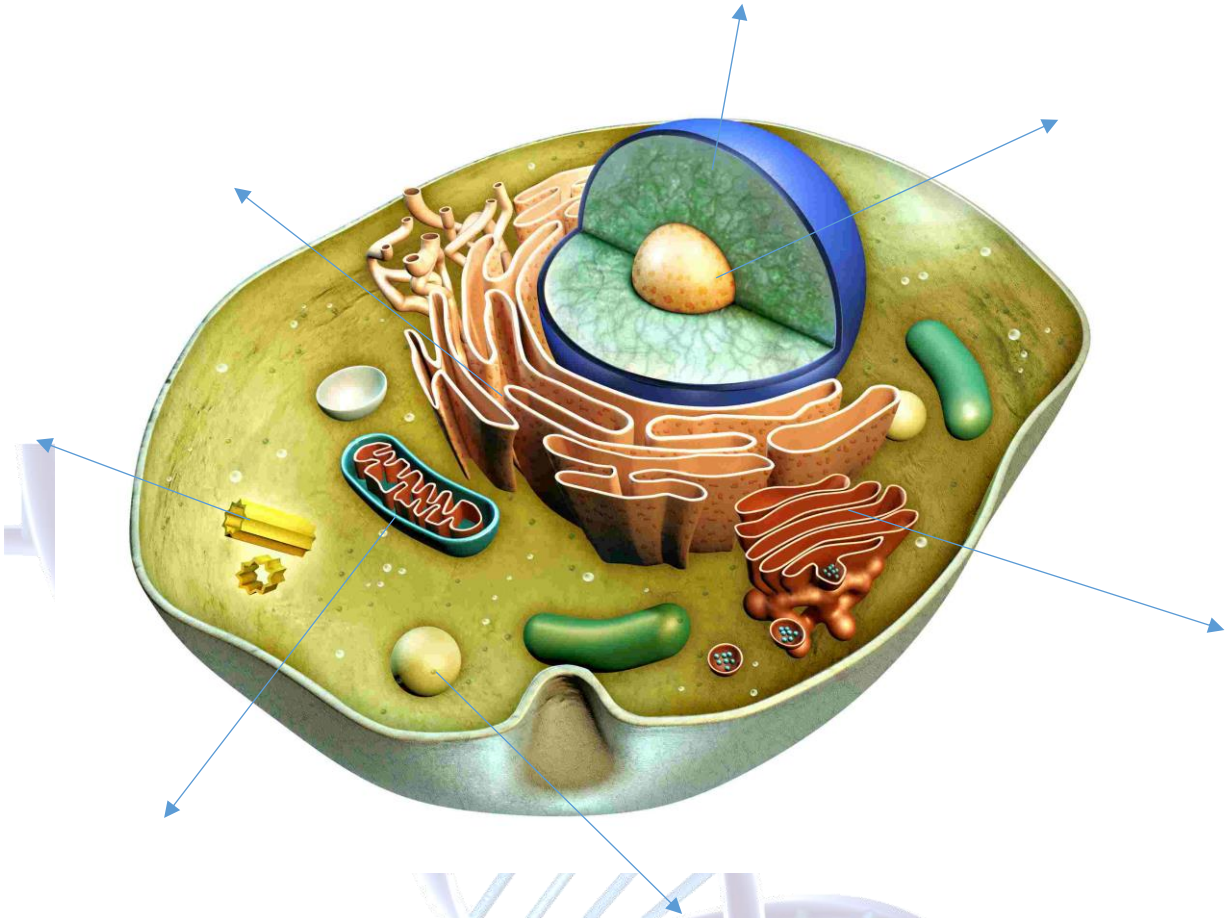
Organelle	***Structure and function***	***Plant cell***	***Animal cell***
Nucleus  			

Mitochondria 			
Lysosome 			
Ribosome 			
Endoplasmic reticulum 	***Rough endoplasmic recticulum (RER)*** ***Smooth endoplasmic reticulum (SER)***		
Golgi apparatus 			

Chloroplasts			
Centrioles			

Label the cell:





Activity 3

Maths skills

Biology now is also testing your maths skills. You must be able to recall your GCSE maths and apply it to various biological concepts.

Please download and print the maths spec and brush up on all your GSCE maths BEFORE you begin biology AS level.

http://www.ocr.org.uk/qualifications/beta/as-a-level-gce-biology-a-h020-h420-from-2015/planning-and-teaching/

Some new maths skills are taught – but very many are from GCSE – you MUST be confident with these before you start biology A level.

Practice 1 – Standard deviation

Worked example: Petiole length variation in ivy leaves

Standard deviation (denoted with the Greek letter σ) is a measurement of the spread of data.

It is calculated using the following formula:

$$\sigma = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n - 1}}$$

Σ = the sum (total) of

x = value measured

$\bar{x}$ = mean value

n = total number of values in the sample

Follow the worked example below to work out the standard deviation of the length of petioles (the stalk attaching the leaf to the stem) of a sample of 10 ivy leaves. The data collected was:

Sample Number	1	2	3	4	5	6	7	8	9	10
Petiole length / mm	28	30	17	31	35	45	46	67	33	57

1 Calculate the mean value $\bar{x}$

$$\bar{x} = \frac{\text{sum of the individual measurements}}{\text{number in the sample}}$$

$$= \frac{389}{10} = 38.9\,\text{mm}$$

2 Subtract the mean value from each measured value: $x - \bar{x}$

For example, the first measurement was 28 mm.

Measured value (x) – mean value ($\bar{x}$)
= 28 – 38.9 = –10.9 mm

For the other measurements you would calculate: –8.9 mm, –21.9 mm, –7.9 mm, –3.9 mm, 6.1 mm, 7.1 mm, 28.1 mm, –5.9 mm, 18.1 mm

3 Square each of these values $(x - \bar{x})^2$

For example $-10.9^2 = 118.81$

For the other measurements you would calculate: 79.2 mm, 479.6 mm, 62.4 mm, 15.2 mm, 37.2 mm, 50.4 mm, 789.6 mm, 34.8 mm, 327.6 mm

4 Sum each of these values $\Sigma (x - \bar{x})^2$

118.8 + 79.2 + 479.6 + 62.4 + 15.2 + 37.2 + 50.4 + 789.6 + 34.8 + 327.6 = 1994.8 mm

5 Divide this value by the sample size minus one $\frac{\Sigma (x - \bar{x})^2}{n - 1}$

$$\frac{\Sigma (x - \bar{x})^2}{n - 1} = \frac{1994.8}{10 - 1} = \frac{1994.8}{9} = 221.7$$

6 Find the square root of this value $\sqrt{\frac{\Sigma (x - \bar{x})^2}{n - 1}}$

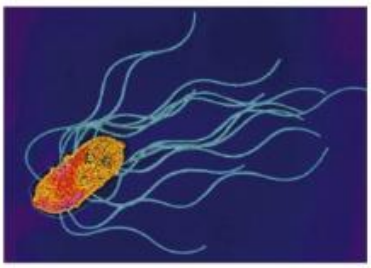
$$\sigma = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n - 1}} = \sqrt{221.7} = 14.9$$

Flagella length variation in *Salmonella*

Salmonella bacteria have a number of flagella to enable them to move. Five bacteria were chosen at random, and their longest flagellum measured. This is the data that was collected:

Bacterium	1	2	3	4	5
Longest flagellum (μm)	3.0	2.5	1.8	2.0	2.7

1. Calculate the mean value for the length of flagella in *Salmonella* bacteria.
2. Using the formula given in the worked example, calculate the standard deviation for the length of flagella in *Salmonella* bacteria. State your answer to two decimal places.
3. State the range of flagella lengths that 68% of the *Salmonella* population will have.
4. State and explain what type of variation is shown by the length of flagella in *Salmonella*.



▲ **Figure 6** *This is a* Salmonella *bacteria (*Salmonella *sp.). The length of their flagella shows continuous variation*

Practice 2 – Correlation coefficient

Worked example – Using Spearman's rank correlation coefficient to compare ivy leaves' petiole length and leaf width

The correlation coefficient is calculated using the following formula:

$$r_s = 1 - \frac{6\Sigma d^2}{n(n^2 - 1)}$$

where:

r_s = correlation coefficient

Σ = the sum (total) of

d = difference in ranks

n = number of pairs of data

The group of students next wanted to find out if the petiole length of the ivy was related to the width of an ivy leaf. They took a sample of 10 ivy leaves from the north facing side of the stump. The data they collected is shown below.

Sample Number	1	2	3	4	5	6	7	8	9	10
Petiole length / mm	28	58	57	59	27	59	44	54	79	63
Leaf width / mm	38	66	64	66	30	65	48	54	78	62

The data for the two variables should be rank ordered, from lowest to highest. Using a table can help to make manipulating the data more straightforward.

Where identical values exist, the 'average rank' should be used. So, if two equal values appear at rank 5, both are assigned the rank 5.5 (between ranks 5 and 6).

petiole length / mm	leaf width / mm	Rank: petiole length	Rank: leaf width	Rank difference d	d^2
28	38	2	2	0	0
58	66	6	8.5	−2.5	6.25
57	64	5	6	−1	1
59	66	7.5	8.5	−1	1
27	30	1	1	0	0
59	65	7.5	7	0.5	0.25
44	48	3	3	0	0
54	54	4	4	0	0
79	78	10	10	0	0
63	62	9	5	4	16
					$\sum d^2 = 24.5$

Substituting values from the table:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)} = 1 - \frac{(6 \times 24.5)}{10 \times (10^2-1)} = 1 - \left(\frac{147}{990}\right) = 0.852$$

where:

An r_s value of +1 shows a perfect positive correlation.

An r_s value of −1 shows a perfect negative correlation

An r_s value of 0 shows no correlation

Therefore in this example, petiole length and leaf width show an excellent correlation.

To work out the statistical strength of the correlation, the value should be looked up in the correlation coefficient critical value tables. Some tables refer to the number of data pairs (n); others ask you to calculate the degrees of freedom (df). The tables you will be using for your Spearman's rank correlation coefficient use n.

Synoptic link

You will learn how to calculate degrees of freedom in Topic 20.4, Phenotypic ratios.

Then look at the probability values for this number of data pairs. As before, for the data to be considered significantly different from chance alone, the probability must be 5% (0.05) or less – a certainty of 95% or more.

	$p = 0.1$	$p = 0.05$	$p = 0.02$	$p = 0.01$
	10%	5%	2%	1%
n				
1	–	–	–	–
2	–	–	–	–
3	–	–	–	–
4	1.0000	–	–	–
5	0.9000	1.0000	1.0000	–
6	0.8286	0.8857	0.9429	1.0000
7	0.7143	0.7857	0.8929	0.9286
8	0.6429	0.7381	0.8333	0.8810
9	0.6000	0.7000	0.7833	0.8333
10	0.5636	0.6485	0.7455	0.7939
11	0.5364	0.6182	0.7091	0.7545
12	0.5035	0.5874	0.6783	0.7273

If p=0.01 then this correlation has only a 1% probability of having occurred by random chance. As the correlation is positive, we can conclude that the greater the petiole length, the greater the leaf width.

5 The following data was collected from a student's fieldwork study:

Diameter of rose bush stem / mm	1	2	3	5	8	10	11	14
Number of thorns per unit length	8	11	9	12	12	27	23	30

a Calculate Spearman's rank correlation coefficient for this set of data *(6 marks)*

b Evaluate the strength of the correlation calculated in part (a) *(3 marks)*

Activity 4

Conservation and preservation

What do the 2 words mean?

Conservation_____

_____

Preservation_____

_____

Research what these organisations do:

CITES	International union for the conservation of nature	The Rio convention	Countryside stewardship scheme

BIOLOGY A LEVEL

Top tip:

Organise your file at the start – so that you can find it easier to revise once you have been taught. Put in dividers for – tests, exam packs, notes, research, PAGS, AST work.

Please ensure you have completed the contents of your pack BEFORE you start the Sixth Form Programme