Yr11 – 12 Transition Activities

Subject: A level Biology

CELLS

THE CITY OF LEICESTER COLLEGE

A Level transition work

What is included:

- Book recommendations
- Video recommendations
- Guidance on how to make notes

- **Research activities – The Big Picture**

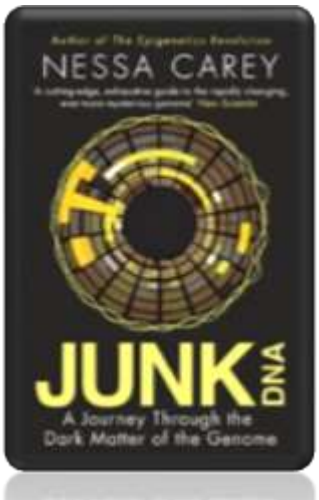
- Notes

- **TASKS – 5 tasks (2 GCSE recap and 3 A level) – all must be completed**

- **A level exam questions (task 5) – these need to be printed and completed (do not resize as it will affect the magnification questions**

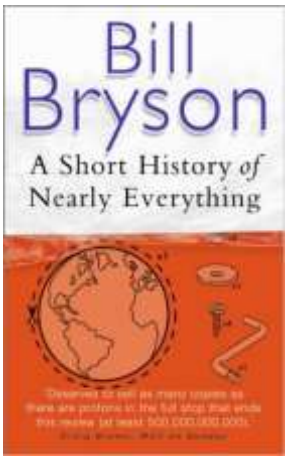
Book Recommendations

Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Biology



Junk DNA

Our DNA is so much more complex than you probably realize, this book will really deepen your understanding of all the work you will do on Genetics. Available at amazon.co.uk



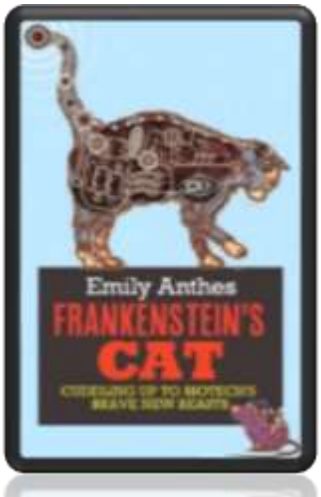
A Short History of Nearly Everything

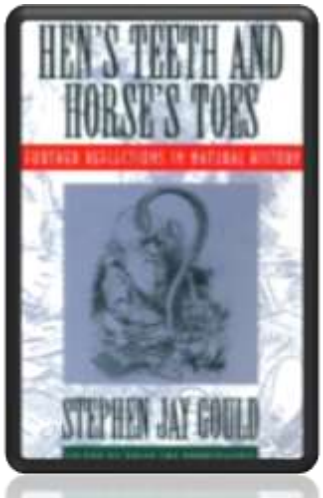
A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at amazon.co.uk

An easy read..

Frankenstein's cat

Discover how glow in the dark fish are made and more great Biotechnology breakthroughs. Available at amazon.co.uk





Studying Geography as well?

Hen's teeth and horses toes

Stephen Jay Gould is a great Evolution writer and this book discusses lots of fascinating stories about Geology and evolution. Available at amazon.co.uk

Research activity

The Big Picture is an excellent publication from the Wellcome Trust. Along with the magazine, the company produces posters, videos and other resources aimed at students studying for GCSEs and A level.

For each of the following topics, you are going to use the resources to produce one page of Cornell style notes.

Use the links of scan the QR code to take you to the resources.

Topic 1: The Cell

Available at: http://bigpictureeducation.com/cell

The cell is the building block of life. Each of us starts from a single cell, a zygote, and grows into a complex organism made of trillions of cells. In this issue, we explore what we know – and what we don't yet know – about the cells that are the basis of us all and how they reproduce, grow, move, communicate and die.

NOTES

Below are some notes on the topics you are covering in this pre-learning booklet. You can use these as well as the videos to complete the tasks below.

Reference https://pmt.physicsandmathstutor.com/download/Biology/A-level/Notes/AQA/2-Cells/Summary%20Notes.pdf

Microscopy

Methods of studying cells

There are many methods for studying cells and one way in which this is done is through the use of microscopes of which there are two main types.

Light Microscopes

Light microscopes use a pair of convex glass lenses that can resolve images that are 0.2um apart. The reason for this is that this is wavelength of light and therefore restricts the resolution that a light microscope resolve to. This is compared to electron microscopes which can distinguish between items 0.1nm apart.

The magnification of an image as seen through a microscope can be calculated using the following equation:

Magnification = size of image/size of real object

Resolution is defined as the minimum distance apart that two objects can be distinguished as separate objects in an image. The greater the resolution the more clear the image will be.

Electron Microscopes

The limitation of light microscopes only resolving to a resolution of 0.2um means that electron microscopes can be used to look at objects that are closer than 0.2um apart. There are two main types of electron microscope, these are transmission electron microscopes (TEM) and scanning electron microscopes (SEM). Electron microscopes work in a similar way to light microscopes, but instead use a beam of electrons that are focused by electromagnets inside a vacuum environment. The vacuum environment is needed so that particles in the air do not deflect the electrons out of the beam alignment.

The following details how each type of electron microscope works:

1.Transmission Electron Microscope - a beam of electrons passes through a thin section of a specimen. Areas that absorb the electrons appear darker on the electron micrograph that is

produced.

2.Scanning Electron Microscope - in a scanning electron microscope a beam of electrons passes across the surface and scatter. The pattern of scattering builds up a 3D image depending on the contours of the specimen.

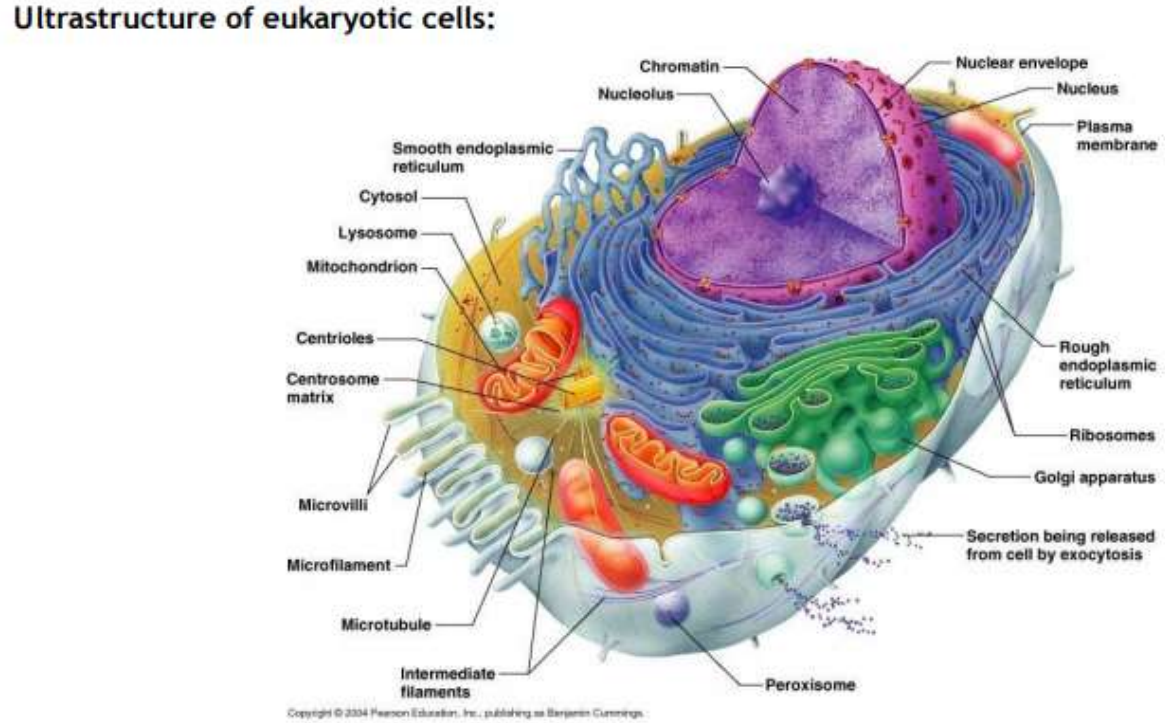
There are some limitations though when using electron microscopes, the limitations for SEM and TEM are:

- The whole system must be in a vacuum so living specimens cannot be observed.
- A complex staining process is required which may introduce artefacts into the image.
- Specimens have to be very thin, particularly for TEM so that the electrons can pass through.
- SEM has a lower resolving power than TEM, but both have greater resolving power than a light Microscope.

Cell structure

All living organisms are made of cells, of which there are several different types of cells, some of them sharing some common features. Humans are made up of eukaryotic cells. All eukaryotic cells contain a nucleus and membrane bound organelles. A more detailed structure of cells called the ultrastructure can be obtained by using a microscope.

Ultrastructure of eukaryotic cells:



• Nucleus is a double membrane called the envelope containing ~3000 nuclear pores that enables molecules to enter and leave. It also contains chromatin and a nucleolus which is the site of ribosome production. A granular jelly like material called nucleoplasm makes up the bulk of the nucleus.

• Rough endoplasmic reticulum is a series of flattened sacs enclosed by a membrane with ribosomes on the surface. RER folds and processes proteins made on the ribosomes.

• Smooth endoplasmic reticulum is a system of membrane bound sacs. SER produces and processes lipids.

• Golgi apparatus is a series of fluid filled, flattened & curved sacs with vesicles surrounding the edges. Golgi apparatus processes and packages proteins and lipids. It also produces lysosomes.

• Mitochondria are oval shaped, bound by a double membrane called the envelope. The inner membrane is folded to form projections called cristae with a matrix on the inside containing all the enzymes needed for respiration.

• Centrioles are hollow cylinders containing a ring of microtubules arranged at right angles to each other. Centrioles are involved in producing spindle fibres for cell division.

• Ribosomes are composed of two sub units and are the site of protein production.

---------- END OF NOTES----------

TASKS

The cell is a unifying concept in biology, you will come across it many times during your two years of A level study. Prokaryotic and eukaryotic cells can be distinguished on the basis of their structure and ultrastructure. In complex multicellular organisms cells are organised into tissues, tissues into organs and organs into systems.

TASK 1 – GCSE RECAP

1- Draw a labelled eukaryotic cell and a labelled prokaryotic cell
2- Make a table listing the ALL **similarities and differences** between eukaryotic and prokaryotic cells

TASK 2- GCSE RECAP

Conversions

1 metre (**m**) = 1000 millimetres (**mm**)
1 mm = 1000 micrometres (**µm**) (or microns)
1 µm = 1000 nanometres (**nm**

Copy and complete the table below into your workbook

Cm (centimetre)	Mm (millimetre)	µm (micrometre)	Nm (nanometre)
5			
	85		
		1000	
			70

TASK 3- MICROSCOPES

https://www.thermofisher.com/blog/microscopy/tem-vs-sem-whats-the-difference/

https://www.khanacademy.org/science/high-school-biology/hs-cells/hs-introduction-to-cells/a/microscopy

Make notes comparing the 3 microscopes; inc the advantages and disadvantages of each

Now watch this video on Microscopy calculations

https://www.youtube.com/watch?v=VBdVARYWq1c

make notes on magnification calculations. You will need these for task 5

TASK 4 – A LEVEL (Cell organelles)

Read the information on these websites (you could make notes if you wish):

https://www.youtube.com/watch?v=rKS-vvhMV6E

https://alevelnotes.com/notes/biology/cells/cell-structure/organelle-structure-and-function

Task:

Produce a one page revision guide summarising the following topic: Cells and Cell Ultrastructure,

Your revision guide should include:

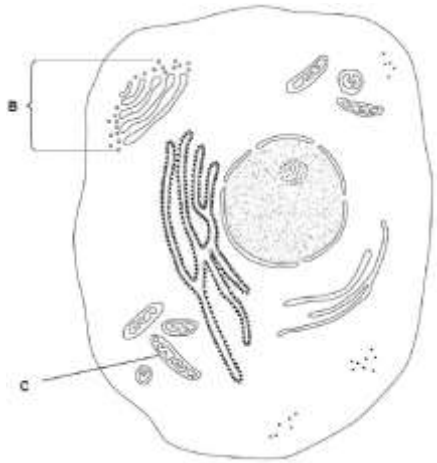
- Key words
- A labelled diagram of the cell
- Short explanations of the role of each organelle
- Explanation of how the organelles work together

TASK 5 – Application

Print off the exam questions on the next page and complete them

Exam questions – print these pages off

Q1. Below is a diagram of an animal cell.



(a) Name the organelles labelled:

B _____

C _____

(2)

(b) Name **two** structures present in plant cells that are **not** present in animal cells.

1. _____

2. _____

(1)

Q2.

(a) Structures **A** to **E** are parts of a plant cell.

A Cell Wall
B Chloroplast
C Nucleus
D Mitochondrion
E Golgi apparatus

Complete the table by putting the correct letter, **A**, **B**, **C**, **D** or **E** in the box next to each statement.

Statement	**Letter**
Has stacked membranes arranged in parallel and contains DNA.	
Is made of polysaccharide.	
Is an organelle and is **not** surrounded by two membranes.	

(3)

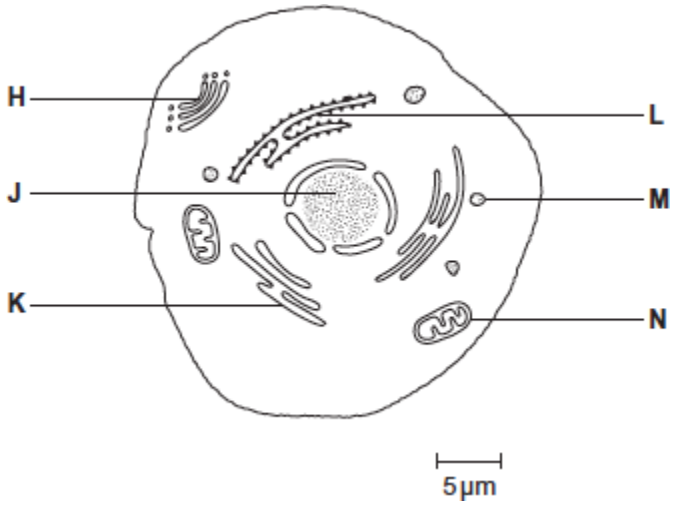
(b) Human breast milk is produced and secreted by gland cells. These gland cells have adaptations that include many mitochondria and many Golgi vesicles. The milk contains a high concentration of protein.

Explain the role of these cell adaptations in the production and secretion of breast milk.

(2)

(Total 5 marks)

Q3. The diagram shows a eukaryotic cell.



(a) Complete the table by giving the letter labelling the organelle that matches the function.

Function of organelle	Letter
Protein synthesis	
Modifies protein (for example, adds carbohydrate to protein)	
Aerobic respiration	

(3)

(b) Use the scale bar in the diagram above to calculate the magnification of the drawing.
Show your working.

Answer = _____

(2)

(Total 5 marks)

Q4.

(b) The table shows features of a mitochondrion and a chloroplast. Complete the table with ticks where a feature is present.

Feature	Mitochondrion	Chloroplast
Double outer membrane		
Starch grains		
Diffusion of oxygen into the organelle		

(3)

(c) Give the function of a mitochondrion.

_____

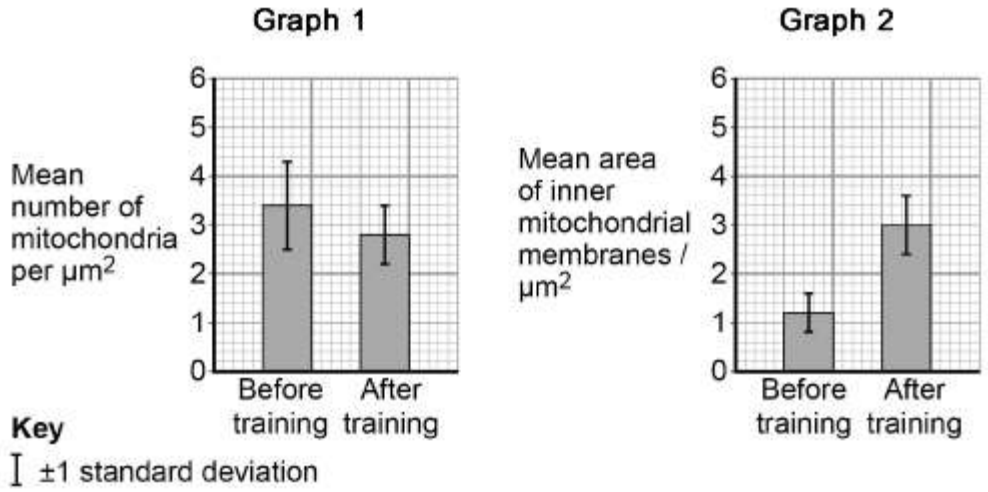
_____

_____

(1)

(d) Scientists investigated the effect of an exercise programme on the number and size of mitochondria in skeletal muscle. They took samples of muscle from a large number of volunteers before and after the exercise programme. From each sample, they cut thin sections and used these to determine the mean number of mitochondria per μm^2 and the mean area of inner mitochondrial membranes.

Their results are shown in **Graph 1** and **Graph 2**.



What do the data in **Graph 1** and **Graph 2** suggest about the effect of the exercise programme on mitochondria?

(2)

Q5.(a) Contrast how an optical microscope and a transmission electron microscope work **and** contrast the limitations of their use when studying cells.

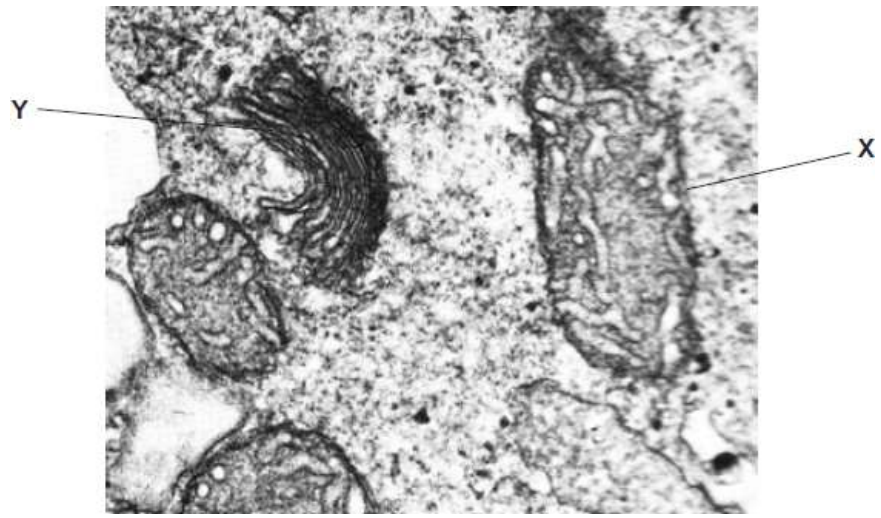
_____

_____

_____

(6)

Q6. The photograph shows part of the cytoplasm of a cell.



(a) (i) Organelle **X** is a mitochondrion.

What is the function of this organelle?

_____

_____

(1)

(ii) Name organelle **Y.**

_____

(1)

(b) This photograph was taken using a transmission electron microscope. The structure of the organelles visible in the photograph could not have been seen using an optical(light) microscope. Explain why.

_____

_____

_____

_____

_____

(2)

(Total 4 marks)

Science on Social Media

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts. Here are some of our top tips to keep up to date with developing news or interesting stories:

Follow on Twitter:
Commander Chris Hadfield – former resident aboard the International Space Station @cmdrhadfield
Tiktaalik roseae – a 375 million year old fossil fish with its own Twitter account! @tiktaalikroseae
NASA's Voyager 2 – a satellite launched nearly 40 years ago that is now travelling beyond our Solar System
@NSFVoyager2
Neil dGrasse Tyson – Director of the Hayden Planetarium in New York
@neiltyson
Sci Curious – feed from writer and Bethany Brookshire tweeting about good, bad and weird neuroscience
@scicurious
The SETI Institute – The Search for Extra Terrestrial Intelligence, be the first to know what they find!
@setiinstitute
Carl Zimmer – Science writer Carl blogs about the life sciences
@carlzimmer
Phil Plait – tweets about astronomy and bad science
@badastronomer
Virginia Hughes – science journalist and blogger for National Geographic, keep up to date with neuroscience, genetics and behaviour
@virginiahughes
Maryn McKenna – science journalist who writes about antibiotic resistance
@marynmck

Science websites

These websites all offer an amazing collection of resources that you should use again and again through out your course.

Probably the best website on Biology….
Learn Genetics from Utah University has so much that is pitched at an appropriate level for you and has lots of interactive resources to explore, everything from why some people can taste bitter berries to how we clone mice or make glow in the dark jelly fish.
http://learn.genetics.utah.edu/

ZSL
LIVING CONSERVATION

In the summer you will most likely start to learn about Biodiversity and Evolution. Many Zoos have great websites, especially London Zoo. Read about some of the case studies on conservation, such as the Giant Pangolin, the only mammal with scales.
https://www.zsl.org/conservation

At GCSE you learnt how genetic diseases are inherited. In this virtual fly lab you get to breed fruit flies to investigate how different features are passed on.
http://sciencecourseware.org/vcise/drosophila/

DNA from the beginning is full of interactive animations that tell the story of DNA from its discovery through to advanced year 13 concepts. One to book mark!
http://www.dnaftb.org/

Ok, so not a website, but a video you definitely want to watch. One of the first topics you will learn about is the amazing structure of the cell. This BBC film shows the fascinating workings of a cell… a touch more detailed than the "fried egg" model you might have seen.
http://www.dailymotion.com/video/xzh0kb_the-hidden-life-of-the-cell_shortfilms
If this link expires – google "BBC hidden life of the cell"

Science: Things to do!

Day 4 of the holidays and boredom has set in?
There are loads of citizen science projects you can take part in either from the comfort of your bedroom, out and about, or when on holiday. Wikipedia does a comprehensive list of all the current projects taking place. Google 'citizen science project'

Bumblebee Conservation Trust

AgeGuess

OPAL EXPLORE NATURE

big butterfly count 15th July - 7th August

THE SHORE THING GET INVOLVED!

eoceans www.eoceans.org

WildlifeLog SPOT IT - SHARE IT - SAVE IT

The Big Moss Map

MOOC

canvas edX coursera OPEN 2 STUDY UDACITY F/L FUTURELEARN KHAN ed2go

Want to stand above the rest when it comes to UCAS? Now is the time to act.
MOOCs are online courses run by nearly all Universities. They are short FREE courses that you take part in. They are usually quite specialist, but aimed at the public, not the genius!
There are lots of websites that help you find a course, such as edX and Future learn.
You can take part in any course, but there are usually start and finish dates. They mostly involve taking part in web chats, watching videos and interactives.

Completing a MOOC will look great on your Personal statement and they are dead easy to take part in!