A level Biology Transition Work

2025



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So you are considering A level Biology? Great!

We consistently achieve the best value added A level grades at Caludon but there is so much more to Biology than just fantastic results…..

This transition work will give you a gentle introduction to Cells and movement of substances into and out of them. Read the revision guide style bullets and then have a go at the questions at the bottom of each page.

I have also included some movie recommendations for you….it's a long summer!

It's only too apparent that corona virus and Covid-19 have impacted us in ways we would never have thought possible even a couple of months ago. The A level website link I have included for you is all about the immune system - the very organ system at the centre of our fight against Covid-19. Immunity is a key part of the AS level course. In fact the antibody test for the virus is based on a technique called ELISA which is also covered on the course.

I have also included some TedTalk video links about some topical areas of Biology that you may find interesting. I hope the links all still work by the time you click on them!

Finally the last slide contains some fascinating general Biology websites that will spark your passion!

Have a great summer and stay safe.

Eukaryotic and Prokaryotic Cells

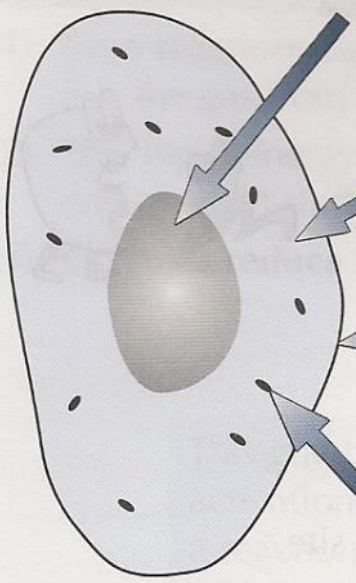
Organisms can be *Prokaryotes* or *Eukaryotes*

1) **Prokaryotic** (pronounced like this: pro-carry-ot-ick) organisms are prokaryotic cells (i.e. they're **single-celled** organisms) and **eukaryotic** (you-carry-ot-ick) organisms are made up of eukaryotic cells.
2) Both types of cells contain **organelles**. Organelles are parts of cells — each one has a **specific function**.

Eukaryotic cells are **complex** and include all **animal** and **plant** cells.

Prokaryotic cells are **smaller** and **simpler**, e.g. **bacteria**.

4 organelles **animal** and **plant** cells have in **common**:



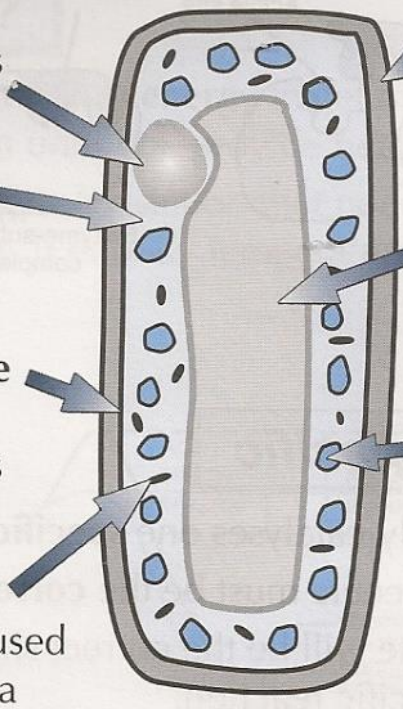
Nucleus contains genetic material (DNA) that controls what the cell **does**.

Cytoplasm contains enzymes that speed up biochemical reactions.

Cell-surface membrane holds the cell together and controls what goes **in** and **out**.

Mitochondria are where glucose and oxygen are used in **respiration** to provide a source of **energy** for the cell.

3 extras that **only plant cells** have:



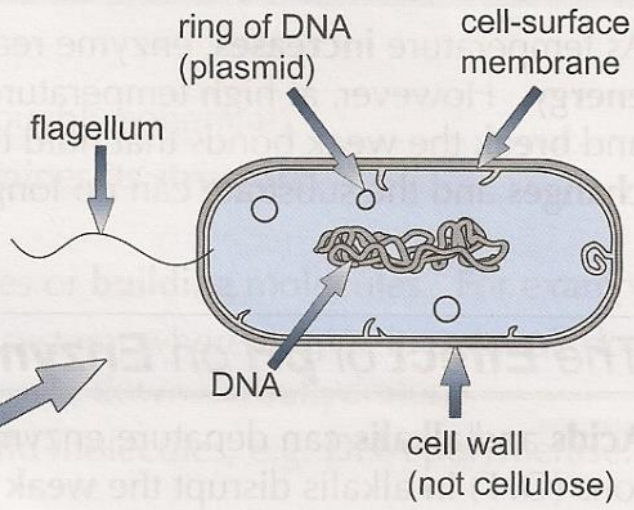
Rigid cell wall made of **cellulose**, gives the cell support.

Vacuole contains **cell sap**, a weak solution of sugar and salts.

Chloroplasts contain **chlorophyll** for **photosynthesis**. They're found in the **green** parts of plants, e.g. leaves and stem.

Bacterial Cells are *Prokaryotic*

1) Prokaryotes like bacteria are roughly a **tenth the size** of eukaryotic cells.
2) Prokaryotic cells **don't contain** a nucleus, mitochondria or chloroplasts.
3) As they **don't** have a nucleus, their **DNA floats freely** in the **cytoplasm**. Some prokaryotes also have **rings of DNA** called **plasmids**.
4) Some prokaryotes have a **flagellum** which **rotates** and allows the cell to **move**.
5) The diagram shows a bacterial cell as seen under an **electron microscope** (see next page).



Bacterial cheerleaders — they never stop swirling their flagella...

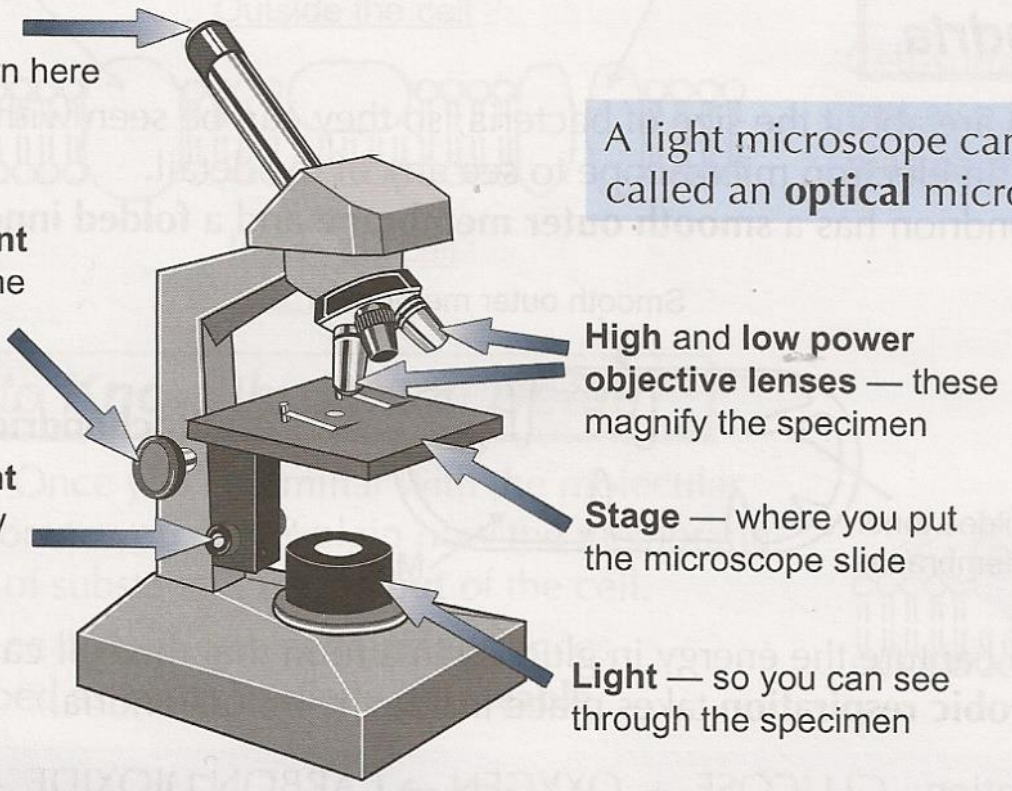
1) Give an example of a prokaryotic cell.
2) Name four organelles that plant and animals cells both have.
3) What is the function of mitochondria?

Microscopes

You Can **See Cell Structure** with a **Light Microscope**

A **light microscope** can magnify up to 1500 times and allows you to see individual animal and plant cells along with the organelles inside them.

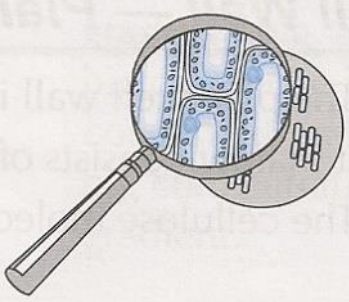
1) If the cells have been **stained** you can see the dark-coloured **nucleus** surrounded by lighter-coloured **cytoplasm**.
2) Tiny **mitochondria** and the black line of the **cell membrane** are also visible.
3) In plant cells, the **cell wall**, **chloroplasts** and the **vacuole** can be seen.



A light microscope can also be called an **optical** microscope.

Electron Microscopes have a **Greater Magnification**

1) The detailed **ultrastructure** of cells was revealed in the 1950s when the **electron microscope** was invented.
2) An electron microscope can **magnify** objects more than 500 000 times and, more importantly, it allows **greater detail** to be seen than a light microscope. For example, it allows you to see the detailed **structures inside organelles** such as mitochondria and chloroplasts.
3) The image that's recorded is called an **electron micrograph**.



I put a slide on the stage and then slid straight off the edge...

1) Name three things visible with a light microscope in both animal and plant cells.
2) Which type of microscope must be used to show the detailed ultrastructure of a cell?
3) What is the image recorded by an electron microscope called?

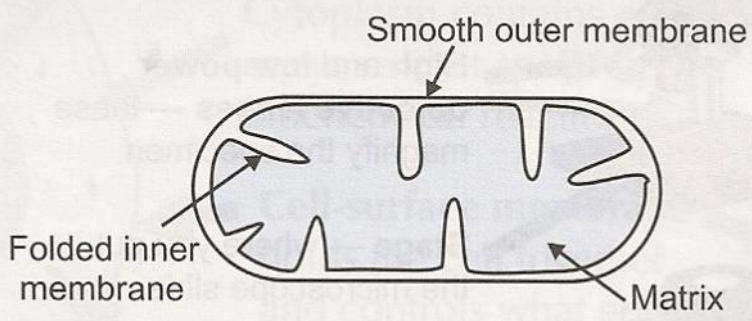
Functions of the Nucleus, Mitochondria and Cell Wall

Nucleus

1) The **nucleus** is the control centre of the cell.
2) It contains **DNA** (deoxyribonucleic acid): the coded information needed for **making proteins**.
3) During **cell division** the chromosomes carrying the long DNA molecules coil up, becoming shorter and thicker and visible with a light microscope.
4) Electron micrographs show that there's a **double membrane** around the nucleus.

Mitochondria

Mitochondria are about the size of bacteria, so they can be seen with a light microscope, but you need an electron microscope to see any of the detail.
Each mitochondrion has a **smooth outer membrane** and a **folded inner membrane**:



A **mitochondrion**

Their job is to capture the energy in glucose in a form that the cell can use.
To do this **aerobic respiration** takes place inside the mitochondria.

Word equation: GLUCOSE + OXYGEN → CARBON DIOXIDE + WATER + (ENERGY)

The energy released by respiration ends up in molecules of **ATP** (adenosine triphosphate). ATP is used in the cell to provide the energy for **muscle contraction**, **active transport** (called active uptake in some text books) and **building large molecules** from small ones, as well as many other processes.

Cell Wall — Plants

1) The plant cell wall is relatively rigid and provides **support** for the cell.
2) It mainly consists of bundles of long, straight **cellulose molecules**.
3) The cellulose molecules lay side by side to form **microfibrils**.

*Doctor, doctor my DNA is getting shorter and thicker...**

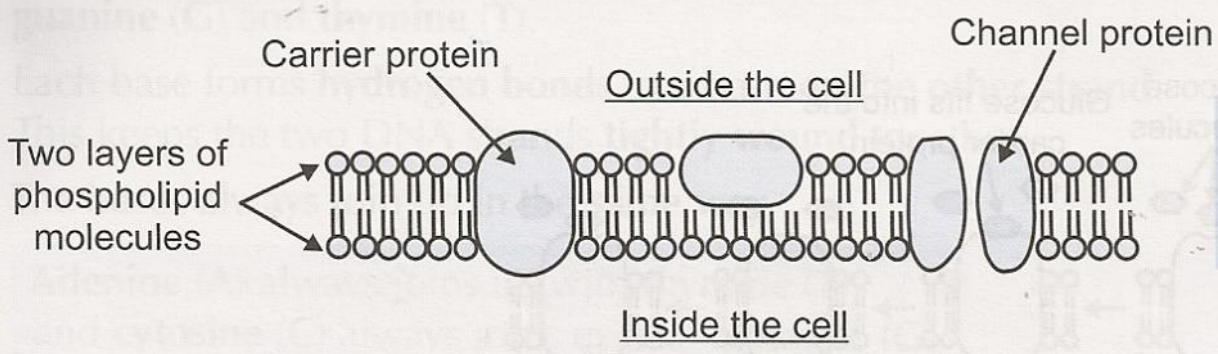
1) Which organelle acts as the control centre of the cell?
2) In which organelle does aerobic respiration occur?
3) Describe the membranes of a mitochondrion.
4) What is the word equation for aerobic respiration?
5) Name the molecule used to provide energy for processes in the cell.
6) Name the molecule that is found in bundles in plant cell walls.

Cell Membranes

Structure of the *Cell-Surface Membrane*

The **cell-surface membrane** is the very thin structure around an individual cell.

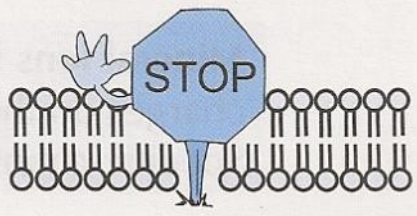
1) Electron micrographs show that the cell-surface membrane consists of a double layer of **phospholipid** molecules tightly packed together.
2) Bigger **protein molecules** are embedded in the phospholipid molecules.
3) Some proteins go **all the way through** the membrane and some only go **halfway**.
4) Membranes surrounding the **organelles** inside cells have the **same** structure.



Cell-surface membranes can also be called **plasma membranes**.

*Do I **Really** have to **Know** this Much **Detail**?*

1) The answer is "Yes". Once you're familiar with the molecular structure of the membrane you can explain how the membrane **controls** the passage of substances **in** and **out** of the cell.
2) Because the membrane only allows certain substances through it, it's described as being **partially permeable**.



*Substances **Pass Through** Membranes by **Four Methods***

1 Diffusion

1) The particles of liquids and gases are constantly **moving about**. This movement causes the particles to spread from an area of **higher** concentration to an area of **lower** concentration.
2) Particles will **diffuse** through the cell membrane as long as they are small enough to pass through the very small gaps **between** the phospholipid molecules. Water, oxygen and **carbon dioxide** molecules can do this.
3) The cell **doesn't** need to provide any energy for this process.

The difference in concentration is sometimes called a **concentration gradient**, e.g. a big difference in concentration is a big concentration gradient.

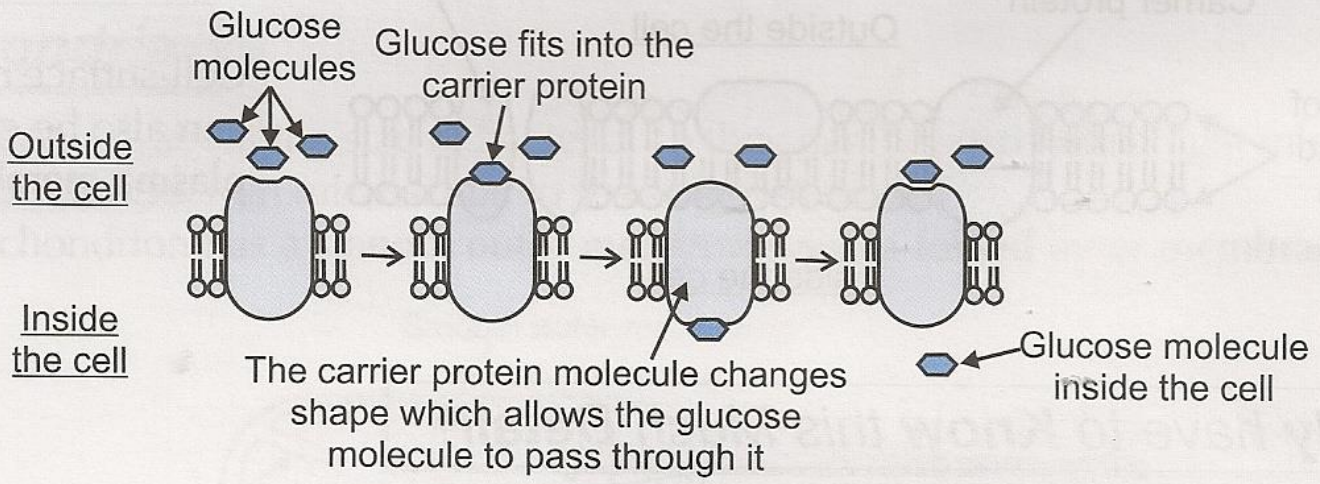
2 Osmosis

1) **Osmosis** is the diffusion of **water** molecules across a partially permeable membrane from a region of **higher concentration** of water molecules to a region of **lower concentration** of water molecules. The cell **doesn't** need to provide energy.
2) The concentration of water molecules is also referred to as the **water potential**. At AS and A-level, you tend to talk about water moving from a region of **higher water potential** to a region of **lower water potential**.

Cell Membranes

3 Facilitated Diffusion

1) Glucose and many other water soluble molecules are **too big** to diffuse across the membrane by themselves. They must be helped across by **carrier proteins**.
2) Each substance has its **own specific** carrier protein.
3) For example, a molecule of glucose fits onto the outside end of a **glucose carrier protein**.
4) This causes the protein to **change shape**, allowing the glucose molecule to diffuse through it into the cytoplasm of the cell. The cell **doesn't** need to provide any energy.



Mineral ions like sodium (Na^+) and potassium (K^+) have electrical charges on them, so they also need help to cross the membrane. Specific **channel proteins** in the membrane allow them to diffuse through.

4 Active Transport (or Active Uptake)

1) When a cell needs to move substances across the membrane from a region of **low** concentration to a region of **higher** concentration, it must provide **energy**.
2) The substance fits into a **specific carrier protein**, then molecules of **ATP** (see page 8) provide the energy to change the shape of the protein.
3) As it changes shape the protein **actively transports** the substance across the membrane.
4) These special **carrier proteins** are sometimes called "**pumps**" because they're moving substances **against** a concentration gradient.

Active transport — isn't that just riding a bike?

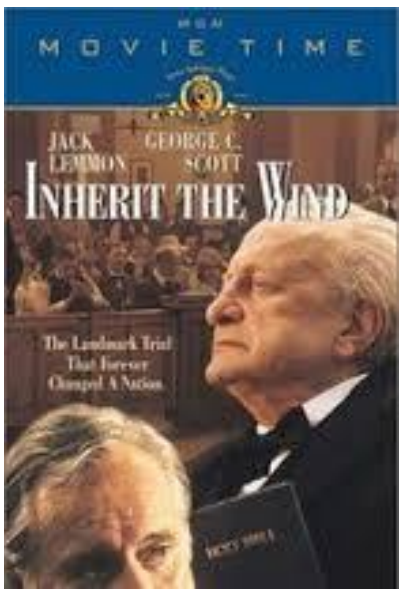
1) Name the two types of molecule that make up the cell membrane.
2) Give four ways substances can cross cell membranes.
3) What do you call the diffusion of water molecules through the cell membrane?
4) Give another term for the concentration of water molecules.
5) Name the two types of protein involved in facilitated diffusion.
6) Why does active transport require ATP?

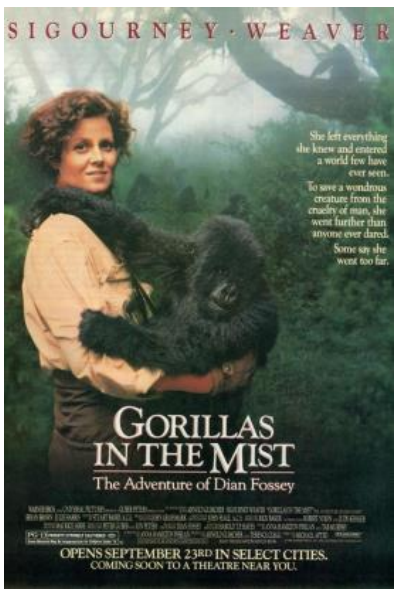
Movie Recommendations

Everyone loves a good story and everyone loves some great science. Here are the top 5 picks based on real life scientists and discoveries. Great watching for a rainy day.



Inherit The Wind (1960)
Great if you can find it. Based on a real life trial of a teacher accused of the crime of teaching Darwinian evolution in school in America. Does the debate rumble on today?





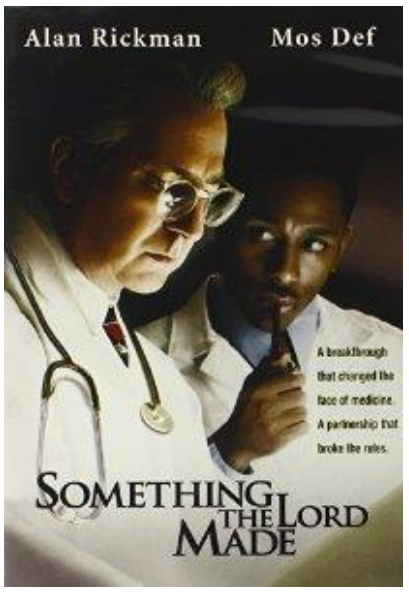
Gorillas in the Mist (1988)
An absolute classic that retells the true story of the life and work of Dian Fossey and her work studying and protecting mountain gorillas from poachers and habitat loss. A tear jerker.

Andromeda Strain (1971)
Science fiction by the great thriller writer Michael Cricthon (he of Jurassic Park fame). Humans begin dying when an alien microbe arrives on Earth.





Lorenzo's Oil (1992)
Based on a true story. A young child suffers from an autoimmune disease. The parents research and challenge doctors to develop a new cure for his disease.



Something the Lord Made (2004)
Professor Snape (the late great Alan Rickman) in a very different role. The film tells the story of the scientists at the cutting edge of early heart surgery as well as issues surrounding racism at the time.

There are some great TV series and box sets available too, you might want to check out: Blue Planet, Planet Earth, The Ascent of Man, Catastrophe, Frozen Planet, Life Story, The Hunt and Monsoon.

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.
Use the link to access the resources and carry out a little research of your own.



The Immune System
Available at:
https://www.stem.org.uk/resources/elibrary/resource/35694/immune-system



The immune system is what keeps us healthy in spite of the many organisms and substances that can do us harm not least of all corona virus. In this issue, explore how our bodies are designed to prevent potentially harmful objects from getting inside, and what happens when bacteria, viruses, fungi or other foreign organisms or substances breach these barriers.

There are many other topics in this series that you could also take a look at if you wished

Video Clip Recommendations

If you have 30 minutes to spare, here are some great presentations from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link or scan the QR code to view:

A New Superweapon in the Fight Against Cancer
Available at :
http://www.ted.com/talks/paula_hammond_a_new_superweapon_in_the_fight_against_cancer?language=en
Cancer is a very clever, adaptable disease. To defeat it, says medical researcher and educator Paula Hammond, we need a new and powerful mode of attack.



Why Bees are Disappearing
Available at :
http://www.ted.com/talks/marla_spivak_why_bees_are_disappearing?language=en
Honeybees have thrived for 50 million years, each colony 40 to 50,000 individuals coordinated in amazing harmony. So why, seven years ago, did colonies start dying en-masse?



Why Doctors Don't Know About the Drugs They Prescribe
Available at :
http://www.ted.com/talks/ben_goldacre_what_doctors_don_t_know_about_the_drugs_they_prescribe?language=en
When a new drug gets tested, the results of the trials should be published for the rest of the medical world — except much of the time, negative or inconclusive findings go unreported, leaving doctors and researchers in the dark.

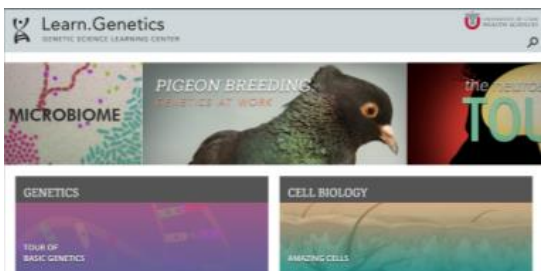


Growing New Organs
Available at :
http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue?language=en
Anthony Atalla's state-of-the-art lab grows human organs — from muscles to blood vessels to bladders, and more.



Biology websites

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



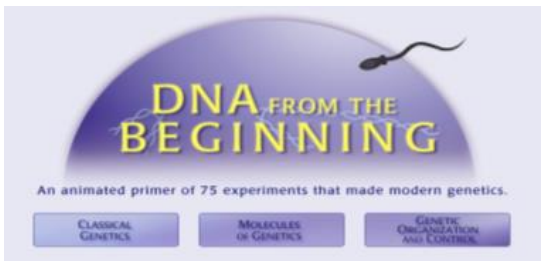
Probably the best website on Biology….
Learn Genetics from Utah University has so much that is pitched at an appropriate level for you and has lots of interactive resources to explore, everything from why some people can taste bitter berries to how we clone mice or make glow in the dark jelly fish.
http://learn.genetics.utah.edu/

ZSL
LIVING CONSERVATION

At the end off year 12 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”