ST CUTHBERT'S
CATHOLIC HIGH SCHOOL

AQA A Level Biology

SIXTH FORM PREPARATION MATERIALS

Name: _____

Submission Deadline: Friday 4th September 2026

Welcome

Dear Student,

Welcome to A-level Biology. The scope of this course is broad, extending from molecular biology and biochemistry through to cell biology, physiology, evolutionary biology and ecology. In the classroom you will experience the excitement of exploring what's known and, more importantly, the questions that remain in these dynamic times and with our guidance we aim to open your minds to the multitude of career opportunities available to Biologists.

There is a big jump from GCSE to A-level biology which will require you to recall a lot of the biology basics in detail in order to comprehend your new content. Therefore to prepare you fully for the year ahead we have designed this bridging booklet so that it gives you a head start with the course content as well as introducing you to the approach we expect you to use when reviewing a topic (Reading and Reviewing, Processing and Thinking, then Applying your knowledge to exam questions and other resources).

We have concentrated the content of this booklet around the mathematical and practical skills you will need and the basic concepts from the first two topics you will study: Cells and Microscopy, then Biological Molecules. Therefore completion of this booklet before September is essential.

We look forward to working with you in September,

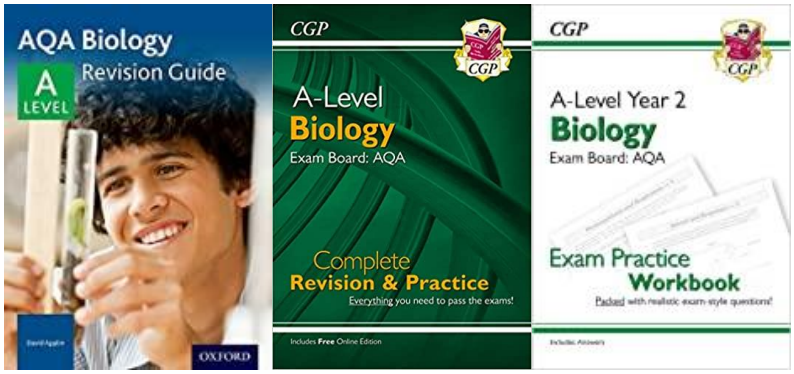
St Cuthbert's Biology Department

Before September

You will need to get yourself a folder with dividers in ready to organise your notes, independent work and further reading. You will also need to place your completed transition booklet in your folder.

It is an expectation that you will complete 45 minutes to 1 hour work to consolidate your notes, complete homework and do further reading from each lesson you attend.

Revision guides are useful but do not contain all of the information you need to learn for the course. The recommended revision guides are:



Specification

In Biology, the subject content is split between AS and A level (sections 3.1 – 3.4) and A level only (sections 3.5-3.8). The section titles are listed here:

3.1	Biological molecules
3.2	Cells
3.3	Organisms exchange substances with their environment
3.4	Genetic information, variation and relationships between organisms
3.5	Energy transfers in and between organisms (A level only)
3.6	Organisms respond to changes in their internal and external environments (A level only)
3.7	Genetics, populations evolution and ecosystems (A level only)
3.8	The control of gene expression (A level only)

Assessment structure

The assessment for the A-level consists of three exams, which you will take at the end of the course.

Paper 1
What's assessed • Any content from topics 1-4 including relevant practical skills
How it's assessed • Written exam: 2 hours • 91 marks • 35% of the A-level
Questions • 76 marks: a mixture of short and long answer questions • 15 marks: extended response questions

Paper 2
What's assessed • Any content from topics 5 – 8 including relevant practical skills
How it's assessed • Written exam: 2 hours • 91 marks • 35% of the A-level
Questions • 76 marks: a mixture of short and long answer questions • 15 marks: extended response questions

Paper 3
What's assessed • Any content from topics 1-8 including • relevant practical skills
How it's assessed • Written exam: 2 hours • 78 marks • 30% of the AS-level
Questions • 38 marks: structured questions, including practical techniques • 15 marks: critical analysis of given experimental data • 25 marks: one essay from a choice of two titles

Assessment objectives

As you know from GCSE, we have to write exam questions that address the Assessment objectives (AOs). It is important you understand what these AOs are, so you are well prepared. In Biology there are three AOs.

- AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques, and procedures (A-level about 30-35% of the marks).
- AO2: Apply knowledge and understanding of scientific ideas, processes, techniques, and procedures;
    - in a theoretical context
    - in a practical context
    - when handling qualitative data
    - when handling quantitative data

  (A-level about 40-45% of the marks).
- AO3: Analyse, interpret, and evaluate scientific information, ideas, and evidence, including in relation to;
    - make judgements and reach conclusions
    - develop and refine practical design and procedures

  (A-level about 25–30% of the marks).

Other assessment criteria

At least 10% of the marks for AS and A-level Biology will assess mathematical skills, which will be equivalent to Level 2 (Higher Tier GCSE Mathematics) or above.

At least 15% of the overall assessment of AS and A-level Biology will assess knowledge, skills and understanding in relation to practical work.

Command words

Command words are used in questions to tell you what is required when answering the question. You can find definitions of the command words used in Biology assessments on the AQA website. They are very similar to the command words used at GCSE

Subject-specific vocabulary

You can find a list of definitions of key working scientifically terms used in the AQA A-level specification here.

You will become familiar with, and gain understanding of, these terms as you work through the course.

Transition activities

Research and Reading

Extended Writing:

This is an 'open book' activity, meaning you can use notes/ resources to help you.

Before attempting the question below, you might want to remind yourself of the work you did on the following topics at GCSE (using notes/ textbooks/ revision guides etc):

- the theory of evolution
- the role of mutation and natural selection

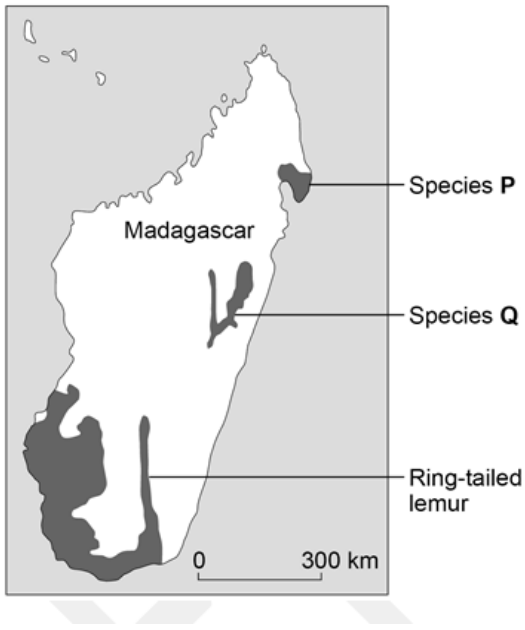
There are also many excellent websites to use when "reading around the subject". Part of being an excellent A-Level Biologist (or an excellent student in general) is to take an interest in the topic you are studying and read from sources beyond the expected curriculum. The following Google search terms will return helpful articles;

National Geographic Education Theory Evolution

Natural History Museum What is Natural Selection

Berkeley The History of Evolutionary Thought

Lemurs are only found on the island of Madagascar. Madagascar is off the coast of Africa. Scientists think that ancestors of modern lemurs evolved in Africa and reached Madagascar about 50-60 million years ago.
Today there are many species of lemur living on Madagascar
Figure 1 shows the distribution of three species of lemur on Madagascar.



Describe how the ancestors of modern lemurs may have evolved into the three different species shown on the map (species P, species Q and ring tail lemurs)

Problem Solving - Revision

Reading Task: Using a highlighter, highlight sentences and keywords that you believe to be significant, that way you are learning to "REDUCE" the content to key points.

Microscopy is probably the most important technique used in Biology. The vast majority of living organisms are too small to be seen in any detail with the human eye, and cells and their organelles can only be seen with the aid of a microscope. Cells were first seen in 1665 by Robert Hooke (who named them after monks' cells in a monastery), and were studied in more detail by Leeuwehoek using a primitive microscope.

By using more lenses microscopes can magnify by a larger amount,

Magnification is how much bigger a sample appears to be under the microscope than it is in real life.

Overall magnification = Objective lens x Eyepiece lens

By using more lenses microscopes can magnify by a larger amount, but this doesn't always mean that more detail can be seen. The amount of detail depends on the **resolving power** of a microscope, which is the **smallest separation at which two separate objects can be distinguished** (or resolved).

The resolving power of a microscope is ultimately limited by the wavelength of light (400-600nm for visible light). To improve the resolving power a shorter wavelength of light is needed, and sometimes microscopes have blue filters for this purpose (because blue has the shortest wavelength of visible light).

Resolution is the ability to distinguish between two points on an image i.e. the amount of detail

- The resolution of an image is limited by the wavelength of radiation used to view the sample.
- This is because when objects in the specimen are much smaller than the wavelength of the radiation being used, they do not interrupt the waves, and so are not detected.
- The wavelength of light is much larger than the wavelength of electrons, so the resolution of the light microscope is a lot lower.
- Using a microscope with a more powerful magnification will **not** increase this resolution any further. It will increase the size of the image, but objects closer than 200nm will still be seen as one point.

Different types of microscopes:

Light Microscopy: This is the oldest, simplest and most widely-used form of microscopy. Specimens are illuminated with light, which is focussed using glass lenses and viewed using the eye or photographic film. Specimens can be living or dead, but often need to be stained with a coloured dye to make them visible. Many different stains are available that stain specific parts of the cell such as DNA, lipids, cytoskeleton, etc. All light microscopes today are **compound microscopes**, which means they use several lenses to obtain high magnification. Light microscopy has a resolution of about 200 nm, which is good enough to see cells, but not the details of cell organelles. There has been a recent resurgence in the use of light microscopy, partly due to technical improvements, which have dramatically improved the resolution far beyond the theoretical limit. For example **fluorescence microscopy** has a resolution of about 10 nm, while **interference microscopy** has a resolution of about 1 nm.

Preparation of Slide Samples

- **Fixation:** Chemicals preserve material in a life like condition. Does not distort the specimen.
- **Dehydration:** Water removed from the specimen using ethanol. Particularly important for electron microscopy because water molecules deflect the electron beam which blurs the image.
- **Embedding:** Supports the tissue in wax or resin so that it can be cut into thin sections. Sectioning Produces very thin slices for mounting. Sections are cut with a microtome or an ulramicrotome to make them either a few micrometres (light microscopy) or nanometres
  (electron microscopy) thick.
- **Staining:** Most biological material is transparent and needs staining to increase the contrast between different structures. Different stains are used for different types of tissues. Methylene blue is often used for animal cells, while iodine in KI solution is used for plant tissues.
- **Mounting:** Mounting on a slide protects the material so that it is suitable for viewing over a long period.

Electron Microscopy. This uses a beam of electrons, rather than electromagnetic radiation, to "illuminate" the specimen. This may seem strange, but electrons behave like waves and can easily be produced (using a hot wire), focused (using electromagnets) and detected (using a phosphor screen or photographic film). A beam of electrons has an effective wavelength of less than 1 nm, so can be used to resolve small sub-cellular ultrastructure. The development of the electron microscope in the 1930s revolutionised biology, allowing organelles such as mitochondria, ER and membranes to be seen in detail for the first time.

The main problem with the electron microscope is that specimens must be fixed in plastic and viewed in a vacuum, and must therefore be dead. Other problems are that the specimens can be damaged by the electron beam and they must be stained with an electron-dense chemical (usually heavy metals like osmium, lead or gold). Initially there was a problem of artefacts (i.e. observed structures that were due to the preparation process and were not real), but improvements in technique have eliminated most of these.

There are two kinds of electron microscope. The **transmission electron microscope** (TEM) works much like a light microscope, transmitting a beam of electrons through a thin specimen and then focusing the electrons to form an image on a screen or on film. This is the most common form of electron microscope and has the best resolution. The **scanning electron microscope** (SEM) scans a fine beam of electron onto a specimen and collects the electrons scattered by the surface. This has poorer resolution, but gives excellent 3-dimentional images of surfaces.

Transmission Electron Microscope (TEM)	Scanning Electron Microscope (SEM)
• Pass a beam of electrons through the specimen. The electrons that pass through the specimen are detected on a fluorescent screen on which the image is displayed. • Thin sections of specimen are needed for transmission electron microscopy as the electrons have to pass through the specimen for the image to be produced. • This is the most common form of electron microscope and has the best resolution Bacterium (TEM) *(Image provided by: ceiba.cc.ntu.edu.tw)*	• Pass a beam of electrons over the surface of the specimen in the form of a 'scanning' beam. • Electrons are reflected off the surface of the specimen as it has been previously coated in heavy metals. • It is these reflected electron beams that are focussed of the fluorescent screen in order to make up the image. • Larger, thicker structures can thus be seen under the SEM as the electrons do not have to pass through the sample in order to form the image. This gives excellent 3-dimensional images of surfaces • However the resolution of the SEM is lower than that of the TEM.

Comparison table of the light and electron microscope

Light Microscope	Electron Microscope
Cheap to purchase (£100 – 500)	Expensive to buy (over £ 1 000 000).
Cheap to operate.	Expensive to produce electron beam.
Small and portable.	Large and requires special rooms.
Simple and easy sample preparation.	Lengthy and complex sample prep.
Material rarely distorted by preparation.	Preparation distorts material.
Vacuum is not required.	Vacuum is required.
Natural colour of sample maintained.	All images in black and white.
Magnifies objects only up to 2000 times	Magnifies over 500 000 times.
Specimens can be living or dead	Specimens are dead, as they must be fixed in plastic and viewed in a vacuum
Stains are often needed to make the cells visible	The electron beam can damage specimens and they must be stained with an electron-dense chemical (usually heavy metals like osmium, lead or gold).

Use this space to reduce your highlighted sentences into bullet points

Analysis and Evaluation

Biological investigations often result in large amounts of data being collected. It is important to be able to analyse this data carefully in order to pick out trends.

Activity 7 – Data: *Answer the questions.*

Table 4

	Type of replacement heart valve	
	Mechanical	**Biological**
Number of patients given the valve	2852	1754
Number of patients who died from heart-related problems after valve replacement	180	178
Percentage of patients alive after 5 years	91	89
Percentage of patients needing a second valve replacement within 6 years	2.2	5.2
Percentage of patients who had a blood clot on the brain after surgery	5.8	0.1

A patient with a leaking heart valve may have the valve replaced. A study compared two different types of replacement heart valve:

- mechanical valves
- biological valves from pigs.
-

The data used in the study was collected from female patients aged 50–69. **Table 4** shows the data

1. Give one conclusion about the death of patients from heart-related problems after a valve replacement.

   Include calculations to support your answer.

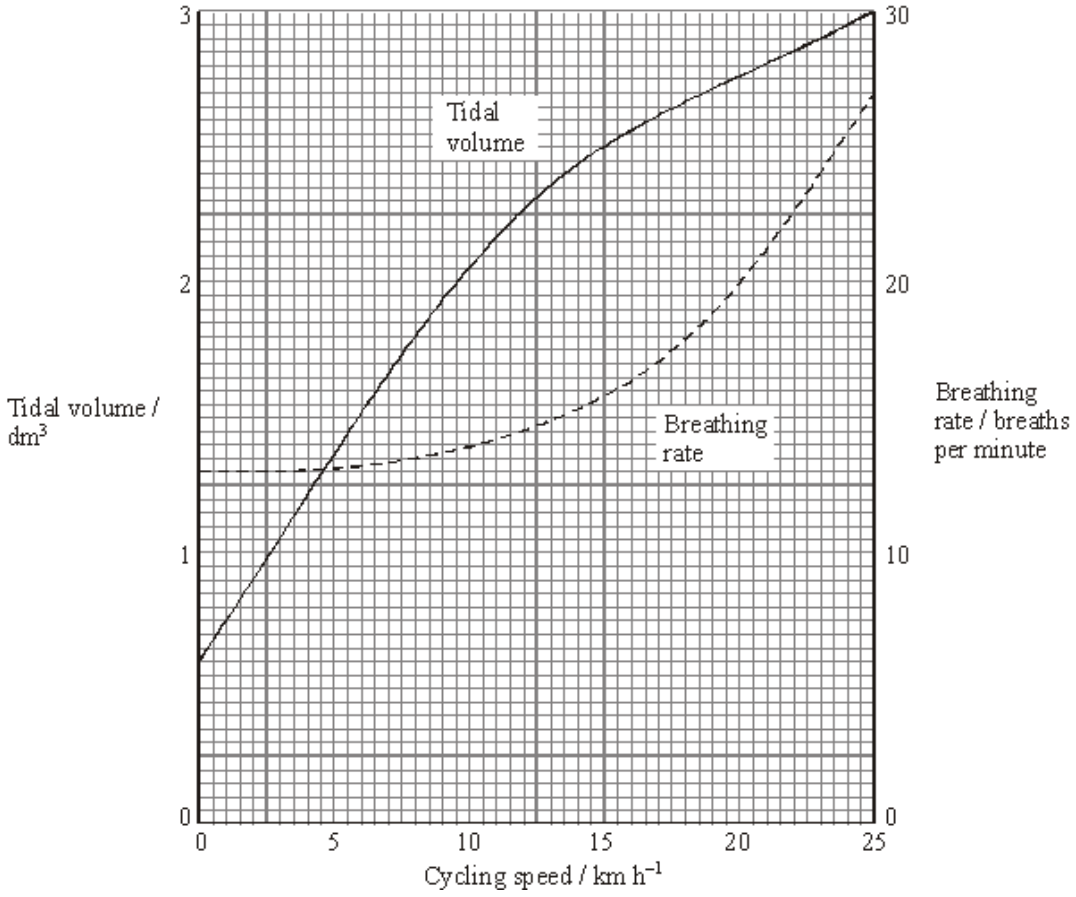
2. Evaluate the use of mechanical replacement heart valves and biological replacement heart valves.

   Use information from Table 4.

Activity 8 – Data in tables: *Answer the questions.*

The volume of air breathed in and out of the lungs during each breath is called the tidal volume.

The breathing rate and tidal volume were measured for a cyclist pedaling at different speeds. The graph shows the results



1. State the tidal volume when the cycling speed was 17 km h^{-1}.

2. State the breathing rate when the cycling speed was 8 km h^{-1}.

3. Calculate the change in breathing rate when the cyclist speed changed from 10 to 20 km h^{1}.
   Express this as a percentage.

4. State the speed at which the breathing rate starts to increase.

5. The tidal volume increased linearly with the cycling speed up to about 10 km h^{-1}.
   Calculate the increase in volume for each increase in speed of 1 km h^{-1}.

Communication Skills - Understanding and using scientific vocabulary

Understanding and applying the correct terms are key for practical science. Much of the vocabulary you have used at GCSE for practical work will not change but some terms are dealt with in more detail at A-level so are more complex.

Activity 1 - Investigations: Link each term on the left to the correct definition on the right.

Hypothesis	The maximum and minimum values of the independent or dependent variable
Dependent variable	A variable that is kept constant during an experiment
Independent variable	The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres
Control variable	A proposal intended to explain certain facts or observations
Range	A variable that is measured as the outcome of an experiment
Interval	A variable selected by the investigator and whose values are changed during the investigation

Activity 2 - Measurements: Link each term on the left to the correct definition on the right.

True value	The range within which you would expect the true value to lie
Accurate	A measurement that is close to the true value
Resolution	Repeated measurements that are very similar to the calculated mean value
Precise	The value that would be obtained in an ideal measurement where there were no errors of any kind
Uncertainty	The smallest change that can be measured using the measuring instrument that gives a readable change in the reading

Activity 3 - Errors: Link each term on the left to the correct definition on the right.

Random error	Causes readings to differ from the true value by a consistent amount each time a measurement is made
Systematic error	When there is an indication that a measuring system gives a false reading when the true value of a measured quantity is zero
Zero error	Causes readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next

Communication Skills - Understanding and using SI units

There are seven SI base units, which are given in the table.

Physical quantity	Unit	Abbreviation
Mass	kilogram	kg
Length	metre	m
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
luminous intensity	candela	cd

All other units can be derived from the SI base units. For example, area is measured in metres square (written as m^2) and speed is measured in metres per second (written as $ms^{-1,}$ this is a change from GCSE where it is written as m/s).

Very large and very small numbers can be complicated to work with if written out in full with their SI unit. For example, measuring the width of a hair or the distance from Manchester to London in metres (its SI unit) would give numbers with a lot of zeros before or after the decimal point, which would be difficult to work with.

So, we use prefixes that multiply or divide the numbers by different powers of ten to give numbers that are easier to work with. You will be familiar with the prefixes milli (meaning 1/1000), centi (1/100), and kilo (1 × 1000) from millimetres, centimetres, and kilometres.

The most common prefixes you will encounter are given in the table.

Prefix	Symbol	Power of 10	Multiplication factor	
Tera	T	10^{12}	1 000 000 000 000	
Giga	G	10^{9}	1 000 000 000	
Mega	M	10^{6}	1 000 000	
kilo	k	10^{3}	1000	
deci	d	10^{-1}	0.1	1/10
centi	c	10^{-2}	0.01	1/100
milli	m	10^{-3}	0.001	1/1000
micro	μ	10^{-6}	0.000 001	1/1 000 000
nano	n	10^{-9}	0.000 000 001	1/1 000 000 000
pico	p	10^{-12}	0.000 000 000 001	1/1 000 000 000 000
femto	f	10^{-15}	0.000 000 000 000 001	1/1 000 000 000 000 000

Activity 4 – Units and Prefixes: *What would be the most appropriate unit to use for the following measurements?*

1. The time between heart beats
2. The diameter of a cheek cell
3. The distance that a migratory bird travelled each year
4. The thickness of a DNA helix
5. The mass of a rabbit
6. The mass of iron in the body
7. The diameter of a glucose molecule

Activity 5 – Units: *Choose the most appropriate unit and estimate the size of each of the following.*

1. The mass of an earthworm
2. The volume of water in a teardrop
3. The volume of water in a garden pond
4. The time taken for a sunflower to grow
5. The temperature difference between the blood in the heart and in the ear on a cold day
6. The diameter of a human hair
7. The length that your fingernails grow each day
8. The total length of DNA in one human body cell

Activity 6 – Units: *Re-write the following.*

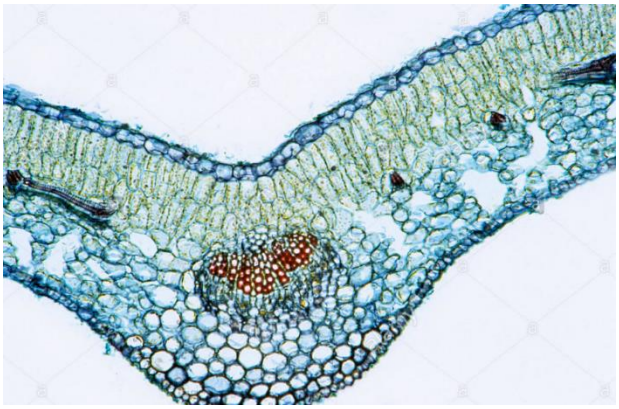
1. 0.00224 metres in millimetres
2. 104 micrograms in grams
3. 6.2 kilometres in metres
4. 10 micrograms in nanograms
5. 70 decilitres in litres
6. 10 cm^3 in litres

Communication Skills - Scientific Drawing

Scientific drawings can be made using several methods, depending on a particular laboratory investigation. For a microscopy lab, the drawings are made in circles that represent the viewing field of a microscope. For other labs such as dissection labs, the drawings are representative of the entire organism or parts of the organism. These drawings show the relative size, shape, and location of anatomical structures. Most scientific drawings are labelled.

Use the following guidelines to help make your scientific drawing as clear as possible:

- Use pencil
- Title your drawing
- Use most of the space provided (>50%)
- Use a ruler to draw label lines
- Do not use arrow heads for label lines
- Label lines should point to the centre of the structure being labelled
- Print all labels horizontally
- Print, do not write in cursive
- Label the right-hand side of the drawing, if possible
- Do not cross label lines
- All lines must be continuous, no gaps!
- Do not shade, instead print the colour of shaded region under the label
- Include magnification (if a microscopic drawing) or a scale (if a macroscopic drawing).



Below is a photomicrograph of a section through a dicot leaf (x100)

<u>SCIENTIFIC DRAWING TASK</u>:
In the box provided AND using the rules above, draw a high powered drawing of a section of cells (at least 10 cells) spanning the upper and lower epidermis.

Communication Skills - Presenting Information

Using a highlighter, highlight sentences and keywords that you believe to be significant. Use these to produce a plan for a "presentation" on Cells (you could present it to someone at home if you want!)

The cell is the living functional unit of all organisms. An organism may be composed of one cell only (Unicellular) e.g. Bacteria and Algae or of several cells (Multicellular) e.g. Man. The cell exists in two forms:

1. Eukaryotic cell, which has a nucleus that is enclosed in a nuclear envelope and several membrane- limited compartments e.g. the human cell.

2. Prokaryotic cell which has no nucleus and is devoid of membrane-limited compartments e.g. the bacterial cell.

Structure & function of the cellular components of eukaryotic cells

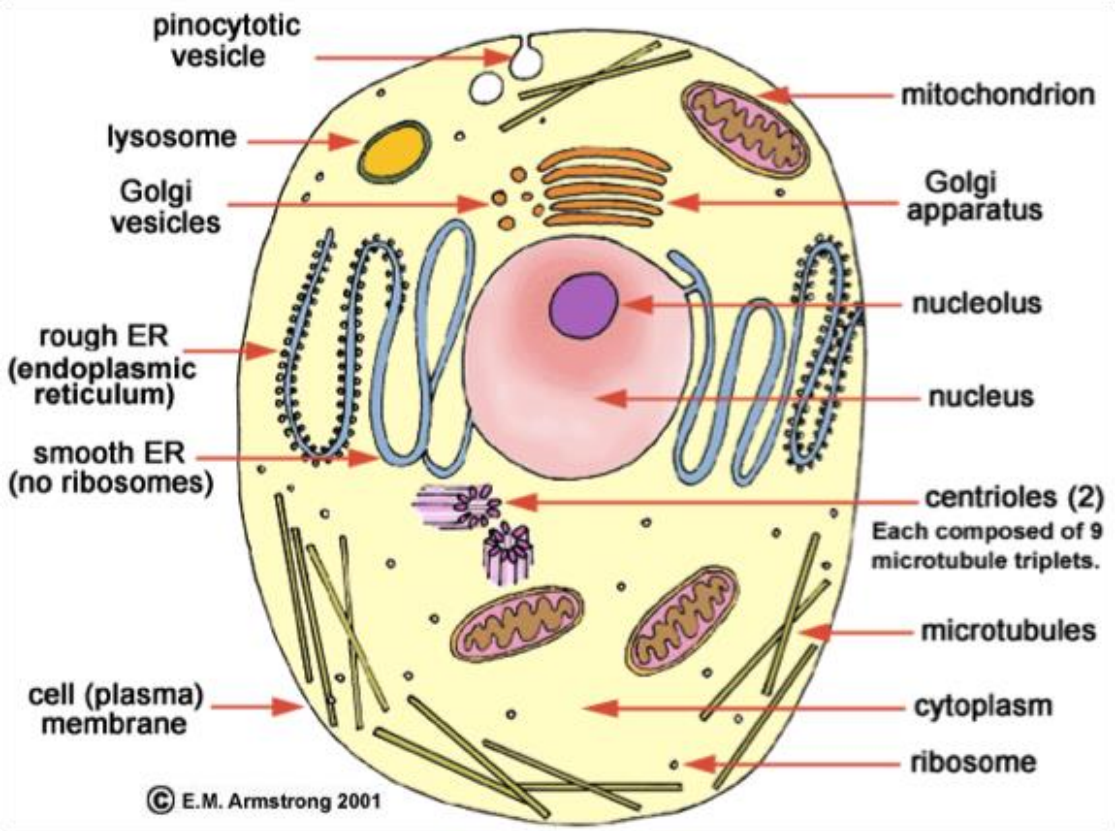
All Eukaryotic cells conform to a basic structural model. Thus the eukaryotic cell is composed of two basic parts; the Cytoplasm and the Nucleus.

THE NUCLEUS

This is the largest organelle of the cell often located in the central part of the cytoplasm and enclosed in a double-layered nuclear membrane. Its shape usually corresponds to the shape of the cell in which it is found. It contains a nucleolus/nucleoli (which produces ribosomal subunits) and chromatin (DNA). The latter is the genetic material implicated in cell division and in the synthesis of several molecules particularly proteins. The nucleus as the control centre of the cell contains the blueprint for all cellular structure and activities and in its absence the cell can neither function nor survive. The nuclear envelope is perforated by pores (3000-4000), which facilitate communication between the nucleus and the cytoplasm. Attached to the outer membrane of the nuclear envelope are polyribosomes. This membrane is also continuous with the rough endoplasmic reticulum of the cytoplasm.

THE CYTOPLASM

The fluid component of the cytoplasm is the **Cytosol** (pH 7.2) while the metabolically active contents of the cytoplasm are the **Organelles**. Apart from being metabolically active, organelles are permanent residents of the cell which would survive cell division i.e. they reappear in the daughter cells following cell division. Organelles occur in two forms, freely within the cytosol or enclosed in membrane. The cytoplasm also contains substances which are not metabolically active. These are called Inclusion Bodies. Inclusion bodies are the transitory residents of the cytoplasm not involved in cell metabolism and do not survive cell division. They comprise mainly accumulated metabolites, lipid droplets, pigments and minerals and are sporadically distributed in body cells. The eukaryotic cell is enclosed in a limiting membrane called the Plasma membrane.



MEMBRANE BOUND ORGANELLES

Organelles are the metabolically active and permanent residents of the cell. Organelles exist in two forms; membrane-bound and not bound by membrane. The principal cytoplasmic organelles include:

Mitochondria

Mitochondria are membrane-bound enzyme storage organelles. Mitochondrial enzymes are involved in aerobic respiration, production of ATP and heat energy for maintenance of body temperature. The mitochondrion is enclosed in two sheets of membrane. An outer sieve-like unfolded membrane and an inner membrane which is thrown into long finger-like folds called cristae. The number of cristae corresponds to the cell's energy needs. The space between the two membranes is the intermembrane space while the space deep to the inner membrane is referred to as the matrix. Mitochondria are eosinophilic, elongated rod-like organelles 2 to 5 micrometres in length. They are wildly distributed in all cells but occur abundantly in cell with very high energy needs (Heart muscles and kidney cells).

The Endoplasmic Reticulum (ER)

This organelle is made up of anastomosing network of intercommunicating cisternae enclosed in a continuous membrane. ER occurs in two forms, namely **Rough** and **Smooth** which are also interconnected. While the cisternae of smooth ER are tubular in shape, those of Rough ER are flattened.

Rough Endoplasmic reticulum (RER)

The roughness on the surface of rough ER is due to the adsorption of polyribosome on their outer surface. Polyribosome also impacts the basophilic staining characteristic on RER. Furthermore, its membrane is continuous with that of the nuclear envelope. RER is prominent in protein synthesising cells such as; Pancreatic acinar cells, cells of the endocrine glands, plasma cells, fibroblast etc. Proteins synthesised in RER are stored in **Lysosomes** or granules; stored temporarily before **exocytosis** or used as integral membrane proteins.

Smooth Endoplasmic Reticulum (SER)

This is ER not bound to polyribosomes but continuous with RER and are less abundant is cell containing RER. SER is found in all cells where they are involved in:

The synthesis phospholipids and cholesterol used in all cellular membranes including membranes of organelles. They occur in abundance in other cells where they are involved in:

- Sequestration and release of Calcium ions a vital process in muscular contraction
- Biosynthesis of Lipids required for synthesis of steroid hormones
- Detoxification of potentially harmful compounds such as alcohol and barbiturates

Lysosymes

Are small bags, the membrane of which is derived from Golgi apparatus while the enzymes are synthesised in the endoplasmic reticulum. They contain up to 40 different acid Hydrolytic enzymes (pH – 5) Most of these are acid hydrolases and are involved in breaking down a wide range of macromolecules. Therefore they are found at sites of intracellular digestion or sites of turnover of cellular components

Therefore it is found in cells involved in extensive phagocytic activities, e.g. Macrophages. The lysosomal enzymes are used for intra-lysosomal digestion or for Extracellular digestion/destruction

Golgi Apparatus

This is a complex of smooth membranous saccule usually located between the apical membrane and the nucleus of the secretory cell. Within its saccule are various enzymes implicated in processing proteins synthesised in the endoplasmic reticulum. The Golgi apparatus receives transport vesicles containing proteins from the endoplasmic reticulum and **packages** modified proteins into condensing vesicles for transportation to other organelles or to the cell membrane for release of modified proteins as secretory products.

ORGANELLES WITHOUT MEMBRANES

THE Cytoskeleton

This is composed of a complex of microtubules, microfilaments (Actin Filaments), and Intermediate Filaments.

Microtubules - These are tubular protein subunits involved in cellular shape, cell division, intra and extra cellular movements and transport of substances in the cytoplasm of the cell. Microtubules are widely distributed within the cytoplasm where they occur in various forms which include:

- Cytoplasmic microtubules for intracellular transport of materials including organelles
- Centrioles which are involved in cell division
- Mitotic spindles which are involved in cell division
- Cilia and Flagella which are motile structures implicated in cellular motion
- Basal bodies which are located at the bases of cilia and flagella and are involved in the configuration of these structures.

Microfilaments/Actin Filaments - Microfilament is a double-stranded helix of globular protein subunits which is widely distributed in all body cells and is involved in the structural integrity and contractility of the cell as well as movement of organelles in the cytosol. Actin filaments are also implicated in cell cleavage during cell division and involved in:

- Muscular contraction in collaboration with myosin filaments
- Cell shape integrity and locomotion (stress fibres of crawling cells)
- Movement of organelles and other cytosolic contents (cytoplasmic steaming)
- Cellular cleavage in mitotic cells

Intermediate Filaments - As the name implies, intermediate filament are intermediate in size to microtubules and microfilaments (10-12 nanometer in diameter). They are more stable structurally than Microtubules/filament and are composed of variable protein subunits depending on their localization and functions Examples of intermediate filaments include: Keratin of epithelial cell for strength and protection

Centrioles

The Centrioles are two cylindrical shaped microtubular structures oriented at right angles to one another. Each cylinder is made up of nine triplets of parallel microtubules. Centrioles are implicated in organising the microtubules of the cell as in the organization of mitotic spindles during cell division. They also form the basal bodies of cilia and flagella.

Ribosomes

Ribosomes are small, electron-dense particles not enclosed in membrane and are located in the cytosol. Measuring about 20-30 nanometres they are basophilic and stained by all basic dyes. Ribosome is composed of rRNA and about 80 different proteins. It usually occur in two subunits, large and small subunits. The rRNA of the ribosome is synthesised in the nucleus while its protein is synthesised in the cytosol. Ribosomes are involved in protein synthesis. While cytosolic proteins (free proteins) are synthesised by polyribosomes, secretory and endoplasmic reticulum proteins are synthesised on the membrane of rough endoplasmic reticulum.

Ribosomes occur in three forms:

- In isolated particles
- Assembled in cluster on mRNA strand to form Polyribosome
- Adsorbed to the membrane of endoplasmic reticulum through their large subunit to form Rough Endoplasmic Reticulum. Protein synthesis by ribosomes also implicates: mRNA, tRNA and rRNA.

Use this space to reduce your highlighted sentences into bullet points