



Year	Biology
7	Welcome to the lab
	Cells and Movement
	Breathing and digestion
	Relationships within ecosystems
8	Photosynthesis and respiration
	Reproduction
9	Health and disease
	Key concepts
	Ecosystems
10	Cells and control
	Genetics
	Natural selection and genetic modification
	*Plant structure and function
11	Animal coordination and homeostasis
	Exchange and Transport



Slides with this icon are for separate or triple science students only

f Pathogens have artigens

Same of the lymphocytes secrete age amounts of artibodies. The libodies stick to the ontigens and

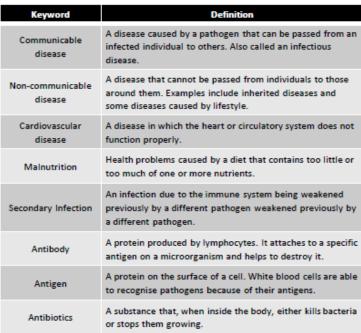
imphocytes, ready to respond nmediately if the same antigen ever B how the immune system attacks a pathogen

estroy the pathopen. Other lymphocytes wrain in the blood as memory

2 Alymphocyte with an antibody

that perfectly fits the antipen is

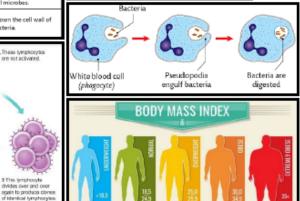
on their surface that are



			or stops them grown	'5∙	
nical ways ns		Nose	Nasal hairs, sticky mucus and cilia prevent pathogens entering through the nostrils.	Pathoge	nic Diseases
rnical and phy from pathoge	(h)	Trachea and branchus (respiratory system)	Uned with mucus to trap dust and pathogens. Olia move the mucus upwards to be swallowed.	Ear Infection     Presumenta     Pood polsoning	RIA VIRUS
has several chemical and ing protection from paths	N	Stomach acid	Stomach acid (pH1) kills most ingested pathogens.	FUNG  Althorn's Feet	PROTISTS
of providin	1000	Skin	Hard to penetrate waterproof barrier. Glands secrete oil which kill microbes.	Bacteria	
1			Been to down the cell well of	Dacter in	

These lymphocytes

3 This lamphocyte



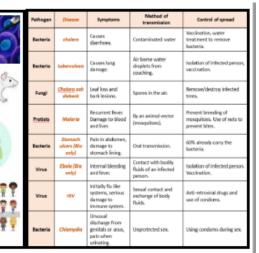
Preclinical Testing Potential new drug is tested on cells in a laboratory. **Animal Testing** 

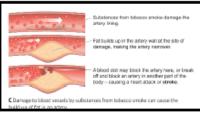
Drug is tested on live animals to test whether the drug works and whether it may be toxic or harmful. Small Clinical Trail

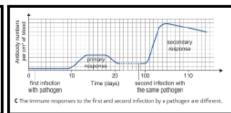
Drug is tested open a small group of healthy volunteers to test for any potential side effects.

### Large Clinical Trial

Drug is tested on a larger group of volunteers including those that have the target illness to test for the correct dosage with the least side effects.







There are two methods that can be used to measure obesity – BMI and waist:hip ratio. For the waist:hip ratio if a person has a value greater than 1 it means they are more at risk of becoming obese.

BMI = Mass (kg) Height (m)2 Waist:Hip Ratio = Waist Circumference Hip Circumference

### **Key Facts**

Risk factors can increase the chances of a person developing a non-communicable disease. An unbalanced diet, drinking too much alcohol, smoking, lack of exercise, obesity and air pollution are all risk factors.

STI's are caused by pathogens transmitted by the exchange of bodily fluids as a result of unprotected sexual intercourse.

Commonly misspelt words

https://www.bbc.co.uk/bitesize/guides/zwtgpb

k/revision/1

### Communicable Disease Vaccination Immunisation Lymphocyte Phagocyte Cardiovascular Cilia Hydrochloric Hygiene 11. Tuberculosis 12. Chlamydia Wider Uses Useful links Communicable disease https://www.bbc.co.uk/bitesize/guides/zts9y4j /revision/1 Non-communicable disease https://www.bbc.co.uk/bitesize/guides/z8pcsrd /revision/1 Medicine Testing https://www.bbc.co.uk/bitesize/guides/zx3wgd m/revision/1 Disease Prevention

Prior learning recap:

Quick fire questions (Answers can be found on knowlegde organiser):

- 1. Which pathogen cause malaria?
- 2. How can HIV be transmitted from one person to another?
- 3. Put these stages of drug testing in the correct order
  - rrect order a) Large clinical trial
  - b) Animal testing
  - ) Small clinical trial ) Pre-clinical trail
- 4. What are the risks of an artery being fully blocked by a build up of fat?
- 5. Identify the physical barrier the body has to protect itself from pathogens.

  6. Identify the chemical barriers
- Identify the chemical barriers that body has to protect itself from pathogens.
- 7. What classification would be given to a person with a BMI of 32?

### At home (parents/ carers may be able to help with this):

- BMI Calculation using a pair of weighing scales weigh yourself (or a person in your household) in kilograms (Ka)
- (Kg).Next measure your height (or the height of a person in your household)
- in centimetres (cm)

  3. Finally take your data and use the BMI calculation on the previous page to calculate the BMI.
- Find out which group the BMI falls into.
- Is the BMI accurate? How could a person's BMI change as they are growing?



# **Eukaryotes complex organisms** a.lhucleus

1.fanimalizell	d.@ibosome e.@initochondria@	f.ivacuole g.icelliwaliii h.ichloroplast	[
cytoplasm	site of chemical reactions in the cell	gel like substance containing enzymes to catalyse the reactions	
nucleus	contains genetic material	controls the activities of the cell and codes fro proteins	
cell semi permeable		controls the movement of substances in and out of the cell	
ribosome	site of protein synthesis	mRNA is translated to an amino acid chain	
mitochondr ion	site of respiration	where energy is released for the cell to function	
permanent contains vacuole cell sap		keeps cell turgid, contains sugars and salts in solution	
cell wall	made of cellulose	supports and strengthens the cell	
chloroplast site of photosynth esis		contains chlorophyll, absorbs light energy	

Prokaryotes simpler organisms				
j.litelliwall k.litellimembrane				
i.izytoplasm				
m.liplasmidiDNAlii LibacterialiiDNAlii				
3.@bacterial cell				
bacterial not in nucleus floats in the cytoplasm		controls the function of the cell. Can be found as chromosomal DNA and plasmid DNA (small rings).		
cell wall	NOT made of cellulose	supports and strengthens the cell		

allows the

bacterial cell to

move

Microscope	
eyepiecellens objectivellens focusing@wheel	
magnification M = Msize of Image To real size of Inhe object	<b>₽</b> A

whip like

tail

flagella

Prefixes						
Prefix	Prefix Multiple					
centi (cm)	1 cm = 0.01 m	x 10 <sup>-2</sup>				
milli 1 mm = 0.001 m (mm)		x 10 -3				
micro (μm)	1 μm = 0.000 001 m	x 10 <sup>-6</sup>				
nano (nm)	1nm = 0.000 000 001 m	x 10 <sup>-9</sup>				
pico (pm)	1pm = 0.000 000 000 001m	x 10 <sup>-12</sup>				

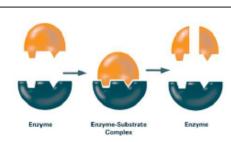
Feature	Light micros cope	Electron microscope
Radiation used	Light rays	Electron beams
Max magnificati on	~ 1500 times	~ 2 000 000 times
Resolution	200nm	0.2nm
Size of microscope	Small, portabl e	Very large, not portable
Cost	~£100	£100,000 to £1 million plus

### KS4 Science B1 Key concepts in biology

### Specialised cells nutrients in the fertilise cytoplasm, haploid d by a nucleus and changes Egg in the cell membrane sperm after fertilisation streamlined with a long tail acrosome containing Sperm fertilise enzymes an egg large number of mitochondria. haploid nucleus Ciliate Thin layer of moving push hairs on the surface and epithe of the cells called move lial cell cilia. mucus

### Enzymes

The 'lock and key theory' is a simplified model to explain enzyme action



Enzymes catalyse specific reactions in living organisms due to the shape of their active site.

### **Enzymes Activity**

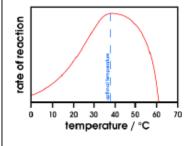
Enzymes catalyse and speed up specific reactions in living organisms.

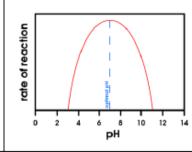
The activity of enzymes is affected by changes in temperature, pH and substrate concentration

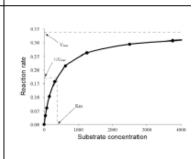


Enzyme activity has an optimum pH

Increasing substrate concentration increases rate (limited by number of active sites)







Large changes in temperature or pH can stop the enzyme from working (denature).

Temperature too high

pH too high or too low

Enzyme changes shape (denatures) the substrate no longer fits the active site.

### Rate of reaction

	Nate of reaction					
	Rate of reaction $=\frac{1}{\text{Time}}$	Rate of reaction $=$ $\frac{\text{Change}}{\text{Time}}$				
Units	s <sup>-1</sup>	cm <sup>3</sup> s <sup>-1</sup>				



### KS4 Science B1 Key concepts in biology

	Digestive enzymes				
Digestive enzymes speed up the conversion of large insoluble molecules (food) into small soluble molecules that can be absorbed into the bloodstream.					
Carbohydr ases (e.g. amylase)	124	Made in salivary glands, pancreas, small intestine	Break down carbohydrates to simple sugar (e.g. amylase breaks down starch to glucose).		
Proteases	Enzyma	Made in stomach, pancreas	Break down protein to amino acids.		
Lipases		Made in pancreas (works in small intestine)	Break down lipids (fats) to glycerol and fatty acids).		

The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used for respiration.

	Food tests						
CHEMICAL	TESTS FOR9	HOW TO CARRY OUT THE TEST	RESULT	CHEMICAL	TESTS FOR?	HOW TO CARRY OUT THE TEST	RESULT
NOBINE SOUTTON	Starch	1.) Add the lodine solution directly to the substance to be tested (in solid or liquid form) and look for a colour change.	Turns blue black with starch	BURET'S SOLUTION	Protein	Add Biuret's to the solution/ suspension to be tested and look for a colour change.	Turns purple with protein
RENEDICTS SOLUTION	Reducing Sugar	1.) Add Benedict's to the solution/ suspension to be tested. 2.) Heat for 2 mins in a water bath at boiling point and look for a colour change.	Turns brick red with reducing sugars (green/ yellow/ orange if less sugar present)	EMIANOL S	Lipid (known as the Emulsion test)	1.] Add ethanol to the solution/ suspension to be tested and shake thoroughly.  2.] Then add water and look for a colour change.	Turns cloudy/ milky with lipid

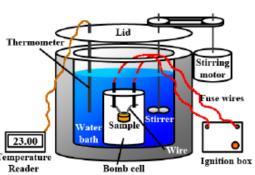


Transport in cells				
Diffusion <u>No</u> energy required	Movement of particles in a solution or gas from a higher to a lower concentration	E.g. O <sub>2</sub> and CO <sub>2</sub> in gas exchange, urea in kidneys. Factors that affect the rate are concentration, temperature and surface area.		
Osmosis <u>No</u> energy required	Movement of water from a dilute solution to a more concentrated solution	E.g. Plants absorb water from the soil by osmosis through their root hair cells. Plants use water for several vital processes including photosynthesis and transporting minerals.		
Active transport ENERGY required  Movement of particles from a dilute solution to a more concentrated solution		E.g. movement of mineral ions into roots of plants and the movement of glucose into the small intestines.		

### Calculate percentage gain/loss of mass in osmosis.

$$\% \ change \ in \ mass = \frac{(final \ mass \ - initial \ mass)}{initial \ mass} \times 100$$

### Calorimetry



The energy in food can be calculated by how much it heats up water when it burns in a calorimeter.

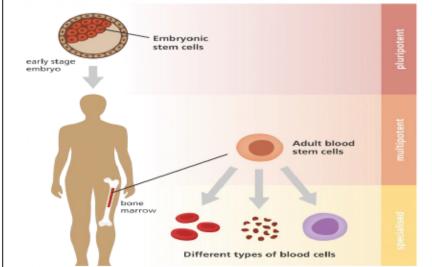


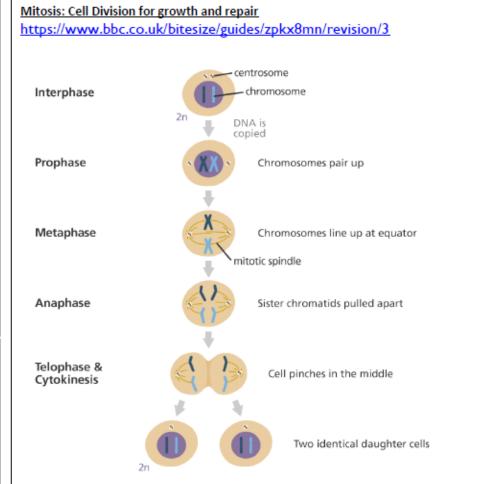


# Year 9: Summer Term

Keyword	Definition
cell cycle	A sequence of growth and division that happens in cells.
daughter cell	New cell produced by cell division.
diploid	A cell with two sets of chromosomes.
haploid	A cell with one set of chromosomes.
mitosis	Cell division to produce two daughter cells that are genetically identical to the parent.
spindle fibre	Filament formed in a cell during mitosis, which helps to separate chromosomes.
differentiate	To change into different types.
stem cell	Unspecialised cell that continues to divide by mitosis to produce more stem cells and cells that differentiate into specialised cells.

### Stem Cells: https://www.bbc.co.uk/bitesize/guides/zpkx8mn/revision/7





### **Useful links**

Stem cells: <a href="https://www.bbc.co.uk/bitesize/guides/zpkx8mn/revision/8">https://www.bbc.co.uk/bitesize/guides/zpkx8mn/revision/8</a>
Pros and cons: <a href="https://www.bbc.co.uk/bitesize/guides/zpkx8mn/revision/9">https://www.bbc.co.uk/bitesize/guides/zpkx8mn/revision/9</a>
nervous system: <a href="https://www.bbc.co.uk/bitesize/guides/zp86dxs/revision/1">https://www.bbc.co.uk/bitesize/guides/zpkx8mn/revision/9</a>

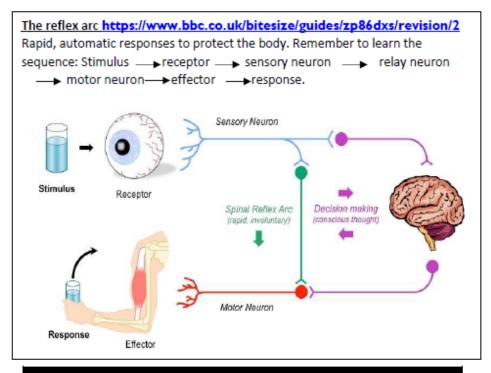
Interesting facts/ links: Real life example of someone having stem cells https://www.youtube.com/watch?v=cEB8656TCIE



Keyword	Definition
stimulus	Change in a factor (inside or outside the body) that is detected by receptors.
effector	Muscle or gland in the body that performs an action when an impulse from the nervous system is received.
sensory neurone	Neurone that carries impulses from receptor cells, towards the central nervous system.
motor neurone	Neurone that carries impulses to effectors.
relay neurone	A short type of neurone found in CNS that links sensory, motor and other relay neurones.
myelin sheath	Fatty covering around the axons of many neurones.
axon	The long extension of a neurone that carries an impulse away from the dendron or dendrites towards other
synapse	Point at which two neurones meet. https://www.bbc.co.uk/bitesize/guides/zp86dxs/revision/1

Synapse: The gap between neruones.
Receiving resures  Syraptic total  Syraptic cleft  Syraptic results re
Meurotransmitter Kocaptor molecules úbis

When an impulse reaches an axon terminal, a neurontransmitter is released into the gap. This is detencted by the next neurone, which generates a new impulse. Synapses slow down neurotransmission. Neurotransmitters are ONLY released at axon terminals so the impulse can only flow in one direction. Synpases can also build impulses from several neurones into one neurone,



### **Key Facts**

Every living thing needs to be able to grow and repair itself. The process of growth and repair requires news cells, these are produced in the cell cycle.

**Growth** of an organism is an increase in size as a result of an increase in the number or size of cells; it is recorded using measurements eg mass or length.

Cell differentiation (specialisation) only occurs in the embryo in animals but occurs in adult plants throughout life in the meristem and root tip.

Changes in cells can lead to uncontrollable cell division, or cancer. This rapid cell division produces lumps of cells called tumours.

The CNS (Central Nervous System) is just the brain and the spinal cord.

Nerves make up the rest of the nervous system. This system allows all parts of the body to communicate using electrical signals called impulses.

Receptor cells create impulses which usually travel to the brain to tell us everything that is happening around us, for example this way we know if it is hot or cold. The brain processes this information, and can cause a response.



### Chromosome Chromosome Chromosome Chromosome Chromosome Thymine Cytosine Gene Phosphate and sugar back bone

### **Nucleus**

Genetic material in the nucleus is composed of a chemical called DNA.

A gene is a small section of DNA on a chromosome.

DNA is a polymer made up of two strands of nucleotides forming a double helix.

Each nucleotide consists of a common sugar, phosphate and base.

In DNA, C always linked to G on the opposite strand and A to T.

### Extracting DNA

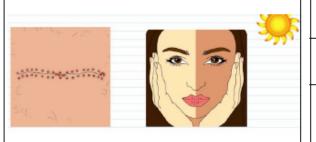
### DNA can be extracted from fruit

Dissolve salt and washing up liquid together with a mashed up sample of fruit (kiwi fruit is good) and place in a 60°C water bath for 15 minutes.

Filter and add protease solution to the filtrate in a boiling tube. Tilt the boiling tube and carefully add ice cold ethanol.

The white layer that forms at the interphase is DNA and can be pulled out on a glass rod

### Variations



### Genetic and environmental variations

Variation: difference in the characteristics of individuals in a population may be due to

Genetic causes (inheritance)	Environmental causes	A combinat- ion of genes and environmen
(mmerreamee)		environmen
		t

There is usually extensive genetic variation within the population of a species e.g. hair colour, skin colour, height that can also be affected by environment e.g. nutrition, sunlight.

### Genetic variations

All genetic variation arises in mutation, most have no effect on phenotype, some influence but very rarely a single mutation determines phenotype.

### **Human Genome**

The genome is the entire DNA of an organism.

### It is of great importance for future medical developments

Searching for genes linked to different types of disease.

ding and treatment of inherited disorders.

Understan

Tracing migration patterns from the past.

### **Cell divisions**

	Mitosis	Meiosis
No. of cells produced	2	4
No of chromosome in parent cell	46	46
No of chromosome in daughter cell	46	23
Haploid or diploid	Diploid	Haploid
Body cells or sex cells	Body cells	Sex cells
No. of cell division	One	Two
Asexual or sexual	Asexual	Sexual



### Meiosis

Meiosis halves the number of chromosomes

Gametes are made in reproductive organs (in animals ovaries and testes)

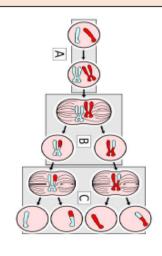
Cells divide by meiosis to form gametes

### Stages of Meiosis

Copies of the genetic information are made.

The cell divides twice to form four daughter cells each with half the number of chromosomes.

All haploid gametes are genetically different from each other.



The new cell divides by mitosis. The number of cells increase. As the embryo develops cells differentiate.

### **Fertilisation**



Gametes join at fertilisation to restore the number of chromosomes

### Reproduction

. 1			
	Sexual	Asexual	
	Needs two parents.	Only one parent needed (quicker).	
	Produces variation in the offspring.	Identical offspring (no variation).	
	If the environment changes variation gives a survival advantage by natural selection.	Vulnerable to rapidly changing conditions due to lack of variation.	
	Negative mutations are not always inherited.	Negative mutation can affect all offspring.	
	Natural selection can by speeded up using selective breeding to increase food production.	Food/medicine production can be extremely quick.	
: 1			

food production.			
Define terms linked to genetics			
Gamete	Sex cells produced in n	neiosis.	
Zygote	Single cell that results	from fusion of egg and sperm cell.	
Chromosome	A long chain of DNA fo	und in the nucleus.	
Gene	Small section of DNA t	hat codes for a particular protein.	
Allele	Alternate forms of the same gene.		
Dominant	A type of allele – always expressed if only one copy present and when paired with a recessive allele.		
Recessive	A type of allele – only expressed when paired with another recessive allele.		
Homozygous	Pair of the same alleles, dominant or recessive.		
Heterozygous	Two different alleles are present 1 dominant and 1 recessive.		
Genotype	Alleles that are present for a particular feature e.g. Bb or bb		
Phenotype	Physical expression of an allele combination e.g. black fur, bl hair, blue eyes.		



### Genetic inheritance



### Gregor Mendel

In the mid 19<sup>th</sup> century carried out breeding experiments on plants

Inheritance of each characteristic is determined by units that are passed on to descendants unchanged.

Chromosomes had not yet been discovered so the mechanism for inheritance was unknown.

### Alleles

Some characteristics are controlled by a single gene e.g. fur colour, colour blindness. The alleles present operate at a molecular level to develop characteristics that can be expressed as a phenotype.

Most characteris tics are as a result of multiple genes interacting.

Dominant	Recessive
Represented by a capital letter e.g. B.	Represented by a lower case letter e.g. b.

### 3 possible combinations:

Homozygous dominant BB Heterozygous dominant Bb Homozygous recessive bb

### Genetic crosses: probabilities and ratios

### Using a punnet square (using mouse fur colour as an example)

		•
Parent phenotype	Black fur	White fur
Parent genotype	ВВ	bb
What gametes are present	In each egg	In each sperm

Gametes	þ	þ
В	>Bb	Bb
В	Bb	Bb

The probability of black fur offspring phenotype is 100%. All offspring genotypes are heterozygous (Bb).

### Crossing two heterozygous mice (Bb)

Gametes	В	b
В	ВВ	Bb
b	Bb	bb

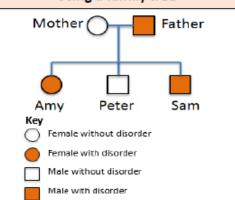
The probability of black fur is 75% and white fur 25%. The ratio of black to white mice is 3:1

### Sex determination Female Male

XX			ΧY	1
	Gametes	Х	Υ	
	Х	XX	ΧY	_
	Х	ΧX	XY	-

The probability of a male of female child is 50%. The ratio is 1:1

### Using a family tree

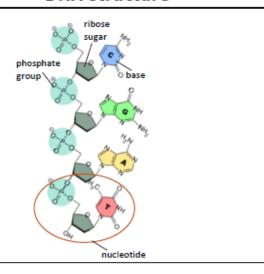


### Some disorders are inherited on the chromosomes that determine sex (e.g. colour blindness in men)

The X chromosome carries one normal or one faulty allele (the normal is dominant). The shorter Y chromosome does not carry the allele and so X chromosome allele is always expressed in men.



### **DNA** structure



### Repeating nucleotide units

DNA is polymer made from four different nucleotides. Each nucleotide consists of a common sugar, phosphate group and one of 4 different bases A, C, G & T

Not all parts code for proteins. Non-coding parts can switch genes on and off. Mutations may affect how genes are expressed.

Genetic variants		
In non coding DNA	Affects phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced.	
In coding DNA	Affects phenotype by altering the sequence of amino acids and therefore the activity of the protein	

produced.

### Protein synthesis

Making new proteins (protein synthesis) transcription and translation

Composed of chains of amino acids. A sequence of 3 bases (codon) codes for a particular amino acid.

RNA polymerase binds to non-coding DNA located in front of a gene.



RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene.



mRNA moves from the nucleus and attaches to a ribosome in the cytoplasm.



Ribosomes translate each triplet of bases (codons) into specific amino acids according to mRNA template



Amino acids are transferred to the ribosome by tRNA.



Amino acids are linked together to form polypeptides.

A sequence of 3 bases is the code for a particular amino acid. The order of bases controls the order in which each amino acids combine and fold to produce a specific shaped protein such as enzymes..

### **Blood groups**

Blood type	Ger	otype
Α	IA, IO	AO AA
В	I <sup>B</sup> , I <sup>O</sup> I <sup>B</sup> , I <sup>B</sup>	BO BB
AB	IA, IB	AB
0	Io Io	00

Determined by multiple alleles (A,B,O) and codominance

AO, AA blood group A

BO, BB blood group B

OO blood group O

AB blood group AB. A and B are codominant





# **B4 Natural Selection**

### **Charles Darwin**



### Theory of evolution by natural selection

Individual organisms within a species show a wide range of variation for a characteristic.

Individual most suited to the environment are more likely to breed successfully.

Characteristics enable individuals to survive are then passed on to the next generation.

Developed since its proposal from information gathered by other scientists.

### Alfred Wallace



### Independently proposed the theory of evolution by natural selection

Published joint writings with Darwin in 1858.

Worked worldwide gathering evidence.

Best know for work on warning colouration in animals and his theory of speciation.

Did much pioneering work on speciation but more evidence over time has led to our current understanding.

Evidence from around the world, experimentation, geology, fossils, discussion with other scientists (Alfred Wallace) lead to:

Charles Darwin published 'On the Origin of the Species' (1859)

Slowly accepted; challenged creation theory (God), insufficient evidence at time, mechanism of inheritance not yet known.

Both Darwin and Wallace's work contributed to the modern science of genetics and 'molecular biology'.

### Evidence for evolution

Antibiotic resistance in bacteria provides evidence for evolution.

Mutations produce antibiotic resistant strains which can spread

Resistant strains are not killed.

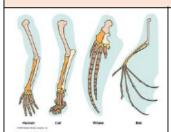
Strain survives and reproduces.

People have no immunity to strain and treatment is ineffective.

The beneficial characteristics are passed on to offspring in genes.

Evidence for Human evolution		
Fossils	Stone tools	
Ardipithecus ramidus 'Ardi' from 4.4 million years ago	Earliest simple stone tools from 3.3 million years ago.	
Australopithecus afarensis 'Lucy' from 3.2 million years ago	The age of different layers of rock can be dated. Stone	
Leakey's discovery of	tools found in those	

### Evidence for evolution from pentadactyl limb



Homo habilis from 1.6

million years ago

Darwin suggested that the five finger (pentadactyl) limb found across many vertebrates suggest a common ancestor

layers are the same

age.



### Classification of living

### Five kingdoms of life

Was proposed by Carl Linnaeus in the 1700s.

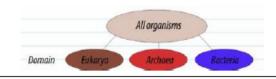
The five kingdoms are animals, plants, fungi, protista, prokaryotes



### 3 domains of life

Was proposed by Carl Woese based on genetic analysis.

The 3 domains are Eukarya, Archaea, Bacteria



Full human classification		
Domain	Eukarya	
Kingdom	Animalia	
Phylum	Chordata	
Class	Mammalia	
Order	Primates	
Family	Hominidae	
Genus	Ното	
Species	sapiens	

### Selective breeding

Choosing parents with the desired characteristics from a mixed population (see below)

Desired characteristics are chosen for usefulness or appearance.

Disease resistance in food crops.	
Animals which produce more meat or milk.	
Domestic dogs with a gentle nature.	
Large or unusual flowers.	

Chosen parents are bred together.



From the offspring those with desired characteristics are bred together.



Repeat over several generations until all the offspring show the desired characteristics.

### **Genetic Engineering**

### Modification of the genome of an organism to introduce desirable characteristics

- Restriction enzymes are used to isolate and cut out the required gene.
- 2. If sticky ends of DNA on the isolated gene and the plasmid DNA match they can be joined up.
- 3. DNA is joined in the plasmid DNA using the enzyme ligase bacterial plasmid or virus.
- 4. Genes are transferred to plants/ animals/ microbes in a vector (bacteria or virus) at an early stage of development so they develop the required characteristics.

E.g. Genetically modified crops (GMO) have genes from other organisms. This allows them to become resistant to insect or herbicides.

### Risks and benefits (practical and ethical)

	Genetic	engineering
--	---------	-------------

**Risks:** Seeds from GM plants can be very expensive. Some people think eating GM plants is bad for health although there is no evidence to support this view.

**Benefits:** decreased use of herbicide with increase in yield from food crops. Medicines tailored for individuals.

### Selective breeding

**Risks:** alleles that may be useful in future may be bred out. Populations with low variation can be vulnerable to genetic diseases.

**Benefits:** Increased growth and yield of plants and animals for food.



Tissues cultures		
Cloning techniques in plants/animals		
	Small groups of cells to grow new plants in nutrient solution or solid agar.	
Tissue culture	Advantage: Important for preservation of rare plants and commercially in nurseries.	
rissue culture	Small groups of human cells used to grow new tissues.	
	Advantage: matched tissues can be grown that are not rejected by the body's immune system.	

	Genetic engineering
Advantages	Modification of crop plants e.g. insect resistance from Bacillus thuringiensis.
Advantages	Modification of bacteria to produce human hormones e.g. human insulin made by bacteria.
	Resistant crops could pass on genes to wild plants affecting food chains.
Disadvantages	Insulin produced using GM bacteria is not identical to human insulin and not everyone can use it.

Agricultural solutions	
Fertilisers	Advantages: Increases the growth and yield of crop plants.
	<b>Disadvantages:</b> Excess fertiliser can run off into lakes and rivers and cause pollution leading to the death of other plants and animals.
Biological control	Advantages: Insects can be used to control weed populations. No herbicides are necessary.
	<b>Disadvantages:</b> Introduced insects can complete for non weed plants and disrupt other species food chains.





	D. C. W
Keyword	Definition
biodiversity	The variety of species in an area.
biotic factors	Living components (the organisms) in an ecosystem.
abiotic factors	Non-living conditions that can influence where plants or animals live (e.g. temperature, the amount of light).
mutualism	A relationship between individuals of different species where both individuals benefit, e.g. by getting more food
parasitism	A feeding relationship in which a parasite benefits and its host is harmed.
eutrophication	The addition of more nutrients to an ecosystem than it normally has.
indigenous	Organisms that have always been in an area. (Another word for native.)
conservation	The protection of an area or species to prevent damage.
reforestation	Planting new forests where old forests have been cut down.
desalination	A process that produces fresh drinking water by separating the water from the salts in salty water.
potable	Suitable for drinking.
biomass	The total mass in living organisms, usually shown as the mass after drying.
decay	A process in which dead plant and animal biomass are broken down by decomposers into simpler substances.
decomposer	An organism that feeds on dead material, causing decay.
nitrogen-fixing bacteria	Bacteria that can take nitrogen from the atmosphere and convert it to more complex nitrogen compounds such as ammonia.

### **Mutualism and Parasitism**

Remember, who benefits? If the relationship is beneficial to both parites it is **mutualism**; if one organism suffers, it is **parasitism** 





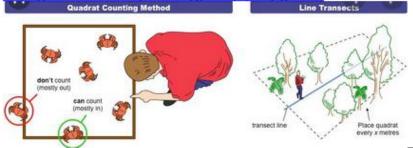
Mutualism

Parasitism

### Quadrats and sampling

You will need to know how to sample an area using these methods. Check out this video for more info:

https://www.bbc.co.uk/bitesize/guides/zpw3jty/video



### **Key Facts**

All the organisms that live and interact in an ecosystem for a community. The community is made of **populations** of different species.

These species depend on each other for resources, so we say they are interdependent.

The distribution of organisms is where they are found in an ecosystem.

Distribution can be affected by physical factors such as temperature or water (abiotic factors) or by other organisms in the ecosystem (biotic factors)

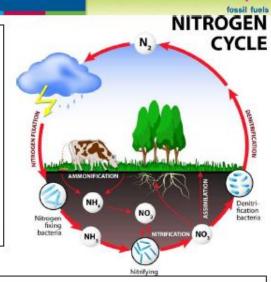
Abundance is a measure of how common something is in an area, such as it's population size. Measuring population size by counting all the organisms in an area is often impossible. Instead estimations are made using a quadrat.



### THE WATER CYCLE Carbon cycle The burning n the atmosphere of fuel **EVAPORATION** Gas exchang Breathing INFILTRATION SURFACE WATER GROUNDWATER

**Biodiversity and humans** Biodiversity Conservation

**Nutrient Cycles: Living** organisms need different substances from their environment to stay alive such as water, carbon and nitrogen compounds. There are only limited amounts of these substances on Earth, so they much be recycled through organisms and their environment in order



### Useful links

https://www.bbc.co.uk/bitesize/topics/z3n8v9q https://www.bbc.co.uk/bitesize/guides/zcb6gdm/revision/1 https://quizlet.com/ 89m3h9?x=1qqt&i=2rzq6c

Interesting facts/links:

https://www.naturevolunteers.uk/

### **Key Facts**

Biodiversity is the variety of living species in an ecosystem. Humans affect biodiversity in many ways.

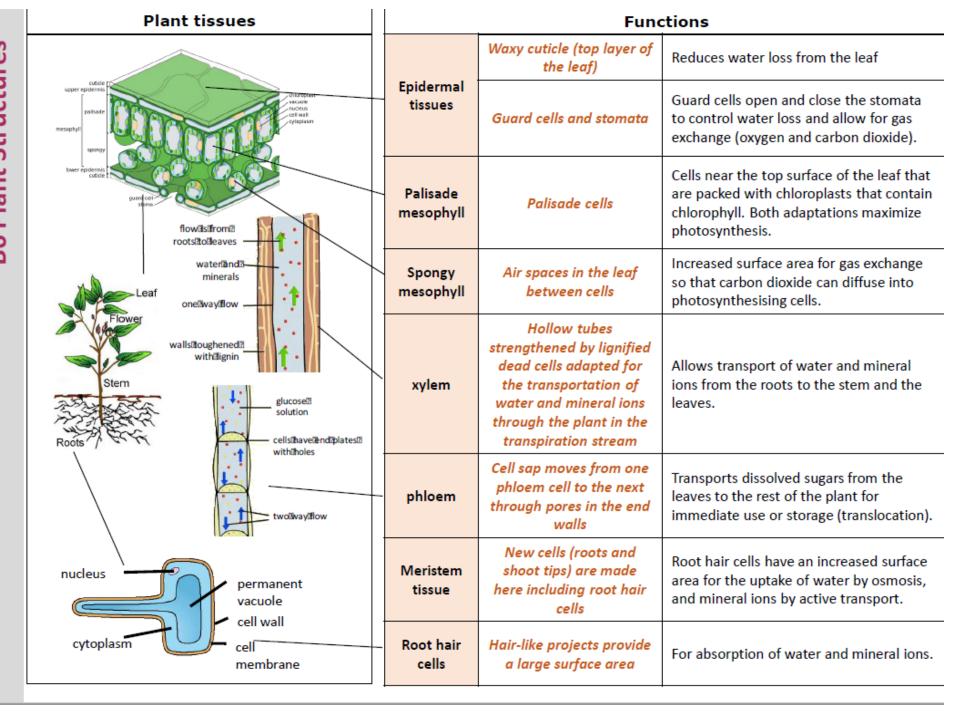
Eutrophication is the addition of more nutrients to an ecosystem than it normally has. This can cause harm to ecosystems, especially lakes.

Fish farming, introducing new species and deforestation, are just three ways in which humans affect biodiversity.

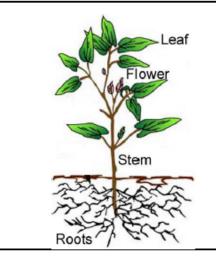
Conservation is when an effort is made to protect rare or endangered species or habitats. This is one way to increase biodiversity.

Preserving biodiversity is not just important for individual species or communities. Areas with greater diversity recover better from natural disasters such as flooding or fire.

Rainforests are incredibly diverse, with around 500 species of tree per hectare (compared to 6-12 for a UK forest!). Many rainforests could be used to develop new medicines, and there are still many plants to discover.



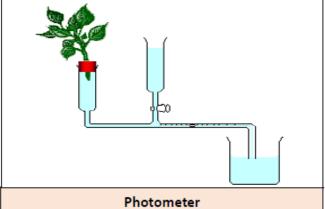
### Plant organ systems



The roots, stem and leaves form a plant organ system for transport of substances around the plant

In extreme conditions (high temperature, low water) plants have adapted by reducing the size of the leaf to reduce surface area and have fewer stomata to reduce water loss

### Transpiration



### Tilotometer

A photometer is used to measure the amount of water lost over time (rate of transpiration)

The rate at which water is lost from the leaves of a plant. The transpiration stream is the column of water moving through the roots, stem and leaves

Temperature, humidity, air movement and light intensity affect the rate of transpiration.

### Plant responses using hormones (auxins)

Gravity (geotropism or gravitropism)

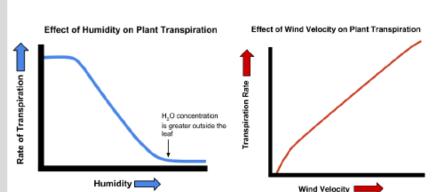
Light (phototropism)

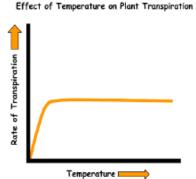
new
shoots
from a
seedling
the
unequal
distributi
on of
auxins
causes
the shoot
to grow
away
from
gravity.

Gravity causes an unequal distribution of auxins. In roots the side with the lowest concentratio n has the highest growth rate and the root grows in the direction of gravity.

Light breaks down auxins and they become unequally distributed in the shoot. The side with the highest concentration of auxins has the highest growth rate and the shoot grows toward the light.



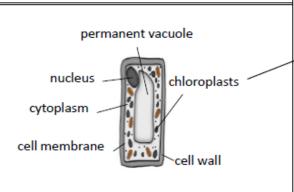


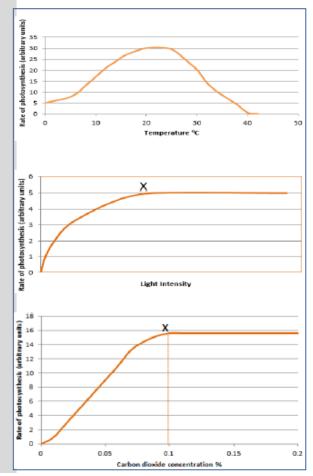


The shape of the graph for light intensity is the same for temperature (energy)

## **B6 Plant Structures**

### **Photosynthesis**





### Photosynthetic reaction

**Photosynthesis** 

Plants make use of light energy from the environment (ENDOTHERMIC) to make food (glucose)

Carbon dioxide + Water	light >	Oxygen + Glucose
CO <sub>2</sub> + H <sub>2</sub> O _	light ->	O <sub>2</sub> + C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>

The plant manufactures glucose from carbon dioxide and water using energy transferred from the environment to the chloroplasts by light

Plants use the glucose produced in photosynthesis in a variety of ways.

Respiration, stored as insoluble starch, fats or oils for storage, cellulose for cell walls, combine with nitrates from the soil to form amino acids for protein synthesis

### The rate of photosynthesis is affected by temperature, light intensity, carbon dioxide concentration.

Temperature	As the temperature of the environment the plant is in increases rate of photosynthesis increases (up to a point) as there is more energy for the chemical reaction.	Photosynthesis is an enzyme controlled reaction. If the temperature increases too much, then the enzymes become denatured and the rate of reaction will decrease and stop
Light intensity	Light intensity increases as the distance between the plant and the light sources increases. As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.	At point X another factor is limiting the rate of photosynthesis. This could be carbon dioxide concentration, temperature or the amount of chlorophyll
Carbon dioxide concentration	Carbon dioxide is needed for plants to make glucose. The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).	At point X another factor is limiting the rate of photosynthesis. This could be light intensity, temperature or the amount of chlorophyll

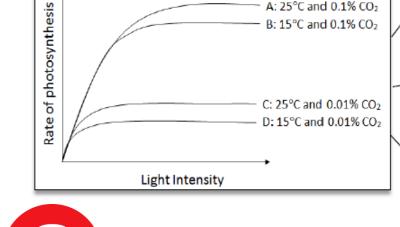
Plant growth hormones have commercial uses		
Plant responses using hormones (auxins)		
Auxins	Weed killers, rooting powders, promoting growth in tissue culture.	
Ethene	Control ripening of fruit during storage and transport.	
Gibberellins	End seed dormancy, promote flowering, increase fruit size.	

### Rate of Photosynthesis

Graph line A: Rate could be limited by temperature and/or amount of chlorophyll. Plant tissue can be damaged when carbon dioxide concentrations exceed 0.1%

Graph Lines A and B: If carbon dioxide concentration is increased from 0.01% to 0.1% then a large increase in rate occurs up to a point.

Graph lines C and D: If temperature is increased by 10°C then a slight increase in rate of photosynthesis occurs.



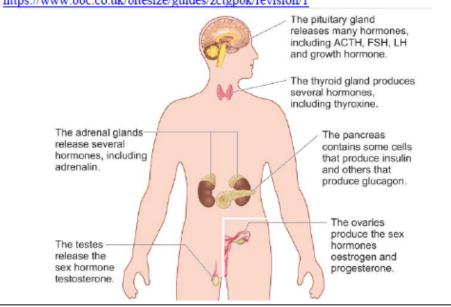
A: 25°C and 0.1% CO2

Graph lines A and D: If carbon dioxide concentration and temperature are increased the rate of photosynthesis increases significantly up to a point.

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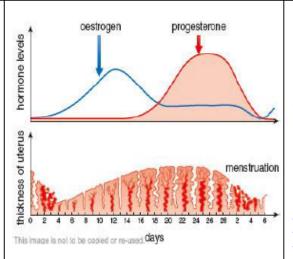
Keyword	Definition
endocrine glands	An organ that makes and releases hormones into the blood.
target organ	An organ on which a hormone has an effect. An organ that makes and releases hormones into the blood.
hormone	Chemical messenger released into the blood by endocrine glands, causing target cells to change how they work.
pituitary gland	An organ just below the brain that controls many activities of the body by the release of hormones
thyroid gland	A gland that releases the hormone thyroxine into the blood.
adrenal gland	A gland located on top of a kidney that produces the hormone adrenalin. It can be referred to as an adrenal.
Testis (plural testes)	An organ in the male reproductive system that produces sperm cells and the hormone testosterone.
ovary	Organ in the female reproductive system that releases egg cells and the hormones oestrogen and progesterone.
pancreas	Organ in the body that produces some digestive enzymes, as well as the hormones insulin and glucagon.

The hormonal system uses chemical messengers called hormones, which are carried by the blood and so take time to get around the body. Different hormones are released by a range of different endocrine glands in the body. They work on specifc target organs changing what the organ is doing, eg growth hormone stimulates cells in muscle and bones to grow and divide. Some glands stimulate other glands to produce other hormones, eg sex hormones. https://www.bbc.co.uk/bitesize/guides/zctgpbk/revision/1

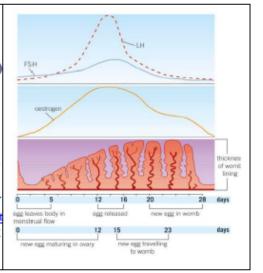


Menstrual cycle is a cycle of changes in a women's reproductive system that takes place about 28 days. The cycle continues from puberty (around 12yrs) until the menopause (around 50 years) and prepares the woman's body for the fertilisation of an egg cell, leading to pregnancy. The menstrual cycle is controlled by the sex hormones oestrogen and progesterone which are released by the ovaries into the blood. The release of the egg occurs around day 14 of the menstural cycle. This is known as ovulation.

https://www.bbc.co.uk/bitesize/guides/zt9x 8mn/revision/1



FSH (follicle stilumlating hormone) and LH (luteinising hormone) are released by the pituitary gland in response to high levels of oestrogen. These hormones control the release of the new egg and ovulation HT ONLY https://www.bbc.co.uk/bit esize/guides/zt9x8mn/rev ision/2



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Keyword	Definition
diabetes	A disease in which the body cannot control blood glucose concentration at the correct level.
glucagon	A hormone that increases blood glucose concentration.
homeostasis	Controlling the internal environment of the body at stable levels.
insulin	A hormone that decreases blood glucose concentration by causing cells to take in glucose.
Type 1 diabetes	A type of diabetes in which the pancreas does not produce insulin.
Type 2 diabetes	A type of diabetes in which cells do not respond to insulin, or too little insulin is produced.
Body Mass Index (BMI)	An estimate of the amount of fat in a person's body on which judgements of health are made.
Hip: waist ratio	An estimate of the amount of the fat in the body, calculated by dividing the waist measurement by the hip

### Diabetes

https://www.bbc.co.uk/bitesize/guides/zctgpbk/revision/6

### Type 1 diabetes

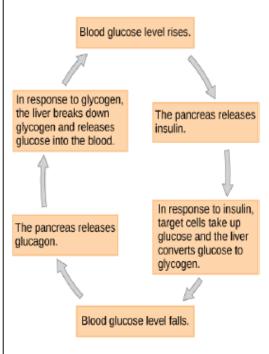
- Type 1 diabetes (insulindependent)
- It is a disease that destroys pancreatic cells meaning no insulin production is possible.
- Is typically developed as a child or young adult.
- Insulin injections to control blood glucose and regular monitoring of levels throughout the day.

### Type 2 diabetes

- <u>Type 2 diabetes</u> (non-insulin dependent diabetes)
- Those suffering from type 2 are unable to produce enough insulin.
- It is much more common than Type 1 and typically affects people over the age of 45, who are also overweight.
- Treatment includes: healthy diet, exercise and eventually insulin injections if it can't be controlled

### Control of blood sugar During digestion glucose is released from carbohydrates in our food and easily absorbed by the small intestine into our blood. It is then used by cells for respiration. It takes time for cells to use the glucose, so there is a risk that glucose could reach high levels and cause damage. For most people, cells in the pancreas easily regulate the level of glucose in the blood by producing insulin. HT ONLY If levels of glucose fall too much, carbohydrate stores (Glycogen) in the liver can be broken down by another hormone, Glucagon. This allows glucose levels to rise. https://www.bbc.co.uk/bitesize/g

uides/zctgpbk/revision/5



### **Key Facts**

The hormonal system works more slowly than the nervous system but allows responses in many parts of the body. Once in the blood stream, hormones can work on different target organs and glands at the same time.

The hormonal systems are controlled by negative feedback. This is because an increase in their concentration, directly causes a change that brings about a decrease in the amount of the hormone being released into the blood.

Usually only one egg is released during **ovulation**. However, sometimes two or more are released at the same time, this can lead to multiple pregnancies.

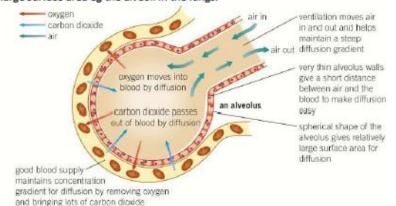
The use of female hormones is now widely used to increase the likelihood of pregnancy using assisted reproductive technology such as IVF.

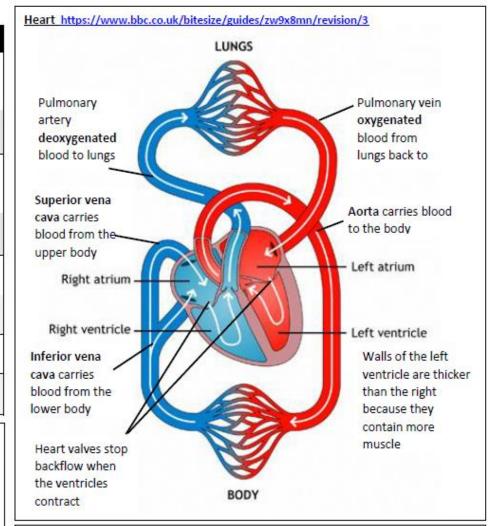
Contraception is the prevention of fertilisation. Whilst many contraceptive methods are barriers preventing the sperm reaching the egg, many involve the use of female hormones to prevent ovulation. These have a high success rate.

Keyword	Definition
diffusion	The random movement and spreading of particles. There is a net (overall) diffusion of particles from a region of higher concentration to a region of lower concentration.
gas exchange	A process in which one gas diffuses across a membrane and another gas diffuses in the opposite direction.
surface area (SA) : Volume (vol) ratio	The total amount of surface area of an object divided by its volume. The bigger the ratio, the more surface area something has per unit volume.
deoxygenated blood	Blood in which the red blood cells are only carrying small amounts of oxygen.
oxygenated blood	Blood in which the red blood cells are carrying large amounts of oxygen.
haemoglobin	The red, iron-containing pigment found in red blood cells.
stroke volume	The volume of blood the heart can pump out with each beat.
cardiac output	The volume of blood the heart can pump out in one minute.

### Efficient exchange systems https://www.bbc.co.uk/bitesize/guides/zgs9y4j/revision/3

Many substances move into and out of the body by diffusion. To make sure a lot of particles diffuse quickly, the surfaces through which they move are thin and have a large surface area eg the alveoli in the lungs.





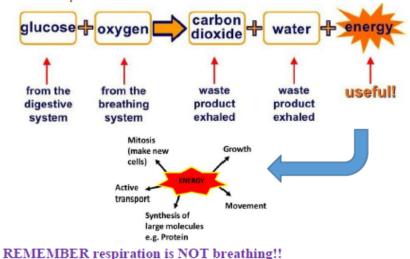
### Cardiac output https://www.bbc.co.uk/bitesize/guides/zw9x8mn/revision/4

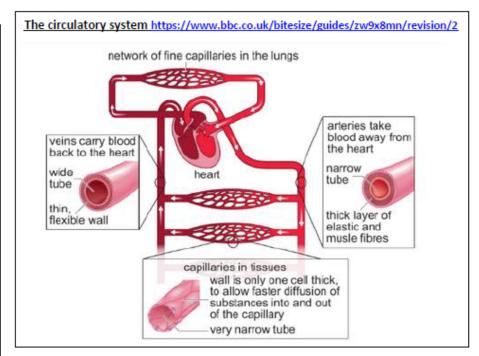
The contraction and relaxation of muscles during each heartbeat is controlled by nerve impulses. The heart rate is number of heart beats in a minute. The volume of blood pushed out into the aorta in each beat is the stroke volume. The cardiac output is the volume pushed out each minute and can be caluclated using the equation below:

Cardiac output = stroke volume x heart rate (litres/min) (litres/beat (beats/min)

Keyword	Definition
capillary	A tiny blood vessel with thin walls to allow for the transfer of substances between the blood and tissues.
artery	A blood vessel that carries blood away from the heart.
vein	A blood vessel that transports blood towards the heart.
plasma	The straw-coloured liquid component of blood.
platelet	Cell fragments that are important in the clotting mechanism of the blood.
Aerobic respiration	A type of respiration in which oxygen is used to release energy from substances such as glucose.
Anaerobic respiration	A type of respiration that does not need oxygen.
Lactic acid	The waste product of anaerobic respiration in animal cells.

<u>Cellular respiration</u> is a series of chemical reactions that release energy from glucose. Some energy is transferred out of the cells by heating. It is an **EXOTHERMIC** reaction. The main type of respiration is aerobic respiration which takes place in the mtiochondria.





### **Key Facts**

All the chemical reactions in your body (your metabolism) produce wastes which must be excreted so they do not cause problems. Your kidneys remove urea; your lungs remove carbon dioxide.

It would take too long for materials to diffuse through cells on the outside of a tissue to reach the inside, so multicellular organisms have transport systems. In humans, a network of capillaries use blood to transport to and from all cells.

Veins contain valves to prevent blood flowing the wrong way. Arteries don't need valves; blood comes directly from the heart and is under high pressure.

In humans, the heart is a double pump. First it pumps blood to the lungs to collect oxygen and then it pumps this oxygen rich blood around the body.

The sound that you can hear as a 'lub-dub' when listening to the heart is the heart valves opening and closing. These stop the blood from flowing in the wrong directions as the ventricles contract. Damage to these valves, stops the heart from working properly.





### **AGRICULTURE**

This sector employs over 350,000 people across the UK. Although core agricultural roles are expected to drop by 2030, many new jobs will be created in 'agri-tech'.

Carem pathic Ecologist, farmer, food scientist



### MEDICINE & HEALTHCARE

The UK healthcare industry employs over four million people, making it one of the largest employment sectors. Four of the five highest average graduate salaries are in fields related to medicine.

Coreer pather Dontal nurse, physiotherapist, vet



### SCIENCE & RESEARCH

Between 2016 and 2023, jobs in science and research will grow at twice the rate of other industries, creating 142,000 new jobs. One in every six jobs will be in science and research.

Career paths: Botechnologist, laboratory technician, research scientist



fight crime.

There are currently 431,000 people employed in the sport & fitness industry. The number of people employed in the industry has grown every year since 2013.

**ENGINEERING** 

the last decade. This means there will be a high demand

Career paths: Biomedical engineer, design engineer, project engineer

POLICE & EMERGENCIES

There is a high demand for trained paramedics with

digital and IT skills are highly sought after to better

Career paths: Crime score investigator, fire person, paramedic

**SPORT & FITNESS** 

one in 10 vacancies unfilled. Within the police force,

The proportion of young engineers has dropped over

for younger workers in coming years.

Corner paths: Personal trainer, rehabilitation therapist, ski instructor.

INVESTMENT 20/20 Part of The Investment Assectation

By studying biology you will be able to start a career in the investment management industry, as a key part of your studies is to compare data, which is a useful skill in this field.







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