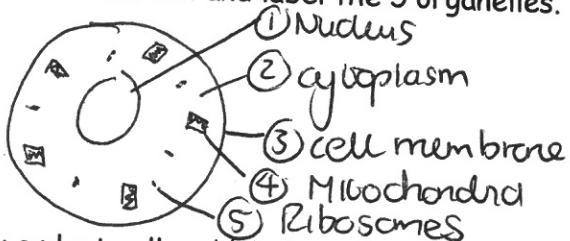
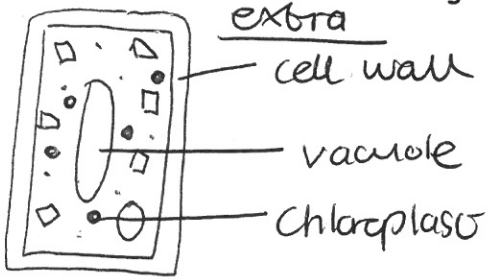
pg 11 - 17 (B1) eukaryotic (nucleus) prokaryotic (no nucleus)

CB1 Key Concepts in Biology

Draw an animal cell and label the 5 organelles.



Draw a plant cell and label the 8 organelles



What are the functions of the following:

(Highlight the organelles only found in plants)

Chloroplasts photosynthesis occurs contain green pigments - chlorophyll

Nucleus contains genetic (traps light) material - controls the activity of cell

Ribosomes - synthesis of proteins

Mitochondria where respiration occurs and energy is released

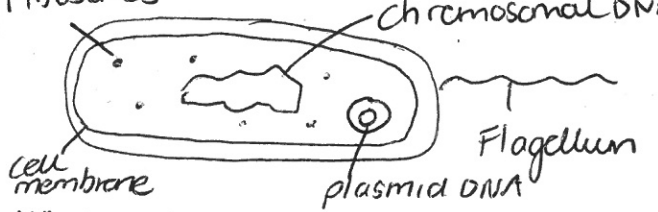
Cell wall made of cellulose - supports the cell + strengthens it.

Vacuole contains cell sap - maintains internal pressure

Cell membrane holds the cell together + controls what goes in + out

Cytoplasm gel-like substance where most of the chemical reactions happen.

Draw a bacterial cell and label the parts:



What are the two types of DNA found in bacterial cells:

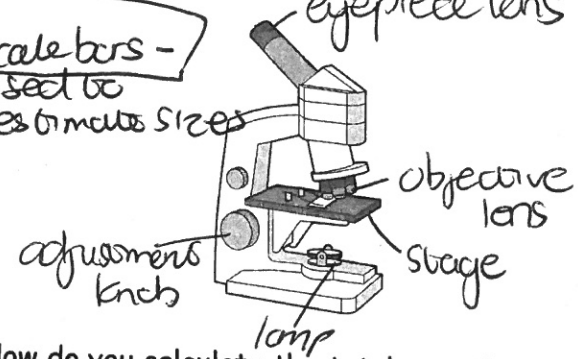
1) Chromosomal DNA
2) plasmid DNA

Microscopes: Field of view - circular area you see in light microscope

Draw diameter - to estimate sizes

Label the microscope:

Scale bars - used to estimate sizes



How do you calculate the total magnification from eyepiece lens and objective lens?

eyepiece lens × objective lens

What does the term resolution mean?

means how well a microscope distinguishes between 2 points that are close together

What does the term magnification mean?

make them look bigger

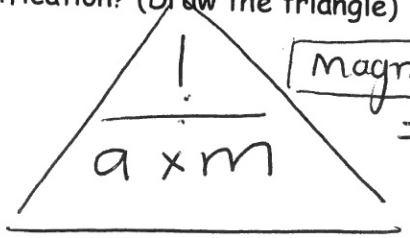
→ higher resolution - image can be seen

Microscopes continued:

Explain why light microscopes are better than electron microscopes

use electrons more than light
- have a higher magnification + resolution than light microscopes
- let us see much smaller things in more detail like internal structure of mitochondria + chloroplasts (subcellular structures)

What is the equation for calculating magnification? (Draw the triangle)



magnification = image size / actual size

An image has a length of 3mm. It has been magnified by x50. Calculate the actual length

$a = \frac{I}{mag} = \frac{3}{50} = 0.06\,mm$

How do you convert to the following:

Specialised cells:

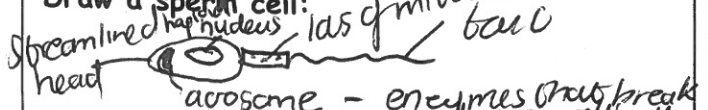
Draw a ciliated epithelial cell:

Line the surface of organ

Describe how this cell is adapted to its function of absorbing food.

microvilli - increase the surface area of the cell - more area for molecules of food to be absorbed

Draw a sperm cell:



Describe how the sperm cell is adapted to its function

Streamlined shape - swim faster
Tip of head acrosome
Tail - allows to swim
Lots of mitochondria to release lots of energy to power the tail

Draw an egg cell

Describe how the egg cell is adapted to its function

After fertilisation - cell membrane become hard to stop other sperm from entering.
Cytoplasm - has lots of nutrients to supply fertilised egg with energy + raw materials for growth
Jelly coat - protects. Hardens after fertilisation

Enzymes:

Enzymes are **biological catalysts** which mean they speed up the rate of reaction without being used up themselves

Enzymes are proteins which means they are made up of amino acids

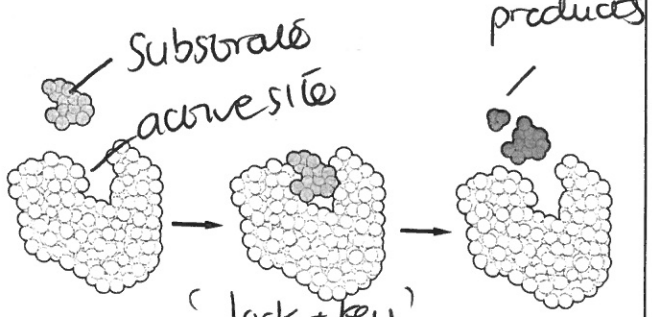
Proteins → amino acids (by enzyme protease)

Starch → glucose (by enzyme amylase) (carbohydrase)

Lipids → fatty acids + glycerol (by enzyme lipase)

Enzyme action:

Using the diagram below describe how enzymes work. Label the diagram.



Substrate held in active site (specific) - bonds are broken. Product is released.

Enzyme activity:

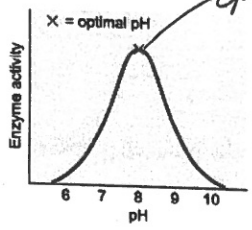
Name 3 factors that affect enzyme activity

1) Temperature
2) pH
3) Substrate concentration

What does 'optimum' mean?

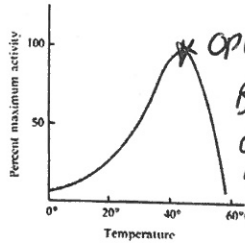
What they work fastest (best) at.

Use the graphs to describe what is happening in each.



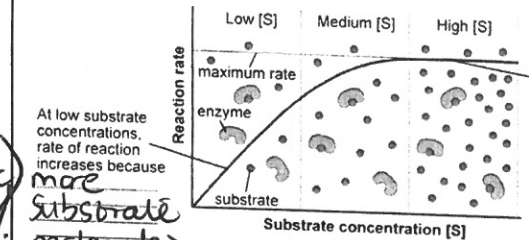
optimum pH

At pHs above + below optimum the shape of the active site is altered + so the enzyme does not work well.



optimum temp

Bonds holding enzyme together break. Change shape of active site + denatured



At low substrate concentrations, rate of reaction increases because more substrate molecules are available

At high substrate concentrations, rate of reaction doesn't change because all the active sites are full.

adding more substrate makes no difference

CB2 Revision Mat pg (20) - (24)

Mitosis:

Describe the process of mitosis: cell splits to form (2) daughter cells - identical to parent cell

Interphase → Mitosis → (3) anaphase → (4) telophase → (2) metaphase → (1) prophase → (5) cytokinesis

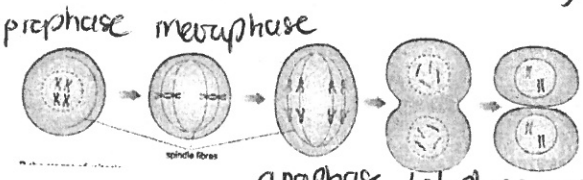
DNA copied + forms X-shaped chromosomes

What is mitosis needed for?
Growth + repair of cells

What does the term diploid mean? Give an example of diploid cells
2 sets of chromosomes - human body cells

What does the term haploid mean? Give an example of haploid cells
1 copy of each type of chromosome - gametes (sex cells)

Stages of mitosis:
Identify each stage



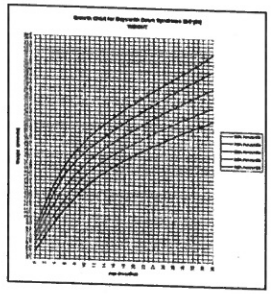
What is the difference between sexual and asexual reproduction?
asexual - reproduce using (1) parent - clones
sexual - (2) parents - variation

Growth in animals

What is growth?
an increase in size as a result of an increase in number or size of cells.

cell division / differentiation / elongation

Percentile charts:



What is meant by being on the 95th percentile?
roughly 95% of babies are lighter and 5% are heavier.

What is cell differentiation?
process by which a cell changes to become specialised for its job

How is a red blood cell adapted for its function?
No nucleus - more space for haemoglobin
large surface area

Explain how a single fertilised egg cell can develop into billions of different cells in a human adult
- cell division
- differentiation

Growth in plants

What is found at the end of shoots and roots to enable plants to keep growing?
meristems

What processes do cells undergo in plants?
Mitosis (cell division)
Elongation
Differentiation

How are root hair cells adapted for their function?
- Large surface area - ↑ water + mineral uptake
- Lots of mitochondria for active transport

How do you calculate percentage change in mass?
$\frac{\text{final value} - \text{starting value}}{\text{starting value}} \times 100$

Stem Cells

What are the two types of stem cells in humans?
1) embryonic stem cells
2) adult stem cells (bone marrow) → can be versatile

What is the difference between these two types?
cells of an early - stage embryo - can produce any type of cell
Where are stem cells found in plants?
meristems

What process do stem cells undergo to become specialised?
differentiation

Stem Cells cont

Complete table

Advantages	Disadvantages
treat diseases	Can cause cancer if controls lost
	Rejection from immune system
	Disease transmission

The Nervous System

What does the central nervous system consist of?

1) Brain
2) Spinal cord

What do receptor cells do?

Detect stimuli

Complete the table summarising the three types of neurones and their functions.

Neurone	Function
Sensory	Carry impulse from receptor towards CNS
Relay	Carry nerve impulse from sensory neurone to motor neurone
Motor	Carry impulse from CNS to effector cells

What is the role of the myelin sheath?

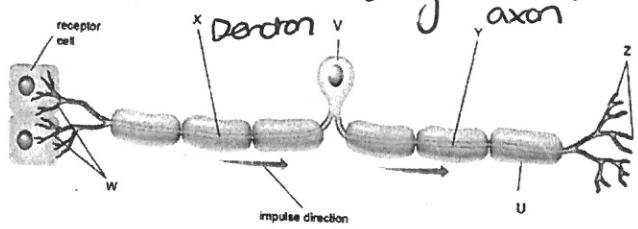
Electrical insulator - speeding up electrical impulses

When the brain coordinates a response impulses are sent to effects such as Muscles or Glands

The Nervous System continued

Identify structures on sensory neurone:

U myelin sheath.
V cell body (middle)
W Dendrites
X Dendron (towards cell body)
Y Axon (away from cell body)



Explain why dendrons and axons are usually long.

Speeds up impulse - one long neurone is much quicker than lots of short ones joined together

Identify the motor neurone and the relay neurone.

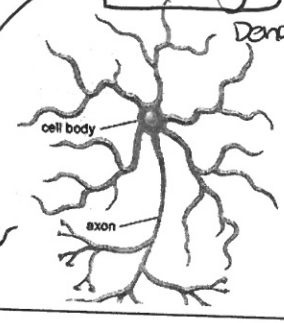
What is the function of each?

Motor - carry impulses to effectors

No Dendron
Dendrites are on cell body

Short neurones found in Spinal cord
Key link motor and sensory neurones

Relay



Neurotransmission speeds

What is a synapse?

Connects neurones - contains a tiny gap.

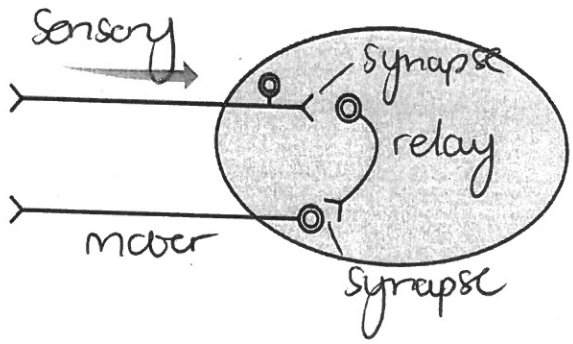
What is released from synapses? chemical neurotransmitter

What do synapses do to the speed of neurotransmission?

Slow it down as neurotransmitter has to diffuse across gap (synapse)

Reflex arc:

Label the 3 neurons in the diagram below.



Complete flow chart for the reflex arc:

Receptor → Sensory neurone → relay neurone → motor neurone → E. effectors

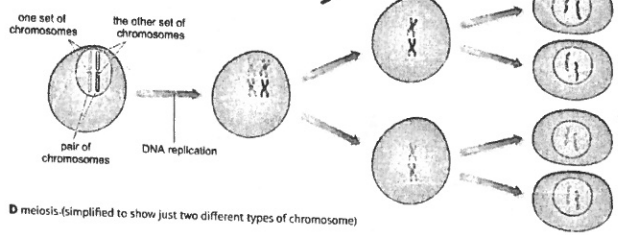
What are the advantages of reflex arcs?

automatic, rapid responses to stimuli - reduce the chance of being injured

CB3 Revision Mat: pg (26) - (31)

Meiosis

Describe the process of meiosis:
Cell division - production of gametes
Doesn't produce identical cells
(2 divisions)



D meiosis (simplified to show just two different types of chromosome)

How many chromosomes do gametes (sex cells) have? 23

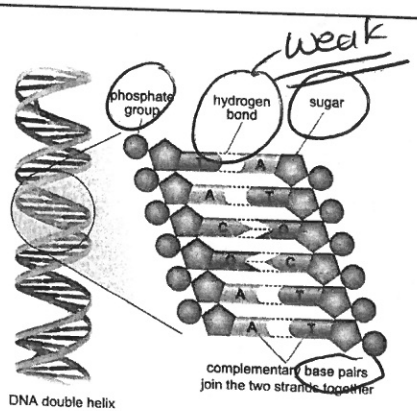
Describe the process of fertilisation
A male gamete fuses with a female gamete to produce a fertilised egg.

How many chromosomes does a zygote have? 46
fertilised egg

Compare and contrast mitosis and meiosis:

Similarities	Differences
Cell divisions	Mitosis - 1 division Meiosis - 2 divisions
	Mitosis - exact copy Meiosis - sex cells/gametes
	Mitosis - diploid (2 pairs) Meiosis - haploid
	Mitosis - 2 daughter cells Meiosis - 4 daughter cells

DNA



DNA double helix
B the structure of DNA

Describe the structure of DNA: (polymer)
- Double helix
- Complementary base pairs join the 2 strands together A-T, C-G

What is a gene?
Section of DNA on a chromosome that codes for a particular protein
The sequence of bases in the gene determine what protein is made

DNA Extraction:

What substance causes DNA to precipitate?
Cold alcohol (white precipitate)

What equipment is needed to filter a solution?
Filter funnel
Filter paper

Explain why the sample needs to be crushed.
To extract the DNA

Explain why detergent is used.
Detergents - break down cell membrane

Explain why salt is used.
Salt - DNA sticks together

Explain why protease is used.
Breaks down proteins

Alleles

What is an allele?
Different form of the same gene

Define the following terms:

Homozygous
Both alleles for one gene are the same

Heterozygous
Alleles are different

Dominant
Overrule recessive alleles (capitals)

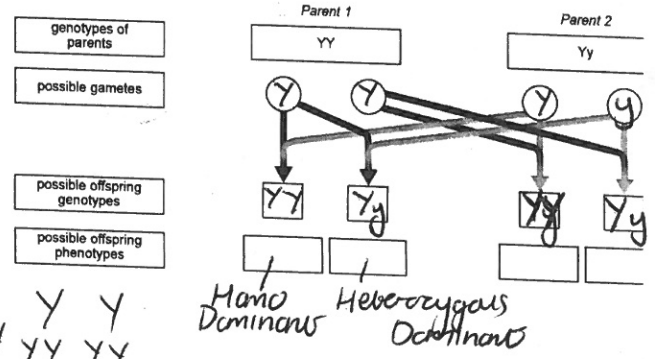
Recessive
Both alleles must be recessive to see characteristic (lower case)

Genotype
Combination of alleles you have (BB)

Phenotype
What characteristics you have

How do genetic diagrams show if the characteristic has dominant or recessive alleles?
Shows the possible combinations of alleles when 2 organisms breed

Complete genetic diagram



	Y	Y
Y	YY	YY
y	Yy	Yy

Inheritance

What are the sex chromosomes of a female?

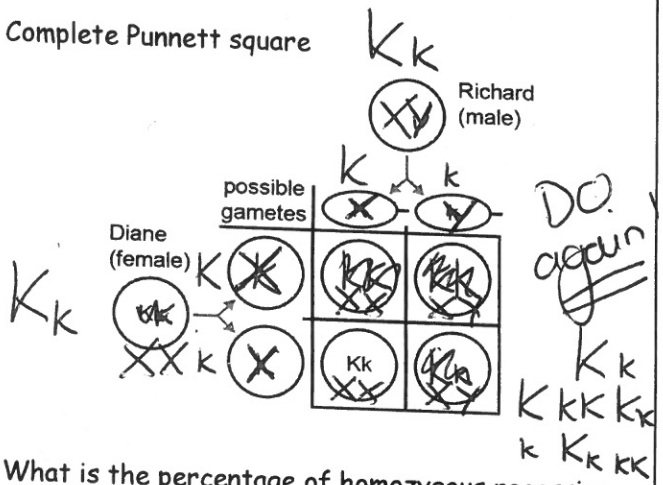
XX

What are the sex chromosomes of a male?

XY

Which gamete decides the sex of a child? Sperm

Complete Punnett square



What is the percentage of homozygous recessive offspring? 25%

What is the percentage of heterozygous offspring? 50%

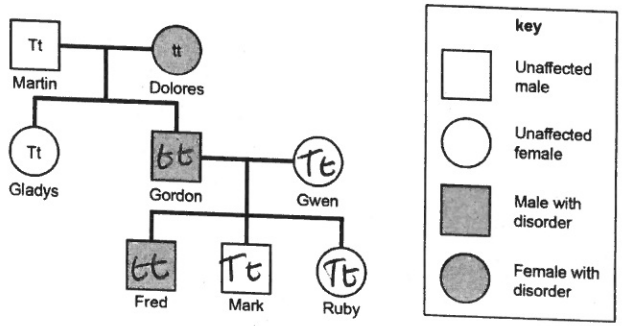
Use a Punnett square to show that the chance of two parent's having a girl is 50%

	X	X
X	XX	XX
Y	XY	XY

50:50

Pedigree Analysis

Recessive disorder



Which of Mark's grandparent's is homozygous?

Gordon

What must Gwen's genotype be?

Tt

What is the ratio of Gordon and Gwen's children for affected to unaffected? 1:2

Gene mutation:

What is a mutation? changes to the base sequence of DNA

A change in a gene that creates a new allele

Explain why the risk of skin cancer increases with the amount of sunlight your skin received

Sunlight contains ultraviolet radiation that can cause mutations in skin cells, which can result in skin cancer.

Explain how mutations cause variation

New combinations of alleles may interact with each other to produce new phenotypes

Human Genome project:

What is the human genome project?

An international research project with the goal of determining the sequence of base pairs that make up human DNA

What are the advantages of mapping a genome?

- Prediction + prevention of disease
- Testing + treatment for inherited disorders
- New + better medicines

Variation:

What are the two types of variation?

1) Genetic
2) Environmental

List examples of each type of variation in each column and examples of variation caused by both

Genetic	Environmental	Both
Blood group	Skin colour	Height
eye colour		weight

What is meant by continuous variation and give an example

Data can be any value in a range eg height

What is meant by discontinuous variation and give an example

Data can only take a limited set of values eg eye colour

CB4 Revision Mat: pg (32) - (37) (unused + used DNA)

Evidence of human evolution:

What is evolution?
The gradual change in the characteristics of a species over time.

Place the fossils in order of discover (oldest to youngest)

Homo sapiens (5), *Homo habilis* (3), *Ardipithecus ramidus* (1), *Australopithecus afarensis* (2) and *Homo erectus* (4)

Oldest: Ardipithecus ramidus
Australopithecus afarensis
Homo Habilis
Homo erectus
Youngest: Homo Sapiens

How do stone tools provide evidence for human evolution?
Scientists can work out the age of different layers of rock. They then assume that a stone tool is about the same age as that layer of rock
oldest stones - very simple
more recent - more sophisticated (bigger brain)

Darwin's theory:
'survival of the fittest'

What is natural selection?
Variation of individuals make them better at coping with change than others + so are more likely to survive

How does natural selection lead to evolution?
If environment is changed - natural selection occurs over + over again + a new species evolves with all the individuals having the better-adapted variations

Darwin's theory cont.

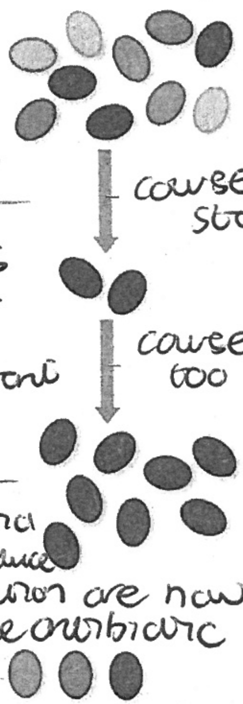
Bacteria show variation in the amount of resistance to an antibiotic

course started

Antibiotic kills more + more of the bacteria. The most resistant bacteria take longest to die

course finished too early

Resistant bacteria survive + reproduce
The new population are now resistant to the antibiotic



Explain how bacteria become resistance to antibiotics, supporting Darwin's theory.

Stopping an antibiotic early can cause resistance to develop in a species of bacterium

Classification: an up date but still used
Complete the table identifying the kingdoms and their main characteristics.

Kingdom	Characteristics
Animal	Fish/mammals/reptiles/birds amphibians multicellular cells have nuclei / no cell walls
Plants	Grasses / trees multicellular chloroplasts for photosynthesis cellulose cell walls
Fungi	mushrooms/toadstools multicellular (apart from yeast) cells have nuclei, cell walls contain chitin (not cellulose)
Protists (algae)	unicellular cells have a nucleus eukaryotic
Prokaryotes	unicellular cells do not have nuclei, flexible cell walls (prokaryotic)

What can be said about the DNA analysis of closely related organisms?
Similar patterns in the alleles - tells you that they are closely related

Explain how genetic analysis led to Archaea being placed in their own domain.
Led to (3) large groups called domains. Some members of prokaryote kingdom were not as closely related. Proposal that this kingdom should be split into (2) groups called Archaea + Bacteria

Breeds and varieties

What is selective breeding?

When humans artificially select the plants & animals that are going to breed so that the genes for particular characteristics remain in the population

State characteristics that plants and animals are bred for:

- disease resistance (crops)
- yield (crops)
- animals produce more meat/milk
- Flavour (crops)
- Fast growth (crops)

What is genetic engineering?

Changing the DNA of one organism by inserting genes from another.

Explain the advantages and disadvantages of GM rice 'golden rice'

Advantages: 2 genes into genome (1) from daffodil and (1) from bacteria

Rice produce beta-carotene in its grain (yellow) & used to make Vitamin (A)

Lack of vitamin (A) = blindness

Disadvantages: can be grain in poorer countries where vit (A) deficiency is a problem

Transplanted genes may get into environments

Adversely affect food chains + human health.

Genes in agriculture and medicine

What are the benefits of selective breeding?

- improve meat yields
- alcoholism traits have been bred with either a strong preference for alcohol or a weak preference

Can compare differences - behaviour + how brain works

What are the risks of selective breeding?

Reduces gene pool (inbreeding)

Harmful genetic defects (cystic fibrosis)

considerations (runs breathing difficulties)

Disease - could wipe all of plant/animal not much variation

Explain the advantages and disadvantages of **GM herbicide resistant plants**: (Chemicals that kill plants)

Advantages

Can spray crops to kill weeds without affecting crop = ↑ crop yield

Disadvantages expensive

Resistant gene may be picked up weeds, creating a new 'superweed' variety

GM crops could adversely affect food chains + human health

Explain the advantages and disadvantages of **GM insulin** concerns

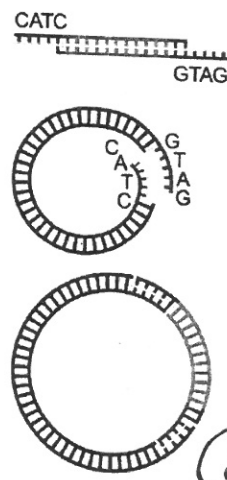
Advantages

Cheaper + suitable for vegans or people who don't eat pork or beef / religious reasons

Disadvantages

Slightly different to insulin that human makes + so not all diabetics can use it

Genetic engineering of bacteria (Higher)



Used to transfer DNA into a cell

2 types (plasmid) (viruses)

Explain how genetic engineering of bacteria is carried out.

Include following keywords: restriction enzymes, sticky ends, ligase, vector

DNA you want to insert is cut out using restriction enzyme.

The vector DNA (plasmid) is cut open using the same restriction enzyme

- creates complementary sticky ends

- Mixed with ligase enzyme which joins the sticky ends together

- formed recombinant DNA

- put back into bacteria

CB5 Revision Mat

pg (39) - (46)

Health and Disease

What is the WHO definition of health?

"a state of complete physical, mental + social well being and not merely the absence of disease or infirmity" (World Health organisation)

Define disease

a condition where part of an organism doesn't function properly

What are diseases caused by?

Pathogens / fault in gene / lifestyle (communicable - non-communicable)

Explain the difference between communicable and non-communicable diseases

Communicable disease - caused by pathogens - spread between individuals
Non-communicable - can't be transmitted between individuals

Give an example of a communicable disease

Cholera / Tuberculosis / Malaria / Chalara ash dieback

Give an example of a non-communicable disease

Cancer / heart disease / cardiovascular disease

Suggest why someone with HIV, a disease that attacks the immune system is more likely to get other communicable diseases

more susceptable to diseases as body becomes weakened by the disease so is less able to fight off others (immune system)

Non-communicable diseases

What causes non-communicable diseases:

1. Lifestyle Factors
2. Fault in genes

What is malnutrition?

Don't have the 7 food groups in the correct amounts - underweight / overweight

Nutrient	Disease caused by deficiency of nutrient	Symptoms of disease	Good sources in diet
protein	kwashiorkor	enlarged belly, small muscles, failure to grow properly	meat, fish, dairy, eggs, pulses (e.g. lentils)
vitamin C	scurvy	swelling and bleeding gums, muscle and joint pain, tiredness	citrus fruits (e.g. oranges) and some vegetables (e.g. broccoli)
vitamin D and/or calcium	rickets or osteomalacia	soft bones, curved leg bones	vitamin D: oily fish calcium: dairy products
iron	anaemia	red blood cells that are smaller than normal and in reduced number, tiredness	red meat, dark green leafy vegetables, egg yolk

Suggest how you would treat scurvy

eat more citrus fruits / vitamin C supplements

What disease is caused by drinking too much alcohol?

Liver disease eg cirrhosis

Explain why liver disease is a non-communicable disease

alcohol broken down by enzymes in the liver + proteins are toxic
cannot be passed between individuals - caused by lifestyle.

Non-communicable diseases

Give a reason why drinking too much alcohol is a problem for the society the person lives in

high odds of non-communicable diseases
- Pressured resources of local hospitals
- Not able to work (economy)

Cardiovascular disease

What is cardiovascular disease? CVD

Is any disease associated with your heart + blood vessels

What lifestyle choices increase your risk of cardiovascular disease?

Smoking / diet high in fat (obesity)

How do you calculate BMI?

$$BMI = \frac{\text{weight (kg)}}{\text{height}^2\text{ (m)}}$$

What does your BMI have to be over if you are classed as obese?

>30

How does smoking cause disease?

- Nicotine - increases heart rate (↑ blood pressure)
- High blood pressure damages artery walls - build up of fatty deposits in arteries. Deposits restrict blood flow and increase risk of heart attack / stroke
- Smoking increases the risk of blood clots

Explain how stents and bypasses treat CVD

- Tubes inserted inside arteries (Crestriced blood flow) keep open so blood can pass through to the heart muscle. Lowers risk of heart attack
- Part of blood vessel blocked - piece of healthy vessel taken from elsewhere

Pathogens

What types of organisms cause diseases: Pathogens

1) Viruses
2) Bacteria
3) Fungi
4) Protists

} Communicable diseases

Disease	Pathogen that causes disease	Symptoms
Tuberculosis	Bacterium	Coughing + lung damage
Cholera	Bacterium	Diarrhoea
HIV	VIRUS	Kills white blood cells (poor immune response)
Chalera dieback	Fungus infects ash trees	Leaf loss + bark lesions (wands)
Malaria	Protist	Damage to RBCs + liver

Explain why the above diseases are examples of communicable diseases

Diseases that can be spread between individuals

Transporting substances

- Diffusion
- osmosis
- active transport

% change in mass

$$= \frac{\text{final mass} - \text{initial mass}}{\text{initial mass}} \times 100$$

- STIs
- Fight disease
  - Memory lymphocytes + immunisation
  - Antibiotics + pain medicines