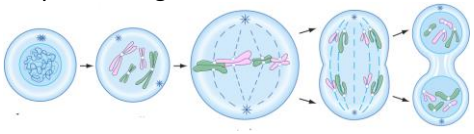
AQA Trilogy-Biology key terms – Inheritance, variation and evolution

Evolution, inheritance and variation	
Nucleus- the part of a cell where **all** of the genetic information is found (i.e. DNA, genes, chromosomes etc)	**Genome**- The entire genetic material of an organism
DNA- a polymer made of 2 strands forming **a double helix**. Found in the nucleus and makes up chromosomes.	**Genes** are short sections of **DNA** on a chromosome that contain a code for a particular sequence of amino acids, to make a specific protein.
Chromosomes- Long molecules of DNA that contain a large number of genes. These are in pairs, one from each parent. We have **46** chromosomes in each body cell & **23** in each gamete (sex cell).	**Allele-** A version of a gene (e.g. A or a)
Dominant alleles (e.g. A) are always shown in the phenotype.	**Recessive alleles** (e.g. a) are only shown in the phenotype if there are 2 copies.
Homozygous is when the alleles of a gene are the same (e.g. HH). **Heterozygous** is when the alleles of a gene are different (e.g. Hg).	**Genotype** is the set of alleles for a characteristic (e.g. aa). **Phenotype** is the physical characteristics of a person due to the environment **&** genotype
Some features are controlled by 1 gene (e.g. fur colour in mice). Most features are controlled by **several genes** interacting (not just 1)	**Variation**- differences in features of different people. Can be inherited, environmental or a combination of both. **Identical twins** may be used to compare the effects of environment.
A **Punnett square** can be used to show what alleles someone is likely to inherit from their parents (you need to be able to draw these) B b B BB Bb b Bb bb **Make sure you circle and label which ones have a certain feature/condition!**	**Sex chromosome** (only 1 of the 23 pairs determines our gender)- **Male = XY. Female= XX** You need to be able to draw Punnett squares to show this like the one below. X X X XX XX Y XY XY
Genetic diseases are inherited from parents. **Polydactyly** (extra fingers/toes)is caused by a dominant allele, so only one parent needs to pass on the allele. **Cystic fibrosis** is caused by a recessive allele so both parents must pass on an allele for the child to have the disease. If a person carries one allele for a **recessive disease** they are called a **carrier.** They can **pass it on,** but won't have the disease themselves.	**H Tier only**- Some rules for patterns in **pedigree charts (family trees)**: - **Evidence that proves it's a recessive gene** that causes a condition→ 2 parents don't have condition, but their child does- parents must be carriers/ both parents have the condition, so all their children must too. **Evidence that proves it's a dominant** gene → 2 parents have a condition, but their child doesn't
H Tier only- In pedigree charts (family trees) it may be **hard to see if someone is homozygous dominant (e.g. BB) or heterozygous (e.g. Bb)** as they will both have the same feature. To find out, cross them both with a homozygous recessive individual (bb). If the offspring (children) have the recessive feature they must be Bb. If not, they are likely to be BB.	**H tier only-Flies** are often used in genetics experiments: -Short life cycle/small space needed/lays lots of eggs/not endangered
Embryo screening. Testing an embryo to see if it has a particular condition (e.g. cystic fibrosis). Often used in **IVF**- the embryos are tested and a family will decide whether to implant it or not. You may be asked to **evaluate** the use of this. You will be given information, but you need to include some **good and bad points, as well as a conclusion.**	**Gene therapy**- Using genes to treat or prevent disease. In the early stages of testing and has had mixed results. Like embryo screening, you may be asked to **evaluate** this when given information.
Mitosis forms 2 genetically **identical body** cells. It is used for **growth/repair**. Cell parts (e.g. ribosomes) are grown, then the DNA replicates and then the cell divides.	May show diagrams like the one below for mitosis  Diagram 1-DNA is replicating 2/3- cell is preparing to divide 4-one set of chromosomes is being pulled to each end of the cell

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<table>
<tr><td></td><td>5- one set of chromosomes at each end of cell and cytoplasm starts to divide to form 2 identical daughter cells
The quicker each stage is (or the less cells in this stage)- the quicker mitosis is</td></tr>
<tr><td>Mitosis questions often look at root tips (i.e. meristem tissue on plants)- because the cells are dividing quickly here.</td><td><u>Cancer</u> = <u>uncontrolled</u> <u>growth</u> <u>and division</u> of a cell (by mitosis).</td></tr>
<tr><td><u>Benign tumour</u>- growth of abnormal cells that are contained in 1 area. They do not invade other parts of the body</td><td><u>Malignant tumour</u>- this is <u>cancer</u>. They <u>invade</u> neighbouring tissues and can <u>spread</u> to other parts of the body, as cells can break off and travel in the blood. Some cancers are more aggressive than others.</td></tr>
<tr><td>Meiosis forms 4 cells (gametes) that are <u>non-identical</u>. They carry half the DNA of the parent cell (23 chromosomes). In fertilisation, the number of chromosomes is restored to the full number.</td><td>Cancer survival rates are improving:
-Better drugs/ earlier diagnosis/more cancer screening/ patients know more about risk factors</td></tr>
<tr><td>Questions often ask you to identify if something is mitosis or meiosis. Always mitosis unless a sex cell is being made. When the egg is fertilised and cells of the embryo divide, this is mitosis! Also, you must learn the spellings of mitosis and meiosis –very picky on this!</td><td>
<table>
<tr><th>Mitosis</th><th>Meiosis</th></tr>
<tr><td>chromosome number remains same (2 sets)</td><td>chromosome number halved (1 set)</td></tr>
<tr><td>cells made identical</td><td>cells made <u>not</u> identical</td></tr>
<tr><td>2 cells made</td><td>4 cells made</td></tr>
<tr><td>Cell divides once</td><td>Cell divides twice</td></tr>
<tr><td>Used to make body cells</td><td>used to make gametes</td></tr>
<tr><td colspan="2">If you compare these in an exam, you must use like for like points!</td></tr>
</table>
</td></tr>
<tr><td><u>Asexual reproduction</u> is when an organism makes a <u>genetically identical</u> copy of itself forming a <u>clone.</u> 1 parent. No joining of gametes. <u>Uses mitosis only</u></td><td><u>Sexual reproduction</u> is where the sex cells <u>(gametes)</u> from a male and female organism fuse together to form a <u>zygote (fertilisation).</u> Gives <u>variation</u>. 2 parents. <u>Uses meiosis</u> to form the gametes. In plants, pollen (not sperm) mixes with an egg cell.</td></tr>
<tr><td>Evolution is a change in the inherited features of a population over time. Happens by natural selection.</td><td>Present day organisms have evolved <u>from</u> <u>simpler organisms</u> – over 3 billion years ago.</td></tr>
<tr><td><u>Natural Selection</u>-described by Charles Darwin
Stages involved-
1There is <u>variation</u> in a species -caused by a random mutation
2. Gives some individuals a survival advantage (say how)
3. They can then reproduce and pass on their genes
4. The amount of individuals with this feature gradually increases</td><td><u>Mutation</u>- a change in the DNA. They can cause <u>new proteins</u> to be made, which can change characteristics.

Mutations happen <u>all the time</u>. However only rarely does it lead to a new phenotype. But, if it gives a survival advantage, it can rapidly change the phenotype of the species.</td></tr>
<tr><td>Fossils are the remains of organisms that lived millions of years ago. The fossil record can be evidence of evolution, as it shows the <u>change</u> over time. So can antibiotic resistance in bacteria.</td><td>Most common way a fossil forms:
1. Animal/plant is <u>buried</u> in sediment (e.g. mud)
2. Hard parts do not decay (soft parts do)
3. Eventually the bones are replaced by minerals-called mineralisation</td></tr>
<tr><td><u>Other ways fossils form:</u>
-Animals can leave traces (e.g. footprints), which are preserved
-Conditions needed for decay are missing (e.g. oxygen). (e.g. why we have full mammoths</td><td>Scientists are still unsure how life began, as there is not enough evidence</td></tr>
<tr><td><u>There are gaps in the fossil record</u>- some fossils not yet found, <u>conditions</u> may not be right for fossilisation or geological activity can destroy fossils</td><td>Extinction are when there are no remaining individuals of a species alive. May be caused by a new predator, a new disease, new competitor or changes in the environment</td></tr>
<tr><td>Species-A group of individuals with similar genes that are able to <u>breed</u> with each other to produce <u>fertile</u> offspring</td><td><u>Speciation</u>-evolution of a new species from an existing one.
1. Species is separated by geographical barrier
2. The environments are different in the 2 separated areas
3. Mutations occur
4. Those that are better adapted survive and reproduce
5. Favourable alleles (from the mutations) are passed on
6. Eventually the 2 populations are unable to breed successfully with each other and have <u>fertile offspring</u></td></tr>
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Genetic engineering is **cutting out useful genes** from one organism and **inserting them** in another (e.g. **disease resistance** in plants or **insulin production** in bacteria).	Crops that have had genetic engineering are called **GM (or genetically modified**). E.g. for insect resistance. **Good** → usually better yields. **Bad**→ Full effect on human health may not yet be known. People worried about effect on wild flower/insect populations.
H tier only- **Steps involved in genetic engineering:** 1. **Enzymes** used to **cut out** required gene (say where from). 2. Gene is inserted into a vector (e.g. virus/plasmid from bacteria) 3. Vector is used to insert gene into required cells in nucleus 4. Genes are transferred to cells of organism in the early stage of development so they develop with the desired characteristics.	**H tier only** **Vector** (e.g. plasmid) • Carrier of DNA / gene • Into cell / other organism
Selective breeding- humans breed plants/animals for particular genetic characteristics.	**Examples** of selective breeding- disease resistance in crops/animals with more milk or meat/large or unusual flowers/dogs with a gentle nature.
Steps 1.**Choose parents** with desired characteristic 2. **Breed** together 3.From their **offspring** (children), ones with the desired characteristic are bred together 4.Continue over **many generations**	Can lead to **inbreeding**. Can lead to disease or inherited defects. This may make it more **expensive for farmers** as they have to pay higher vet bills and may get less income from the animals (e.g. from milk etc)
Classification- by Carl Linnaeus Living things can be put into groups depending on their structure/characteristics. Put into following groups: Kingdom/ Phylum/ Class/Order/Family/Genus/Species (think ***k*ing *p*rawn *c*urry *o*n *F*ridays *g*enerally *s*peaking** to help you remember the order)	Organisms are named by the binomial system of genus and species (e.g. a lion is Panthera *leo*) • **Genus** must always have a CAPITAL letter at start. • **Species** = underlined/italics (if on computer) **Good** because →Means **everyone uses the same name** and the genus gives **some idea of ancestry**.
Evolutionary trees • Can show evolutionary relationships • Closely related animals have a **common ancestor** that split off more recently	Improved microscopes and better understanding of biochemical processes have meant new models of classification have been suggested. **Three domain system**- developed by **Carl Woese**. Organisms divided into: -**Archaea** (primitive bacteria in extreme conditions) -**Bacteria** (true bacteria) -**Eukaryota** (plants, animals, fungi and protists)