Year 10 Biology 6: Inheritance. Variation and Evolution Knowledge Organiser

1.Keywords

Mitosis	A type of cell division which create two identical daughter cells
Meiosis	A type of cell division the create 4 unique gametes
Gametes	Sex cells eg sperm + egg and pollen + ovum
Sexual reproduction	Reproduction involving the fusion of gametes. Make unique offspring that resemble both parents
Asexual reproduction	Reproduction involving only one parent. No gametes fuse. Offspring are identical to parent
DNA	Deoxyribose nucleic acid. Polymer made of 2 strands forming a double helix. Contains the instructions for an organism.
Chromosomes	Long strands of DNA found in the nucleus. Humans have 23 pairs
Gene	A section of DNA which codes for a protein
Genome	All the genes of an organism

5. Sex determination

No of chromosomes in a human	23 pairs (22 normal, 1 pair of sex)
Male	XY (50% chance)
Female	XX (50% chance)
Sperm	Can hold Y or X chromosome so determine gender of embryo

6. Variation

Variation	Changes within a population. Caused by mutation
Genetic	Changes due to inheriting different alleles of genes
Environmental	Changes due to the effect the environment has

2. Meiosis

1. DNA replication: chromosome number doubles
2. Cell divides: two cells now
3. Those cells divide: four gametes now with half the number of chromosomes

4. Inherited disorders

Inherited disorders	Disorders that are caused by inheriting faulty genes from parents
Polydactyly	A dominant inherited disorder which causes extra fingers or toes to form
Cystic fibrosis	A recessive inherited disorder which causes sticky mucus to block air ways

8 Genetic engineering

	The process of changing the genome by adding a desirable gene from another organism
GM crops	Genetically modified crops that are resistant to disease or grow bigger crops. Controversial to some

3. Genetic inheritance

Allele	Different forms of the same gene. eg hair colour
Dominant	When only one copy of the allele is needed to show in the offspring
Recessive	When the allele only shows when there are two copies
Homozygous	Two copies of the same allele
Heterozygous	Two different alleles
Genotype	The set of genes in our DNA
Phenotype	The outward appearance a set of genes displays

7 Evolution

Evolution	The change in the inherited characteristics of a population due to natural selection. May result in a new species
Natural selection	The process where the organism best adapted to the environment survives and passes on their characteristics
Species	A group of organisms with similar features which can breed to make fertile offspring

Stages of evolution

1. Population shows variation due to their genes
2. Environment changes
3. Some individuals are best adapted and live longer
4. These can breed and produce more offspring
5. Over a long period of time the offspring dominate the population

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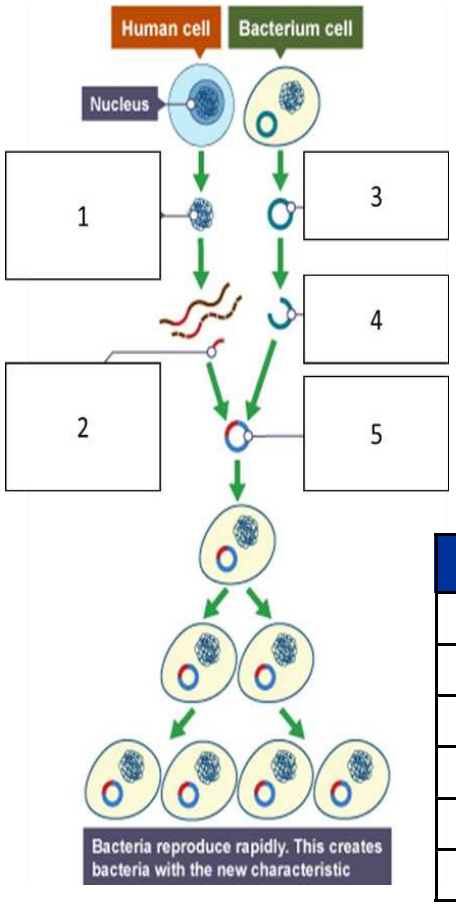
9. Selective breeding	
Selective breeding	The ancient practice of artificially selecting animals and plants to breed together to create certain characteristics
Inbreeding	The consequence of too much selective breeding. Can lead to disease or defects
Outcomes of selective breeding	•Disease resistance in crops •Increased meat and milk production •Domestication of pets •Large unusual flowers



10. Process of genetic engineering (HT ONLY)	
1	DNA containing desired gene removed from cell
2	Enzyme cuts out gene
3	Plasmid taken from bacteria
4	Plasmid cut by same enzyme
5	Plasmid and human gene joined by an enzyme

11. Fossils	
Fossil	Remains of a plant or animal that were alive millions of years ago. Found in rocks. Normally only the hard parts
Fossil formation	•Parts of organisms that have not decayed because one or more of the conditions needed for decay are absent •Parts of the organism are replaced by minerals as they decay •Preserved traces of organisms, such as footprints
What they tell us	Early life was simple As the fossils get newer the life becomes more complex
Why do we not have a fossil for every living thing	•Early life forms were soft bodied so not fossils formed •Geological activity destroyed fossils

12 Extinction	
Extinction	When an entire species has died
Causes of extinction	1.Disease 2.New predators 3.Famine 4.Natural disaster (meteor, volcano)

13. Resistant bacteria	
MRSA	A type of bacteria that has evolved to be resistant to antibiotics
How to prevent antibiotic resistance	1.Not prescribing antibiotic for viral and non-threatening infections 2.Completing the course of antibiotic given 3.Restricting the use of agricultural antibiotics

14. Classification of organisms	
Carl Linnaeus	Invented the groups we classify organisms into 1.Kingdom 2.Phylum 3.Class 4.Order 5.Family 6.Genus 7.Species
Binomial name	The official name of all organism consisting of genus and species
3 domain system	
Archaea	Primitive bacteria normally found in extreme environments
Bacteria	True bacteria
Eukaryotes	Plants, animals, fungi and protists

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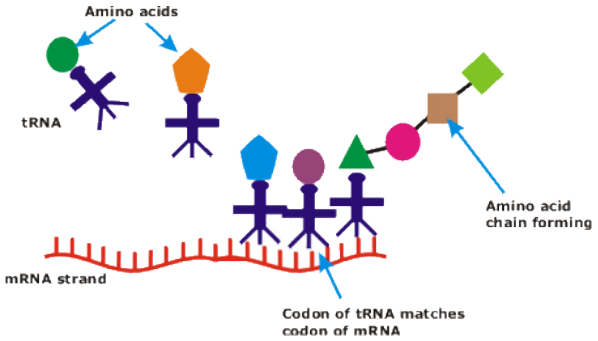
Advantages of reproduction (TRIPLE ONLY)	
Advantages sexual	Advantages asexual
Causes variation	Only need 1 parent
If environment changes natural selection can occur	Energy and time efficient (fast)
Humans can selectively breed organisms for beneficial characteristics	Lots of offspring can be produced when conditions are good
Organisms that can use both	•Malaria •Fungi •Plants

Protein synthesis and gene expression (HT TRIPLE ONLY)	
Pairing of nucleotide bases	A and T, C and G
Transcription	When the DNA is read and converted into messenger RNA (mRNA)
Translation	When the mRNA is read by ribosomes and use to build the amino acid sequence
Transfer RNA (tRNA)	Carries the correct amino acid to the ribosome for the mRNA triplet code
Coding DNA	DNA which codes for a protein, a gene
Non-coding DNA	DNA which does not code for a protein. Can be involved in turning on or off genes.
Mutation	A change to the DNA sequence. Most are harmless but some can stop proteins working correctly



DNA structure (TRIPLE ONLY)	
Nucleotide	The monomer of DNA. Consists of a sugar, phosphate and a base
Base	One of 4 different chemicals that make the triplet code. A G T C
Triplet code	3 bases in a row give a code for a specific amino acid

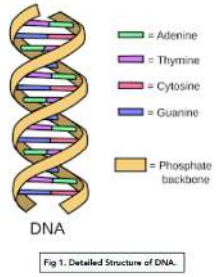


Fig 1. Detailed Structure of DNA.

Theory of evolution (TRIPLE ONLY)	
Charles Darwin	Proposed the theory of evolution in his book 'on the origins of species'
Darwin's theory took a long time to be accept-ed because:	•It challenged the idea that God made all creatures •There was not enough evidence at the time •Mechanism of inheritance was not understood for another 50 years.
Jean-Baptiste Lamarck	Had a different theory about inherited characteristics. He believed they were ac-quired through the life of the parents. He was wrong
Alfred Russell Wallace	Independently came up with the idea of evolution and natural selection at the same time as Darwin. Worked on the idea of speciation
Speciation	Formation of a new species as a result of evolution

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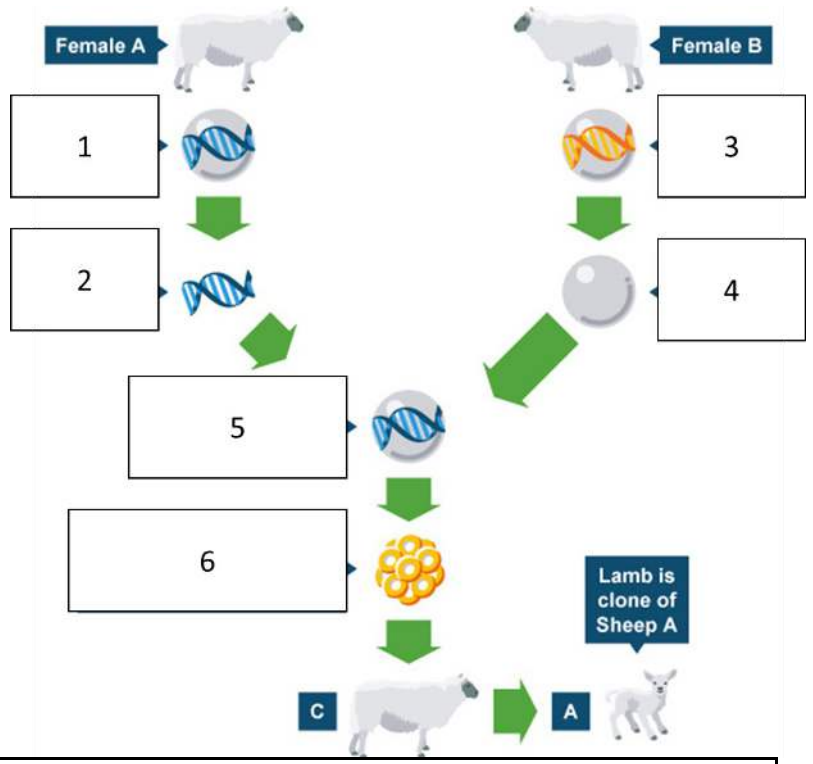
Cloning (TRIPLE ONLY)	
Tissue cloning	Using groups of cells from a plant to grow a identical new plants
Cuttings	Old fashioned simple method of growing a new plant from part of an old plant
Embryo transplant	Splitting apart unspecialised animal cells from an embryo and transplanting them into host mother



Adult cell cloning	
1	Body cell taken from Sheep A
2	DNA removed
3	Egg taken from Sheep B
4	Nucleus removed
5	DNA and cell fused with electric shock
6	Cell develops into embryo and implanted into surrogate (c)

Understanding genetics (TRIPLE ONLY)	
Mid 19th century	Gregor Mendel a monk who carried out breeding experiments on plants. Discovered the inheritance of characteristics as 'units'
Late 19th century	Chromosomes observed
Early 20th century	Chromosomes linked to inheritance. Genes discovered.
Mid 20th century	Structure of DNA discovered and the way genes code for proteins.
Today	Antibiotic resistance provides real time evidence of evolution in action