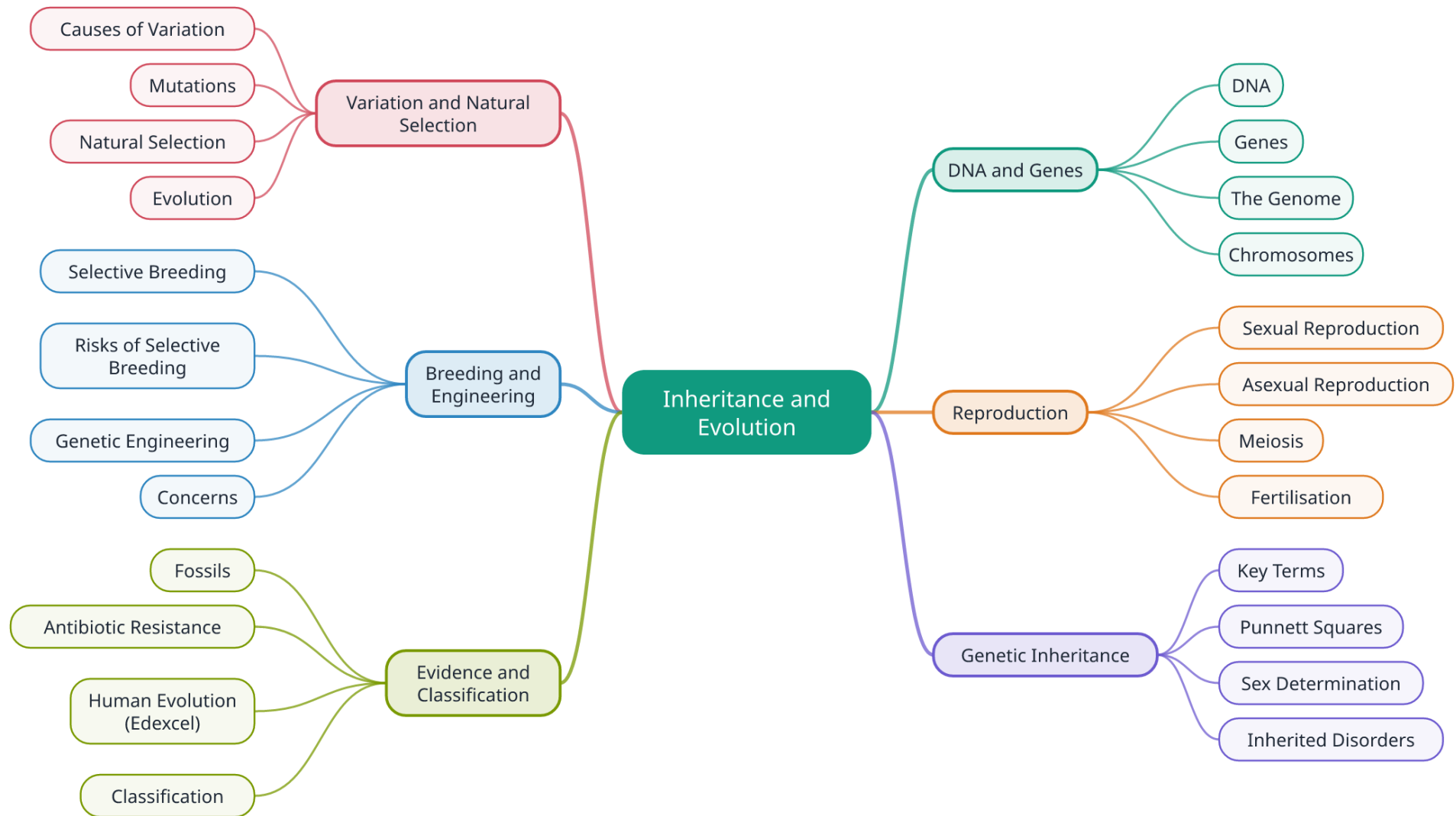


Inheritance, Variation and Evolution Mind Map (GCSE)

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Inheritance and Evolution mind map explained

DNA and Genes

The genetic material in the nucleus of a cell is made of DNA.

DNA

A polymer made of two strands twisted into a double helix. DNA is found in structures called chromosomes.

Genes

A gene is a small section of DNA on a chromosome. Each gene codes for a particular sequence of amino acids, to make a specific protein.

The Genome

The entire genetic material of an organism. The whole human genome has been studied, which helps identify genes linked to diseases and trace human migration.

Chromosomes

Human body cells have 23 pairs of chromosomes. One pair are the sex chromosomes: XX in females and XY in males.

Reproduction

Organisms reproduce sexually, asexually or both.

Sexual Reproduction

Male and female gametes (sperm and egg cells, or pollen and egg cells) join at fertilisation. The offspring get a mix of genes from both parents, so they vary.

Asexual Reproduction

One parent, no joining of gametes, and offspring that are genetically identical clones. It happens by mitosis.

Meiosis

Cell division that makes gametes. The chromosomes are copied, then the cell divides twice, giving four gametes, each with a single set of chromosomes and each genetically different.

Fertilisation

The gametes join, restoring the full number of chromosomes. The new cell divides by mitosis as the embryo develops.

Genetic Inheritance

Most characteristics are controlled by several genes, but some by a single gene.

Key Terms

- Allele: a version of a gene
- Dominant: always expressed, even with only one copy
- Recessive: expressed only with two copies
- Homozygous: two identical alleles; heterozygous: two different alleles
- Genotype: the alleles present; phenotype: the characteristic shown

Punnett Squares

Show the possible offspring of two parents. Write each parent's alleles along the edges, fill in the grid, and give the outcome as a ratio, a probability or a percentage.

Sex Determination

Crossing XX with XY gives a 50% chance of a boy and a 50% chance of a girl.

Inherited Disorders

Polydactyly (extra fingers or toes) is caused by a dominant allele. Cystic fibrosis, a disorder of cell membranes, is caused by a recessive allele. Embryo screening raises ethical and economic issues.

Variation and Natural Selection

Differences between individuals in a population are the raw material for evolution.

Causes of Variation

Variation comes from the genes inherited, from the environment, or from a combination of both.

Mutations

Changes to DNA happen all the time. Most have no effect, a few change the phenotype, and very rarely one gives an advantage.

Natural Selection

Darwin's theory:

- Individuals vary because of their genes
- Those best suited to the environment are more likely to survive and breed
- They pass on the useful alleles
- Over many generations, the species changes

Evolution

All species of living things evolved from simple life forms that first developed more than three billion years ago.

Breeding and Engineering

Humans change the genes of plants and animals on purpose.

Selective Breeding

Choose parents with the characteristic you want, breed them, then select the best offspring and repeat over many generations. Used for disease resistance, bigger yields, gentle dogs and large flowers.

Risks of Selective Breeding

Inbreeding reduces variation, so some breeds are more prone to disease or inherited defects.

Genetic Engineering

A gene from one organism is cut out and inserted into another. Examples include bacteria making human insulin, and crops resistant to insects or herbicides, or with bigger fruit.

Concerns

Possible effects on wild plants and insects, and uncertain long-term effects of eating GM crops.

Evidence and Classification

How we know evolution happened, and how living things are grouped.

Fossils

The remains of organisms from millions of years ago, preserved where parts did not decay, where parts were replaced by minerals, or as traces such as footprints. The fossil record is incomplete because many early forms were soft-bodied.

Antibiotic Resistance

Bacteria reproduce quickly, so resistant strains evolve in a short time: evidence of natural selection happening now.

Human Evolution (Edexcel)

Edexcel only. Fossils such as Ardi and Lucy, the work of Richard Leakey's team, and the development of stone tools show how humans evolved.

Classification

Linnaeus grouped organisms into kingdom, phylum, class, order, family, genus and species, and named each with two words (genus and species). Carl Woese's three-domain system splits life into archaea, bacteria and eukaryota.

How to revise with this mind map

1. Practise genetic diagrams until they are automatic. Show the parents' alleles, the gametes, the Punnett square and the outcome as a ratio or percentage: marks are given for each step.
2. Learn the key terms in pairs: dominant and recessive, homozygous and heterozygous, genotype and phenotype. Questions often test whether you can use them precisely.
3. Explain natural selection in steps: variation, survival of the best suited, breeding, passing on alleles, and change over many generations. Missing a step loses marks.
4. Compare meiosis and mitosis in a table: what each is for, how many divisions, how many cells, and whether they are genetically identical.
5. Make it yours. Build your own genetics map in Mindmapi from your class notes, and ask the AI about any branch you are unsure of. The answer is saved into that branch's notes for next time.