



Advantages of sexual reproduction 1

- produces variation in the offspring
- if the environment changes variation gives a survival advantage by natural selection
- natural selection can be speeded up by humans in selective breeding to increase food production.

Sexual

Involves fusion of egg and sperm cells in animals

Involves fusion of pollen and egg cells in plants

Leads to genetic variation

Gametes formed by meiosis

Asexual 2

Involves only one parent

No fusion of gametes

No genetic variation – Genetically identical offspring (clones)

Only mitosis involved

Advantages of Asexual reproduction 3

- only one parent needed
- more time and energy efficient as do not need to find a mate
- faster than sexual reproduction
- many identical offspring can be produced when conditions are favourable

DNA 4

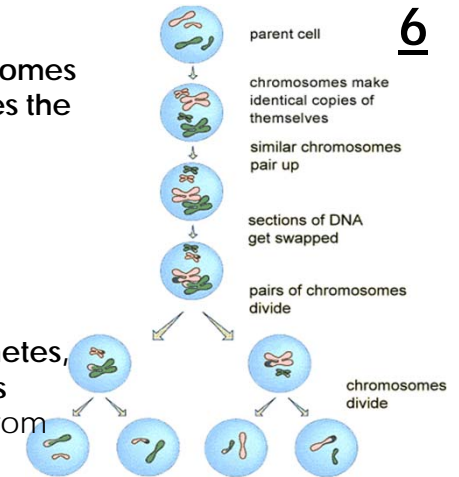
- DNA is a polymer made up of 2 strands forming a **double helix**
- DNA is contained within **chromosomes**
- **A gene is a small section of DNA on a chromosome**
- Each gene codes for a particular sequence of amino acids to make a specific protein
- Mutations change the sequence of amino acids and the protein made
- 3 bases code for one amino acid

The genome 5

- The genome of an organism is the entire genetic material of that organism
- The whole human genome has now been studied
- **It has been identified that specific genes cause certain diseases**
- **Research has allowed scientists to understand and treat inherited disorders**
- Studying the genome has also allowed us to trace human migration patterns from the past

Meiosis

- **Meiosis halves the number of chromosomes in gametes (23) and fertilisation restores the full number of chromosomes (46).**
- Cells in reproductive organs divide by meiosis to form gametes.
- When a cell divides to form gametes copies of the genetic information are made
- **The cell divides twice to form four gametes, each with a single set of chromosomes**
- All gametes are genetically different from each other.



The Punnett Square

Key Vocabulary:

Phenotype: the physical expression of the genotype

Genotype: the inherited alleles of a gene

Homozygous: when the alleles of a gene are the same

Heterozygous: when the alleles of a gene are different

Dominant: the stronger allele, only one is needed for the phenotype

Recessive: the weaker allele – 2 are needed for the phenotype

Parental phenotypes: brown x black
 Parental genotypes: bb BB
 Parental gametes: (b) (b) (B) (B)
 Punnett Square:

	B	B
(b)	Bb	Bb
(b)	Bb	Bb

Offspring genotype(s): All Bb
 Offspring phenotype(s): All will have black fur

Alleles are different versions of the same gene, e.g. brown fur, black fur

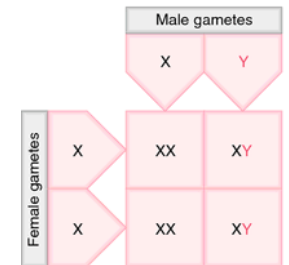
Inherited disorders 8

Some disorders are inherited. These disorders are caused by the inheritance of certain alleles.

- **Polydactyly** (having extra fingers or toes) is caused by a **dominant** allele.
- **Cystic fibrosis** (a disorder of cell membranes) is caused by a **recessive** allele.

Sex determination 9

- In females the sex chromosomes are the same (XX).
- In males the chromosomes are different (XY)
- **Chance of Child being a Boy = 50%**
- **Chance of Child being a Girl = 50%**





Variation 1

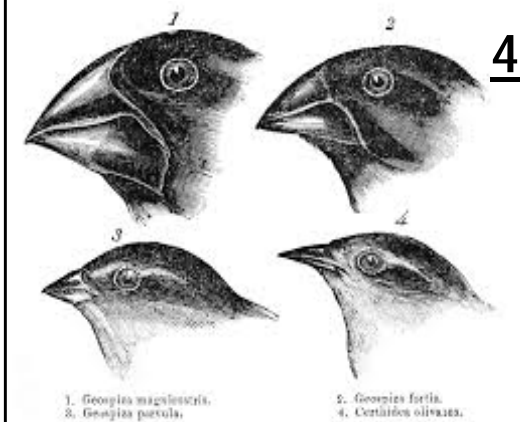
- The genome and its interaction with the environment influence the development of the phenotype of an organism.
- **Variation and may be due to differences in:**
- **the genes they have inherited (genetic causes)**
- **the conditions in which they have developed (environmental causes)**
- **a combination of genes and the environment.**

Variation within a population 2

- usually extensive genetic variation within a population of a species
- **all variants arise from mutations and that most have no effect on the phenotype**
- Mutations occur continuously.
- Very rarely a mutation will lead to a new phenotype.
- **If the new phenotype is suited to an environmental change it can lead to a relatively rapid change in the species.**

Evolution 3

- **Evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment.**
- If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.



Example: Finches evolved to have different beaks in order to exploit different food sources. Creating new species of finch

Selective breeding 5

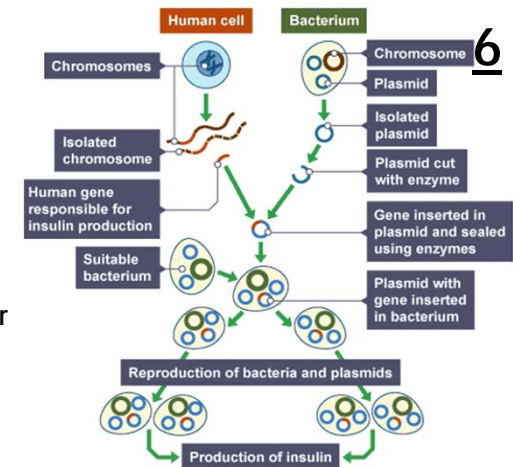
A process by which humans breed plants and animals for particular genetic characteristics. **Selective breeding involves choosing parents with the desired characteristic from a mixed population. They are bred together. From the offspring those with the desired characteristic are bred together.** This continues over many generations until all the offspring show the desired characteristic. Examples:

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

Selective breeding can lead to 'inbreeding' where some breeds are particularly prone to disease or inherited defects.

Genetic engineering 6

- A process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.
- Plant crops have been **genetically engineered to be resistant to diseases or to produce bigger better fruits.** Bacterial cells have been genetically engineered to **produce useful substances such as human insulin to treat diabetes.**



Evidence for evolution: 7

Fossils

Fossils are the 'remains' of organisms from millions of years ago, which did not decay and are found in rocks. Fossil records show how features of organisms changed over time, and allows the identification of similarities and differences from organisms today

Resistant bacteria 8

Mutations of bacterial pathogens produce new strains. Some strains might be resistant to antibiotics. They survive and reproduce, so the population of the resistant strain rises. To reduce the rate of antibiotic resistant strains:

- doctors should not prescribe antibiotics for non-serious or viral infections
- patients should complete their course of antibiotics
- the agricultural use of antibiotics should be restricted.

Extinction 9

Extinctions occur when there are no remaining individuals of a species still alive.

Factors contributing to extinction:

- **Poaching**
- **Destruction of habit**
- **Lack of food**
- **Disease**

Classification 10

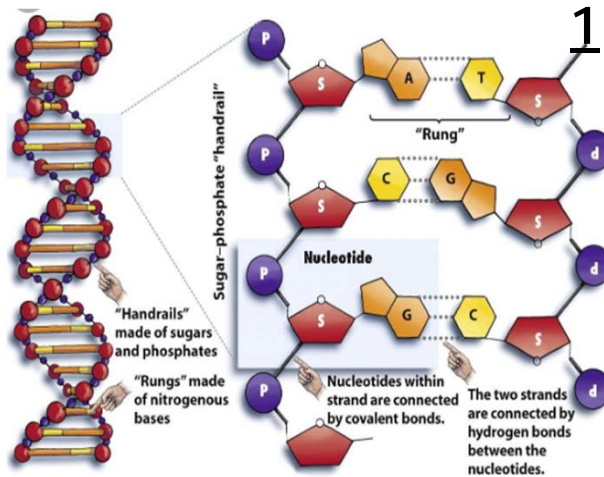
Three-domain system

- **Archaea** (primitive bacteria usually living in extreme environments)
- **Bacteria** (true bacteria)
- **Eukaryota** (which includes protists, fungi, plants and animals).

B6 Knowledge Organiser – 4.6.1 – Inheritance (Biology only)

DNA Structure

- 4 bases
- A pairs with T
- (2 hydrogen bonds)
- G pairs with C
- (3 hydrogen bonds)
- Mutations cause base pairs to bond incorrectly coding for incorrect amino acids
- Sugar-phosphate backbone



1

Protein synthesis

2

- Proteins are synthesised on **ribosomes**
- Carrier molecules bring specific amino acids to add to the growing protein chain in the correct order.
- When the protein chain is complete it folds up to form a **unique shape**. This unique shape enables the proteins to do their job as enzymes, hormones or forming structures in the body such as collagen.

Cloning – key words

3

Tissue culture: using small groups of cells from part of a plant to grow identical new plants. This is important for preserving rare plant species

Cuttings: used by gardeners to produce many identical new plants from a parent plant.

Embryo transplants: splitting apart cells from a developing animal embryo before they become specialised, then transplanting the identical embryos into host

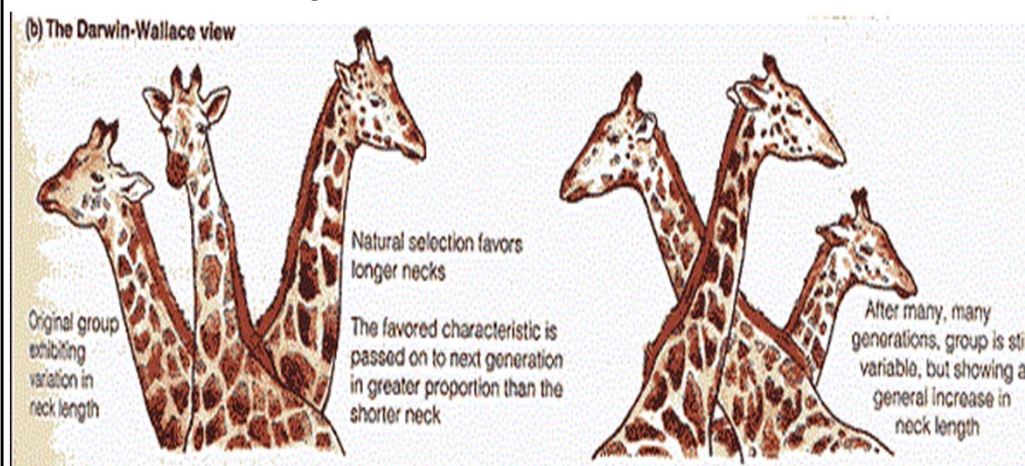
Cloning - process

4

1. The nucleus is removed from an unfertilised egg cell.
2. The nucleus from an adult body cell, such as a skin cell, is inserted into the egg cell.
3. An electric shock stimulates the egg cell to divide
4. These embryo cells contain the same genetic information as the adult skin cell.
5. When the embryo has developed into a ball of cells, it is inserted into the womb of an adult female

Darwin's Theory of evolution

5



Accepting Darwin's theory

6

Only gradually accepted because:

- The theory challenged the idea that God made all the animals and plants that live on Earth
- There was insufficient evidence at the time the theory was published to convince many scientists
- The mechanism of inheritance and variation was not known until 50 years after the theory was published.

Speciation

7

- Formation of new species due to isolation because of physical barriers

 1. Large population with **common gene pool**
 2. **Physical barrier/geographical isolation** causes separation of the population
 3. **Mutations** occur over time causing each population to adapt to its environment
 4. **Natural selection** due to environmental pressures occur in both populations
 5. Forms two new species that can **no longer reproduce to produce fertile offspring**

Mendel

8

- In the mid-19th century Gregor Mendel carried out breeding experiments on pea plants. One of his observations was that the inheritance of each characteristic is determined by 'units' that are passed on to descendants unchanged.
- Purple: White pea plants occur in a 3:1 ratio
- The 'units', now called genes, were located on chromosomes and are responsible for inherited characteristics, e.g. flower colour.

