

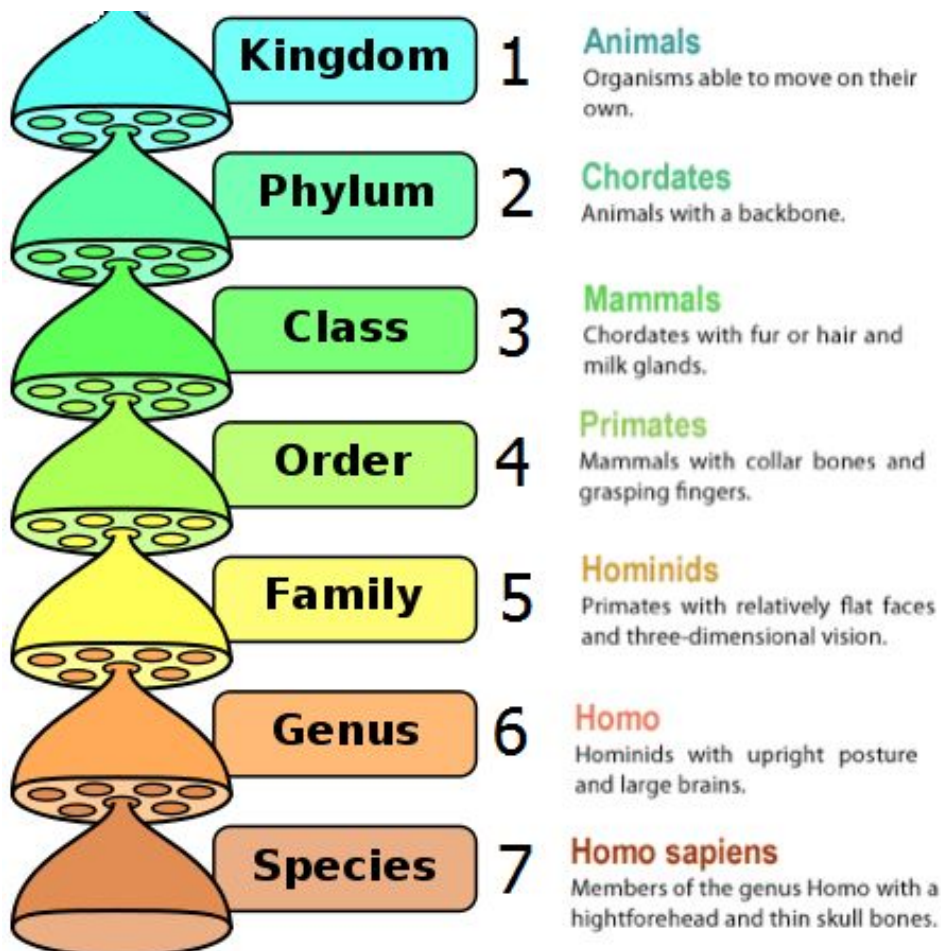
WJEC Biology A-level

Topic 2.1: All organisms are related through their revolutionary history

Notes



Classification is the process of **naming and organising organisms into groups based on their characteristics**. Organisms can be grouped into one of the five kingdoms: **animals, plants, fungi, prokaryotes and protocists**. They can then be grouped further into **phylum, class, order, family, genus and species**. Each species is named according to the **binomial system**, the first part of the name is the genus and the second part of the name is the species.



The analysis of molecular differences in different organisms to determine the extent of their evolutionary relatedness is known as **molecular phylogeny**. The data obtained by molecular phylogeny has been accepted by scientists and this gave rise to new taxonomic groupings – all organisms can be separated into one of the **three domains: Bacteria, Archaea and Eukaryota**.

The scientific community evaluates the data in the following ways:

- The findings are published in **scientific journals** and presented **scientific conferences**.
- Scientists then study the evidence in a process called **peer review**.



- Scientists start **collecting evidence** to either **support or reject the suggestion**.

Biodiversity

Biodiversity is the **variety of living organisms**, over time the variety of life on Earth has become more extensive but now it is being **threatened by human activity** such as deforestation. Biodiversity can be measured in terms of:

- **Species richness** is the **number of different species in a community** and can be measured by simply counting the number of species present via methods such as **random sampling**.
- **Genetic diversity** is a measure of the **genetic variation** found in a particular species, in other words it is the **number of alleles in a gene pool**. It can be determined by calculating the **heterozygosity index (H)**, the higher the heterozygosity index (H), the more genetically diverse the species.

H = number of heterozygotes / number of individuals in the population

Biodiversity can also be measured using the **index of diversity (D)** which can be calculated as following:

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

D = Diversity index

N = total number of organisms

n = total number of organisms of each species

Σ = the sum of

DNA profiling

DNA profiling is a forensic technique used to **identify individuals by characteristics of their DNA**. It can also be used to **determine genetic relationships** between organisms. Main techniques used in DNA profiling are:

- **Polymerase chain reaction known as PCR** which is used to amplify the DNA by making millions of copies of a given DNA sample. It occurs as following:
 - 1) A reaction mixture is set up by mixing the **DNA sample, primers, free nucleotides and DNA polymerase** which is the enzyme involved in creating new DNA strands.
 - 2) The mixture is then **heated to 95 degrees** to break the hydrogen bonds and to separate the two strands.
 - 3) The mixture is then **cooled to a temperature between 50-65 degrees** depending on the type of primers used, so that they can bind to the strands.
 - 4) Temperature is increased to about **70 degrees** as this is the temperature DNA polymerase works best.



- 5) **DNA polymerase** creates a copy of the sample by **complementary base pairing using the free nucleotides**.
 - 6) **This cycle is repeated around 30 times** and gives rise to an amount of DNA sufficient to create a DNA profile.
- **Gel electrophoresis** is a process **separate the DNA fragments according to their size using an electric current** used to. It occurs as following:

Figure S-2: Gel Electrophoresis

