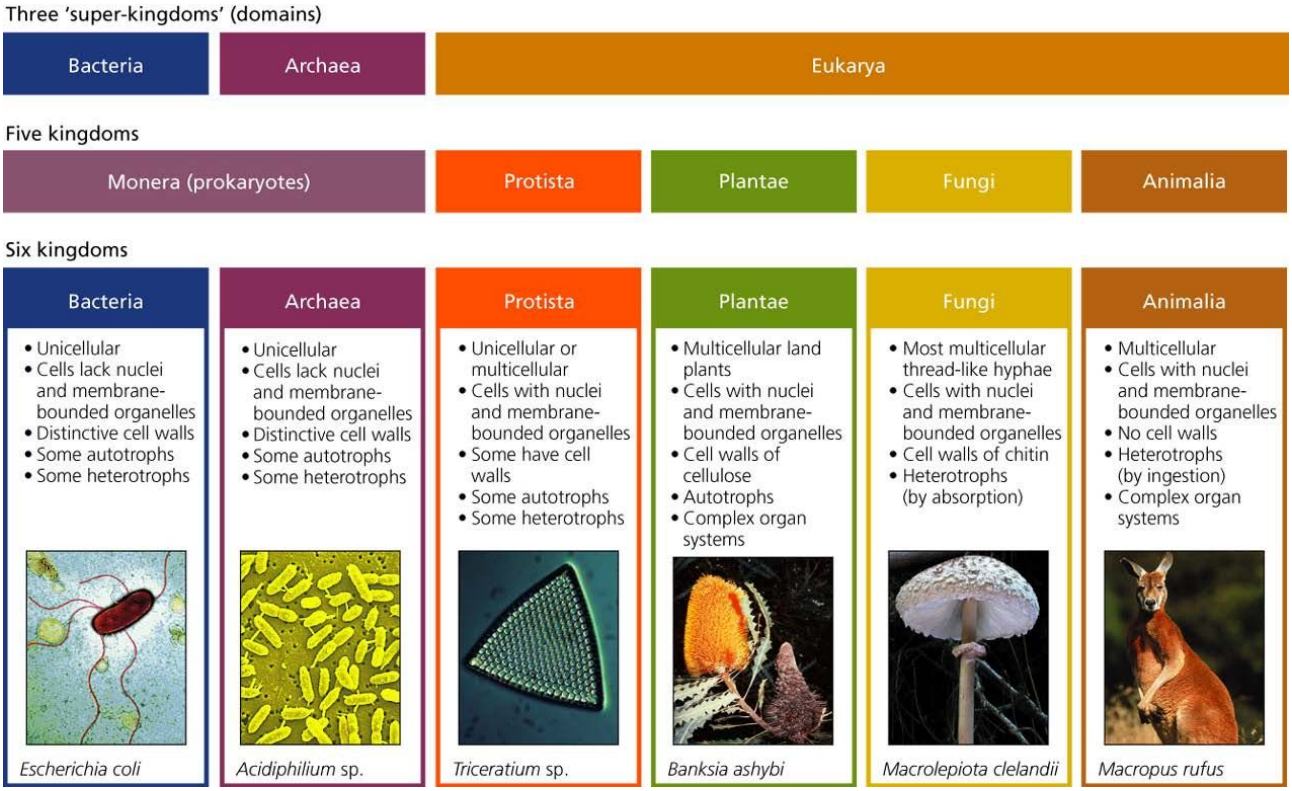
Biodiversity

Know classification systems and why they are important

Know the major differences between kingdoms

- Linean taxonomy is the system we use today to classify life in an organised way - Kind people can often find green shoes
    - Uses a hierarchy of categories to organise organisms into smaller, more specific groups
- Maria Sibylla Merian (the first entomologist) formed a system of classifying insects
    - Things with chrysalises - which were then split into diurnal and nocturnal insects
    - Things without chrysalises - which were split into maggots, worms, flies, and bees
    - This system is not used today but it represents an early attempt to organise the diversity of life
- Linnaeus thought there were two kingdoms - plants (don't move), animals (move)
- Anthonie van Leeuwenhoek made three kingdoms - animals, plants, protista (microbes)
- Today we use the three domain, six kingdom system which is probably wrong but is easier to understand
    - Archaea
        - Prokaryotic
        - Cell membranes composed of glycerol-ether lipids
        - Some are extremophiles
    - Bacteria
        - Prokaryotic
        - Cell walls made out of peptidoglycan
        - Cell membrane composed of phospholipids like everything else
    - Eukarya - cells have membrane bound organelles
        - Plants
            - Photosynthesise
            - Cells have cell walls made of cellulose
        - Animals
            - Heterotrophs
            - Cells have no cell walls
        - Protists
            - Unicellular eukaryotes that don't fit in anywhere else
        - Fungi
            - Heterotroph
            - Cells have cell wall made of chitin



- Scientific names can help deduce relationships between species, they also provide a standardised system of names, as opposed to common names
    - Scientific names of species use the binomial naming system - genus name + species name
    - Binomial names were introduced by Linnaeus

Know how many named species there are and know why it is difficult to count species

- Problems with counting the number of species include:
    - Inaccessible habitat e.g. deep sea, caves, which restrict our knowledge of the species found within them
    - Definition of a species e.g. some microbes which reproduce asexually which makes it difficult to apply the biological species concept
    - Cryptic species (hiding in plain sight) e.g. used to think there was one species of giraffe, but according to genetic sequencing there are 6-11, possible species
    - Morphology is not an accurate way to define a species - molecular evidence is more definitive but this is more expensive to do
    - Complex life cycles e.g. jellyfish where polyp, larvae and adult don't look like each other, sexual dimorphism can also make members of the same species look like they are not closely related
    - Sampling bias e.g. holiday locations - some locations are studied more often and more thoroughly than others
- We don't know how many species there are, latest estimate is 1 trillion; 99.9% of species are unnamed
    - Estimate based off realisation that microbial diversity is hugely underestimated

Know the relative abundance of groups (hint: most animals are insects)

- Most animals are insects
- Invertebrates make up about 98% of animal life
- Vertebrates make up the minority of life - mammals likely occupying the smallest portion

Know how to calculate biodiversity indices

- Biodiversity can be measured through Simpson's index of biodiversity

Simpson's Index of Diversity

$$D = 1 - \sum \left(\frac{n}{N}\right)^2$$

Emphasises common species

Where the summation is over all species

p_i = the proportion of individuals in the *i* th species ($p_i = n_i / N$)

n_i = number of individuals of species *i* in the sample

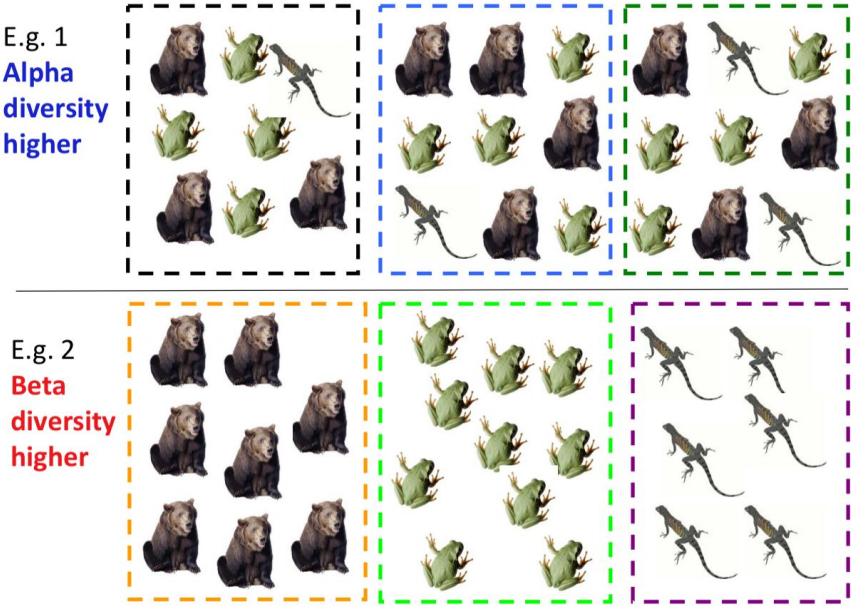
N = the total number of individuals sampled

Index values are high if there are many species, or if evenness (equitability) is high.

Gurevitch, Scheiner, Fox 2002

Know the difference between different types of biodiversity

- Biodiversity is made up of
  - Genetic diversity
  - Community diversity
    - Alpha diversity - number of species in a certain site
    - Beta diversity - diversity of species between different sites includes change of species between samples
    - Gamma diversity - total diversity in a landscape
    - Different types of diversity give us different information about the site e.g. beta diversity is often higher in cities than bushland, but alpha diversity tends to be higher in bushland than cities



- Problems with measuring diversity
    - More diverse is not always better e.g. introduced species outcompeting and preying upon endemic and endangered native species
    - Counting the number of species is not always the best way to measure diversity - if one site has 12 of species A and 1 of species B, and another site has 6 of species A and 7 of species B, they both have two species but the second site has the higher diversity
    - Endemic species are normally measured differently to those that are not - biodiversity is not evenly spread across the globe
        - Conservation International has identified 25 biodiversity hotspots based on: the number of species, number of endemic species, and the degree of threat they face