

LECTURE 2 – BIODIVERSITY	2
LECTURE 3 – DARWINIAN EVOLUTION	5
LECTURE 4 – EVOLUTION OF THE EARTH	ERROR! BOOKMARK NOT DEFINED.
LECTURE 5 – MACROEVOLUTION AND MAJOR TRANSITIONS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 6 – SPECIES AND SPECIALISATION	ERROR! BOOKMARK NOT DEFINED.
LECTURE 7 – PHYLOGENETICS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 8 – MOLECULAR BASES OF INHERITANCE AND THE CENTRAL DOGMA	ERROR! BOOKMARK NOT DEFINED.
LECTURE 9 – MENDELIAN GENETICS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 10 – MENDELIAN GENETICS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 11 – MAPPING THE GENOME	ERROR! BOOKMARK NOT DEFINED.
LECTURE 12 – GENOMES AND TRANSCRIPTOMES	ERROR! BOOKMARK NOT DEFINED.
LECTURE 13 – BIOTECHNOLOGY	ERROR! BOOKMARK NOT DEFINED.
LECTURE 14 – POPULATION GENETICS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 15 – MECHANISMS OF EVOLUTIONARY CHANGE	ERROR! BOOKMARK NOT DEFINED.
LECTURE 16 – EVIDENCE FOR EVOLUTION	ERROR! BOOKMARK NOT DEFINED.
LECTURE 17 – SEX AND THE SINGLE CHROMOSOME	ERROR! BOOKMARK NOT DEFINED.
LECTURE 18 – CELLS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 19 – ENERGY PRODUCTION AND THE EVOLUTION OF ENDOSYMBIONTS	ERROR! BOOKMARK NOT DEFINED.
LECTURE 20 – WHAT IT MEANS TO BE MULTICELLULAR	ERROR! BOOKMARK NOT DEFINED.
LECTURE 21 – HOW TO BUILD A PLANT	ERROR! BOOKMARK NOT DEFINED.
LECTURE 22 – HOW TO BUILD AN ANIMAL	ERROR! BOOKMARK NOT DEFINED.
LECTURE 23 – MOVING ONTO LAND	ERROR! BOOKMARK NOT DEFINED.
LECTURE 24 – ADAPTING TO A CHANGING WORLD	ERROR! BOOKMARK NOT DEFINED.

Lecture 2 – Biodiversity

Problems with counting species

- Inaccessible habitats (e.g. deep sea)
 - Definition of a species (e.g. micro-organisms)
 - Cryptic species (e.g. parasites)
 - Complex life cycles (e.g. jelly fish)
 - Sampling bias (e.g. holiday locations vs. remote areas)
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- Currently 86% of terrestrial life and 91% of marine species is as yet unnamed
 - 98% of mammals have been discovered but only 20% of the earth's insects have been discovered - possibly due to their often-small size, inaccessible habitats
 - Insects are the most abundant animals on earth - estimated approx. 5,000,000 with only 1,000,000 discovered

Classifying Life

- Life > Domain > Kingdom > Phylum > Class > Order > Family > Genus > Species
- Carl Linnaeus - Described 7300 species of plants and introduced binomial nomenclature e.g. Homo sapiens. He described two kingdoms; plants (don't move) and animals (do move)
- Antonie van Leeuwenhoek - scraped plaque from his teeth and wrote that he saw little things moving. Introduced a third kingdom; plants, animals and protista (little things)

Eukaryotes

- EUKARYOTES: nucleus, membrane bound organelles
- Distinguished by where they get their energy

Protista	Plantae	Fungi	Animalia
<ul style="list-style-type: none">• Unicellular or multicellular• Cells with nuclei and membrane-bound organelles• Some have cell walls• Some are autotrophs• Some are heterotrophs	<ul style="list-style-type: none">• Multicellular and plants• Cells with nuclei and membrane-bound organelles• Cell walls made of cellulose• Autotrophs• Complex organ systems	<ul style="list-style-type: none">• Most are multicellular, thread-like hyphae• Cells with nuclei and membrane-bound organelles• Cell walls made of chitin• Heterotrophs -> by absorption	<ul style="list-style-type: none">• Multicellular• Cells with nuclei and membrane-bound organelles• No cell walls• Heterotrophs -> by ingestions• Complex organ systems

- Plants get energy from the sun
- Fungi absorb molecules from the environment
- Animals ingest other animals
- PROTISTA: unicellular/multicellular organisms that do not fit into other kingdoms

Prokaryotes

- PROKARYOTES: no nucleus, no membrane-bound organelles

Bacteria	Archaea
<ul style="list-style-type: none"> - Unicellular - Cells lack nuclei and membrane-bound organelles - Distinctive cell walls - Some are autotrophs - Some are heterotrophs 	<ul style="list-style-type: none"> - Unicellular - Cells lack nuclei and membrane-bound organelles - Distinctive cell walls - Some are autotrophs - Some are heterotrophs

- BACTERIA: bacterial cells do not contain nuclei and rarely harbour membrane-bound organelles
- ARCHAEA: proposed a separate kingdom in 1977, membranes composed of glycerol-ether lipids

Why are Classification Systems Important?

- Classification provides us with logical, universal names
- In different parts of the world, the SAME organism may have different common names of DIFFERENT organisms may have the same common name -> classification systems allow us to distinguish between organisms and reduce confusion sometimes caused by common names

What is Biodiversity?

- Biological diversity or the variety of life on earth
- Number, relative abundance and genetic diversity of organisms on earth
- Components:
 - Genetic diversity (e.g heterozygosity, number of alleles)
 - Species diversity
 - Community diversity

Types of Community Diversity

- ALPHA DIVERSITY: the number of species within a chosen area of community (LOCAL DIVERSITY)
- BETA DIVERSITY: the difference in species between areas or communities (SPECIES TURNOVER)
- GAMMA DIVERSITY: the diversity of a landscape or all areas combined (REGIONAL DIVERSITY)

Measuring Biodiversity

<p>Inverse Simpson's Index</p> $D = 1 / \sum p_i^2$ <p>Emphasises common species</p>	<p>Shannon-Weiner index</p> $H' = - \sum [p_i \ln(p_i)]$ <p>Emphasises rare species</p>
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- 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 = the 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

Problems with using Species Diversity in Conversation

- NZ: has 3 species of mammals prior to the arrival of humans (bats), as it is an isolated country
- Humans introduced many mammals to NZ (32)
- Overall, mammal diversity has INCREASED due to introductions
- But many unique species were lost
- ENDEMIC: those species found exclusively in an ecosystem

Centres of Biodiversity

- Biodiversity is not evenly distributed on the planet
- Conservation International has identified 25 BIODIVERSITY HOTSPOTS based on three criteria:
 - Number of species present
 - Number of those species found exclusively in an ecosystem (ENDEMISM)
 - Degree of threat they face

Lecture 3 – Darwinian Evolution

- Evolution is CURRENTLY OCCURRING and it is VERY WELL SUPPORTED, with multiple lines of evidence – it is probably one of the most supported theories in science
- Evolution is the glue that binds most other theories in science together – knowledge on evolution is needed to understand a number of other theories in science (e.g. inheritance)

Static World View

- A belief that the world hasn't changes very much throughout time
- It was only in the 1200s that certain individuals started to think about the world in a different light – bordering on natural selection/evolution
- In the west, people were starting to have to question their belief of a static world view – they were beginning to realise that these dinosaur fossils weren't just animals that are living in other parts of the world, that they were actually gone or extinct

Catastrophism

- Belief that the world is no completely static – every now and then there is a big CATASTROPHE that WIPES OUT all the animals in the area and then animals from other places have to come and recolonise that area
- However, this DOES NOT link to the theory of evolution as it does not include the change and introduction of new or different species or the extinction of species, just the belief that a certain species has been wipes from a certain area but might still be living somewhere else in the world

Uniformitarianism

- The idea that the world changes gradually over time
- Changes are constantly occurring but so slowly that we can't perceive it
- Close to what we believe today

Lamarckism

- Inheritance of acquired characteristics
- Traits acquired or lost during an organism's lifetime – either by use or disuse – are transmissible to offspring
- This idea is completely UNSUPPORTED by empirical evidence
- EXAMPLE: Lamarck's giraffe – original short necked ancestor keeps stretching its neck to reach leaves higher up on trees and continues to stretch and stretch until its neck becomes progressively longer

Charles Darwin

- Although Darwin was the first person to form the cohesive theory of evolution, he built is theory off the works and ideas of these people before him – he was not the first to think and question these ideas
- At the age of 22, he had the opportunity to voyage around the world on the Beagle
- His main job was to collect and send back specimens that he found