

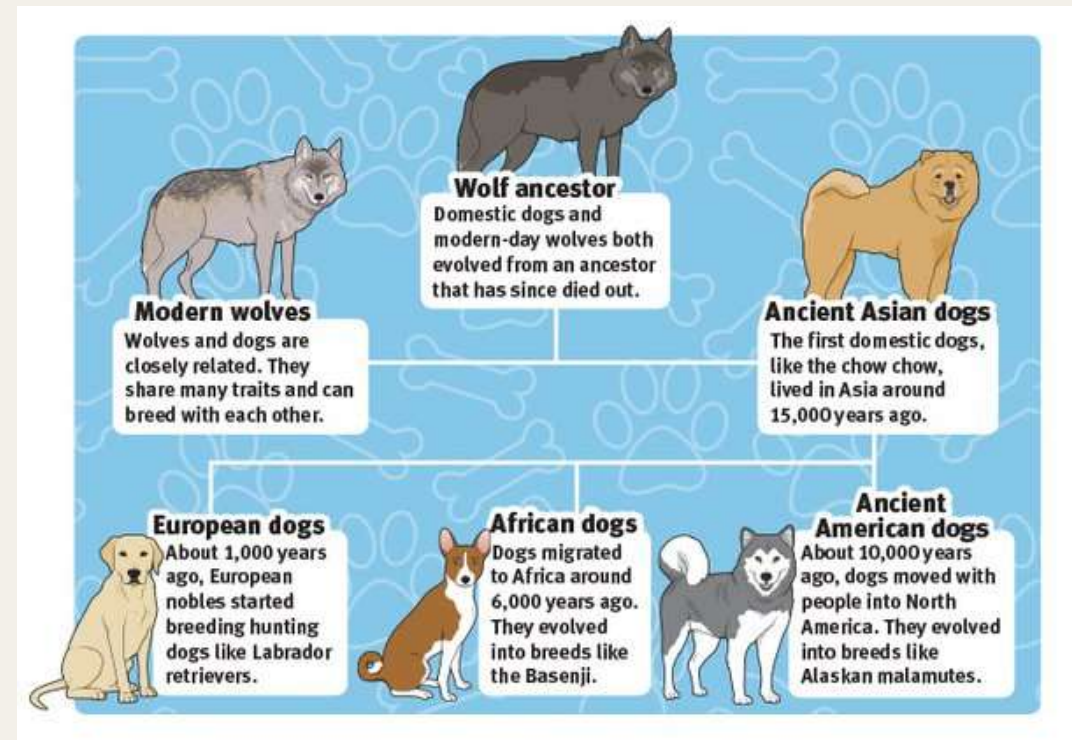
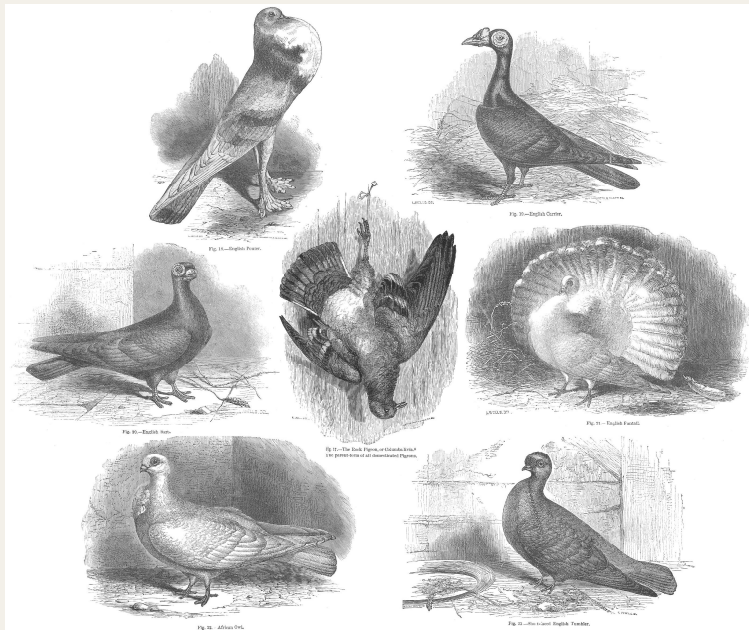


Zoogeography

Lesson 2

Artificial selection

- + Darwin's studies supported animal breeders in being able to modify the anatomical and behavioural characteristics of dogs and pigeons providing a neat parallel to what he believed had happened in nature over long periods of time.



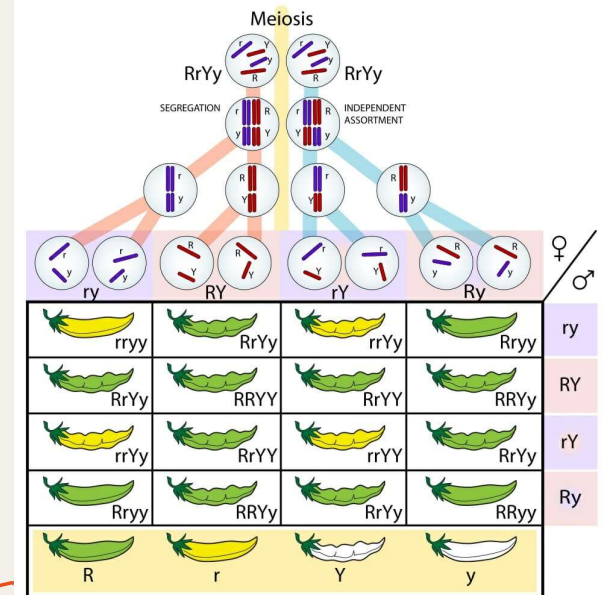
Main issues to Darwin's theory

- + all these different breeds of dog or pigeon were still able to breed with one another, which did not support Darwin's suggestion that this was the way in which new species could appear.
- + Nor could Darwin provide any explanation of precisely how the different characteristics were controlled and passed from generation to generation.
- + most people believed that the Earth was only a few thousand years old.

1866 Gregor Mendel

Genes come in pairs and are inherited as distinct units, one from each parent.

work remained unnoticed until the beginning of 1900

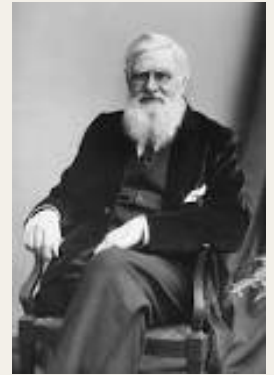




Evolution is driven by natural selection

- + **If the traits of organisms can be shaped through artificial selection, it's possible that a similar natural process could drive the selection of species diversity observed on Earth.**

Wallace the father of biogeography



He believed that plants and animals adapted and evolved in their environment

He hypothesised that **natural selection** contributes to reproductive isolation of *incipient species* by creating barriers and speciation.

Incipient species refers to a population that has been geographically isolated and has already adapted new traits to their new environment.

Wallace proposed the hypothesis that **natural selection could drive the reproductive isolation of two varieties by encouraging the development of barriers against hybridisation**. Thus it might contribute to the development of new species.

Darwinism: Darwin's Theory of Natural selection

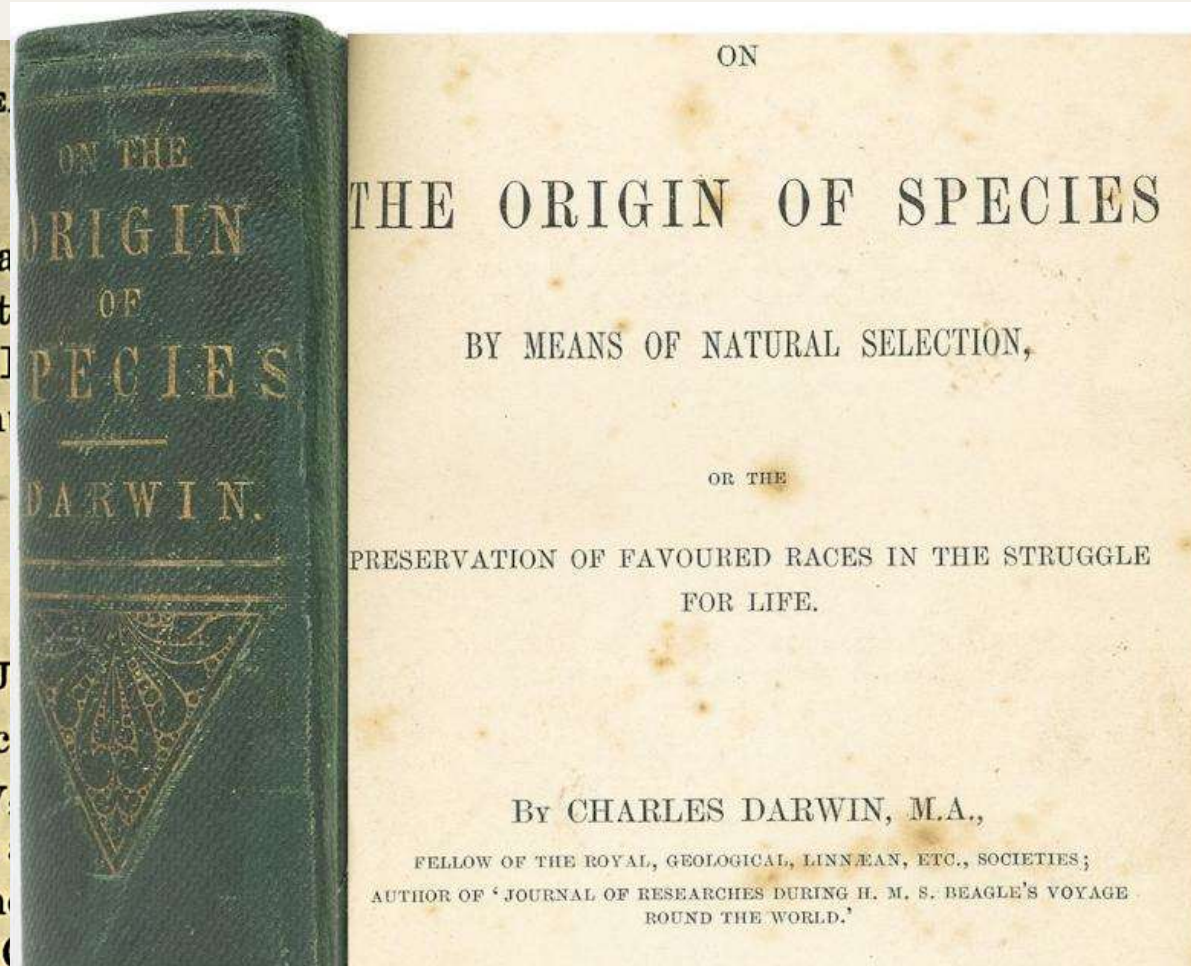
[From the JOURNAL of the PROCEEDINGS OF THE LINNEAN SOCIETY
August 1858.]

On the Tendency of Species to form Varieties; and on the
petuation of Varieties and Species by Natural
Selection. By CHARLES DARWIN, Esq., F.R.S., F.G.S., and ALFRED WALLACE, Esq. Commended by
CHARLES LYELL, F.R.S., F.L.S., and J. D. HENKEL, Esq.,
M.D., V.P.R.S., F.L.S., &c.

[Read July 1st, 1858.]

London, July 1st, 1858.

MY DEAR SIR,—The accompanying papers, which I have the
honour of communicating to the Linnean Society, relate to the same subject, viz. the Laws which govern the
production of Varieties, Races, and Species, contain the results of the
investigations of two indefatigable naturalists, Mr. Charles Darwin
and Mr. Alfred Wallace.



Driving mech. of evolution: Natural selection

Darwin's most famous and most important theory of evolution

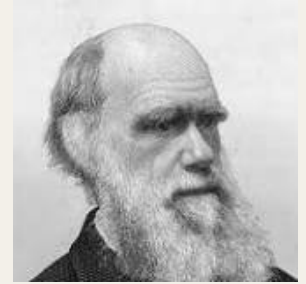
Only process that promote adaptation

The mechanisms for adaptation and evolution is called «**natural selection**»

«**Those organisms best adapted to their environment have a better chance of surviving and reproducing**»



Factor of Darwinism



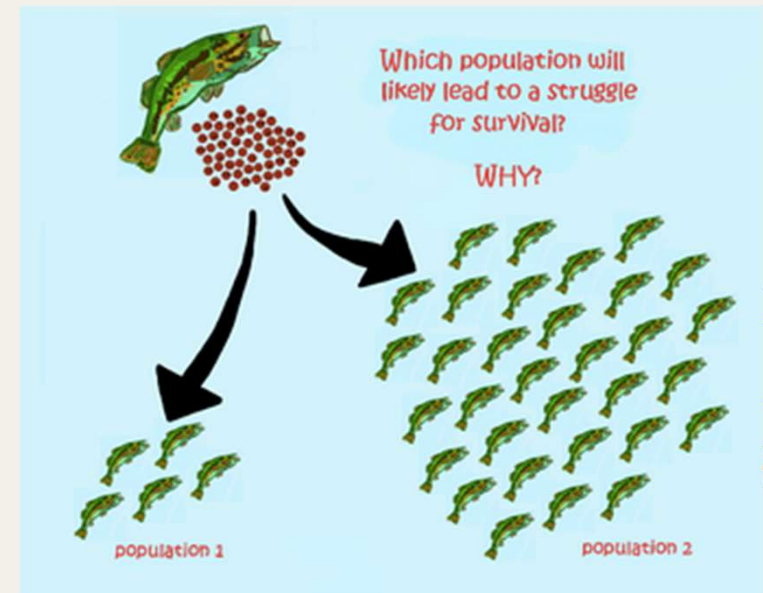
- + Rapid multiplication
- + Limited environmental resources
- + Struggle for existence
- + Variation
- + Survival of the fittest
- + Inheritance of the useful variation
- + Formation of the new specie

1. Rapid multiplication (over production)

+ Any pair of animals or plants produces far more offspring than would be needed simply to replace that pair

e.g. cod fish may produce over a million egg in a year, If all the eggs developed into fishes, the whole Atlantic Ocean will be full of cods in 5 years

- + There must be competition for survival among the offspring
- + Furthermore, these offspring are not identical to one another



2. Limited environmental resources (space and food)

- + Increase population in animal and plants requires more space and food but the universe remain constant.
- + Individuals compete for limited resources:
 - + Food,
 - + Water
 - + Spaces
 - + mates

3. Struggle for existence (competition)

+ Competition among members of a species for food, living space, and other necessities of life

+ Intraspecific struggle

- Within species

+ Interspecific struggle

- Different species

+ Environmental struggle

- Change in environmental factors (heat, cold, flood, etc)



Intraspecific Competition

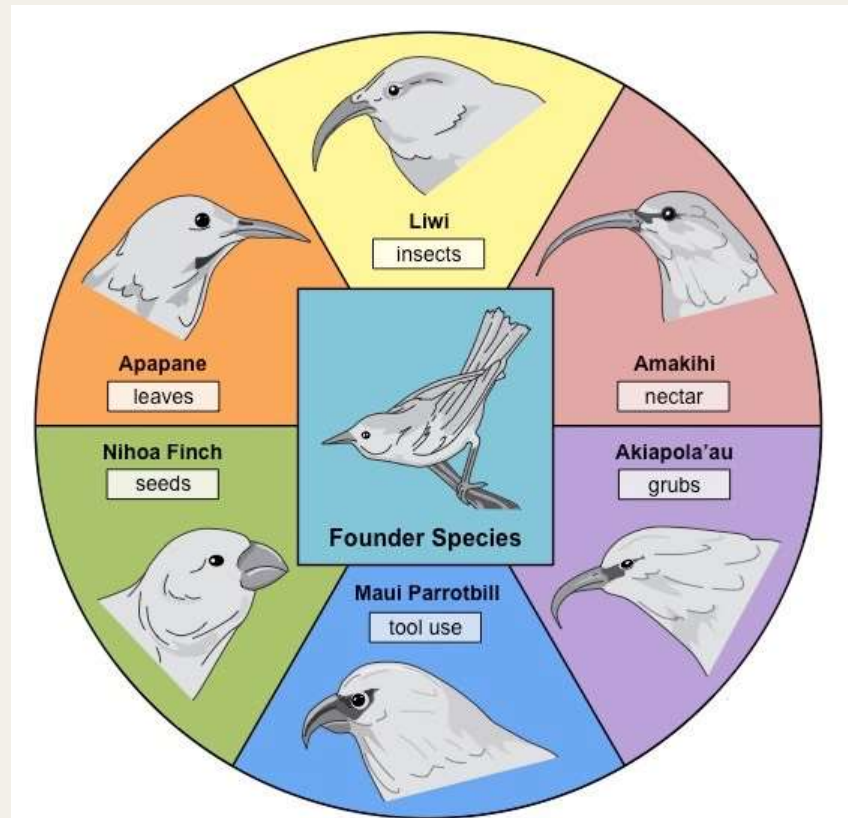


Interspecific Competition



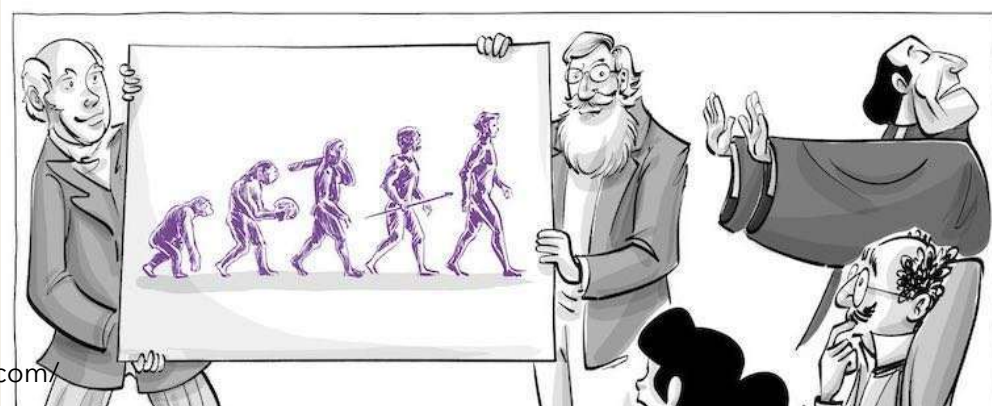
4. Variation and Adaptation

- + Understanding how individuals of the same species vary was key to Darwin developing his theory
- + Because the environment changes, the more **variation** within a species, the more likely it will survive.
- + Each individual has a unique combination of inherited traits.
- + An inherited trait that increases an organism's chance of survival is called «**Adaptation**».



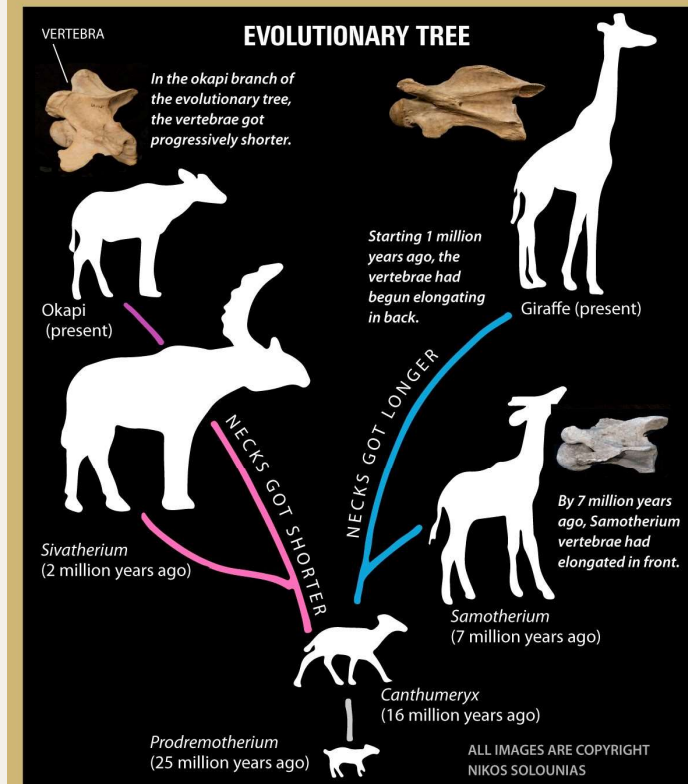
5. Survival of the fittest (natural selection)

- + The individuals with the best traits/adaptations will survive and have the opportunity to pass on its's traits to offspring
- + Natural selection acts on the **phenotype** (physical appereance), not the genotype (genetic makeup)



HOW THE GIRAFFE GOT ITS LONG NECK

By 16 million years ago, the neck of the common ancestor of the okapi and the giraffe had elongated compared with its predecessors. More recently, the evolutionary tree split into two branches. The branch that results in the okapi has animals with necks that get shorter, while the giraffe branch has animals with progressively longer necks. (PHOTO ABOVE: SHUTTERSTOCK)



SOURCES: NIKOS SOLOUNIAS, SHUTTERSTOCK

KARL TATE / © LiveScience.com



6. Inheritance of the useful variation

- + The individuals, selected by nature, pass on their useful variation to the next generation.
- + Thus, offspring of fit individual also be fit.



7. Formation of new species

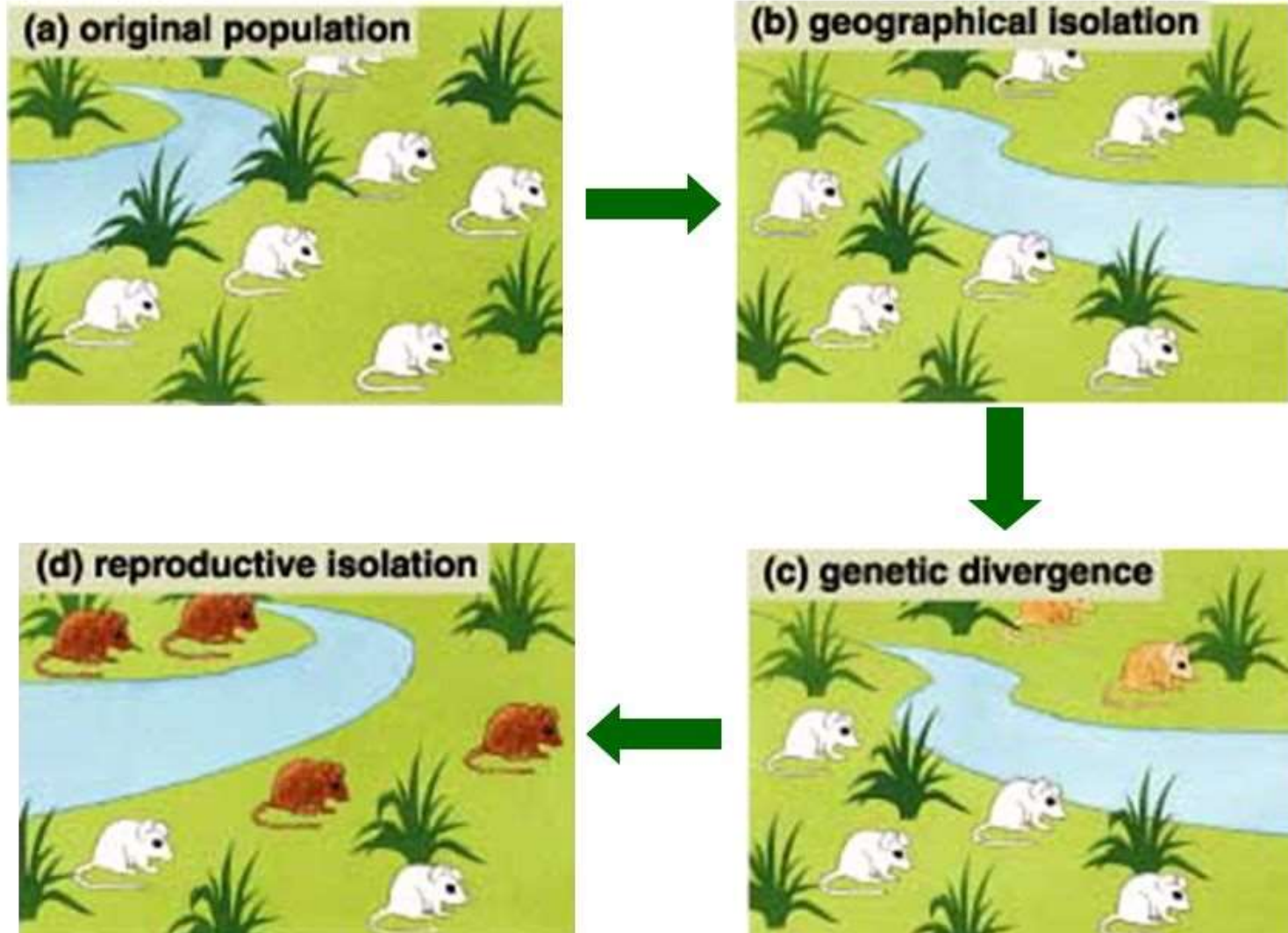
+ In each generation, new favorable variations appear and supplement the favorable.

+ After a number of generation the variations become so many which generate a new species



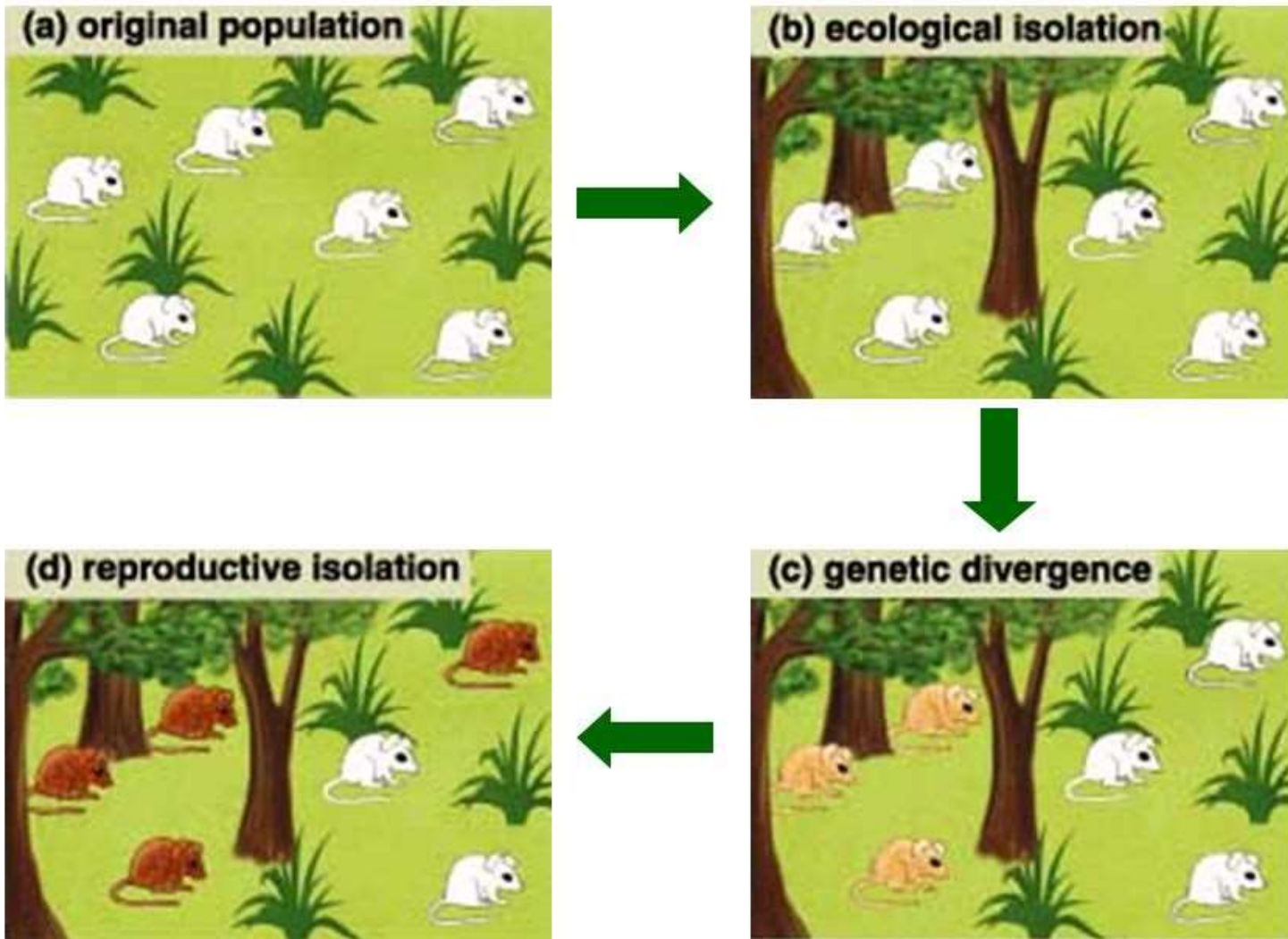
Allopatric speciation

Divergence occurs in geographic isolation



Sympatric speciation

Divergence occurs despite lack of geographic isolation



Early 19th century

- + Since dominant groups as mammals and birds (warm-blooded organisms) are largely insulated from the surrounding and are found in a great variety of environments

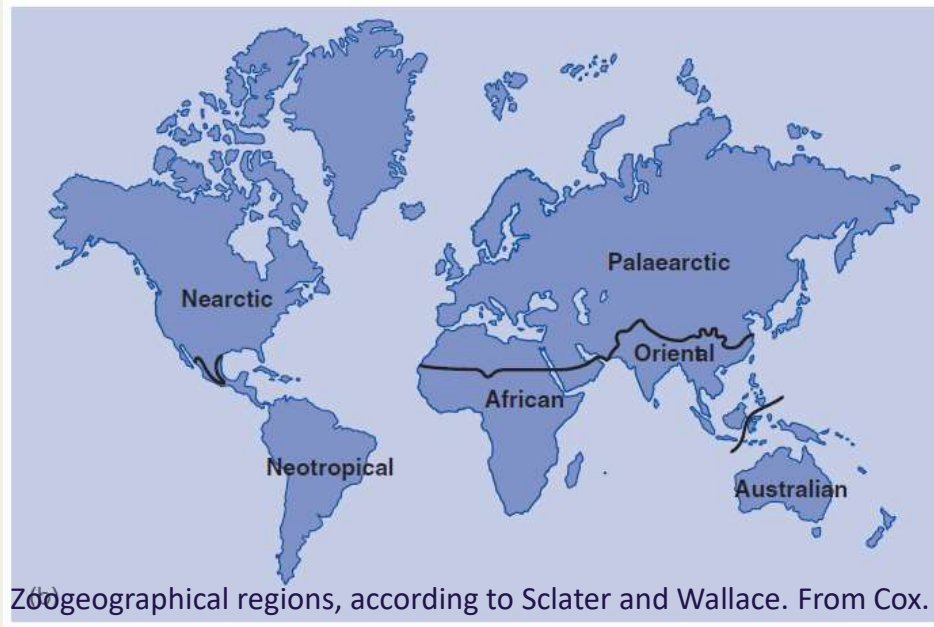


they do not show a close correlation to local ecology.

World Maps: Biogeographical Regions of Animals



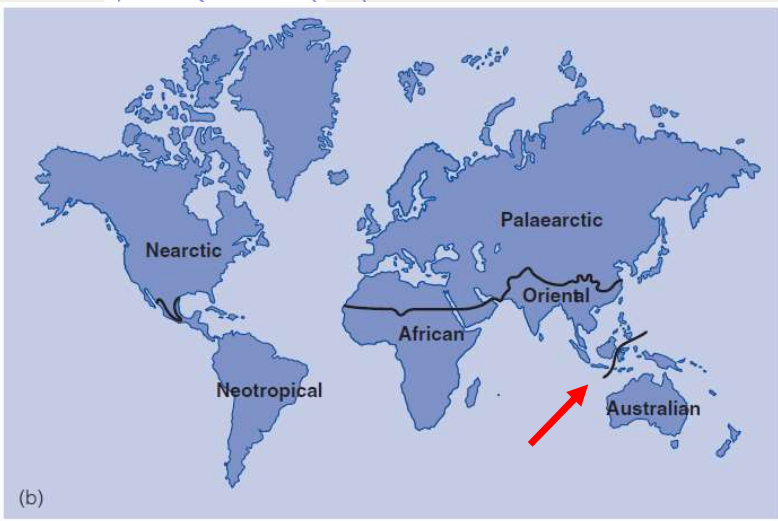
1858



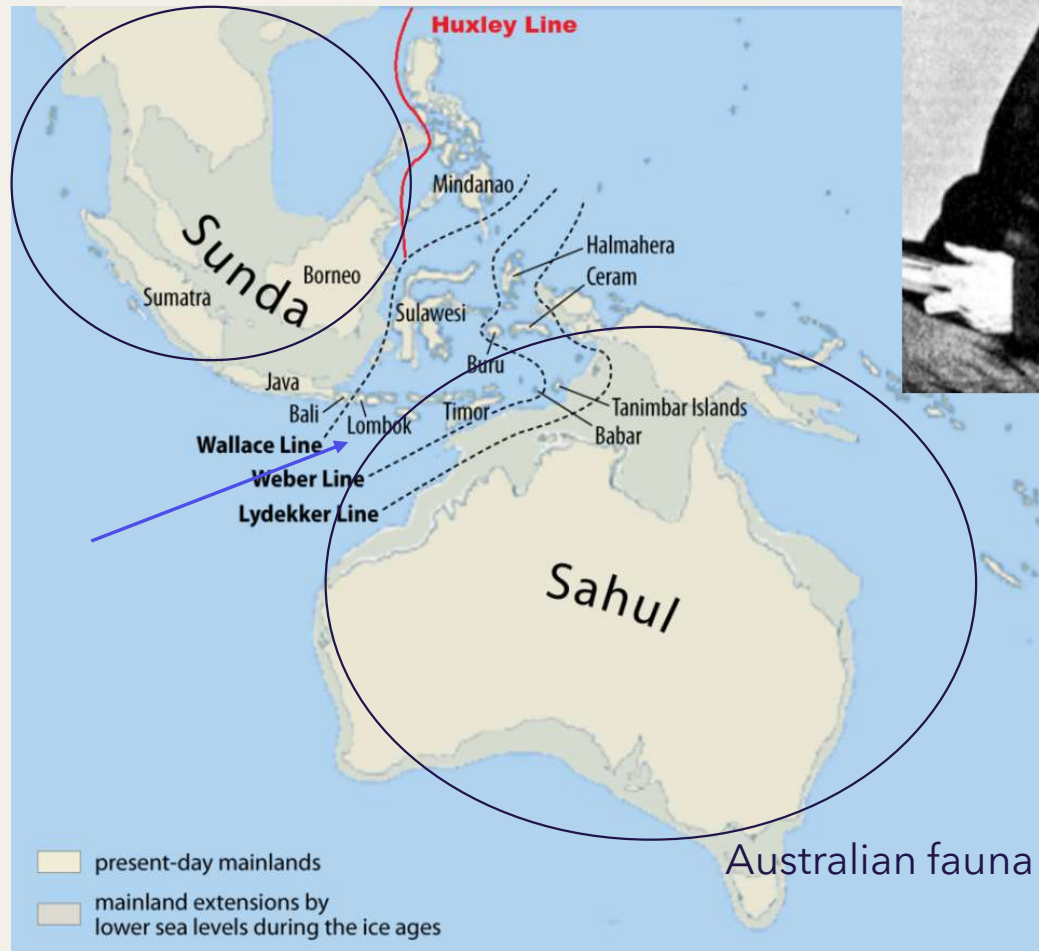
Zoogeographical regions, according to Sclater and Wallace. From Cox.



Because of the pattern of barriers of ocean, desert and mountain between the zoogeographical regions, the only area where there is a significant overlap between the faunas of adjacent regions is precisely where Wallace was working: in the East Indies chain of islands between Asia and Australia



Oriental fauna



The deep water of the **Lombok Strait** between Bali and Lombok formed a water barrier even when lower sea levels linked the now-separated islands and landmasses on either side.

Wallace identified or commented many aspects of biogeography that still occupy us today:

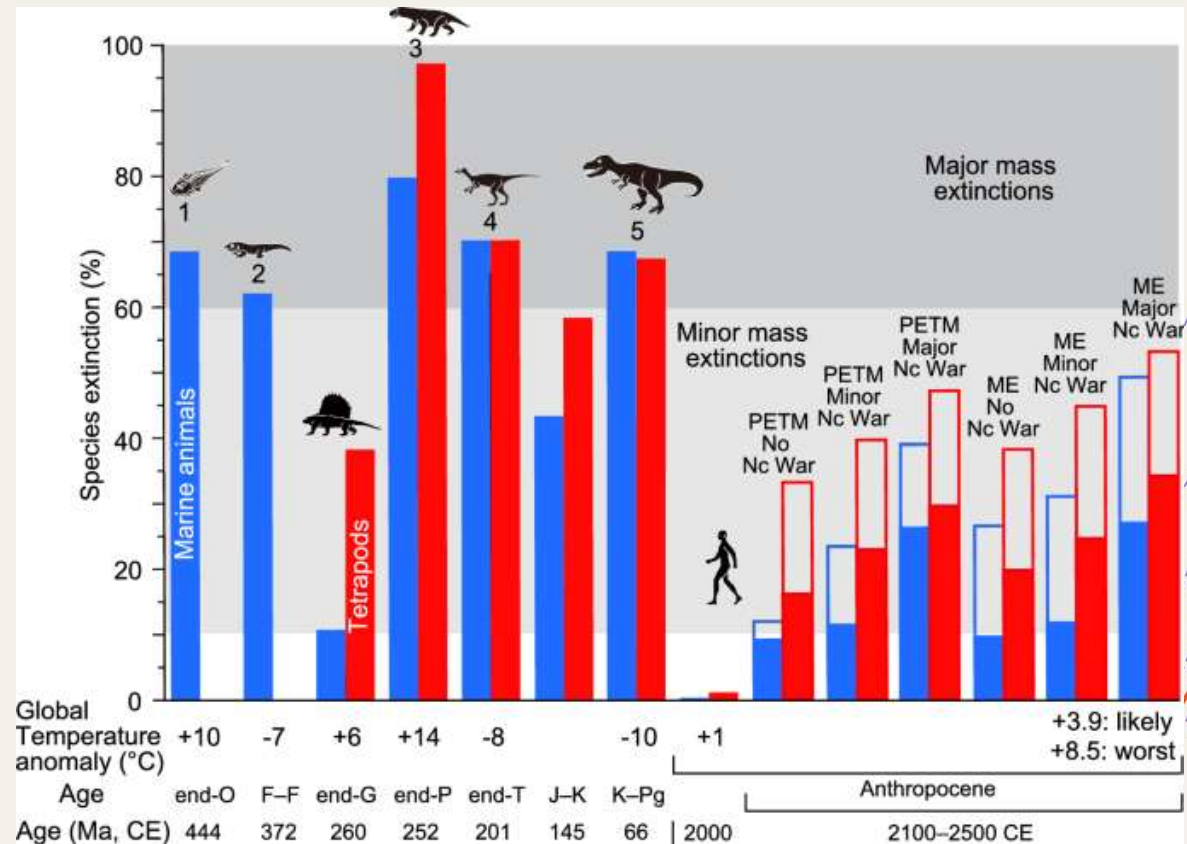


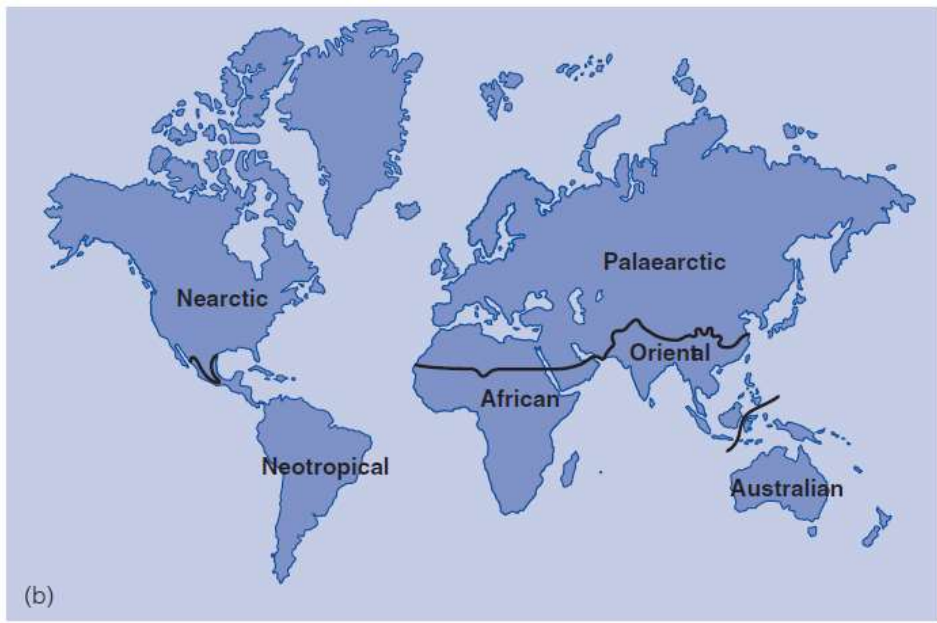
- + Extinctions
- + Dispersal
- + Competition
- + Predation
- + Adaptive radiation
- + Biogeography of islands
- + The possibility that the distributions of organisms might indicate past migrations over still-existing or even now-vanished land connections

What is species extinction?

+ **Extinctions** occur when the last individual of a species dies out.

+ **Functional Extinctions** occur when individuals remain but the odds of sustainable reproduction are low





Dispersalism: assumes that where a taxon or related taxa are found on either side of a barrier to their spread, this is because they had been able to cross that barrier after it formed.

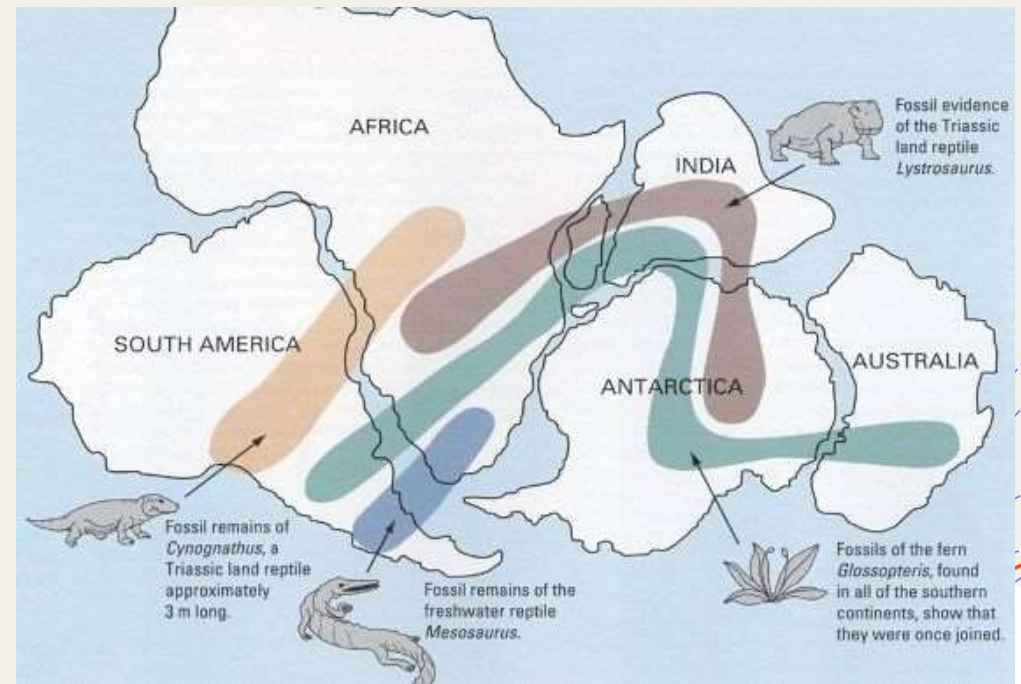


Figure 1.4 How today's landmasses were originally linked together to form a single supercontinent, Pangaea, according to Wegener. (Compare this with Figure 10.1 to see the modern, plate tectonic reconstruction of Pangaea.)

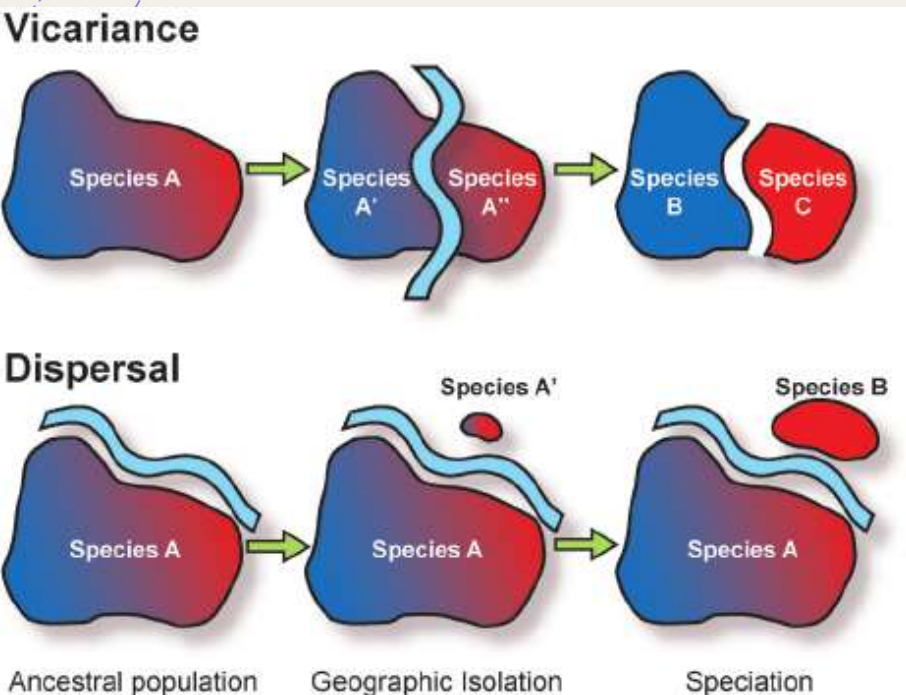


(b)

Vicariance: any barriers, such as mountains or oceans, that exist today within the pattern of distribution of the taxa had appeared after that pattern had come into existence, so that these taxa had never needed to cross them.

Dispersal vs Vicariance

Comparison Chart



Dispersal	Vicariance
Dispersal is the movement of a few members of a species from their birth or breeding site to a new geographical location.	Vicariance is the division of a population into distinct but related species due to the development of a geographical barrier.
Dispersal occurs on the onset of pre-existing geographical barriers.	Vicariance occurs in populations due to the development of new geographical barriers.
The geographic barrier is older than the geographic disjunction.	The geographic barrier cannot be older than the resulting speciation event.