

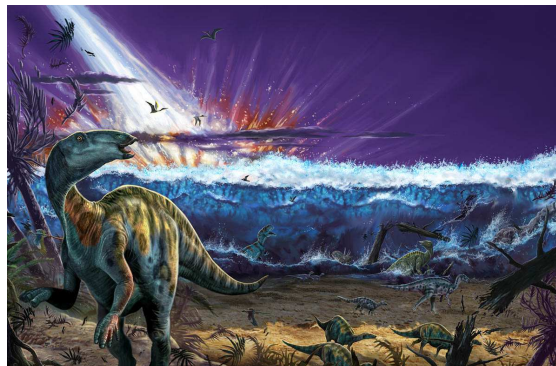
8.2: MACROEVOLUTION

- ☐ Evolution above the species level.
- ☐ Encompasses the grandest trends and transformations in evolution, such as the origin of mammals and the radiation of flowering plants.
- ☐ First figure out what evolutionary events have taken place, then try to figure out how they happened.
- ☐ The basic evolutionary mechanisms — mutation, migration, genetic drift, and natural selection — can produce major evolutionary change if given enough time.
- ☐ Evolution can be divided into two distinct hierarchical processes -- microevolution and macroevolution -- although the distinction between them is somewhat artificial.

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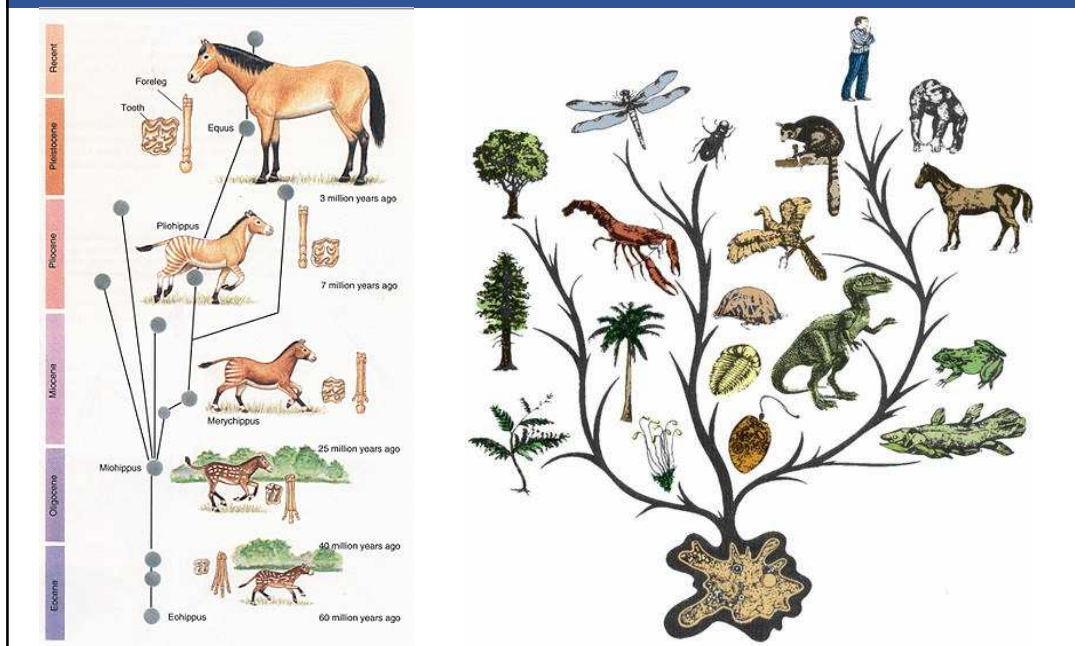
8.2: MACROEVOLUTION

- ☐ Understanding macroevolution is important because it explains both the diversity of life and the pace of evolutionary change.
- ☐ Large changes on the tree of life were preceded by events that were major, even cataclysmic, environmental changes that opened up new niches or caused extinctions.
 - Example: the meteor impact at the end of the Cretaceous that contributed to the extinction of the dinosaurs, and opened up new niches that resulted in the diversification of mammals.

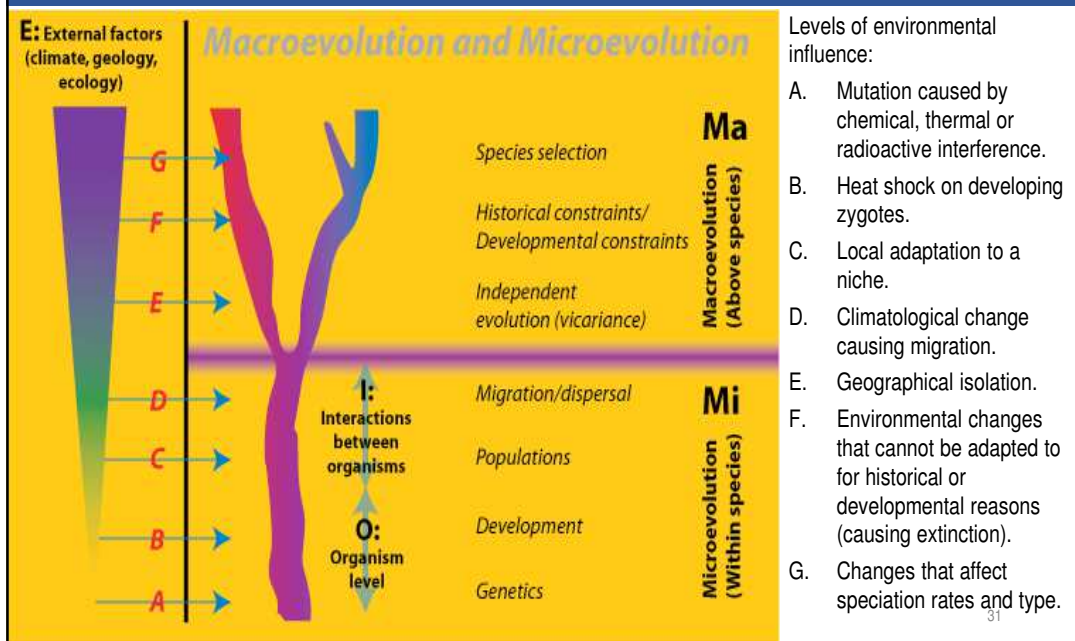


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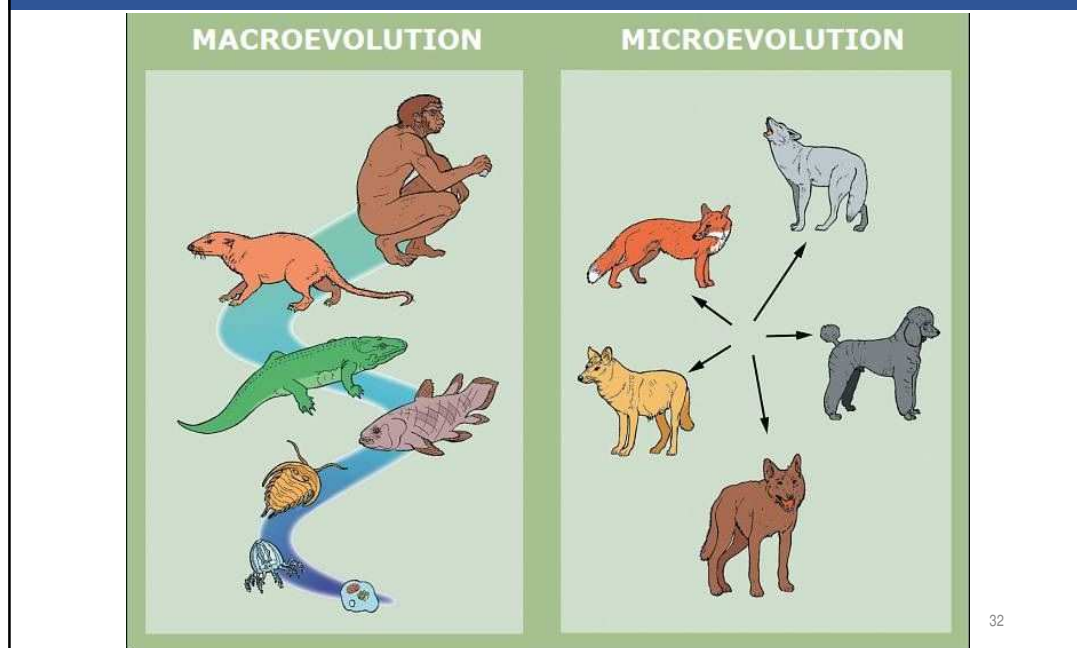
8.2: MACROEVOLUTION



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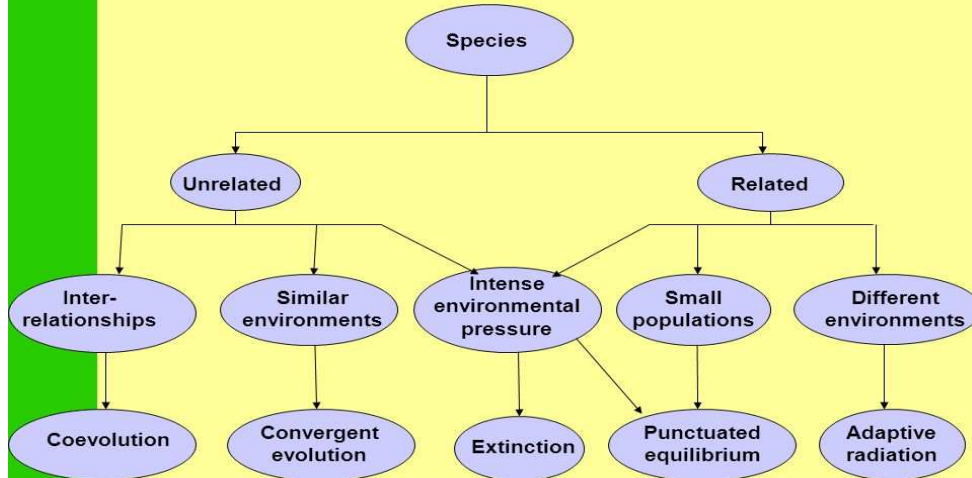
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8.2: MACROEVOLUTION

Microevolution	Macroevolution
1. Small-scale changes in gene frequencies	1. Large-scale changes in gene frequencies
2. Few generations	2. Longer time period
3. Within species/population	3. Above level of species
4. Small evolutionary changes	4. Extended microevolution
5. Observable	5. Not directly observed
6. Experimental evidence	6. Fossil evidence
7. Less controversial	7. More controversial
8. E.g. bacterial resistance to antibiotics	8. E.g. reptiles to birds

8.2: MACROEVOLUTION

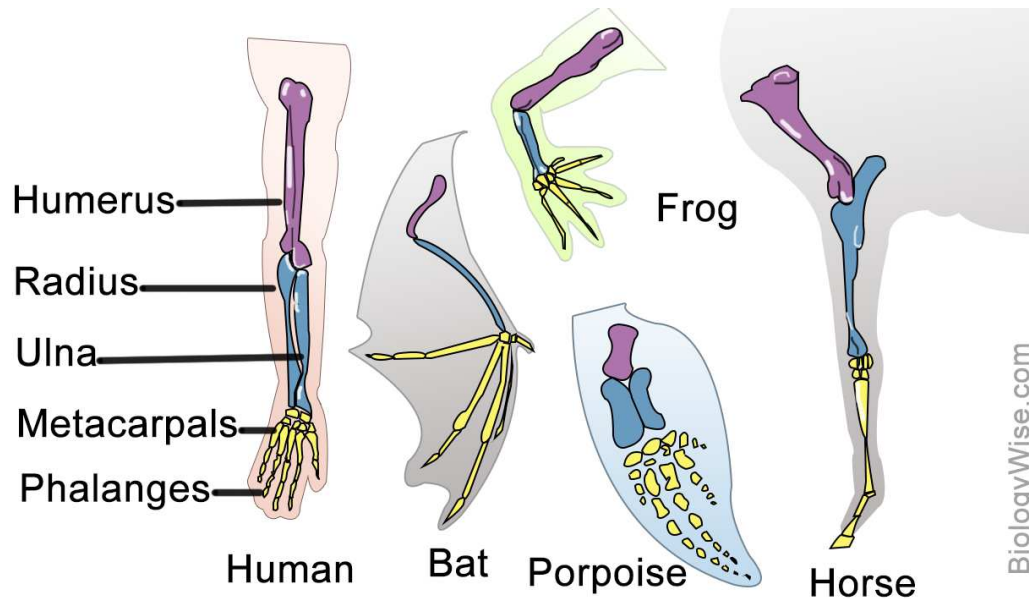
Patterns of Macroevolution



9.1: DIVERGENT EVOLUTION

- ☐ Process in which a trait held by a common ancestor evolves into different variations over time.
- ☐ Vertebrate limb:
 - Whale flippers, frog forelimbs, and your own arms most likely evolved from the front flippers of an ancient jawless fish.
 - Because they share a common evolutionary origin, these are examples of homologous structures.
- ☐ An important consequence of divergent evolution is speciation, the divergence of one species into two or more descendant species. [See topic 7.2]

9.1: DIVERGENT EVOLUTION



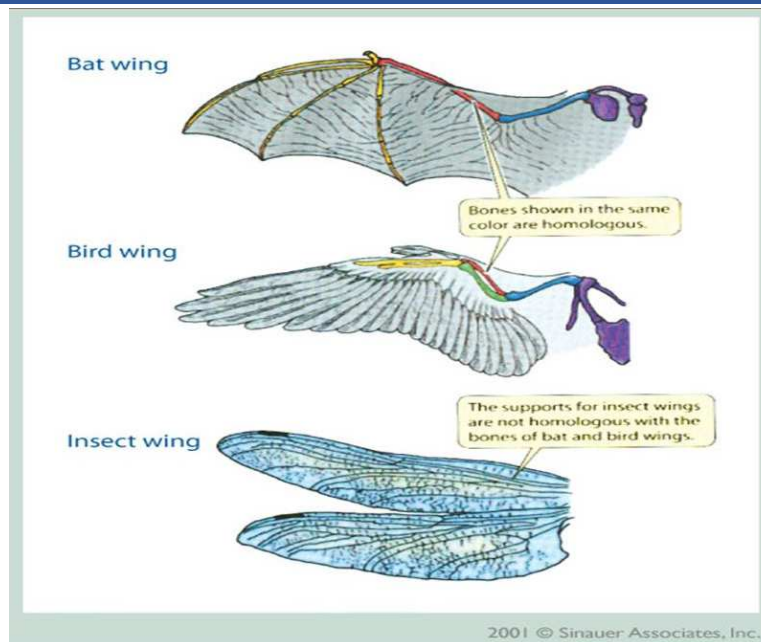
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9.1: CONVERGENT EVOLUTION

- ❑ Process in which species that are not closely related to each other independently evolve similar kinds of traits.
- ❑ Wings:
 - Dragonflies, hawks, and bats all have wings but none of these organisms owes its wings to genes inherited from any of the others.
 - Each kind of wing evolved independently, suggesting that the trait of flight is a useful one for the purpose of survival and reproduction.
 - These independently evolved wings are called analogous structures.

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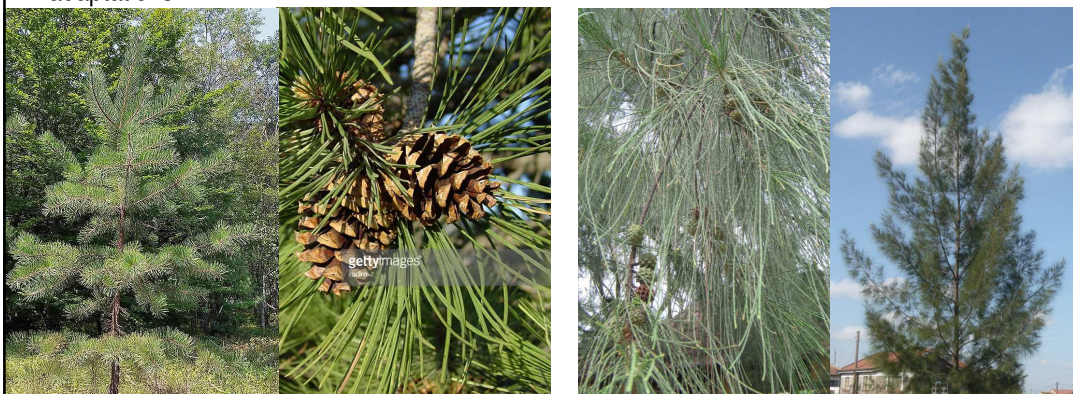
9.1: CONVERGENT EVOLUTION



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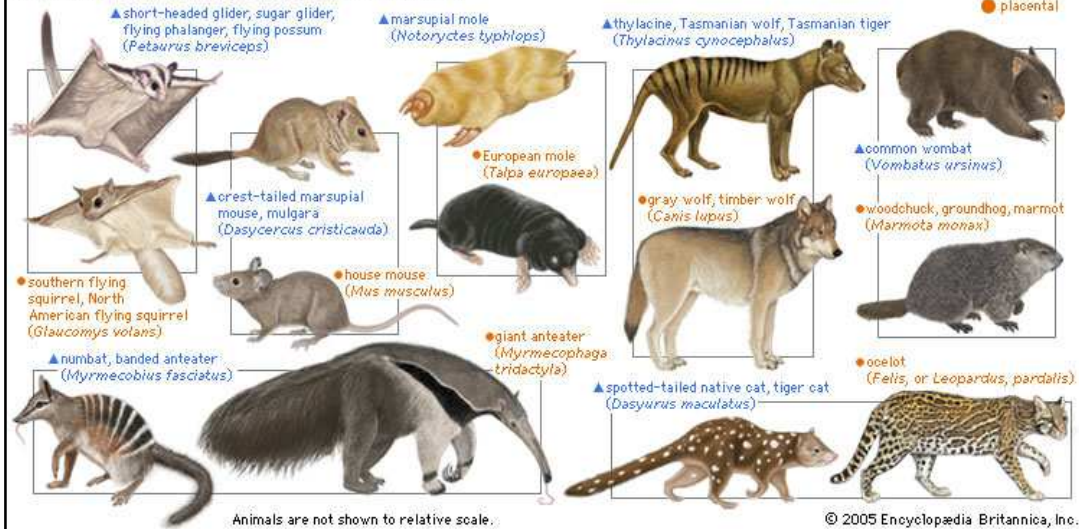
9.1: PARALLEL EVOLUTION

- ☐ Difficult to distinguish from convergent evolution.
- ☐ Occurs when different species start with similar ancestral origins, then evolve similar traits over time.
- ☐ It happens because the two different species (not necessarily share a common ancestor), experience similar kinds of environmental pressures and survive only by undergoing similar adaptations.



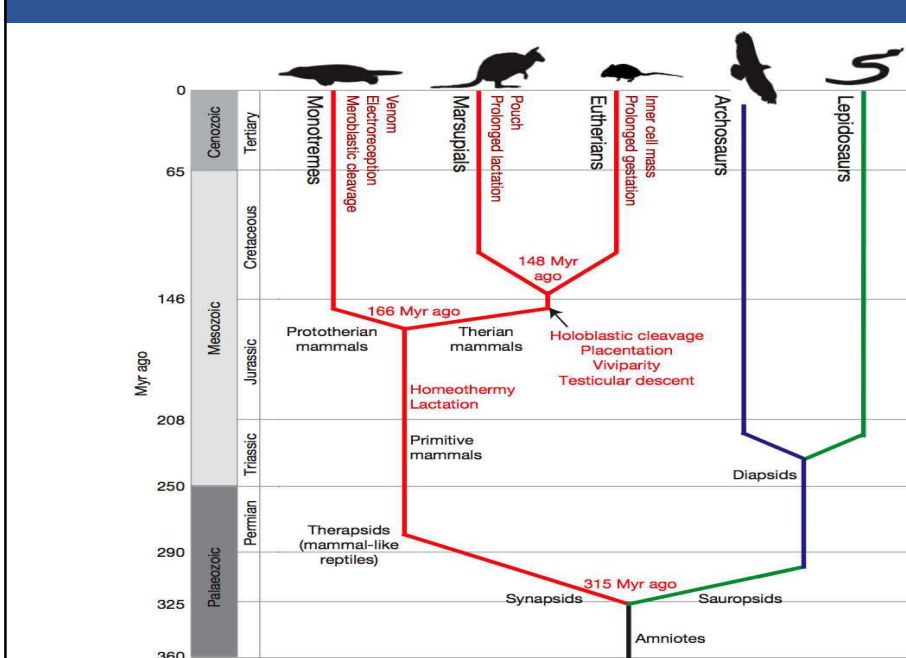
9.1: PARALLEL EVOLUTION

Parallel evolution of marsupial and placental mammals



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9.1: PARALLEL EVOLUTION



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9.2: COEVOLUTION

- ❑ Occurs when closely interacting species exert selective pressures on each other, so that they evolve together in a kind of conversation of adaptations:
 - Two species evolve in response to each other.
 - One species evolved when the other species in association with it evolves (to other stimuli)
- ❑ Coevolution are common among predator-prey and host-parasite pairs (see topic 10.2):
 - Hummingbirds and the flowers from which they seek nectar and unwittingly pollinate
 - Monarch butterfly and butterfly milkweed – toxin developed by milkweed to deter predators makes monarch butterfly toxic similarly toxic to its predators
 - American cheetah and the Pronghorn – these animals can reach such high speeds in response to one another.

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9.2: COEVOLUTION



9.2: COEVOLUTION

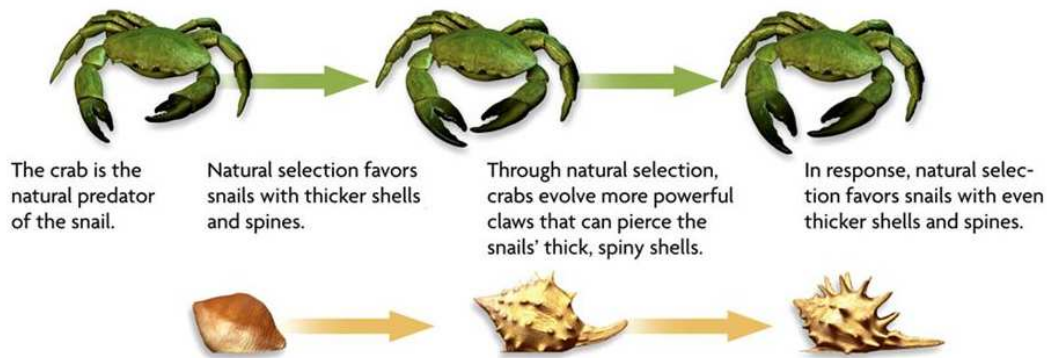


9.2: COEVOLUTION



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9.2: COEVOLUTION



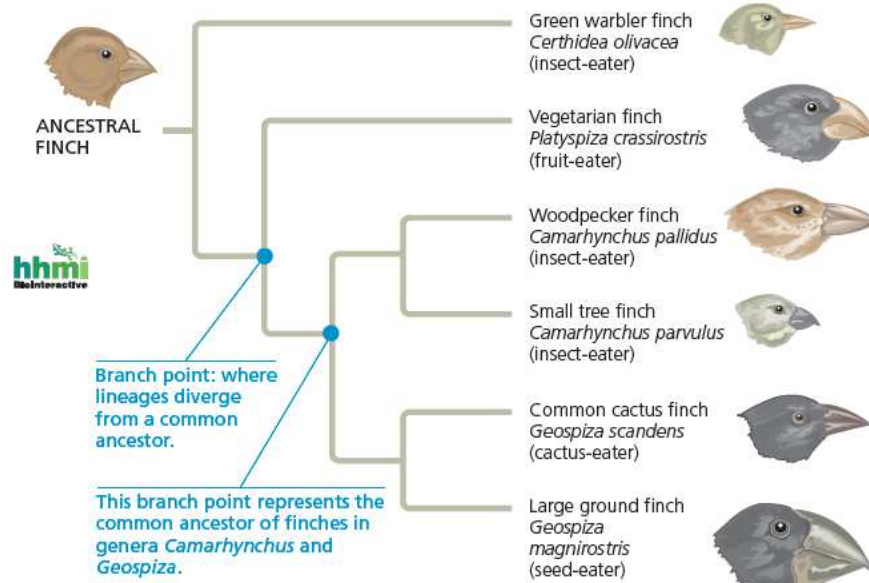
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9.2: ADAPTIVE RADIATION

- ☐ Occurs when a single or small group of ancestral species rapidly diversifies into a large number of descendant species.
- ☐ A rapid increase in the number of species with a common ancestor, characterized by great ecological and morphological diversity.
- ☐ Ecological opportunity is probably foremost among factors that can trigger an adaptive radiation.
- ☐ An ecological opportunity occurs when a small number of individuals of a species are suddenly presented with an abundance of exploitable resources.:
 - Galapagos finches
 - Marsupials

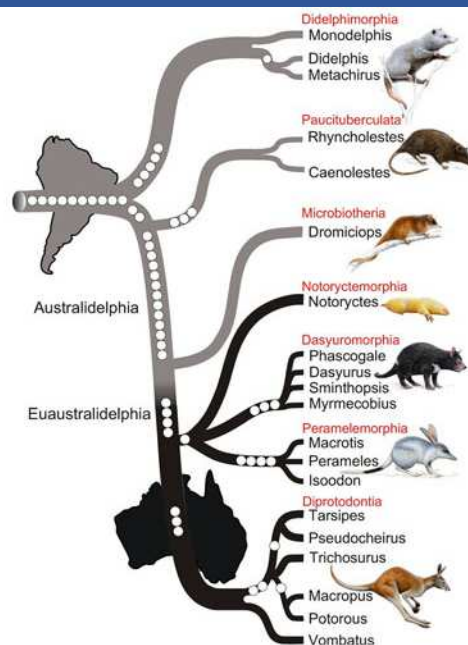
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9.2: ADAPTIVE RADIATION



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9.2: ADAPTIVE RADIATION



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