

Microevolution and Macroevolution

Microevolution:

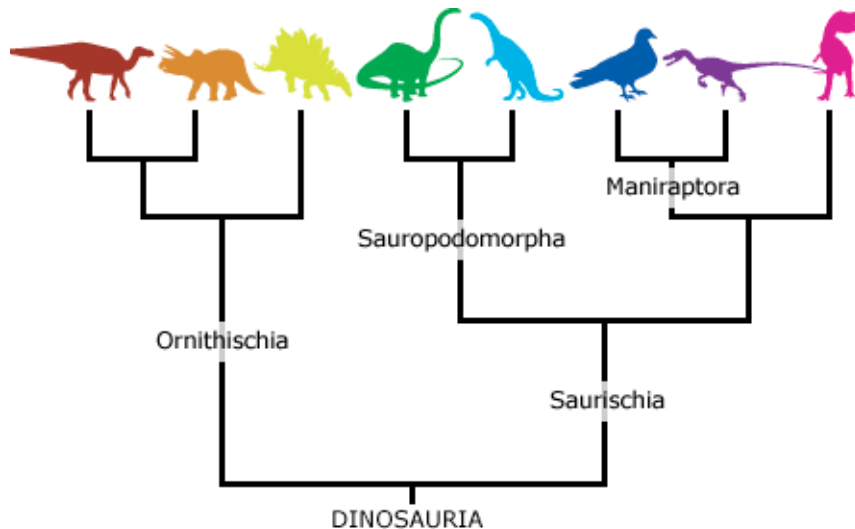
A change in a population's gene pool over time.



Macroevolution:

Evolutionary changes above the species level.

e.g. the adaptive radiation of land plants



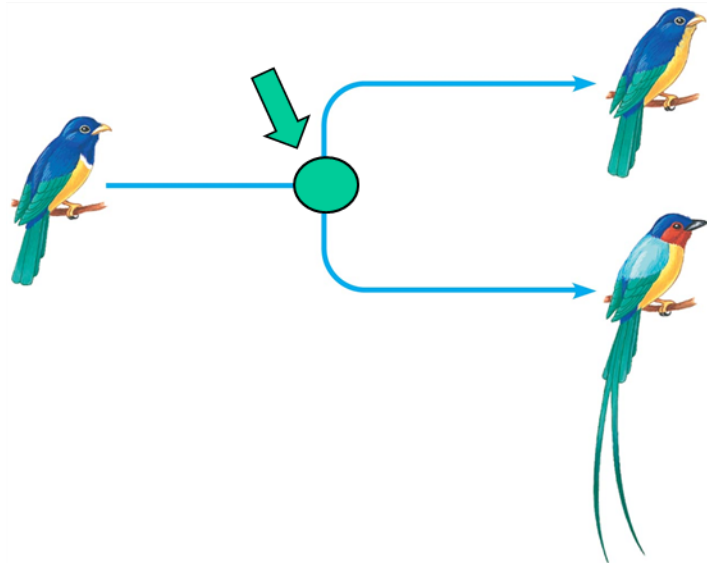
What is a species?

How would you define a species?

Speciation

Formation of new species from existing ones

What is a species?
How does speciation occur?



These two species *look alike* but they
don't interbreed in nature



Eastern meadowlark
(*Sturnella magna*)



Western meadowlark
(*Sturnella neglecta*)



What is a species?

Classical definition:

Biological species concept:

A Population or group of populations which can exchange genetic information & produce **fertile offspring**

This concept emphasizes **reproductive isolation**.

What are some limitations of the Biological Species Concept?

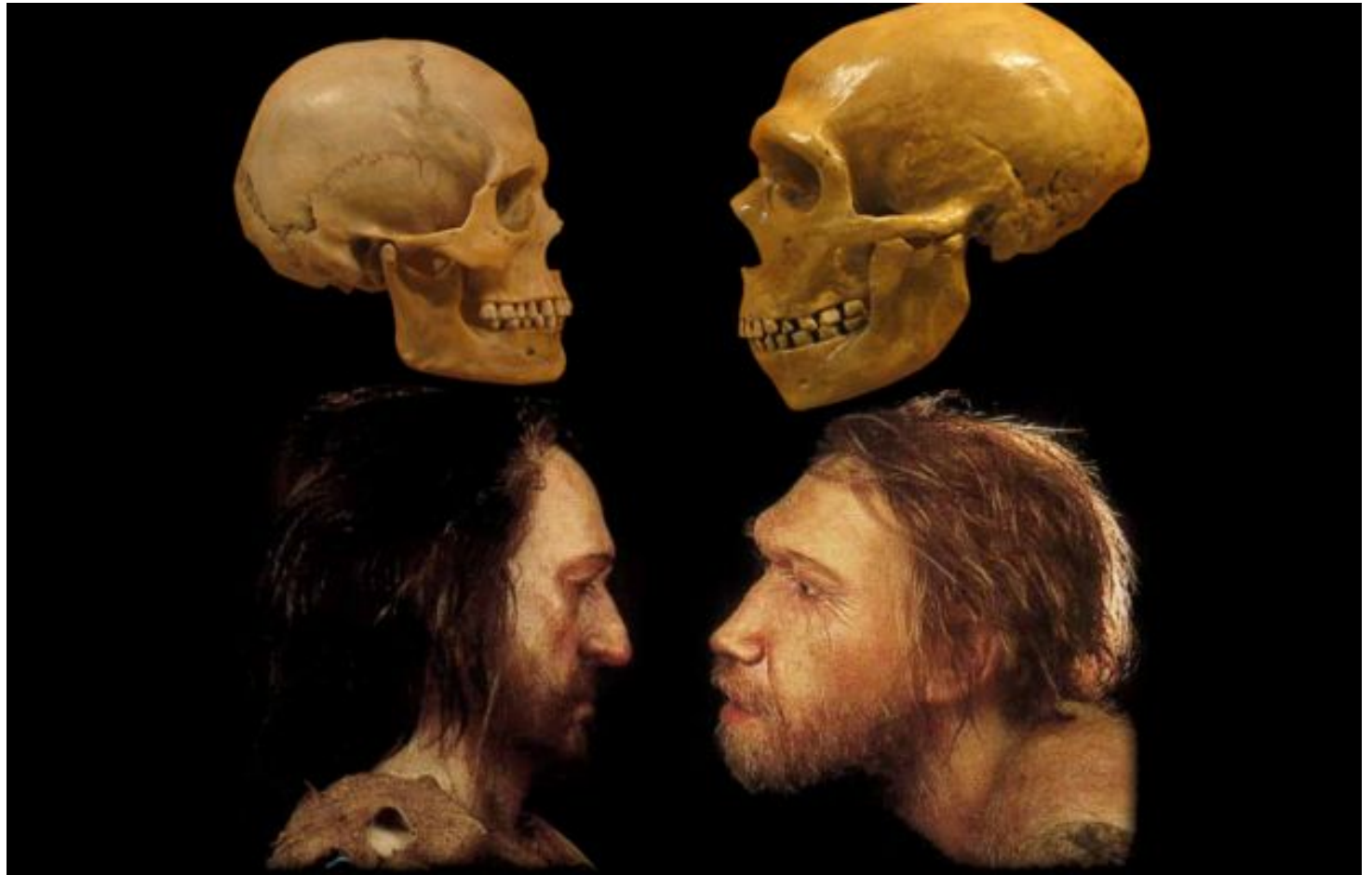
The biological species concept can be applied to both sexually and Asexually reproducing species

True

False

H. sapiens

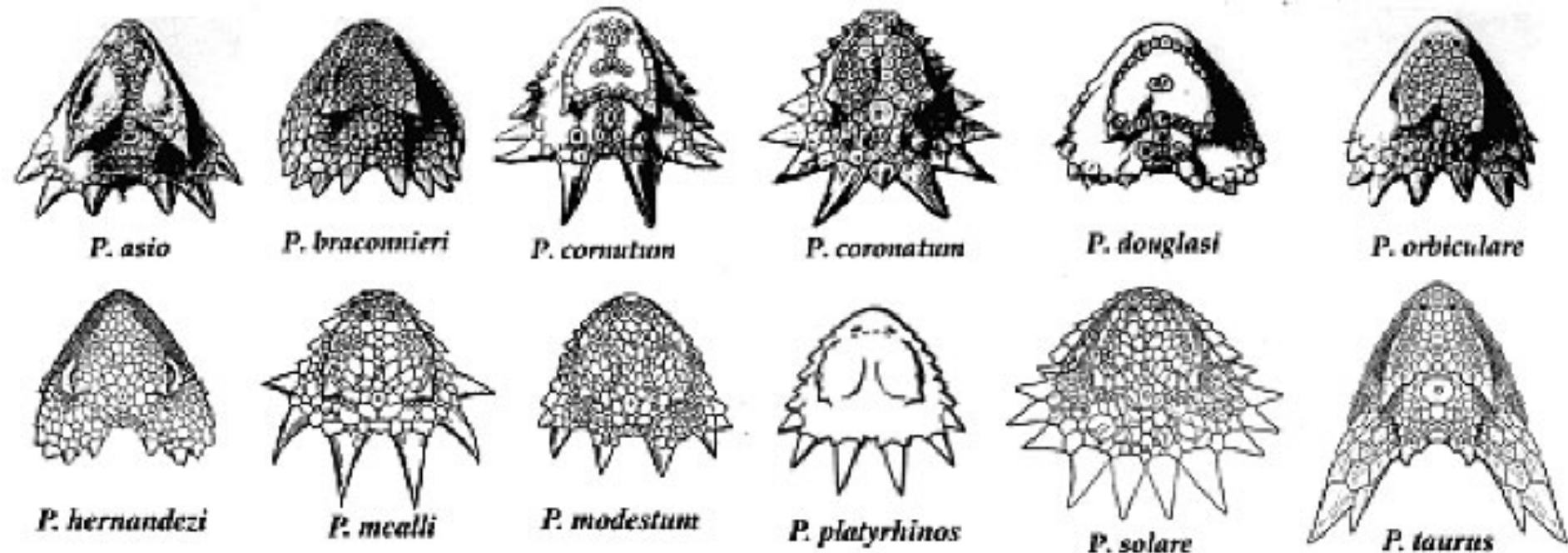
H. neanderthalensis



Alternative ways to define a species

Morphological species concept

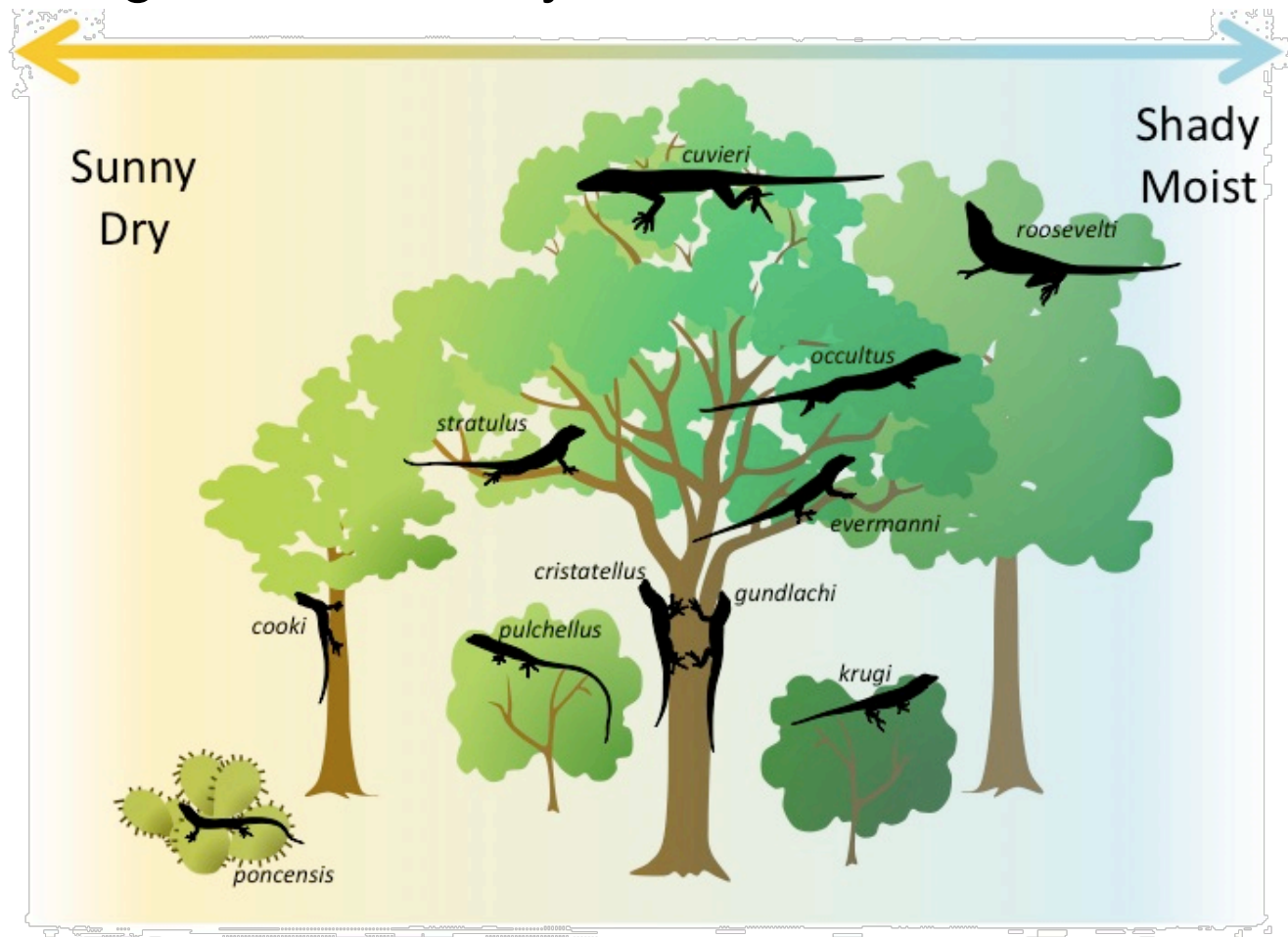
- classifies organisms based on observable physical traits
- can be applied to asexual organisms and fossils.



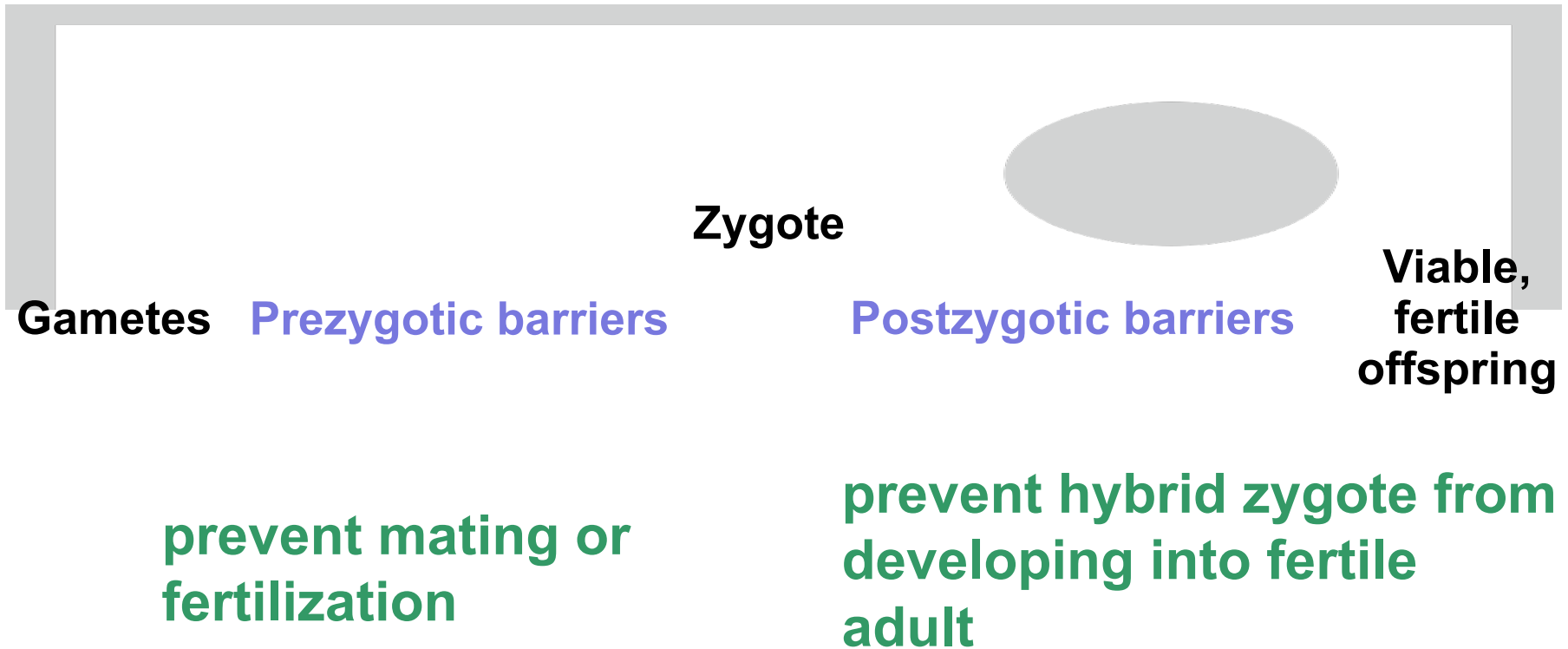
Alternative ways to define a species

Ecological species concept

- defines a species by its ecological niche
- focuses on unique adaptations to particular roles in a biological community.



Reproductive barriers keep species separate



PREZYGOTIC BARRIERS

Habitat isolation
(different habitats)

Temporal isolation
(breeding at different times)

Behavioral isolation
(different courtship rituals)

Mechanical isolation
(incompatible reproductive parts)

Gametic isolation
(incompatible gametes)

POSTZYGOTIC BARRIERS

Reduced hybrid vitality
(short-lived hybrids)

Reduced hybrid fertility
(sterile hybrids)

Hybrid breakdown
(fertile hybrids with
sterile offspring)

A group of related, but different, species often have unique courtship rituals that must be performed correctly for both partners to be willing to mate. Such a ritual constitutes a _____ reproductive barrier.

- A. mechanical; postzygotic
- B. behavioral; prezygotic
- C. temporal; prezygotic
- D. gametic; postzygotic

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Two species that occasionally mate and produce zygotes, but that have incompatible genes that prevent the resulting embryo from developing, are affected by

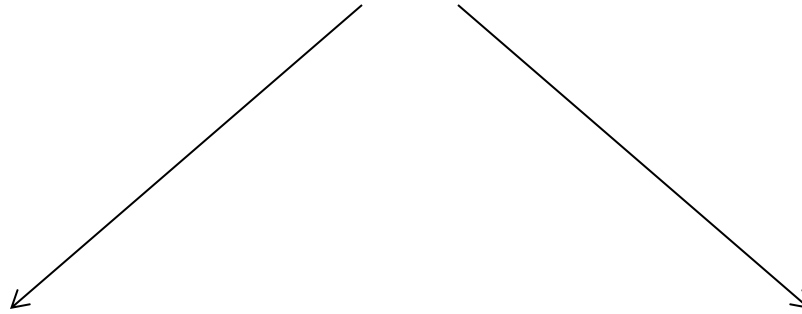
- a. reduced hybrid viability.
- b. behavioral isolation.
- c. gametic isolation.
- d. reduced hybrid fertility.

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Mechanisms of speciation

Two different modes distinguished by how the genetic exchange is *initially* interrupted



Allopatric speciation

- geographical barrier
- physical separation

Sympatric speciation

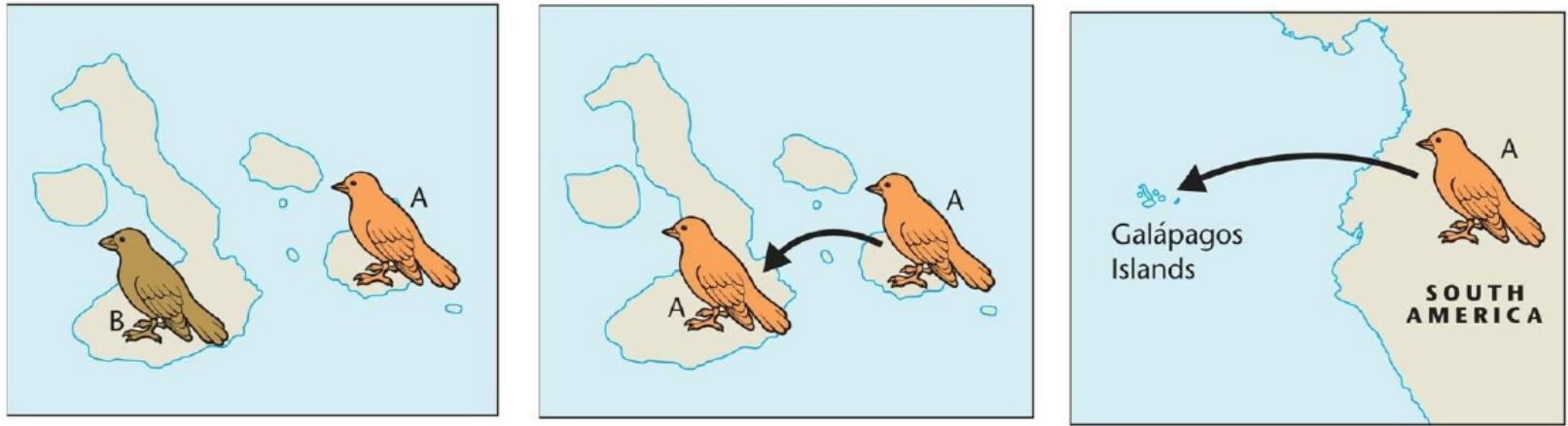
- Non geographical barriers
- The species exist in the same area

Allopatric speciation: geographical barrier



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Allopatric speciation: physical separation



**groups leave parent populations to
colonize new environments.**

Before speciation occurred,
what mechanism(s) of
microevolution was
population A affected by?



Seed-eater
(medium ground finch)

Tool-using insect-eater
(woodpecker finch)

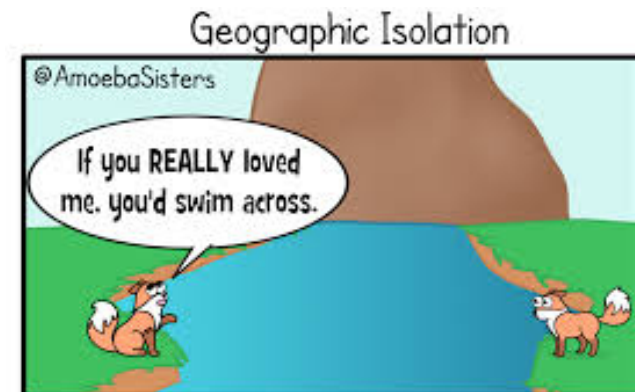
Insect-eater
(warbler finch)

How can new species arise from isolated populations over many generations? Use your previous knowledge about microevolution and allopatric speciation.

In allopatric speciation, physical isolation leads to speciation

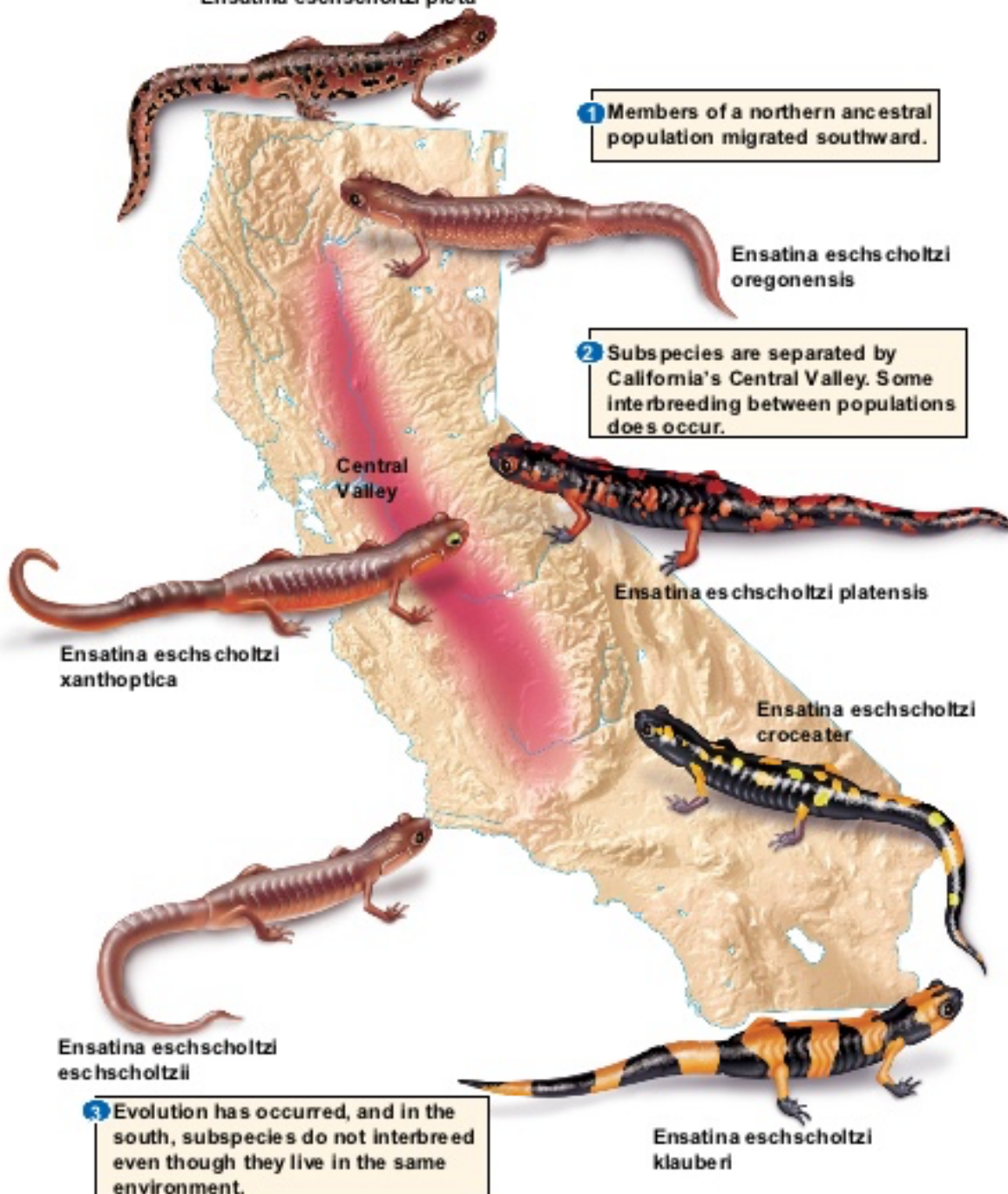
- An isolated population may be exposed to different environments
 - different food sources
 - different types of pollinators
 - different predators
- What mechanism of microevolution would drive changes in a population based on these different environments?

Changes in a population's traits may eventually lead to reproductive barriers, leading to speciation.



Ensatina eschscholtzi picta

Figure 14.3A Allopatric speciation among *Ensatina* salamanders



A population of flies is blown from the California coast to an island and have no contact with the mainland flies for 10,000 years. Then an earthquake results in the island being rejoined to the mainland and the two populations are now able to interact. If mating between flies from the two groups are successful and result in healthy offspring that can reproduce, you could conclude that ____.

- A. No speciation occurred in these flies
- B. A single species had split into two species
- C. Effective isolating mechanisms had evolved
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Sympatric speciation

occurs when a new species arises within the same geographic area as its parent species

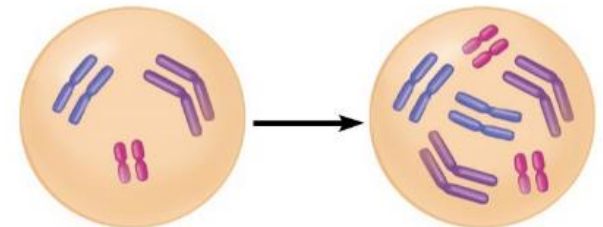
- Habitat differentiation and Sexual Selection
(More common in animals)
- duplication of the chromosome number due to errors in cell division=**Polyploidy**
(mainly in plants). Results in the incompatibility of gametes between different species.



Pundamilia nyererei



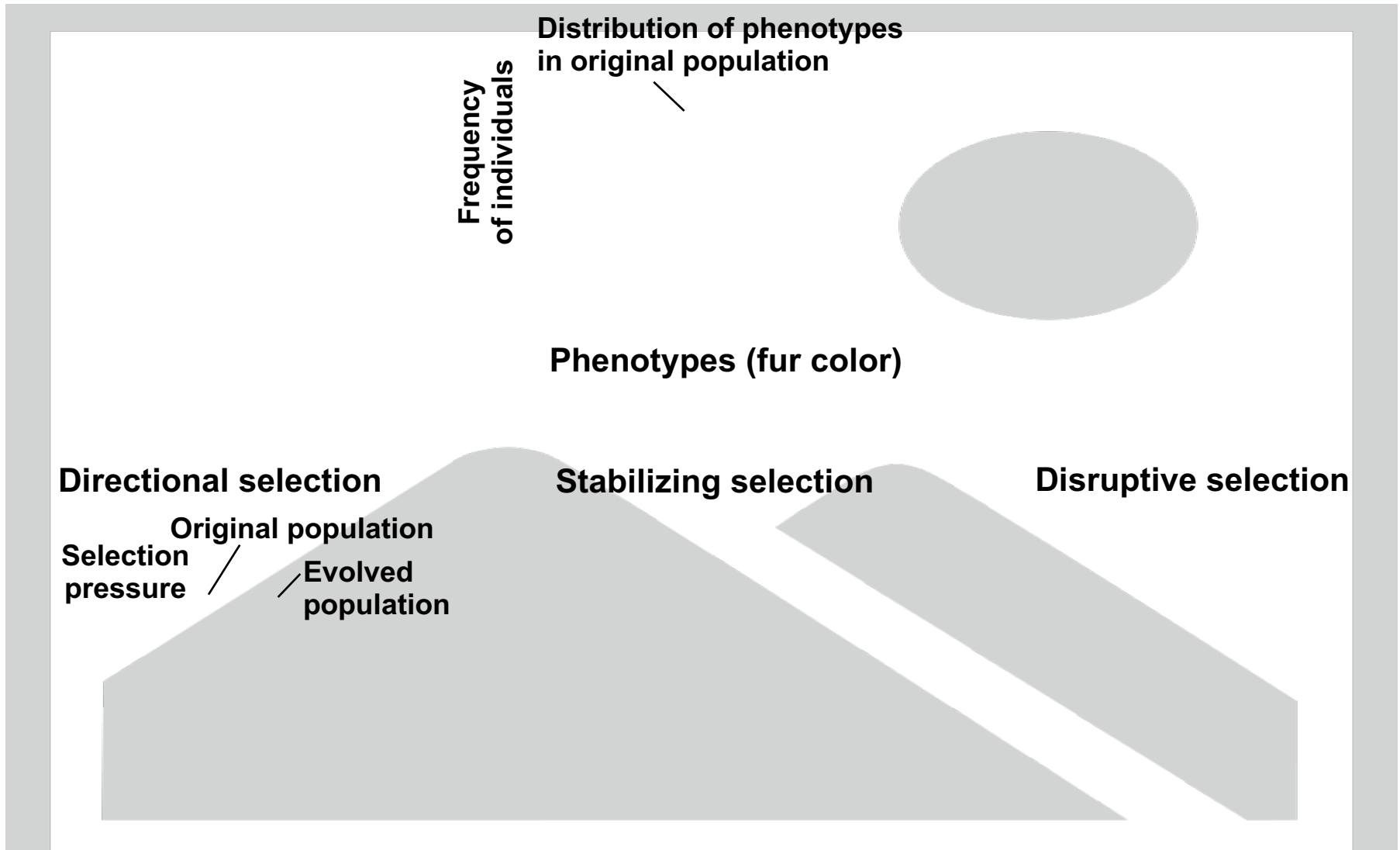
Pundamilia pundamilia



Parent species
 $2n = 6$

polyploid
cells
 $4n = 12$

What type of selection may lead to sympatric speciation?



Speciation, or the formation of new species, is

- a. a form of microevolution.
- b. responsible for the diversity of life.
- c. necessary for natural selection and adaptation.
- d. an event that has occurred only a few times in the history of the planet.

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