

13: Origin of Species

Key Biology Terms

Allopatric Speciation: A series of events initiated by geographic isolation occasionally leading to speciation.

Anagenesis: One pattern of evolution depicting evolutionary relationships and speciation events. Unbranching evolution → direct descendant.

Biological-species concept: Species are defined by their ability to interbreed with members of a specific population but not with other populations. The breeding attempt yields viable, fertile offspring

Cladogenesis: Another pattern of evolution depicting evolutionary relationships and speciation events. "Branching Evolution". Cladogenesis results in more diversity than anagenesis.

Gene Pool: The complete set of genes of all members of a population.
Genotype + Environment → Phenotype

Genotype: The genetic makeup of an organism, also known as genome.

Meiosis: "Reduction division". A process of distributing genetic material to gametes → half the genetic material as a typical body cell.

Morphological-species concept: A means of defining a species. Animals belonging to same species are similar in: form, shape, and appearance. It does not rely on the ability or inability to breed.

Morphology: The study of form or shape of an organism.

Natural Selection: The major mechanism of modification during evolution.

Paleobiology: The study of extinct life through the fossil record and other currently available means of scientific inquiry.

Phenotype: The visible or measurable manifestation of an organism's traits.

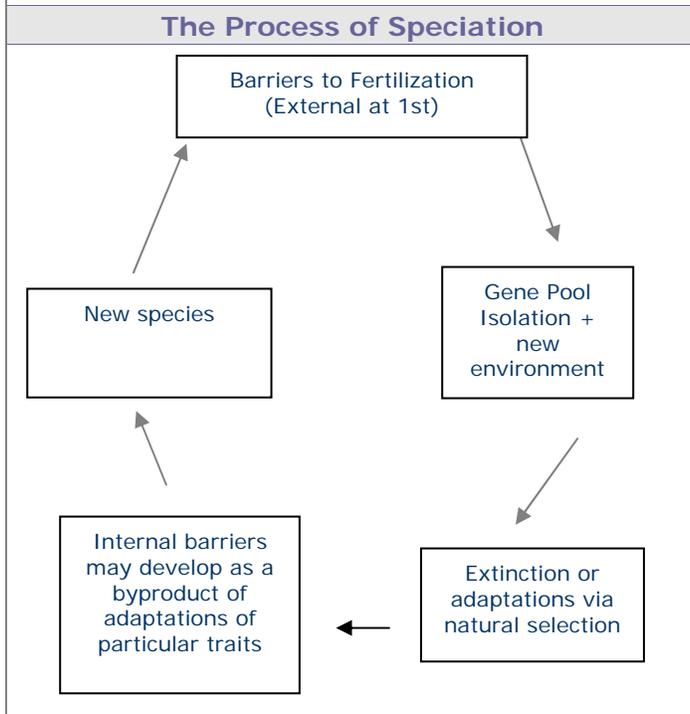
Phylogenetic tree: Depiction of the pattern of evolution or relationship between ancestor and descendant determined by number of shared characteristics in common. Each node = speciation event.

Speciation Event: Members of an established species through evolutionary process form new species.

Species Concepts

Two definitions of species:

- ① Morpho-species concept:
A means of defining a species. Animals belonging to same species are similar in: form, shape, and appearance. It does not rely on the ability or inability to breed.
-- Weaknesses of morpho-species concept:
---Judgement based on appearance which can → ambiguity.
- ① Biological-species concept:
Species are defined by their ability to interbreed with members of a specific population but not with other populations. The breeding attempt yields viable, fertile offspring
-- Weaknesses of Biological-species concept:
-- Ineffective for extinct organisms, because there is no way to determine if extinct organisms can mate
-- Ineffective for organisms that procreate asexually. If organisms are asexual then this criterion can not be used to determine speciation



Speciation Events

Key biological event in speciation / origin of species = isolation of gene pool

Ways to isolate a populations gene pool:

- ① External barriers:
-Meaning external to the organism, or not a part of the organism.
--Shifts in land masses → separation of population into two groups.
----One group being the parental group (usually the one with the greater number of members).
----The other group (usually the smaller group) exposed to a new environment, and hence ill-adapted for the current circumstances and given genotype. Neither group are able to exchange genetic information because neither has access to each others members. The gene pools are isolated secondary to the external barrier.
- ① Internal barriers:
--Meaning intrinsic to the organism, part of their genetic constitution.
--Barriers to reproduction are intrinsic to the organism, and hence → maintenance of gene pool isolation and ultimately speciation.
----In allopatric speciation, internal barriers form after development of external barriers. They form as a byproduct of other traits that are intended to better adapt organisms to their environment.
- ① Types of internal barriers:
--Niche barriers – organisms occupy different habitats and therefore do not meet.
--Timing barriers – Organisms have developed different mating seasons.

Sympatric Speciation

- ① Sympatric speciation = set of speciation events different from allopatric speciation in the following ways:
--Internal barriers develop first without initial external barriers.
---Internal barriers → instant reproductive isolation → gene pool isolation.
---The mechanism of reproductive isolation is usually related to meiotic nondisjunction → doubling of gametic chromosomes → polyploidy and hence inability to mate with usual diploid organisms.
---More important for plant speciation than animal.