



Speciation

EVO-3.D.1

Speciation may occur when two populations become reproductively isolated from each other.

EVO-3.D.2

The biological species concept provides a commonly used definition of species for sexually reproducing organisms. It states that species can be defined as a group capable of interbreeding and exchanging genetic information to produce viable, fertile offspring.



Speciation

EVO-3.E.1

Punctuated equilibrium is when evolution occurs rapidly after a long period of stasis. Gradualism is when evolution occurs slowly over hundreds of thousands or millions of years.

EVO-3.E.2

Divergent evolution occurs when adaptation to new habitats results in phenotypic diversification. Speciation rates can be especially rapid during times of adaptive radiation as new habitats become available.



Speciation

EVO-3.F.1

Speciation results in diversity of life forms.

EVO-3.F.2

Speciation may be sympatric or allopatric.

EVO-3.F.3

Various prezygotic and postzygotic mechanisms can maintain reproductive isolation and prevent gene flow between populations.

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What is the biological species concept?

What is the biological species concept?



Two organisms are from the same species if

they can interbreed AND produce fertile, viable offspring

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**Speciation occurs due to an
absence of gene flow**

- A. True**
- B. False**

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Speciation occurs due to an absence of gene flow

A. True



Due to the absence of gene flow, two organisms could diverge and become two different species.

Recall, the biological species concept states that two organisms are the same species if they are able to interbreed and produce fertile, viable offspring.

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What is speciation?

What is speciation?



An evolutionary process resulting in the production of a new species.

Traditionally, we are looking at one species diverging.

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**What are the two types
of speciation?**

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**What are the two types
of speciation?**



- > **Allopatric**
- > **Sympatric**



Speciation resulting from a geographical barrier

- A. Allopatric**
- B. Sympatric**

**Speciation resulting from
a geographical barrier**

A. Allopatric



Allopatric speciation occurs when two organisms have a geographical barrier that separates the two organisms.

Allopatric = Apart

Sympatric speciation occurs without a geographical barrier that separates the two organisms.

Sympatric = Same



**Speciation resulting from
polyploidy in the same area**

- A. Allopatric**
- B. Sympatric**

**Speciation resulting from
polyploidy in the same
area**

B. Sympatric



Allopatric speciation occurs when two organisms have a geographical barrier that separates the two organisms.

Allopatric = Apart

Sympatric speciation occurs without a geographical barrier that separates the two organisms.

Sympatric = Same

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What is the difference between punctuated equilibrium and gradualism?

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What is the difference between punctuated equilibrium and gradualism?



Punctuated – evolution takes place in a short geologic time period followed by long period of stasis (unchanging)

Gradualism – evolution occurs slowly over MANY years



Mechanism to inhibit hybrid formation after zygote forms

- A. Prezygotic barrier**
- B. Postzygotic barrier**

**Mechanism to inhibit
hybrid formation after
zygote forms**



B. Postzygotic barrier

Break down the words

Post – after

Zygotic – zygote

(result from fertilization)

**This is a barrier that inhibits
and takes place AFTER the
zygote forms**



Hybrid forms but it is sterile

- A. Hybrid breakdown**
- B. Reduced hybrid fertility**
- C. Reduced hybrid viability**

**Hybrid forms but it is
sterile**



B. Reduced hybrid fertility

Fertility is the ability for an organism to reproduce. If an organism is fertile, it is able to reproduce, so reduced fertility would be an individual less able or unable to reproduce (sterile).

Hybrid breakdown refers to the first generation being viable but the second generation is feeble or sterile.

Reduced hybrid viability refers to the hybrid not being viable.



Hybrid from the first generation is healthy but the second generation has reduced fitness

- A. Hybrid breakdown**
- B. Reduced hybrid fertility**
- C. Reduced hybrid viability**

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Hybrid from the first generation is healthy but the second generation has reduced fitness



A. Hybrid breakdown

In hybrid breakdown, the first generation is viable but through subsequent generations the hybrid becomes less viable or less fertile.

Reduced hybrid viability refers to the hybrid not being healthy.

Reduced hybrid fertility refers to the hybrid not being fertile.



Hybrid forms but is not healthy

- A. Hybrid breakdown**
- B. Reduced hybrid fertility**
- C. Reduced hybrid viability**

Hybrid forms but is not healthy

C. Reduced hybrid viability



Viability refers to the healthiness of the organism. If there's a reduced viability, then the hybrid is less viable.

Reduced hybrid fertility refers to the hybrid not being fertile.

Hybrid breakdown refers to the first generation being viable but the second generation is feeble or sterile.

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What does the biological species concept state?

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What does the biological species concept state?



Two organisms are from the same species if they can interbreed and produce viable, fertile offspring



**Mechanism to inhibit two species
from mating**

- A. Postzygotic barrier**
- B. Prezygotic barrier**

Mechanism to inhibit two species from mating

B. Prezygotic barrier



Pre- means before and -zygotic refers to the zygote that is formed from fertilization.

A prezygotic barrier inhibits the formation of the zygote possibly through inhibiting two species from mating.



Mating song or dance or other ritual inhibits two organisms from mating.

- A. Behavioral Isolation**
- B. Gametic Isolation**
- C. Habitat Isolation**
- D. Temporal Isolation**

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Mating song or dance or other ritual inhibits two organisms from mating.

A. Behavioral Isolation



Behavioral isolation is two organisms with different mating behaviors (calls, dances, etc.) that inhibits two organisms from mating.

Gametic isolation is two gametes not being compatible to fuse. Habitat isolation is two organisms living in different habitats, so they do not mate. Temporal isolation is two organisms mating at different times (day, month, year).

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**Mating occurs at different times
of day, month, year, etc.**

- A. Behavioral Isolation**
- B. Gametic Isolation**
- C. Habitat Isolation**
- D. Temporal Isolation**

Mating occurs at different times of day, month, year, etc.

D. Temporal Isolation



Temporal isolation is two organisms mating at different times (day, month, year).

Behavioral isolation is two organisms with different mating behaviors (calls, dances, etc.) that inhibits two organisms from mating. Gametic isolation is two gametes not being compatible to fuse. Habitat isolation is two organisms living in different habitats, so they do not mate.



**Sperm & egg are unable to fuse
due to incompatibility of
proteins**

- A. Behavioral Isolation**
- B. Gametic Isolation**
- C. Habitat Isolation**
- D. Temporal Isolation**

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Sperm & egg are unable to fuse due to incompatibility of proteins

B. Gametic Isolation

Gametic isolation is two gametes (sperm & egg) not being compatible to fuse.

Behavioral isolation is two organisms with different mating behaviors (calls, dances, etc.) that inhibits two organisms from mating. Habitat isolation is two organisms living in different habitats, so they do not mate. Temporal isolation is two organisms mating at different times (day, month, year).



Two species live in different areas and do not interact

- A. Behavioral Isolation**
- B. Gametic Isolation**
- C. Habitat Isolation**
- D. Temporal Isolation**



Two species live in different areas and do not interact

C. Habitat Isolation

Habitat isolation is two organisms living in different habitats, so they do not mate.

Behavioral isolation is two organisms with different mating behaviors (calls, dances, etc.) that inhibits two organisms from mating.

Gametic isolation is two gametes (sperm & egg) not being compatible to fuse. Temporal isolation is two organisms mating at different times (day, month, year).

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**Prezygotic barrier that involves
inability to mate due to
anatomical structure**

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**Prezygotic barrier that
involves inability to mate
due to anatomical
structure**



Mechanical Isolation

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**When new niches open up,
speciation...**

- A. Decreases**
- B. Increases**

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**When new niches open up,
speciation...**

B. Increases

New niches open up allows for organisms to take up different ecological environments. This leads to ecological isolation. As these organisms no longer mate, there is an absence of gene flow which leads to speciation.

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What is polyploidy?

What is polyploidy?



Polyploidy is an organism with more than two sets of chromosomes.

We are diploid. We have two sets (maternal & paternal).

But sometimes, there are errors in which a cell doesn't divide results in a fusion of two diploid cells leads to a tetraploid. This organisms's cell has four sets of chromosomes. It happens more frequently on plants (wheat, bananas, etc.)

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What is speciation?

What is speciation?



Creation of a new species

This comes back to the biological species concept when two individuals are from different species they are unable to interbreed/produce fertile and viable offspring



What is the difference between punctuated and gradual equilibrium?

- A. Gradual occurs after punctuated**
- B. Gradual is abrupt while punctuated is slow**
- C. Punctuated occurs after gradual**
- D. Punctuated is abrupt while gradual is slow**

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What is the difference between punctuated and gradual equilibrium?

D. Punctuated is abrupt while gradual is slow



Punctuated:

the hypothesis that evolutionary development is marked by isolated episodes of rapid speciation between long periods of little or no change

Gradual:

the concept that large changes in species are actually the culmination of very small changes that build up over time

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What is the difference between sympatric and allosteric speciation?

- A. Allopatric is due to divergent events and sympatric is due to convergent evolution**
- B. Allopatric takes place with organisms apart due to a geographical barrier and sympatric takes place without geographical barriers**
- C. Sympatric is due to divergent events and allopatric is due to convergent evolution**
- D. Sympatric takes place with organisms apart due to a geographical barrier and allopatric takes place without geographical barriers**

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What is the difference between sympatric and allosteric speciation?

B. Allopatric takes place with organisms apart due to a geographical barrier and sympatric takes place without geographical barriers



Sympatric speciation refers to speciation that takes place in the SAME area while allopatric speciation refers to speciation that takes place due to a geographical barrier so the organisms are APART.



**Barrier due to different
ecological conditions**

- A. Behavioral**
- B. Habitat**
- C. Mechanical**
- D. Temporal**

Barrier due to different ecological conditions

B. Habitat



Habitat isolation refers to individuals that live in a different habitat or ecological environment. Due to this separation, the two organisms have an absence of gene flow which leads to speciation.



**Barrier due to different
anatomical components**

- A. Behavioral**
- B. Habitat**
- C. Mechanical**
- D. Temporal**

Barrier due to different anatomical components

C. Mechanical



Mechanical isolation refers to two organisms unable to mate due to anatomical differences that inhibit mating.



Barrier occurring in mules that are unable to reproduce

- A. Hybrid breakdown**
- B. Reduced hybrid fertility**
- C. Reduced hybrid viability**

**Barrier occurring in mules
that are unable to
reproduce**



B. Reduced hybrid fertility

The mule is sterile due to an odd number of chromosomes. Since the hybrid between a horse and a donkey is sterile, this is an example of reduced hybrid fertility.



**Barriers due to health problems
of the hybrid**

- A. Hybrid breakdown**
- B. Reduced hybrid fertility**
- C. Reduced hybrid viability**

Barriers due to health problems of the hybrid

C. Reduced hybrid viability



The hybrid has health problems, so this is an example of reduced hybrid viability. The hybrid is not healthy or less viable.



Barrier due to the second generation hybrid has issues

- A. Hybrid breakdown**
- B. Reduced hybrid fertility**
- C. Reduced hybrid viability**

Barrier due to the second generation hybrid has issues



A. Hybrid breakdown

The first generation is viable and fertile, but the subsequent generations have reduced viability or reduced fertility. Overall, the hybrid is breaking down with each generation.

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Which has more reproductive barriers?

- A. Allopatric**
- B. Sympatric**

Which has more reproductive barriers?

B. Sympatric



Sympatric speciation takes place in the same area without a geographical barrier. Since the two populations are coming into contact more frequently, there should be more reproductive barriers to inhibit reproduction.



Which does not occur in the hybrid zone?

- A. Balance**
- B. Fusion**
- C. Reinforcement**
- D. Stability**

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Which does not occur in the hybrid zone?

A. Balance



Fusion refers to the increase of gene flow between Population A, Population B, and Hybrid Population that it fuses into ONE population.

Reinforcement refers to the decrease in gene flow between Population A and B which reinforces the TWO populations.

Stability refers to the decrease in gene flow between the hybrid population and population A or B which stabilizes the hybrid population so there's THREE populations.