

SPECIATION

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SPECIES – BIOLOGICAL CONCEPT

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REPRODUCTIVE BARRIERS

PREZYGOTIC:

POSTZYGOTIC:

MODES OF SPECIATION

ALLOPATRIC	SYMPATRIC

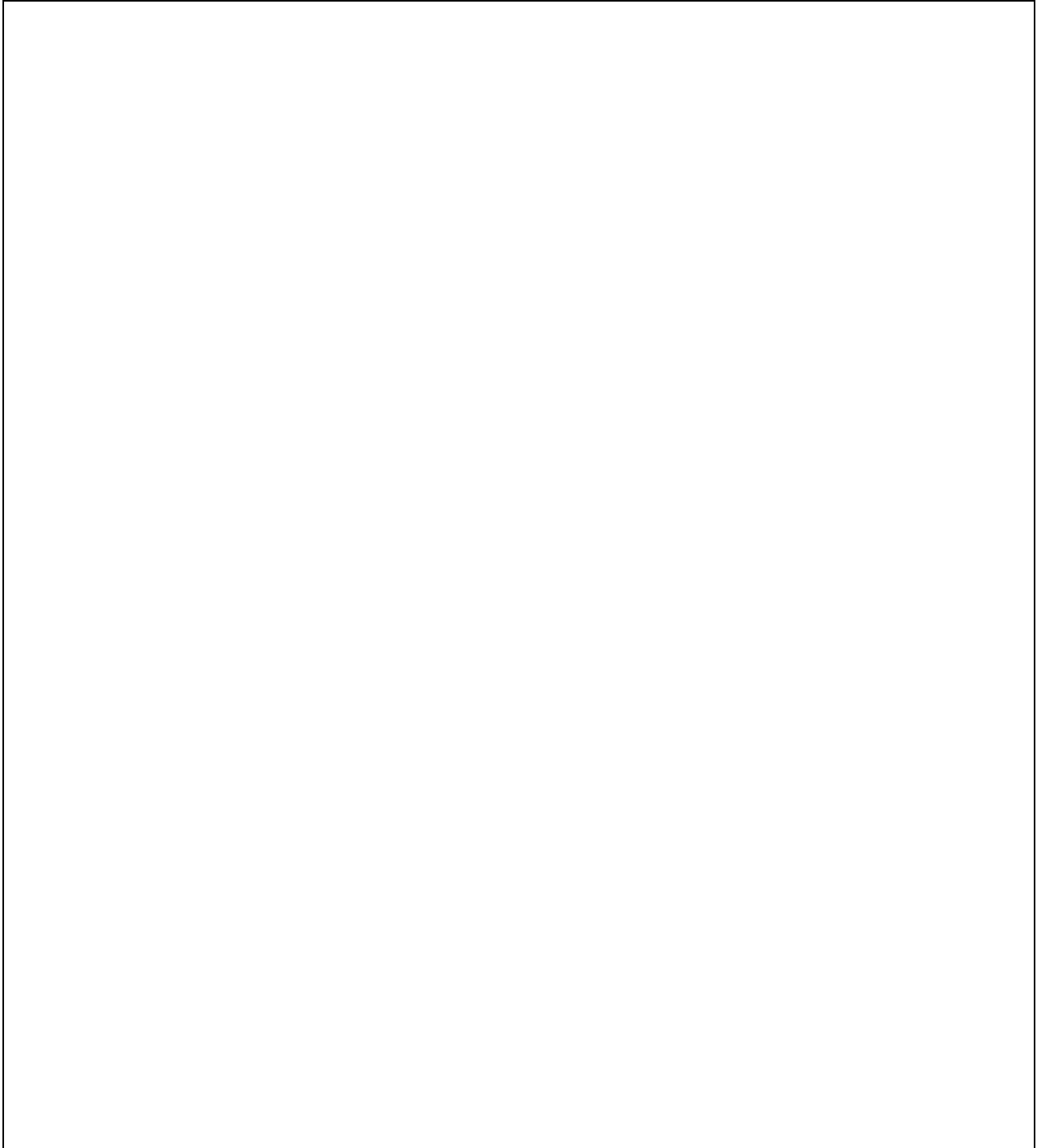
GENETIC CHANGE

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TEMPO OF SPECIATION

GRADUALISM	PUNCTUATED EQUILIBRIUM

EVOLUTIONARY NOVELTIES

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QUESTIONS:

1. What happens during the process of speciation?

2. List the two patterns of speciation and describe each type.

PATTERN	DESCRIPTION

3. How are prezygotic reproductive barriers different from postzygotic barriers?

PREZYGOTIC BARRIERS	Postzygotic Barriers

4. Use the key below to identify the type of reproductive barrier being described.

- A. Habitat isolation
- B. Temporal isolation
- C. Behavioral isolation
- D. Mechanical isolation
- E. Gametic isolation

_____ Gametes fail to fuse

_____ Egg & sperm don't recognize each other

- _____ Differences in sexual or anatomical structures
- _____ Mating dance of a male not recognized by female
- _____ Different mating seasons within the population
- _____ Members of population separated by a mountain range
- _____ Male flowers of some members of a plant species produce pollen before most of the female flowers are open
- _____ Variation in mating ritual not recognized by female
- _____ Male reproductive organs in insect populations vary enormously in size and shape, preventing the effective transfer of sperm to females of different species
- _____ Structure of flower restricts access of insects without specific physical and behavioral adaptations

5. Match the type of postzygotic barrier with the correct description.

- A. Hybrid Breakdown
- B. Hybrid Inviability
- C. Hybrid Sterility

- _____ Zygote fails to develop; zygote fails to reach sexual maturity
- _____ Hybrid fails to produce functional gametes
- _____ Offspring not viable or infertile; offspring of hybrid have reduced viability or fertility

6. Identify the type of reproductive barrier illustrated by the following examples and indicate whether they are pre- or postzygotic barriers.

EXAMPLE	TYPE OF BARRIER	PRE- OR POST-
Two species of frogs are mated in the lab and produce viable, but sterile, offspring		
Two species of sea urchin release their gametes at the same time, but cross-specific fertilization does not occur		
Two species of orchid have different length nectar tubes and are pollinated by different species of moths		
Two species of mayflies emerge during different weeks in springtime		

EXAMPLE	TYPE OF BARRIER	PRE- OR POST-
Two species of salamanders will mate in the lab and produce viable, fertile offspring, but offspring of these hybrids are sterile		
Two similar species of birds have different mating rituals		
When two species of mice are bred in the lab, embryos usually abort		
Peepers breed in woodland ponds, whereas leopard frogs breed in swamps		

7. The result of a cross between a donkey and a horse is a mule. Mules are usually sterile.
- a. What type of reproductive barrier does this represent? How do you know?

- b. Based on these results, would you say that the donkey and horse belong to the same species or to different species? Explain your answer.

8. What are the limitations of the biological concept of a species?

9. Match the species concept with the correct description.

- | | |
|------------------|-----------------|
| A. Biological | B. Cohesion |
| C. Ecological | D. Evolutionary |
| E. Morphological | F. Recognition |

- _____ Defines species on the basis of the ecological role they play and the specific environment in which they live
- _____ Population or group of populations whose members have the potential to interbreed and produce fertile offspring
- _____ Focuses on adaptations that maximize successful mating within a species that enable individuals to recognize a mate and that can be acted on by natural selection
- _____ Based on measurable physical features; used by taxonomists
- _____ Emphasizes adaptations that maintain a species identity despite occasional hybridization with another species
- _____ Defines species in terms of evolutionary lineage and ecological role; populations making up a species are subject to and united by a unique set of selection pressures

10. Two groups of a population are isolated reproductively. What will probably happen over time provided these groups remain isolated from each other?

11. Match the term with the correct definition.

- | | |
|-----------------------|--------------------------|
| A. Adaptive radiation | B. Allopatric speciation |
| C. Endemic species | D. Sympatric speciation |

- _____ New species arise when a population is segregated by geographic barrier
- _____ Emergence of numerous species from a common ancestor that spreads into a new environment
- _____ New species arise within the range of the parent population
- _____ Species found nowhere else on Earth

12. Why is the most favorable condition for allopatric speciation a small population at the fringe of the parent population?

13. Explain how polyploidy could result in sympatric speciation.

14. Explain how balanced polymorphism could result in sympatric speciation.

15. What factors have contributed to the adaptive radiation of the thousands of endemic species on the Hawaiian Archipelago?

16. How is autopolyploidy different from allopolyploidy?

AUTOPOLYPLOIDY	ALLOPOLYPLOIDY

17. A new plant species B forms by autopolyploidy from species A which had a chromosome number of $2n = 10$. How many chromosomes would species B have?

18. If species A ($2n = 10$) were to hybridize by allopolyploidy with species C ($2n = 14$) and produce a new, fertile species, D, how many chromosomes would species D have?

19. Why might sexual selection lead indirectly to reproductive isolation?

20. Why is reproductive isolation so important in the process of speciation?

21. What could happen if two related populations that have been allopatric for some time come back together?

22. What is a hybrid zone?

23. Indicate if each of the following statements is true of **G**radualism or **P**unctuated Equilibrium.

- _____ Gradual divergence of a species from the ancestral form
- _____ Most change occurred when species branched from ancestral form
- _____ Long periods of stasis punctuated by episodes of speciation
- _____ Darwinism
- _____ Evolution occurred in spurts of rapid change
- _____ Big changes occur from the accumulation of many small ones

24. Define exaptation.

25. Define allometric growth.

What effect would a small change in the genetic information controlling allometric growth have on the adult form?

26. How does the growth of a chimpanzee brain differ from that of a human brain and what is the impact of this difference?

27. Describe the two major mechanisms proposed for the origin of evolutionary novelties.

28. Describe what happens during species selection.
