AP Biology
Speciation Review Worksheet

Overview

1. Define **speciation**.

2. Distinguish between **microevolution** and **macroevolution**.

Concept 22.1 The biological species concept emphasizes reproductive isolation.

3. Use the biological species concept to define **species.**

4. What is required for the formation of a new species?

5. Define **reproductive isolation.**

6. What are **hybrids**?

7. Explain the two types of barriers that maintain reproductive isolation.

8. The following chart summarizes the various ways that reproductive isolation is maintained. Explain and give an example of each type of isolating mechanism.

Prezygotic Reproductive Barriers	**Explanation**	**Example**
Habitat Isolation		
Temporal Isolation		
Behavioral Isolation		
Mechanical Isolation		
Gametic Isolation		
Postzygotic Reproductive Barriers	**Explanation**	**Example**
Reduced Hybrid Viability		
Reduced Hybrid Fertility		
Hybrid Breakdown		

9. Discuss one strength and one limitation of the biological species concept.

10. Choose one other species definition (morphological, ecological, or phylogenetic) and compare and contrast it with the biological species concept.

Concept 22.2 Speciation can take place with or without geographic separation.

11. Speciation events are triggered by interruptions in gene flow. Distinguish between **allopatric speciation** and **sympatric speciation**.

12. What type of speciation is caused by a formidable barrier such as the Grand Canyon?

13. How is the example of the snapping shrimp (*Alpheus*) evidence of allopatric speciation?

14. Sympatric speciation occurs in populations that live in the same geographic area. How is this possible?

15. Your response to question 14 should have included polyploidy, habitat differentiation, and sexual selection. Choose either polyploidy or habitat differentiation to explain sympatric speciation.

16. Define **sexual selection** and then explain how sexual selection can drive sympatric speciation.

Concept 22.4 Speciation can occur rapidly or slowly and can result from changes in a few or many genes.

17. Steven Jay Gould and Niles Eldredge coined the term **punctuated equilbria**. What is meant by the punctuated pattern?

18. Explain how punctuated equilibrium differs from gradualism.

19. Explain the limitations of fossils in determining speciation events.

Identifying Independent and Dependent Variables, Making a Scatter Plot, and Interpreting Data

Does Distance Between Salamander Populations Increase Their Reproductive Isolation?
The process of allopatric speciation begins when populations become geographically isolated, preventing mating between individuals in different populations and thus stopping gene flow. It seems logical that as distance between populations increases, so will their degree of reproductive isolation. To test this hypothesis, researchers studied populations of the dusky salamander (*Desmognathus ochrophaeus*) living on different mountain ranges in the southern Appalachian Mountains.

How the Experiment Was Done
The researchers tested the reproductive isolation of pairs of salamander populations by leaving one male and one female together and later checking the females for the presence of sperm. Four mating combinations were tested for each pair of populations (A and B) – two *within* the same population (female A with male A and female B with male B) and two *between* populations (female A with male B and female B with male A).

Data From the Experiment

The researchers used an index of reproductive isolation that ranged from a value of 0 (no isolation) to a value of 2 (full isolation). The proportion of successful matings for each mating combination was measured, with 100% success = 1 and no success = 0. The reproductive isolation value for two populations is the sum of the proportion of successful matings of each type *within* populations (AA + BB) minus the sum of the proportion of successful matings of each type *between* populations (AB + BA). The following table provides data for 27 pairs of dusky salamander populations.

Geographic Distance (km)	15	32	40	47	42	62	63	81	86	107	107	115	137	147
Reproductive Isolation Value	0.32	0.54	0.50	0.50	0.82	0.37	0.67	0.53	1.15	0.73	0.82	0.81	0.87	0.87
Distance (continued)	137	150	165	189	219	239	247	53	55	62	105	179	169	
Isolation (continued)	0.50	0.57	0.91	0.93	1.50	1.22	0.82	0.99	0.21	0.56	0.41	0.72	1.15	

Interpret the Data

1. **State** the researchers' hypothesis, and **identify** the independent and dependent variables in this study. **Explain** why the researchers used four mating combinations for each pair of populations.

2. **Calculate** the value of the reproductive isolation index if (a) *all* of the matings within a population were successful, but *none* of the matings between populations were successful; (b) salamanders are equally successful in mating with member of their own populations and members of another population.

3. **Make** a scatter plot of one variable against the other to help you visualize whether or not there is a relationship between variables. Plot the dependent variable on the y-axis and the independent variable on the x-axis.

4. **Interpret** your graph by (a) **explaining** in words the relationship between the variables that can be visualized by graphing the data and (b) **hypothesizing** the possible cause of this relationship.