

Topic 5.2: Natural Selection

5.2.U1 Natural selection can only occur if there is variation among members of the same species.

1. Give an example of variation in a population.
2. Define the term natural selection.
3. Why is variation important to the process of natural selection?
4. Who noted that variation is important to the theory of evolution?

5.2.U2 Mutation, meiosis and sexual reproduction cause variation between individuals in a species.

5. Outline the three factors can cause variation in in a species.
6. If a population does not sexually reproduce, what is the only source of variation?
7. Why might an asexual species have trouble adapting to a sudden change in the environment?

5.2.U3 Adaptations are characteristics that make an individual suited to its environment and way of life.

8. Define the term correlation.
9. Define the term adaptation.
10. How do adaptations provide an advantage to survival?
11. Give an example of a correlation between the form of an organism's structure and its function in increasing survival.
12. Is evolution of a species directed to make organisms "perfectly fit" for their environment? Explain why or why not.

5.2.U4 Species tend to produce more offspring than the environment can support.

13. Describe two different strategies organisms have for the production of offspring and provide at least one advantage and disadvantage to each strategy.
14. What is the overall trend in all organisms in terms of their reproduction rate? What may happen if this is not true for a species?
15. Define the phrase: the struggle for existence.
16. How does the struggle for existence lead to changes in a population?

5.2.U5 Individuals that are better adapted tend to survive and produce more offspring while the less well adapted tend to die or produce fewer offspring.

17. Darwin noted that there is a struggle for existence; more offspring are born than can survive within a population because of competition for resources, and other factors such as predation and disease. Explain why is it important that species over produce offspring in terms of variation and natural selection?

5.2.U6 Individuals that reproduce pass on characteristics to their offspring.

18. Jean Baptiste Lamarck proposed a theory that giraffes evolved their long necks by individuals stretching their necks to reach leaves in the tall trees during the dry seasons in the savanna. Over its lifetime, a giraffe would acquire a longer neck and thus pass down its acquired trait to its offspring. Over many generations this would lead to the modern day giraffe. Describe why Lamarck's hypothesis was incorrect based on your knowledge of evolutionary theory.

5.2.U7 Natural selection increases the frequency of characteristics that make individuals better adapted and decreases the frequency of other characteristics leading to changes within the species.

19. How does natural selection lead to changes in a species?
20. Read the Application Section: Galápagos Finches and complete the DBQ's page 255-256 #1-6 [5.2.A1]

Topic 10.3 Gene Pools and Speciation

10.3.U1 A gene pool consists of all the genes and their different alleles, present in an interbreeding population.

1. State the definition of the term gene pool.
2. Explain what is meant by the term allele frequency

10.3.U2 Evolution requires that allele frequencies.

3. Outline why for evolution to occur a change in allele frequencies, within a population, is necessary.
4. Suggest ways in which allele frequency could change.

10.3.A1 Identifying examples of directional, stabilizing and disruptive selection.

5. Complete the table giving examples of the different types of selection.

Type Of Selection	Diagram	Example		
		Species	Selective Pressure	Result
directional				
stabilizing				
disruptive				

10.3.U3 Reproductive isolation of populations can be temporal, behavioral or geographic.

6. State what is meant by the term reproductive isolation.
7. Outline the mechanism by which populations can be reproductively isolated giving examples for each mechanism.
 - a. Temporal isolation
 - b. Behavioral isolation
 - c. Geographic isolation

10.3.U4 Speciation due to divergence of isolated populations can be gradual. AND 10.3.U5 Speciation can occur abruptly.

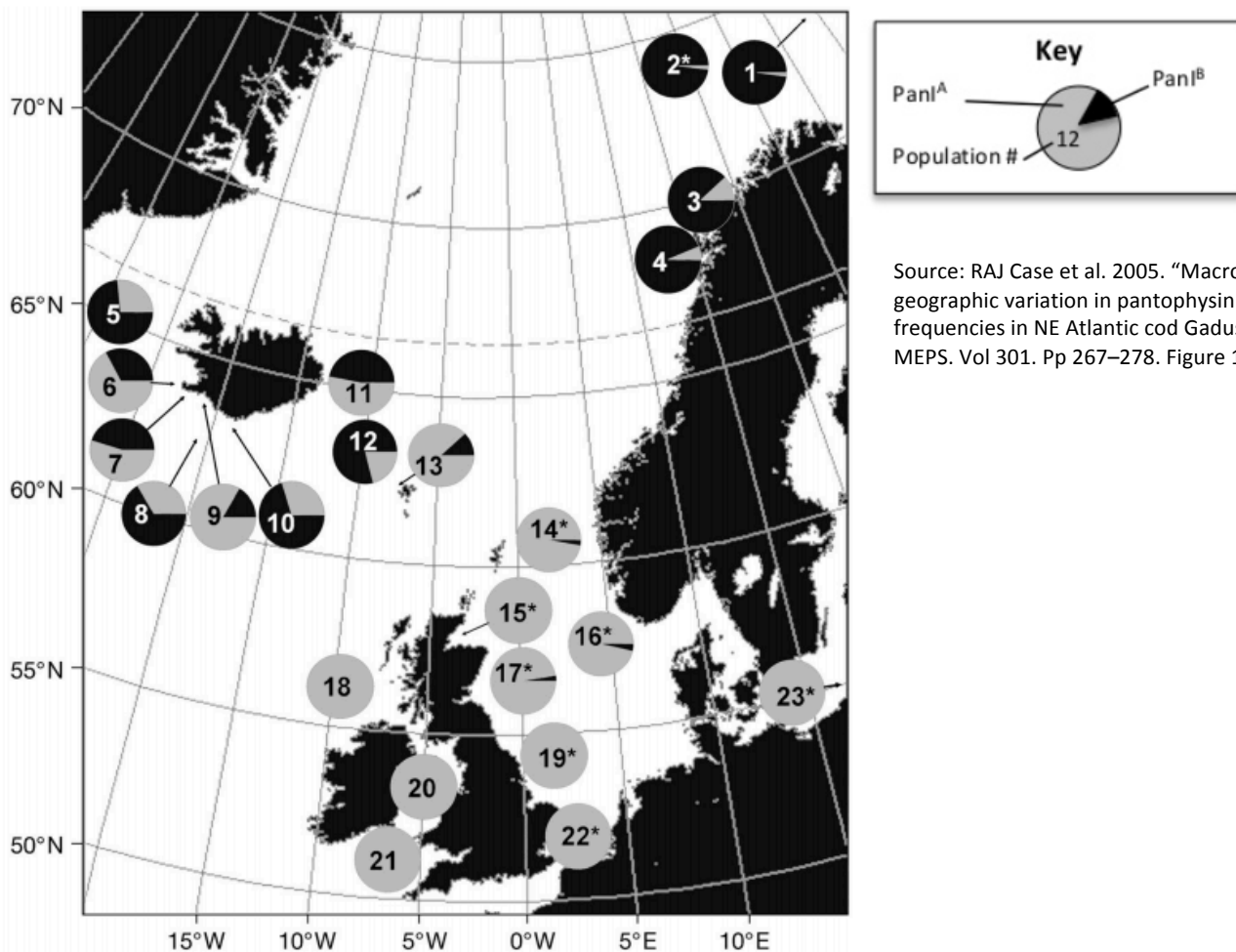
8. Distinguish between the different rates at which speciation can occur: gradual versus abrupt by defining the term and providing a description.

Nature of Science: Looking for patterns, trends and discrepancies - Patterns of chromosome number in some genera can be explained by speciation due to polyploidy. (3.1) AND 10.3.A2 Speciation in the genus *Allium* by polyploidy.

9. Compared to the terms haploid and diploid describe what is meant by the term polyploidy.
10. Outline how polyploidy can occur.
11. Polyploidy is quite common in plants.
 - a. Explain why polyploidy is more common in plants than animals.
 - b. Describe why a polyploid plant can have a selective advantage over diploid rivals.
12. Polyploidy can lead to speciation, as individuals with different numbers of chromosomes cannot interbreed. State two examples of different species found in the plant genus *Allium* and the number of chromosome of each species.

10.3.S1 Comparison of allele frequencies of geographically isolated populations.

13. *PanI* is a gene in codfish that codes for an integral membrane protein called pantophysin. Two alleles of the gene, $PanI^A$ and $PanI^B$, code for versions of pantophysin. Samples of codfish were collected from 23 populations in the North Atlantic and tested to find the proportions of the alleles in each population. The proportions of alleles in a population are called the allele frequencies. The frequency can vary from 0.0 to 1.0 with the total frequency of all alleles always being 1.0 (100%).
 - a. State the two populations with the highest $PanI^B$ allele frequencies.
 - b. State the population in which the allele frequencies were closest to 0.5.
 - c. Deduce the allele frequencies of a population in which half of the codfish had the genotype $PanI^A PanI^A$, and half had the genotype $PanI^A PanI^B$.
 - d. Identify an example of two geographically isolated populations.
 - e. Give suggestions why the $PanI^B$ allele is more common in population 13 than population 22.



Source: RAJ Case et al. 2005. "Macro- and micro-geographic variation in pantophysin (*PanI*) allele frequencies in NE Atlantic cod *Gadus morhua*." MEPS. Vol 301. Pp 267–278. Figure 1 and 3.