

10. Genetics and evolution – 10.3 Gene pools and speciation (AHL)

Name:

Understandings, Applications and Skills (This is what you maybe assessed on)

	Statement	Guidance
10.3.U1	A gene pool consists of all the genes and their different alleles, present in an interbreeding population.	
10.3.U2	Evolution requires that allele frequencies change with time in populations.	
10.3.U3	Reproductive isolation of populations can be temporal, behavioural or geographic.	
10.3.U4	Speciation due to divergence of isolated populations can be gradual.	
10.3.U5	Speciation can occur abruptly.	Punctuated equilibrium implies long periods without appreciable change and short periods of rapid evolution.
10.3.A1	Identifying examples of directional, stabilizing and disruptive selection.	
10.3.A2	Speciation in the genus <i>Allium</i> by polyploidy.	
10.3.S1	Comparison of allele frequencies of geographically isolated populations.	

Recommended resources:

<http://bioknowledgey.weebly.com/103-gene-pools-and-speciation.html>

Allott, Andrew. *Biology: Course Companion*. S.I.: Oxford UP, 2014. Print.



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 change with time in populations.

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
<i>directional</i>				
<i>stabilizing</i>				
<i>disruptive</i>				

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

6. State what is meant by the term reproductive isolation.



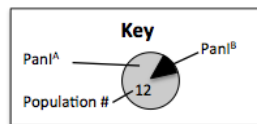
7. Outline the mechanism by which populations can be reproductively isolated giving examples for each mechanism.
 - a. Temporal isolation

 - b. Behavioural isolation

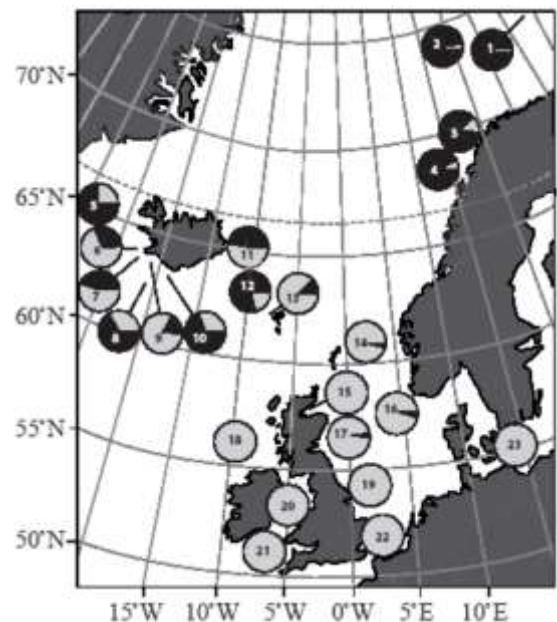
 - c. Geographic isolation

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

8. **PanI** is a **gene** in cod fish 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 cod fish 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.



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. Figs 1 and 3.



- a. State the two populations with the highest PanI^B allele frequencies. [1]

- b. State the population in which the allele frequencies were closest to 0.5. [1]

- c. Deduce the allele frequencies of a population in which half of the cod fish had the genotype PanI^A PanI^A, and half had the genotype PanI^A PanI^B. [2]

d. Identify an example of two geographically isolated populations. [1]

e. Give Suggestions why the PanIB allele is more common in population 13 than population 22. [2]

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

9. Complete the table to distinguish between the different rates at which speciation can occur.

Rate of speciation	Gradual	Abrupt
Term		
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.

10. Compared to the terms haploid and diploid describe what is meant by the term polyploidy.

11. Outline how polyploidy can occur.



12. Polyploidy is quite common in plants.
- Explain why polyploidy is more common in plants than animals.

 - Describe why a polyploid plant can have a selective advantage over diploid rivals.
13. 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.

Citations:

Allott, Andrew. *Biology: Course Companion*. S.I.: Oxford UP, 2014. Print.

