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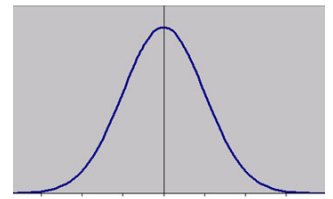
Review Material

Hardy-Weinberg Practice Problems:

- You have sampled a population in which you know that the percentage of the homozygous recessive genotype (aa) is 36%. Using that 36%, calculate the following:**
 - $P =$ _____
 - $Q =$ _____
 - $P^2 =$ _____
 - $2PQ =$ _____
 - $Q^2 =$ _____
- Within a population of butterflies, the color brown (B) is dominant over the color white (b). And, 40% of all butterflies are white. Given this simple information, which is something that is very likely to be on an exam, calculate the following:**
 - $P =$ _____
 - $Q =$ _____
 - $P^2 =$ _____
 - $2PQ =$ _____
 - $Q^2 =$ _____
- A very large population of randomly-mating laboratory mice contains 35% white mice. White coloring is caused by the double recessive genotype, "aa". Calculate allelic and genotypic frequencies for this population.**
 - $P =$ _____
 - $Q =$ _____
 - $P^2 =$ _____
 - $2PQ =$ _____
 - $Q^2 =$ _____
- Cystic fibrosis is a recessive condition that affects about 1 in 2,500 babies in the Caucasian population of the United States. Please calculate the following.**
 - $P =$ _____
 - $Q =$ _____
 - $P^2 =$ _____
 - $2PQ =$ _____
 - $Q^2 =$ _____

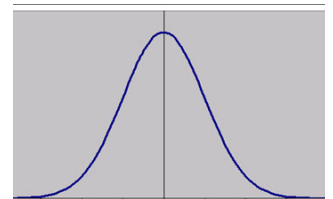
Types of Selection Practice Problems:

1. Infants born around 3-4 kg (the average birth weight) are generally healthier and are less likely to die as infants than those with much smaller or larger birth weights.



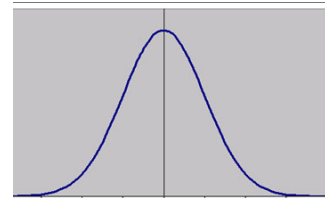
Type of Selection? _____

2. In Cameroon, West Africa, the black-bellied finches with large beaks can crack the hard seeds and the finches with the small beaks crack the soft seeds. Those with intermediate-sized beaks can crack both seeds but do so extremely inefficiently. Those finches with the intermediate sized beak are not as successful in this environment.

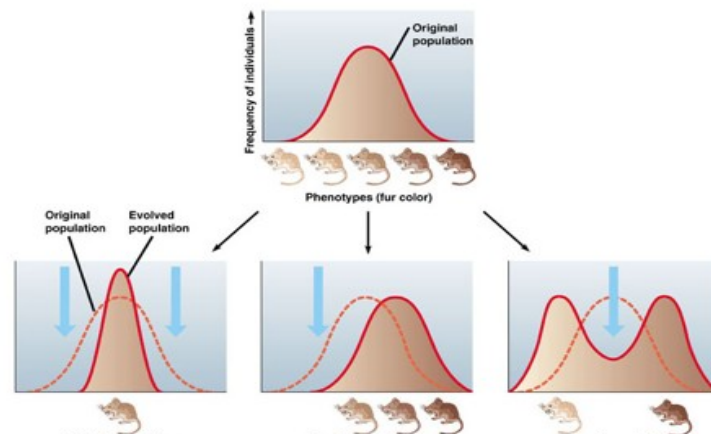


Type of Selection? _____

3. Due to a drought in the Galapagos, there is no more fruit available to the various Finches on the island. Those birds with the largest beaks are the most efficient at cracking open any nuts found and thus their population thrives on the island.



Type of Selection? _____

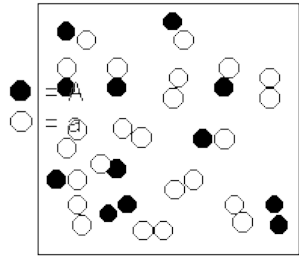


4. _____ 5. _____ 6. _____

Population Genetics Practice Problems

Set I: Gene Frequencies

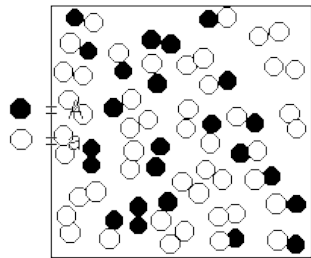
Initial Population - Circles are used to represent genes in this diagram of a population. Individuals are **diploid**, so two circles are used to represent an individual.



1. What is the frequency of A? _____

2. What is the frequency of a? _____

Gene frequency: Generation II - Suppose these represent the genes in the second generation of this population:



3. What is the frequency of A? _____

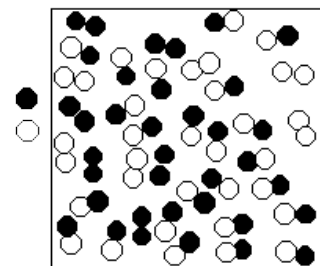
4. What is the frequency of a? _____

5. Has “small-scale” evolution occurred between generation I and generation II (look at the gene frequency)? _____
 Explain your answer. _____

In order for question number 5 to be true, according to the **Hardy-Weinberg principle**, what 5 conditions must be met?

1. _____
2. _____
3. _____
4. _____
5. _____

Gene frequency: Generation III - Suppose these represent the genes in the third generation of this population:



6. What is the frequency of A? _____

7. What is the frequency of a? _____

8. Has “small-scale” evolution occurred between generation II and generation III? _____ Explain your answer.

9. What are some factors that might have caused the change seen between Generation II and Generation III?

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Example	What type of isolation is it?
7. There are 2 different species of cricket that would be indistinguishable unless you heard their mating song: they are of a noticeably different pitch. Members of the separate species do not interbreed because of the different mating songs.	
8. There are 4 groups of Chinook salmon who spawn at different times of the year along California's central coast: winter, spring, summer and fall. The populations who breed in one season never breed with those in another season.	
9. Male fireflies of various species signal to females of their kind by blinking their lights in particular rhythms. The females respond only to signals characteristics of their own species, flashing back and attracting males.	

10. The geographic ranges of the Western Spotted Skunk and the Eastern Spotted Skunk overlap but the two very similar species do not interbreed because the Western Spotted Skunk mates in late Summer and the Eastern Spotted Skunk mates in late Winter.	
11. Two species of garter snakes never mate because one lives mainly in water and the other is primarily terrestrial (on land).	
12. Geologic evidence indicates that most of Death Valley, CA was covered by a huge lake during the last ice age. When the ice age ended, the region became dry. Only small, spring fed ponds remained. Members of a fish species that previously formed a single population in the lake became isolated in different ponds. The environments of the isolated ponds differed enough that natural selection acted on the separate populations. Eventually the fish in the different ponds diverged so much genetically that they could no longer interbreed even if brought together.	

Bottleneck or Founder Effect Practice Problems

1. Cheetahs were once widespread in Africa and Asia. Their numbers fell drastically during the last ice age about 10,000 years ago. Those few that survive reproduced and made up the population that exists today.

2. Northern elephant seals have reduced genetic variation. This is probably due to over-hunting that reduced their population size to as few as 20 individuals at the end of the 19th century. Their population has since rebounded to over 30,000. Because of the over-hunting, the Northern Elephant seals have much less genetic variation than a population of southern elephant seals that was not so intensely hunted.

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3. The Afrikaner population of Dutch settlers in South Africa is descended mainly from a few colonists. Today, the Afrikaner population has an unusually high frequency of the gene that causes Huntington's disease, because those original Dutch colonists just happened to carry that gene with unusually high frequency.

4. European bison, faced extinction in the early 20th century due to over hunting. The animals living today are all descended from 12 individuals and they have extremely low genetic variation, which may be beginning to affect the reproductive ability of bulls

5. The Amish populations in the United States, which have grown from a very few founders, have not recruited newcomers, and tend to marry within the community. Though still rare, phenomena such as polydactyly (extra fingers and toes) are more common in Amish communities than in the American population at large.
