

c. What is the **heterozygosity** of this population?

Population Genetics Assignment

BIOL 01104 Spring 2020

Instructor: Dr. Spielman

**Due Friday 3/13/20 on paper at the beginning of class (11 am), stapled!**

- d. Imagine, one generation of random mating occurs and the population will then be in Hardy-Weinberg equilibrium. What will the **genotype frequencies** be in this next generation?
  
  
  
  
  
  
  
  
  
  
- e. Did heterozygosity **increase, decrease, or stay roughly the same** (e.g. 0.4 and 0.41 are roughly the same. 0.4 and 0.45 are different) when the population entered HWE?
  
  
  
  
  
  
  
  
  
  
- 2. You are studying a population of crocodiles with variation in their teeth characteristics. You find that genotype **SS** individuals have long but dull teeth, genotype **Ss** individuals have average-sized teeth, and genotype **ss** individuals have small but extremely pointy teeth. In a population of 120 crocodiles, 30% of individuals are SS, 60% of individuals are Ss, and 10% of individuals are ss.
  - a. What are the **genotype frequencies** in this population? (Hint: don't think too hard!!!!!! Reading instructions for this question is *very helpful*)
  
  
  
  
  
  
  
  
  
  
  - b. What are the **allele frequencies** in this population?

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- c. You return to the population a few generations later, and you find that of the 120 crocodiles in the population, 80 crocodiles are SS, 24 crocodiles are Ss, and 16 crocodiles are ss. Is it more likely that evolution DID or DID NOT occur at this gene since you last visited? *Hint: Consider whether allele frequencies have changed!*
- d. Again consider your answer to part (c) of this question: Is there evidence that the population is *randomly mating*, undergoing *assortative mating*, or is there no way to tell? (HINT: THERE IS A WAY TO TELL). Answer *with a clear explanation* in 1-2 sentences (no additional math is needed beyond the math you did for part (c)).

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3. You decide to set up an assay to compare fitnesses of the different crocodile genotypes/phenotypes from the previous question. You randomly select 20 individuals with each tooth phenotype, and you give each individual a live chicken to eat. You measure fitness by asking how much of the chicken was eaten after an hour, under the assumption that the rate of consumption is a proxy for fitness. You found these results, on average:

- SS (long but dull teeth) consumed 70% of the chicken
- Ss (average teeth) consumed 50% of the chicken
- ss (small but pointy teeth) consumed 30% of the chicken

Assuming "percent of chicken eaten" is a proxy for fitness, calculate the following quantities in the space provided:

- a. The relative fitness for each genotype.

- b. The selection coefficients for each genotype.

- c. What would be the mean fitness of a hypothetical population of 100 crocodiles, where 25 have long teeth, 2 have average-sized teeth, and 4 have short teeth.

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4. A species of mouse has two color phenotypes: dark fur (genotypes **PP** or **Pp**) or light fur (**pp**). You are studying a population of 250 mice that is known to be in Hardy Weinberg equilibrium. Of these 250, you determined that 125 have a genotype of PP.
  - a. Determine the *number of mice* from population that have each of the other genotypes, Pp and pp. [Hint: The frequency of PP individuals corresponds to the  $p^2$  quantity in Hardy Weinberg calculations. You can use this value to determine  $p$  and  $q$ , from which you can calculate the number of individuals for the other genotypes.]
  - b. Assume the relative fitness of dark-colored mice kernels is 1.0, and the relative fitness of light-colored mice is 0.78. Calculate the mean fitness of this population of 250 mice.