Biology Homework #5

The information presented during the first five weeks of INS is very important and will be useful to know in the future (next quarter and beyond).The purpose of this assignment is to provide students an opportunity to learn what they may not have learned the first time through the material. If you did very well on the first exam, then you can spend some time exploring related topics on your own.

PART I:
If you received a score on the FIRST exam that was lower than the mean (64), then you need to re-do the questions you got wrong on the exam. Write out your answers on a NEW SHEET of paper.

If you received a score above the mean (64) on the FIRST exam, then you need to explore a biology topic that was presented during the first five weeks of the course and interests you. Write a paper (minimum of 0.5 page, double-spaced; maximum of 1 page) about the topic. Use valid sources of information (textbooks, primary and secondary literature, etc…) for your paper and cite your references. Wikapedia is NOT a valid source of information, nor are related sites.

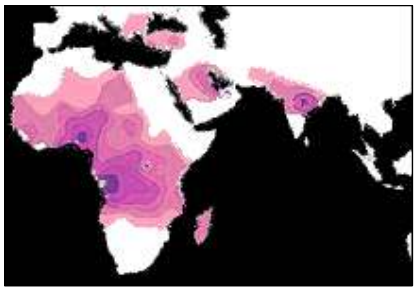
PART II:
Everyone must answer ALL of the questions from the second exam again. You can use your books and study partners to accomplish this task. Print out the following pages and then re-do the exam. If you think you aced it the first time, then congratulations, this should be very easy for you. If you feel like you need to rethink some of your answers, then this gives you the opportunity to do so.

The homework is due next Wednesday after classes.

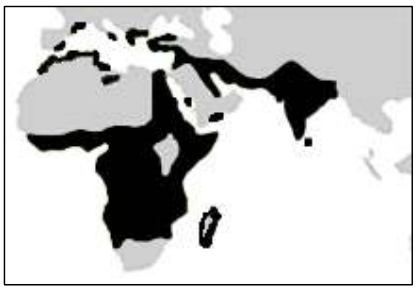
Introduction to Natural Science 2007 **Name (Print):**_____
Biology Exam II

1. Sickle-cell anemia is a genetic disease caused by a mutation in the β-globin gene**.** Individuals who are homozygous recessive for this mutation have red blood cells that readily collapse when deoxygenated; these individuals generally die from the genetic defect. Those who are heterozygous for this condition have an intermediate phenotype and can live with the defect. Interestingly, the malaria parasite cannot survive within these individuals or those with severe sickle-cell anemia.

A. Compare the two images on the right and describe what evolutionary force is at work and why. Use specific vocabulary in your description.



Sickle Cell Distribution (shades of grays)



Malaria Distribution (in black)

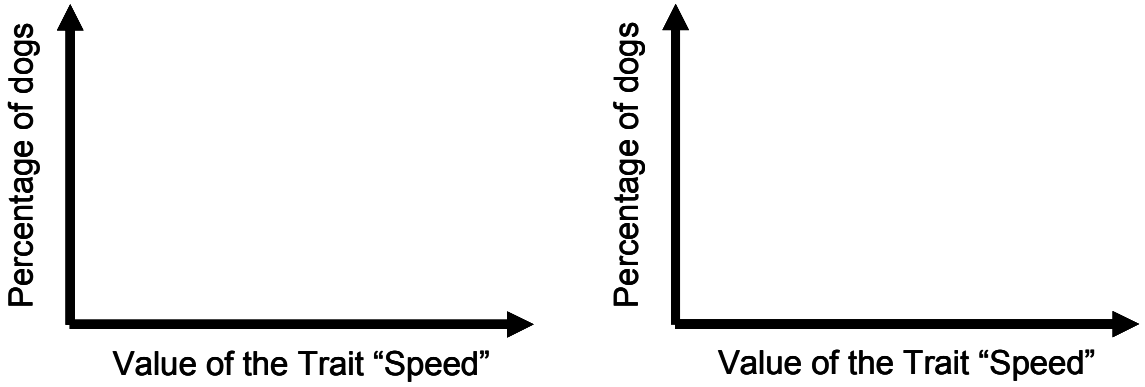
B. If 9% of an African population is born with this severe form of sickle-cell anemia, what percentage of the population will be resistant to malaria but not suffer from sickle-cell anemia? Show your work.

2. Four-o'-clocks produce flowers that are white (recessive), purple (dominant) or an intermediate color, lavender. In a large population that undergoes random mating, what allele frequencies will generate twice as many white flowers compared to lavender flowers? Show your work.

3. Early dog breeders were interested in creating a greyhound dog with the greatest speed. They carefully selected from a group of hounds those who ran the fastest. From their offspring, the greyhound breeders again selected those dogs that ran the fastest. By continuing this selection for dogs who ran faster than most of the hound dog population, they gradually produced a dog who could run up to 64km/h (40mph).

A. On the left, draw a graph corresponding to the time during selection and clearly indicate where there is high fitness.

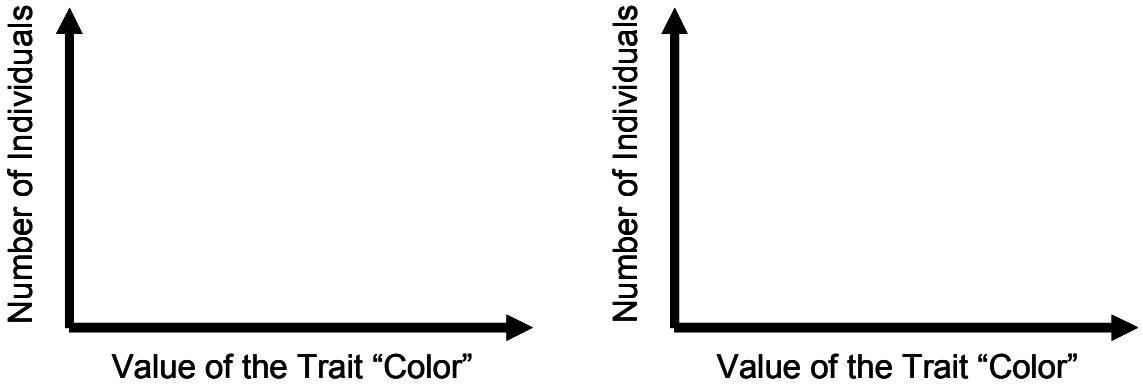
B. On the right, draw a graph corresponding to the time after selection.



4. In a species of African butterfly, *Pseudacraea eurytus*, wing colorations range from a reddish yellow to blue. In both cases, these extremes of color from different ends of the spectrum look like (mimic) other species of butterflies that are not normally the prey of other the local predator group of birds and insects. Those butterflies that are moderate in coloration are eaten in far greater numbers that those at the extremes of the color spectrum.

A. On the left, draw a graph corresponding to the time during selection and clearly indicate where there is high fitness.

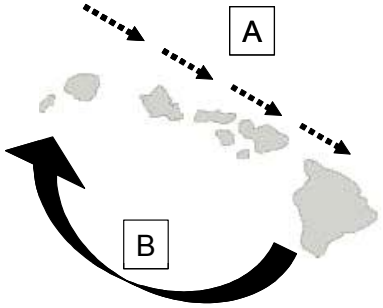
B. On the right, draw a graph corresponding to the time after selection.



5. Describe in your own words why sexual dimorphism exists. Provide an example.

6. Hawaiian Drosophila show remarkable patterns of speciation. There are hundreds of species of Drosophilids on the Hawaiian islands and most are endemic (found only in one location/island). Some traits include: large body sizes, dramatic "picture wings", and "hammer-head" shaped heads. Phylogenetic studies show that flies on each sequential islands are related to species on nearby islands (i.e., flies on Hawaii are derived from ancestors on Maui and so on - indicated by the dashed arrows).

A. The events described above are indicated by the process "A" in the drawing on the right. Please describe the specific type of speciation event that has occurred **and** discuss the possible evolutionary forces involved.



B. If you took a relatively large group of flies from the big island and dispersed them onto the island indicated by the arrow "B", there could be two outcomes: 1) the flies from the big island mate with the flies on the small island and produce offspring, or 2) the flies from the big island and the small island do not produce offspring.
If outcome 1 is occurs, then what evolutionary force is playing a role in changing allele frequencies on both islands?

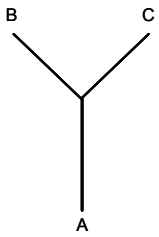
If outcome 2 occurs, then please describe at least 2 possible mechanisms for the reproductive isolation.

7. A misconception about evolution is that organisms have gotten better, more advanced, or more complex. Discuss why this is a misconception, using at least one example in your rebuttal.

8. *Rhagoletis pomonella* is a fly that is native to North America. Its normal host is the hawthorn tree, but sometime during the nineteenth century it began to infest apple trees. There appear to be differences in host preferences among populations. Offspring of females collected from one of these two hosts are more likely to select that host location for having offspring. Laboratory studies have shown an asynchrony in emergence time of adults between these two host races. Flies from apple trees take about 40 days to mature, whereas flies from hawthorn trees take 54-60 days to mature. This makes sense when we consider that hawthorn fruit tends to mature later in the season than apple trees. Hybridization studies show that host preferences are inherited, but give no evidence of barriers to mating.

A. Based on this scenario, make a prediction about the outcome of these organisms.

B. If the tree to the right represents the fate of this population A, what event occurred? Be very specific in your answer for full credit.



9. Red-Green color blindness is an X-linked trait. A woman who is a carrier and a man who does not have color blindness have three children: one child is a carrier, one child has color blindness, and the other is a normal female. Draw a pedigree of this family, indicating females (circles), males (squares), carriers and those with colorblindness. Include their genotypes in the pedigree.