Lab 20 Natural selection

Name _____ Seat number ____

Objectives:

A. Background on natural selection
B. Predator-prey simulation
C. Lab report

A. Background on natural selection

Natural selection is an important process underlying the theory of evolution as proposed by Charles Darwin and Alfred Russell Wallace. "Survival of the fittest," as the outcome of natural selection is sometimes called, is fairly easy to comprehend, especially if we think of the success in breeding dogs or horses or cattle or many kinds of plants to suit our purposes. Humans artificially select the traits they want in the population. Natural selection is sometimes harder to imagine, although it is a fairly straightforward concept. What is more difficult is an appreciation for the effects of natural selection within a population over time.

B. Predator-prey simulation

PURPOSES: The purpose of this lab is to set up a simple simulation of natural selection in a predator - prey system. Students will act as the predators and the effects can be seen, after only a few generations, of one type of predator or prey having an advantage over another; or in other words the effects of natural selection can be observed!

MATERIALS: Four colors of beans **1 point off of labs for every bean found on the ground**

PROCEDURES: Students will feed individually.

1. Work in groups of 4 (if there are 5 students , you will need 2 knives)
2. Each student will be assigned to one of four groups; which represent predators which feed using knife, spoon, fork, or 2 fingers. These variations represent genetically fixed differences in the population. All individuals have cups which represent mouths/stomachs. You may **NOT steal** from each other's cups.
3. Beans will be used to represent prey. 100 beans of each color (400 beans total) will be spread out in pans representing the habitat of these organisms. Mix the colors well (no patches of just one color beans)
4. HYPOTHESES: predict the relative success of each predator and prey; 1 =best, 4 =worst.

Predators:	**Prey**:
Knife _____	white _____
Spoon _____	speckled _____
Fork _____	black _____
2 fingers _____	black-eyed_____

5. When directed by the instructor each student (predator) will move beans (prey) to their cups (mouth/stomach). Continue "hunting" until you are told to stop.

6. The beans (prey) must be picked up with the knife, spoon, fork, or fingers (feeding apparatus) and placed in the cup (mouth/stomach), please don't really eat the beans). No scraping or pushing of the prey into the cup is allowed. You must hold the **bottom of the cup flat against the table**. You may, however, dash in and pick up any prey being pursued by another predator. Don't hesitate to intrude…any hungry natural predator would "go for it!"
7. When told to stop hunting, count and record, in the table on the next page, the number of each type of bean (prey) you captured .We will total the number of beans (prey) captured by type of feeding (predator).
8. This will allow us to see which feeding apparatus (predators) were most successful (measured by success in capturing prey) and which prey were most successful (measured by NOT being captured).
9. We will carry out this process (hunting) for four generations. **Read all of the instructions below before continuing**.
10. Predator types that capture less prey than others are not successful hunters and natural selection might remove them from the population.
    a) **After the second generations the least successful predator type will be considered extinct.**
    b) After the third generation the least successful predator (of the remaining types) will again be considered extinct.

    Students that had those feeding apparatus (became extinct) will be assigned to a successful group and will represent the offspring of the successful predator types.
11. After each period of hunting the prey remaining in the prey population (those not captured) will be doubled to represent reproduction. The additional beans of each color will be added to the remaining population in the habitat.
12. After each generation and the restructuring of the predator and prey populations, predators will again be allowed to hunt for a specified time period and the procedures will be repeated. This will be done for four generations.
13. Fill out the data table (next page) as we work through the exercise.

C. Lab report

The lab report is due at the end of the lab period. You will turn in your summary tables and **on separate sheet(s) of paper**, answer the following questions:

1. Was your hypothesis correct? Explain

2. Which **prey** variation (bean color) appears to be **best** adapted to the environment? Explain, based on your data, why that group is considered to be best adapted. Explain, in the "real world" (that is the world of beans) why this group is best adapted.

3. Which **prey** variation appears to be **least** adapted to the environment? Again, explain, based on your data, why that group is considered to be least adapted.

4. Which **predator** variation ("mouth" type) appears to be **best** adapted to feeding on this prey population? Explain, based on your data, why that group is considered to be best adapted.

5. Which **predator** variation appears to be **least** adapted to feeding on this prey population? Explain, based on your data, why that group is considered to be least adapted.

6. Write a statement explaining natural selection and how this simulation demonstrates the role of natural selection in populations, in the REAL WORLD (both predator and prey). (Expand beyond the predators and prey we used in today's lab).

Natural Selection Data Table

	Generation (Trial)	White	Speckled	Black	Black-eyed	Total
Knife	1					
	2					
	3					
	4					
Spoon	1					
	2					
	3					
	4					
Fork	1					
	2					
	3					
	4					
Two fingers	1					
	2					
	3					
	4					