BIOL 01104, Fall 2019
Natural Selection and Sexual Selection Worksheet
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Part One: Sexual Selection

1. In a species of lizards, males have a colorful neck appendage that they flare out to attract females. However, hawks who eat the lizards are also attracted to the "flared" neck appendage. Experimental data indicate that hawks, who have excellent vision, preferentially eat males whose are actively flaring their necks compared to males who are not flaring their necks.
   Which of the following statements is most likely true? *Only one statement should be selected.*

   a. Lizards living among hawks will flare their necks less frequently compared to lizards who live in hawk-free environments.
   b. Lizards living among hawks will flare their necks more frequently compared to lizards who live in hawk-free environments.
   c. Lizards who live in environments with hawks will never flare their necks, even to attract a mate.
   d. There would be no difference in the frequency of neck-flaring between these two environments.

2. Below are four scenarios where sexual selection is acting. Which of these scenario(s) describe a type of trade-off in sexual selection? *More than one answer may be selected.*

   a. Male antelopes have long horns. Females are attracted to males with long horns, but males with long horns tend to have more parasites compared to males with short horns.
   b. Male porcupines have long spikes. Females are attracted to males with longer spikes, and males with longer spikes experience less predation (as their spikes will ward off predators).
   c. Males giraffes have long necks. Females are attracted to longer necks, and longer necks allow males to eat more leaves from the tops of trees.
   d. Octopi can change their colors. Females are attracted to male octopi who have more vibrant color changes, and more vibrant color changes communicate high genetic quality. However, changing colors too frequently makes males more visible to predators.

3. Studies have shown that female gray tree frogs (Hyla versicolor) prefer males with long mating calls. Welch et al. (1998) wanted to test whether long calls advertised good genes for males. They took eggs from wild females and fertilized them with sperm from males that had either long calls or short calls. They then raised the tadpoles, some on a rich diet and some on a restricted diet, and measured them for four traits associated with fitness.

   The following table summarizes the results collected in 1995 and 1996. "LC" and "SC" refer to long- and short-calling fathers, respectively, and "NSD" refers to no significant difference between tadpoles with either kind of father. In other words, "LC" means the long call males were more fit compared to short call males, and vice versa. "NSD" means long and short calls had no difference in fitness.

	1995		1996	
Fitness measure	**High food**	**Low food**	**High food**	**Low food**
Larval growth	NSD	LC better	LC better	LC better
Time to metamorphosis	LC better	NSD	LC better	NSD
Mass at metamorphosis	NSD	LC better	NSD	NSD
Larval survival	LC better	NSD	NSD	NSD

Based on these results, which statement is most likely true? *Only one statement should be selected.*

a. A female who mates with an LC male will have offspring with higher fitness than if she had mated with an SC male.
b. There is no significant difference in fitness between the offspring of LC and SC males.
c. Offspring of SC males have higher fitness when there is little food, but not when there is a lot of food.
d. Females prefer males that have larger mass at metamorphosis.

Part Two: Natural Selection

For each scenario below, identify if natural selection is acting on the bolded trait. If natural selection is acting, identify the mode of natural selection, either: *directional*, *balancing*, or *disruptive*.

1. A species of snake has a striped coloration pattern on its back, alternating between navy blue and burgundy red, and a yellow belly. All snakes in this species have this precise, invariable **color pattern**, so offspring color patterns can be exactly known from their parents. These snakes are particularly fond of eating mice, although if all goes well, they will be able to find more nutritious chipmunks in the forest where they live.

2. A species of plant grows in a location where there is a high soil concentration of a chemical that inhibits seed production. Individuals vary in their **ability to resist the detrimental effects of the chemical** (such that greater resistance results in more seeds), and resistance is heritable.

3. A species of hummingbird feeds on the nectar of a particular plant whose flower depth varies slightly from plant to plant. **Hummingbird beak length** of parents has a very strong relationship with offspring beak length; a midparent-offspring regression reveals a slope of 0.97. In order to feed within the flower, the birds' beaks must be long enough to reach pollen, but longer beaks are also heavier and make flying more costly in terms of energy.

4. Males of a species of fish have two mating strategies. Some engage in aggressive conflicts with other males, where success results in access to females. Other males avoid conflict and attempt to sneak into nests and fertilize a female's eggs while other males are not around. **Body size** is a heritable trait that varies among individuals. Larger males tend to be more successful in aggressive conflicts, whereas smaller males are better at hiding and darting into unguarded nests. Medium size males tend to be poor fighters and bad hiders.

5. Males in another closely-related species of fish to #4 show the same variation in mating strategies. In this other species, however, **the body size** of parents cannot strongly predict the body size of their children. A midparent-offspring regression of body size reveals a slope of 0.05, which is *not statistically different from 0*. There is still substantial variability in body size, where again larger males are generally are successful in aggressive conflicts, and smaller males are better at hiding and darting into unguarded nests.