

Preview Material - Final Exam – Spring 2002

Dr. Saltspray is interested in determining which of 4 types of algae (yellow, red, brown, and green) have been eaten by crabs. She states that the hypothesis she is testing is “members of the same species will eat the same type of algae”. After conducting her experiment, Dr. Saltspray finds that out of 10 crabs she sampled, 8 of the crabs had eaten the yellow, red, and brown algae, while the other 2 had only eaten green algae. Dr. Saltspray sends a copy of her report to you to review. In her report, she states “I have proven that these 2 green algae eating crabs are evolving into a new species”.

The early voyages to the New World took months. In the first ship, upon first leaving England, there were 20 rats on board. Life on board the ship was good for the rats. There were no cats or dogs on this particular ship and the grain to start the new colony was stored in the hold. When the ship arrived in New England 12 months later, there were 60 rats that colonized the new world along with the pilgrims.

When the first colony of brown rats ($N = 60$) arrived in New England, they did not find conditions in their new surroundings as cushy as it had been on board the ship. There was still food around if one knew how to find it, but there were also foxes and owls that began to reduce their numbers and they were exposed to diseases carried by fleas and ticks on the local rodents. As a result, the colony’s numbers would be limited to 500.

Your lab’s new terrarium is inhabited by lush green ferns, bluebottle flies, several small frogs and a pair of large king snakes. This reflects the order of the terrarium’s food chain (*i.e.* ferns eaten by flies who are eaten by frogs who are eaten by snakes). A miniature pond also exists within the terrarium that is inhabited by a large variety of microorganisms, including photosynthetic green algae, *Daphnia* (water fleas) and many bacterial species.

The terrarium’s miniature pond functions as a latrine (outhouse) for the frog population. After several weeks, you notice that the pond becomes a rich green color as the algae population expands rapidly and the water flea and aerobic bacterial populations decline.

After several generations of frogs, you notice that a small portion of the frog population is no longer eaten by the king snakes. A chemical analysis of one of these frogs reveals a secreted toxin that makes the frog unpalatable (inedible) to the snake.

When frightened, the frogs often secrete a repellent skin toxin. Microscopic analysis of the secretory cells reveals that they are not spherical, but elongated tongue-shaped cells.

In the cichlid fish, *Cyathopharynx furcifer*, males form leks (areas of courting males) similar to prairie chickens by building "bowers," large volcano-shaped structures composed of fine sand, over which the male courts potential mates. Females visit the lek and examine potential mates.

Male Territory size	# males that successfully attract mates	# males that do not attract mates
1 m	23	22
5 m	50	51
10 m	10	10

Difference in fin lengths in pairs of pelvic fins	# males that successfully attract mates	# males that do not attract mates
0 mm	50	1
2 mm	8	23
4 mm	1	16

Not all color-blindness is X-linked. Tritanopia is a rare form of color-blindness in which the affected person cannot distinguish shades of blue. The gene for this condition is found on Chromosome 7.

Tritan gene sequence	Blue visual pigment production	Ability to distinguish blue wavelengths	Number of alleles needed to show effect
TTT TAA AAT	yes	yes	2
TTT CAA AAT	no	no	1 or 2

Neurons do not have receptors to detect bacteria or viruses, yet the presence of these microorganisms can cause profound changes in behavior that result in wasting away or anorexia. Because the immune system has receptors capable of detecting bacteria and viruses, researchers have begun to examine how the immune system might transmit messages to the brain. Recent work has shown that a chemical (TNF α) released by white blood cells affects fat cells.

A farmer starts a field of alfalfa from seeds. The seeds will germinate and develop into mature plants that will be used to feed chickens that in turn are eaten by humans. In order to increase the crop the farmer takes two actions: addition of fertilizers to the soil (the fertilizer contains nitrogen and phosphorus) spraying the plants with a pesticide (long lasting, non-biodegradable) that kills insects that eat the alfalfa leaves.

The spotted salamander (an amphibian) can be found laying its eggs in small pools during the springtime in many areas of the United States. Prior to laying her eggs the female fertilizes them by selecting packets of sperm left behind by males. She retains the fertilized eggs for about a week before she deposits them on a sturdy twig beneath the water's surface where the eggs hang together in a gelatinous mass. If the pool gets enough sunlight, algae will form on the egg mass. The gelatinous substance surrounding the eggs provides an excellent medium for the single-celled plants to attach and grow. In turn the algae transmit oxygen to the salamander embryos, ensuring robust development and increased chances of survival. Once the eggs hatch the young search for food and remain in the ponds until they complete metamorphoses and leave the pool.