

Use a #2 pencil to fill in the information on your NCS answer sheet. Put your **O-Key Account Username** in the boxes indicated for **LAST NAME** and darken the appropriate circles. **Write your Name (Last, First)** and **“Star”** in the space above the boxes containing your **O-Key Account Username**. Darken the (S) in the **last column of the name circles**. Enter the number **912** and **darken the corresponding circles** in the **first 3 columns** of the **“Student ID.”** Failure to perform this correctly will incur a **-10pt handling fee**. Read all questions and answers **carefully** before choosing the **single BEST response** for each question. Feel free to ask the instructor for clarification.

Fugu, Japanese for prepared puffer fish, is known as “the world’s most dangerous meal”. Many puffer fish, as well as the blue-ringed octopus and the xanthid crab, contain tetrodotoxin (TTX). This toxin accumulates in the puffer fish’s intestinal tract (gut) and ovaries. One milligram (1 mg) of tetrodotoxin can kill an adult human. TTX is a powerful blocker of the sodium ion (Na^+) channels in the membranes of neurons. Scientists at the FDA hypothesized that puffer fish (and other species that contain TTX) do not synthesize this toxin themselves but actually obtain it from symbiotic bacteria from the genus *Alteromas*. In fact, FDA scientists were able to raise puffer fish that did not contain any TTX!

When threatened, the puffer fish also will inflate by swallowing water or air rapidly, enlarging itself while displaying spiked scales—a scene that has frightened many predators and fishermen.

The FDA scientists have hypothesized that puffer fish associated with TTX-producing bacteria experience less predation than fish without those bacteria. The bacteria also receive abundant nutrients while inside the fish gut.

Puffer fish are adapted to brackish estuarine waters where the salt content of their external skin cells is equal to that of the estuary.

FDA scientists decided to test the hypothesis that “TTX secretion in puffer fish occurs because fish acquire *Alteromas* from their food”. Worms and squid that are infected by *Alteromas* bacteria were available as were worms that were uninfected. After the experiment, all of the puffer fish were tested for TTX secretion.

During a tsunami, a small sub-population of a puffer fish species are separated from the parent population and are swept into a lagoon with abundant food and few predators. This lagoon population has 75% red puffer fish whereas the parent population had only 30% red puffer fish.

Some species of algae—photosynthetic, unicellular, eukaryotic protists—also hitch a ride on the external gills of puffer fish.

Phyllobates is a genus of poison dart frogs native to South America. The genus *Phyllobates* contains two species, which are the most poisonous species of frogs in the world, the Golden Poison Frog (*Phyllobates terribilis*) and the Black-legged Dart Frog (*Phyllobates bicolor*). They are typical of the poison dart frogs, in that all species are colorful and are active during the day. *Phyllobates* species are used by native Columbian Choco Indians of the Amazon rainforests as sources of poison for their hunting darts. The toxin emitted from the skin of both of these frogs is Batrachotoxin.

Batrachotoxin act directly on sodium ion channels in neurons, to keep them open. The sodium channels of *Phyllobates* species are insensitive to the action of batrachotoxin.

Dart frogs do not make their poisons, but store the chemicals from prey items, such as ants and mites. Because of this, captive-bred animals do not contain significant levels of toxins.

In Colombia 1,000's of Golden Poison Frogs live in the forest. However, during a flood 50 Golden Poison Frog get stranded on a newly created forest island.

After many years scientists noticed that the descendents of the island founder population of Golden Poison Frog are green in color and not yellow. Additionally scientists discover a snake on the island that eats frogs and is resistant to Batrachotoxin.

In the tadpole stage frogs and toads are very vulnerable to predators and it is advantageous for tadpoles to metamorphose as quickly as possible. The tadpoles of Golden Poison Frogs have a pinworm that lives in their intestines. The pinworm is specific to tadpoles of the Golden Poison Frog, and the tadpoles' intestines provide food and a safe environment for the pinworm to reproduce. Tadpoles that are infected with pinworms have more surface area in their intestines, and as a result grow quicker and metamorphose faster than uninfected tadpoles, resulting in higher fitness.

Azaleas are green flowering plants that are pollinated by bees. A small bee that can pollinate azaleas is discovered in a region for the first time. The scientists identify the bee as commonly occurring in another region that is 1000 miles away. They hypothesize that the bee is present because a few individuals were carried in by a very large storm just a week earlier.

A scientist hypothesizes that some azalea plants have more flowers because the plant is growing in soil that has high nitrogen content (an essential plant nutrient). To test the prediction, the scientist randomly selects 100 azalea plants and measures the nitrogen in the soil near their roots and counts the number of flowers on the plant.

BOTOX is a treatment that can help remove wrinkles making the patient look younger. In this treatment, one of the most toxic substances known to man is injected into the patient. The toxin, produced by a bacteria *Clostridium botulinum* and the agent that is responsible for the severe food poisoning known as botulism, prevents the exocytosis of acetylcholine.

An Oklahoma gardener built a greenhouse using a see through plastic material that filters out only green light. The gardener finds some weeds growing among his plants. He sprays them with atrazine, an herbicide that blocks the electron transport chain in Photosystem II. The treatment was only strong enough to partially slow down the electron transport chain.

Drs. Braby and Truman have traced the evolutionary history of the family of butterflies called the Pieridae using molecular techniques (patterns of mutations) and proposed that the family started with a single species feeding on plants of the Fabaceae family and that through repeated colonizations, the species rapidly evolved into many different species that have adaptations allowing them to feed on plants in several other plant families.