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BIOL 1114 Exam #2 (Star Form) March 7, 2016

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**" or **"NoStar" in the space above the boxes containing your O-Key Account Username**. Darken the **(S)** or **(N)** in the **last column of the name circles**. Enter the number **1612** and **darken the corresponding circles** in the **first 4 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.

The electric eel (*Electrophorus electricus*) is one of nature's most unusual aquatic predators. An inhabitant of South American freshwaters, the electric eel obtains most of its prey by generating an electric discharge of up to 600 volts, enough to kill its prey, deter predators or stun a human. Its three electrical generation organs are "bio-batteries" consisting of stacks of specialized muscle cells called electrocytes, which are controlled by signals from neurons across synapses. The electric eel expels CO2 through gills but obtains its oxygen by gulping air at the surface. A rich supply of blood vessels within the mouth take up the oxygen by diffusion. Biochemists have found the electric eel to be an abundant source of ATP and acetylcholine for their research. Physiologists have reported that, just before an electric discharge from an eel, the electrocytes undergo a massive flow of ions into these cells. The electric eel is not a true eel. Most aquatic biologists believe it is more closely related to catfish. Because their mouths are specialized to gulp, electric eels survive well in waters with low levels of dissolved oxygen.

An electric eel at the National Aquarium is discharging electrical shocks too frequently from its electrocytes, and its normal muscles are contracting rapidly enough to create spasms. A veterinarian is called in and recommends injections

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Alex, an aspiring aquatic biologist, recently installed a large pond. Initially, the pond lacked fish so Alex decided to stock it with a few bluegill and largemouth bass that were randomly collected from a much larger population at a nearby fishery.

The next year, Alex decided to begin fishing from the pond. On most days, Alex would catch and release the fish; however, one afternoon Alex decided to keep several bass for dinner. As Alex cleaned the fish, Alex realized that they were infected with parasites. Most people would have been disgusted by the parasites, but as a biologist, Alex recognized the biological beauty of these animals. Alex noticed that hooks used by some parasites to attach to the fish were a perfect match for the shape and size of the fish's intestinal cells. The parasites that had hooks of similar size to the fish's cells were most difficult to remove from the fish (which benefits the parasites). The parasites with hooks that match the shape of their host's intestinal cells are able to survive longer in the guts of their hosts. Parasites and their hosts are often thought to co-evolve. Alex's spouse was disgusted by the idea of eating fish infected with parasites. While Alex was in the lab doing research, Alex's spouse decided to treat the fish in the pond by pouring insecticide that mimicked acetylcholine into the pond water to kill the parasites.

Alex decided to create a second pond. Although both ponds have the same number of fish, pond 2 is about twice the size of pond 1. In pond 1 the aquatic plants are primarily green, and in pond 2 the aquatic plants are primarily brown. These plants are used by the fish to hide from fish-eating mammals and birds.Alex wants to increase the diversity of fishes in the ponds by adding marine clownfish. After releasing the clownfish into the ponds, Alex remembers the ponds are freshwater and have 60% less salt content than the clownfish.

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Whenever exocytosis occurs, there is more membrane added to the cell membrane. This is typically counterbalanced by endocytosis, e.g. when neurotransmitters or the products of their degradation are taken back into the cell, a process called reuptake. Arguably among the world's most deadly toxins is taipoxin, a component of the venom of a snake called the Australian taipan, *Oxyuranus scutellatus*. Taipoxin appears to interfere with the processing of the membrane at the neuromuscular junction. Victims of taipan bites die of respiratory paralysis (stop breathing). So far, the toxin's effects have been irreversible. While trying to escape from a taipan, a mouse would run away by sending a signal to its leg muscles.

Daphne Major of the Galapagos Archipelago is a small island that harbors the medium ground finch *Geospiza fortis*. This species is composed of individuals with variable beak sizes, such as small, medium and large. Individuals with small beak eat small seeds, medium beak sized individuals eat medium sized seeds and large beak birds would eat large seeds. Data from 1976 (Is citation necessary here?) estimated a population of 1200 individuals approximately. During the year of 1977 a terrible and long drought happened that reduced the population of *Geospiza fortis* down to 200 individuals. The drought eliminated small and medium sized seeds.

Rhododendron are highly toxic plants, and may be fatal if eaten. Symptoms from ingestion include over-salivation, watering of eyes and nose, abdominal pain, loss of energy, depression, nausea and vomiting, diarrhea, weakness, difficulty breathing, progressive paralysis of arms and legs and coma, usually leading to death. Andromedotoxin is the toxin that underlies such adverse symptoms. The precise mechanism by which andromedotoxin affects the nervous system is not known. A student designs an experiment to learn how it works in Azaleas, a group of species in the genus *Rhododendron*. She exposes mice to varying levels of the toxin and measures the number of action potentials in a neuron. The student does not find any changes in the functioning of the sodium and potassium gates, as well as the Na-K pump.

To get azaleas for her experiments, the student plants the seeds, which weigh about 2mg and grows them into large bushes weighing upwards of 100 kg. About half of this mass is carbon. The azalea bushes have green leaves, but some have flowers that appear red under visible light. The student decides to see what would happen if she grew them in a room lit by a bulb emitting all visible wavelengths **except** red. She compares their rate of photosynthesis to another bush grown under white light.

After growing these beautiful flowers, she cuts them and presents them to her mother. The Azaleas contain about 1% salts solution in the cells in their stems. Mom places them in a vase filled with a solution of water with some sodium. After 1 hour she noticed that the beautiful azaleas are completely wilted.