BIOL1114, February 7, 2005

Exam #1

Use a #2 pencil to fill in the information on your NCS answer sheet including the appropriate circles. Write [the form name] above your name in the margin of your NCS answer sheet. Read all questions and answers carefully before choosing the single BEST response for each question. Feel free to ask the instructor for clarification.

Fungal spores are small, spherical, metabolically inactive cells that enable fungi to survive harsh environmental conditions such as cold temperatures and low humidity. Long, thin flattened cells called hyphae develop from fungal spores when temperature and moisture conditions are suitable for germination (growth). Both water and warm ambient temperature (25^{o}-27^{o}C) are necessary for spores to germinate. Water diffuses into the spore to initiate growth.

Fungal spores of the lethal Asian Soybean Rust were introduced into the southern U.S from South America by hurricanes. No soybean varieties planted in the U.S. are resistant to the fungus. Both the fungus and the soybean plant are poikilotherms. If the fungus becomes firmly established in the southern states where there is an early planting season, massive numbers of spores could be blown by wind into the midwestern U.S. This could lead to destruction of most of the American soybean crop.

A team of scientists was interested in the effect of wind speed on the northward dispersal of the spores from the U.S. Gulf Coast. Using data from sampling stations throughout the Southeast, the scientists could pinpoint to the day when the spores had reached a particular sampling station. Weather stations throughout the region provided data on average wind speed and direction. To test their hypothesis that the spores dispersed a greater distance northward on strong versus weak south winds, the scientists plotted southerly wind speed against distance dispersed for 10 days. After 10 days, the spores had dispersed 96 kilometers (km) northward. The data look like this:

Day	Wind speed (km/h)	Distance dispersed (km)
1	5	2
2	2	0
3	20	18
4	25	22
5	12	10
6	0	0
7	6	3
8	15	12
9	30	28
10	5	1

Scientists predict that rust resistant varieties of soybean plants will not be available for another 7-8 years. They recommended treating soybean crops with 3 different but costly fungicides. Fungicides are known to disrupt plasma membranes and make them leaky to protons (H^{+}).

Minnesota schoolchildren went on a science field trip and discovered that many of the young frogs they found suffered from deformities such as missing, extra, or misshapen limbs. They reported their findings to local authorities who verified these findings, triggering a nationwide expansion of the study. Deformed

frogs, toads, and salamanders were found in 42 states in the U.S. and sites in Canada. Investigations were initiated to determine the cause.

Pieter Johnson, an undergraduate student at Stanford, conducted one study in California. He found severe deformities in Pacific tree frogs from 35 surveyed ponds in California. Johnson decided to focus his investigations on 4 of the 35 ponds. He questioned whether the deformities were due to pollutants or caused by parasites of the frogs. The pond waters were tested for pollutants and pesticides; heavy metals and other pollutants were not detected. While surveying the ponds, a particular type of snail was found to inhabit all four ponds. Snails can serve as the first of three hosts used by a parasitic flatworm called a trematode. Frogs are frequently the second or third host used by these parasitic flatworms in their cycle of development and maturation. Johnson decided to dissect some of the affected frogs and found immature trematodes (larvae) clustered around the malformations in the frogs. While the trematodes do cause injury to the frogs, the frogs do survive, thus this is classified as a parasitic relationship. To determine whether trematodes caused the deformities, he then collected frog eggs from ponds that did not contain deformed frogs and later exposed the tadpoles that hatched to various concentrations of trematode larvae collected from snails from the four ponds of his study site. One group of tadpoles was not exposed to the trematode larvae. He found no trematodes or deformities in the unexposed group of tadpoles, a high incidence of deformities associated with the presence of trematodes in the exposed tadpoles, and a higher number of deformities with increasing concentrations of larvae. Johnson's work was published in the journal, *Science*.

In just a few weeks, millions of migratory songbirds will begin to experience physiological and behavioral changes that will prepare them for the northward spring migration from wintering areas in Central America and the Caribbean to breeding areas in the U.S. and Canada. Among other changes, they will increase the rate at which they feed so that they can accumulate fat to fuel their journey.

The most difficult part of the journey northward is the non-stop flight across the Gulf of Mexico from the Yucatan Peninsula to the U.S. Gulf Coast. Small songbirds (e.g. 9g Black-throated Green Warbler to 14g Worm-eating Warbler) take off from the Yucatan in the early evening and fly through the night and next morning to finally make landfall sometime in the afternoon. During the roughly 18-hour flight in which they beat their wings several times a second to stay aloft, the birds cannot eat, drink, or land. Songbirds build up a lot of heat while flapping their wings so rapidly during migration. Birds cannot sweat; a flying bird cools itself through breathing.

Some migrating birds, especially large species like geese and pelicans, fly at altitudes much higher than they need to in order to avoid obstacles on the ground. If birds fly too high, they may reach an altitude at which oxygen is limited and their respiratory rate falls below their energy demand for flight.

A 9,000-kg elephant can get mighty warm by mid-day under the hot sun during the East African dry season. African elephants cool off by wallowing in water or mud. When there is no water hole nearby, they cool themselves by fanning their large ears back and forth.

The recent concerns over the possible harmful affects of Vioxx, including heart attacks and strokes, were "based on new, three-year data from a … randomized, placebo-controlled, clinical trial (http://www.vioxx.com/rofecoxib/vioxx/consumer/index.jsp)." The placebo probably consisted of a pill similar in shape, size, color, texture, etc. to Vioxx without the active ingredient, rofecoxib.