# Biology 1114

## Preview Material for Exam 4 - Spring 2003

During their camping trip to New Mexico, Wanda and Louise became very interested in coyote biology - particularly what type of parasites are found in coyotes. The wildlife biologist had mentioned that during the past few years, parasite infections had slowed the growth rate of the coyote population in the park. They learned that one common parasite found in coyotes as well as domestic dogs is the dog tapeworm (*Dipylidium caninum*). The adult tapeworm lives in the animal's intestines where it attaches to the intestinal wall and feeds. The tapeworm sheds segments off of its tail end and these contain as many as 30 eggs/segment. These egg-laden segments are shed in the animal's feces. Fleas (an ectotherm) will often feed on the eggs, which will then hatch into larvae inside the flea. If a coyote swallows a flea that is infected with the larval tapeworms, the larva will be liberated and grow into an adult tapeworm inside the coyote thus completing the cycle.

A fig wasp population on Malta, a lovely and majestic island in the Mediterranean Sea, seventy miles from Sicily, would be a population derived from the surrounding Mainland population. The conditions (including food supply, predators, etc.) on Malta are essentially the same as those in Sicily and much of the surrounding land. Seasonal changes in wind patterns aid the continual migration of fig wasps back and forth between the Maltese and Mainland populations.

Before the start of Gulf War II, Marine Chief Warrant Officer Stacy Jeambert came up with a plan entitled Operation KFC or "Kuwaiti Field Chicken." The plan is simple – place individual chickens (Poultry Chemical Confirmation Devices -- PCCDs) in cages on top of Hum-Vees (a vehicle). Soldiers then monitor the chickens and if a chicken dies, the soldiers put on their protective suits. The chemical-warfare agents of concern are similar to Vx and Sarin gasses, which are **acetylcholinesterase inhibitors**.

During Gulf War I, Jeambert obtained 5 chickens for this purpose. For Gulf War II he "drafted" 250, which were on their way to dinner (for Kuwaiti citizens). Jeambert built a chicken coop for them with the intention of keeping them healthy and fattening them up.

A scientist is called in to help with the production of fat chickens. She finds that there are two distinct forms of chickens. A **NORMAL**, thin type that can be fattened through diet and lack of exercise and an overweight type (**FAT**) that is lethargic (does not move much), eats constantly, and appears to store fat all the time.

Roundup is a general purpose herbicide, used for decades, that kills plants by interfering with their ability to synthesize certain amino acids (tyrosine, phenylalanine, tryptophan) from the carbon chains produced in chloroplasts. The active ingredient in Roundup (glyphosate) inhibits one essential enzyme (EPSPS) in the amino acid synthesis pathway present in plants, bacteria and fungi. If Roundup-treated organisms cannot supply amino acids for protein synthesis, they die. Roundup does not affect animal growth or development because animals do not synthesize these particular amino acids, they must acquire them from food.

In recent years, a strain of soil bacterium, *Agrobacterium tumefaciens* strain CP4, was discovered to have Roundup-resistance. In other words, it is a mutant strain of a common bacterium found in agricultural fields that synthesizes a version of EPSPS that is not inhibited by Roundup (glyphosate). Plant molecular biologists have since inserted the mutant CP4 version of the EPSPS gene directly into soybean chloroplasts, thus genetically engineering a Roundup-resistant form of soybeans (*Glycine max*).

The advantage of Roundup-resistant soybeans or any other similarly genetically modified crop is that a farmer can spray one herbicide to kill all weeds in the field without hurting the soybean crop itself.

Soybeans and other legumes have developed symbiotic relationships with *Rhizobium* spp. (a nitrogen-fixing bacterium). Plants provide a ready source of glucose for the bacteria, which live in specially created root nodules, and bacteria provide a ready source of ammonium and nitrate for the plants. Both species benefit.

In 1967 a group of researchers measured DDT (a non-degradable pesticide) concentrations in the organisms found in an estuary on the south shore of Long Island, New York. Some concentration levels were below the lethal thresholds, but others were enough to interfere with reproductive success.

| **Organism** | **DDT concentration in parts per million** |
|---|---|
| Summer flounder | 1.28 |
| Mud snail | 0.26 |
| Green alga | 0.083 |
| Green heron | 3.57 |
| Herring gull | 18.5 |

Alfalfa plants are grown in fields and their shoots are used to feed chickens. An educated farmer wants to study the effect of a fertilizer that contains phosphate on the development of the alfalfa plants in order to increase the yield. He divides a field into small plots and adds different amounts of the fertilizer to different plots. In a control plot he adds no fertilizer. After a few weeks he harvests and weighs the alfalfa in each plot. To prevent damage by insects he sprays the plants with an insecticide that concentrates in living tissue. The insecticide is effective and kills most of the insects.