Preview Material for Exam 3 Spring 2002

An OSU graduate student (Stella Luna) is studying the genetic relatedness of the members of a population of Ozark Big-eared bats in a cave in eastern Oklahoma. These bats spend the day inside the cave and leave at dusk to forage for insects and drink water from a nearby stream. During the winter months, both sexes can be found in the same cave (hibernaculum), however, in June, the females group together in maternity caves where they give birth to their young and stay with them until they are weaned. By the end of November, they rejoin the males in the hibernaculum. Over a period of 3 years, Stella has netted all the bats in a particular hibernaculum and taken small pieces of skin from the wing membranes using a device similar to a hole punch for paper. She will be able to obtain DNA from the wing samples and a comparison of certain regions of the DNA will be used in her genetic analyses. At the end of the first year of her study Stella found a total of 60 bats in the hibernaculum. During the second year of her study she recorded 26 births and 20 deaths. Stella also calculated the area of the hibernaculum as 100 cubic meters.

Congenital Generalized Hypertrichosis (CGH) is an **X-linked <u>dominant</u> trait** that results in excess facial and upper body hair that covers extensive areas of skin.

Dr. Marley, an instructor of Biology 1114, has been reading about various diseases that affect equines (horses, zebras, etc.) because he recently acquired a horse named Sassie. There are three types of Equine Encephalomyelitis - Eastern, Western, and Venezuelan. The virus that results in Eastern Equine Encephalomyelitis (EEE) is carried by small birds (primarily house sparrows and house finches) in North America. The virus apparently does not harm the birds. The EEE virus can be transmitted to humans or horses by mosquitoes that feed on birds and then horses and humans. This infection results in an inflammation of the brain and the spinal cord. The virus has been isolated and a vaccine for prevention of the disease has been produced. Veterinarians highly recommend that you vaccinate horses against this potentially lethal disease.

In a recent article published in the **Journal of Medical Entomology**, a group of scientists in Massachusetts were interested in determining the effect of the EEE virus on the survivorship of three different species of mosquitoes. Female mosquitoes were allowed to feed on anesthetized chicks that were infected with EEE. Mosquitoes were then placed in cardboard containers covered with netting, provided corn syrup as a food source, and monitored twice a day for a period of 2 weeks. Infection with EEE significantly reduced survival in one species of mosquito.
The Eastern and Western forms of encephalomyelitis are not transmitted directly from horse to horse. However, the Venezuelan virus is contagious. Not only is it spread by mosquitoes from birds to other horses, but also it spreads from horse to horse when they rub noses, or share water and feed containers.

Another concern of horse owners is botulism. It is caused by toxins produced by the bacteria known as *Clostridium botulinum*. *C. botulinum* is an **anaerobic prokaryote** that lives in oxygen free pockets of soil. The bacteria are also capable of becoming inactive and forming spores that can survive in the presence of oxygen. Spores are sometimes found in the soil and on decaying plant or animal matter and can be ingested when horses feed on dirty hay or eat in dirty feeding locations. Once ingested the *C. botulinum* becomes active and produces a powerful toxin that enters the blood stream

and eventually moves into the **presynaptic axon terminals** that synapse with muscles. The major feature of botulism is muscle weakness or paralysis. Botulism can also occur when deep puncture wounds are contaminated with *Clostridium botulinum.*

While the research on the biological basis of human behavior still has most of the story to unravel, interesting progress has been made in understanding the genes that affect behavior through effects on reception of neurotransmitters. One line of research is on the D4DR gene which appears to affect the probability that a person will be a high novelty seeker or a low novelty seeker (Note there are many other genes involved and the overall effect is highly affected by environment and experience). When sequenced, the gene appears in two forms - one much longer than the other. The gene codes for the receptor for the neurotransmitter dopamine, which is released from axon bulbs in the *nucleus accumbens*, the "pleasure center" of the brain. The longer form of the gene results in a receptor on the dendrite that is **less** able to bind with the dopamine. People with one or two long-forms of the gene are more likely to seek stimuli that stimulate dopamine release because they are less stimulated by dopamine than those with two short-forms of the gene.