

Preview Material Exam 2 Spring 2005

An isolated island of volcanic origin supports a simple community with just four conspicuous species: a sunflower, a beetle, a spider, and a small bird that usually eats spiders and beetles, but occasionally takes some sunflower seeds.

Imagine that many individuals (healthy males and females) from the mainland (ancestral) bird population arrive on the island one day, blown far out to sea from a powerful hurricane hitting the mainland. By pure random chance, the colonizing individuals have slightly thicker bills than the existing island population, and tend to spend more time eating sunflower seeds. The two groups cannot co-exist indefinitely eating the same food, in the same habitat.

It's March Madness, and the Cowboys have made it into the final game of the NCAA championship against the surprise upstarts of the tournament, Evil State University (ESU). The nefarious Dr. Evil is out to sabotage the Cowboys in this final game, and he has developed a fast-acting neurotoxin that paralyzes human arms for several minutes. His henchmen (disguised as ESU cheerleaders) have been using little straws to shoot tiny poison darts at the Cowboys throughout game, secretly. As a result, the Pokes are shooting terribly, and in the final seconds of the game, are losing 33-32. With just 5 seconds to go, John Lucas sprints down the court to shoot one of his characteristic running jump shots, but he is hit with a dart on the way up: his arm falls limp and he misses the shot. But wait! He was fouled! A time out is called with 1 second left on the clock. After the time out, John will have the opportunity to sink two free throws that will win the game. But what can he do? How can he possibly hit the shots with his arms paralyzed?

Moments before returning to the court, International Man of Mystery Austin Powers rips off his Pistol Pete costume, throws the giant head to the floor and says, "Like, stop the game, Baby! This is all a plot from Dr. Evil!" Austin then rushes to John Lucas and gives him an antidote before chasing after Dr. Evil out of the venue. John's arms are restored, play resumes, and he sinks both free throws. The Pokes win thanks to Austin Powers! Say, what was in that antidote anyway?

Ruminants are mammals that have stomachs divided into multiple compartments (3-4) that churn and process the large amount of plant material they eat. Plants contain cellulose, a complex carbohydrate, in their cell walls. Ruminants by themselves cannot digest cellulose. The rumen of ruminants harbor simple, single-celled organisms called protozoa. These protozoans are able to digest cellulose and convert it into energy that is used to synthesize other organic compounds such as proteins. Both the ruminant and the protozoa benefit from this relationship.

Tubers of cassava (*Manihot esculenta*) are an important food in human nutrition in tropical Africa. The tubers contain mainly starch. Cassava is a successful crop because the tubers are resistant to insects. The tubers contain high levels of cyanide (hydrocyanic acid), which is toxic to humans and other animals. Cyanide is quickly absorbed from the gastrointestinal tract and acts to bind and disable the last protein in the electron transport chain in the mitochondria. Thus, cyanide is lethal because it shuts down the electron transport chain in cellular respiration. Cyanide can be eliminated from food made from cassava by removing the outside parts that contain the highest levels of cyanide and by long cooking at high temperature during which the cyanide evaporates.

Dr. Dolph Schluter, one of Peter Grant's former students, has been studying three-spined sticklebacks in lakes in British Columbia. The marine ancestors of these freshwater fish were probably isolated in these lakes at the end of the last ice age. What he has found is that there are two types: a large bottom-dwelling type with a large mouth that feeds on large prey, and a smaller surface-dwelling type with a smaller mouth that feeds on the small plankton in open water. Genetic evidence indicates that these two types of sticklebacks are more closely related to each other than they are to any other stickleback species.