BIRD MONOGAMY

Research Area: Ecological Genetics

Background: The breeding behavior of animals can often provide a unique perspective about the overall ecology of the species. How mates are chosen and how family groups are organized are primary factors in shaping intraspecies interactions. The defense of territories, juvenile dispersal patterns, home range size, parental care, and group social structures are all examples of ecological factors that are directly linked to breeding behavior. The variation in mating behavior among species is remarkable. Patterns range from opportunistic meetings of solitary individuals such as gopher tortoises, through highly structure breeding groups as in white-tailed deer harems or prairie-dog coteries, to life-long bonded pairs as in the California deer mouse. Monogamy, considered the simplest mating system, occurs when two individuals pair exclusively and produce offspring together over a long period of time. The pair bonds of some monogamous species are such that they literally pair for life. Other species practice “serial” monogamy with strong bonds forming for the length of one or two breeding seasons or until the death on one of the pair. Monogamous breeding systems have long received attention from ecologists. Information from the behavior of monogamous species is used to define and characterize more complex systems. In a sense, monogamy serves as the “null” hypothesis for the scientific study of breeding behavior. Monogamy is, however, interesting in its own right. Dual parental care, where both parents contribute significantly to rearing of offspring, is rare in most breeding systems except monogamy. The tight pair-bonding associated with monogamy apparently facilitates cooperation among parents. Monogamy also has the consequence of dramatically increasing the importance of mate selection. If an animal is choosing a mate for life, the choice must be a good one. Because of this importance to the survival of a species, the ecology of mate choice has been a focal point in behavioral biology. The extremes that individuals will go to select a good mate or to be selected are well documented. In some species, these activities are so important that they drive an entire subcategory of natural selection, termed *Sexual Selection*. Since the time of Darwin, avian species have served as the models for the study of mate choice and sexual selection. The evolution of body color, feather length, display patterns and mating flights have all, at one time or another, been attributed to sexual selection. Underlying these theories is the widely held belief that most species of birds are strongly monogamous. The validity of this assumption has often been questioned. Birds certainly form strong pairs but opportunities for extra-pair matings are constantly present and no one knows at what actual frequency they occur.

Our research group was recently approached by a graduate student interested in studying mate choice. She had begun a pilot study with two breeding pairs of cardinals. From her observational data, she was sure that the birds were functioning as pairs but she was concerned that several lone males that frequented the area may

have fathered some of the offspring. To address this question she collected blood from the two females and membranes from three egg shells in each nest.

Information and Data:

Being the newest member of our lab group, you are being given the opportunity to learn some new techniques and to demonstrate your mastery of basic Mendelian principles. The primary question being asked is, did more than one male contribute to the offspring in a single nest?

- You are provided with DNA samples from two female cardinals
- You are also given DNA samples from 6 egg membranes. Three of the eggs are known to have come from each female.
- Your laboratory has the capability to determine genotypes at six microsatellite loci. All of the loci exhibit co-dominant modes of inheritance. Some of the locus will be informative, some may not. You may use as many or as few loci as you feel are necessary.

Assignment:

1. Use the *ELS* program to collect genotype data from each of the 8 samples. Be sure to carefully record the sample identification information on the **Electrophoresis Loading Sheets** and the genotypes on the **Genotyping Data Sheet.** Your data set is called *Monogamy (Bird) Data.*

2. Before examining the data, propose a hypothesis for one possible outcome of your investigation. Based on this hypothesis, state a prediction and an alternative that will allow you to answer the investigator's question.

Hypothesis:

Prediction 1:

Alternative:

3. Based on your hypothesis, write down your best guess at which eggs belong in which nest. Use a pedigree chart if you would like and are able.

4. Examine the genotype data from each nest. For each nest, do the data support monogamy? If not, how many different males do you believe were involved? Can you refute either your prediction or the alternative? Carefully consider the logic that you use. Remember that alleles that can exclude samples are more "powerful" than those that are shared.

5. Return to step #3. Indicate on each what the most likely genotypic pattern of male parents would be.

6. Using the word processor on your computer, write a report (see Report Format instructions) outlining your investigation, describing the results and providing your conclusions. Be sure to include careful statements about the logic that led you to your decision.

7. Submit your report and your worksheets to your TA.