One Mate or More?: Molecular Genetics in Animal Behavior

As molecular genetic techniques are becoming more widely accessible, scientists in a variety of fields are using them to answer previously unanswerable questions.

An example of the use of molecular genetics in the field of animal behavior involves the question of monogamous vs. polygamous mating systems in many species of animals that have traditionally been though to form exclusive mating pairs. Many species of bird, in particular, have long been thought to form exclusive breeding pairs, which remain monogamous unless one of the mates in the pair dies and is replaced. Whether or not this is really the case has been a difficult question to address in the field, where observations of actual matings are difficult.

With the advent of molecular genetic techniques, however, a researcher can net and take blood samples from several adult males and females in a population, and also take samples from the brood in each nest. By using protein isoenzyme analysis, a researcher can determine the paternity of the brood in each nest and discover whether all the nestlings have a single male parent or more than one.

In the following activity, assume you are researcher investigating the mating system of the lazuli bunting, a relatively common bird in Colorado. You have taken samples of blood from the three nestlings in one nest as well as a sample from the brood's mother and three males that were netted within the vicinity of the nest. One of the male's in the mate of the brood's mother. You perform protein isozyme analysis of two loci for each of these seven individuals, giving you a total of 14 samples to visualize using gel electrophoresis and staining (individual 1, locus 1; individual 1, locus 2; individual 2, locus 1; etc.). You will stain for two loci:

β-Galactosidase -- a monomer for which an individual can have one slow band, one fast band, or both the fast and slow band

and

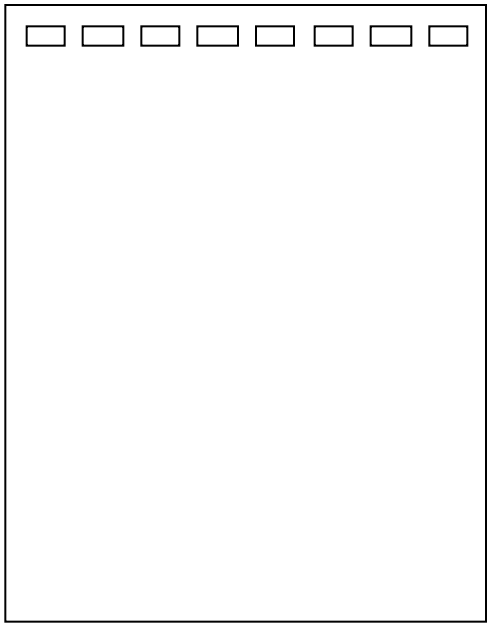
Cytosol Aminopeptidase -- also a monomer for which an individual can have one slow band, one fast band, or both the fast and slow band

- Set up two gels and gel boxes according to the instructions for "Kitchen Electrophoresis".
- Load the gels with 7 reactions in one gel and 7 in the other.

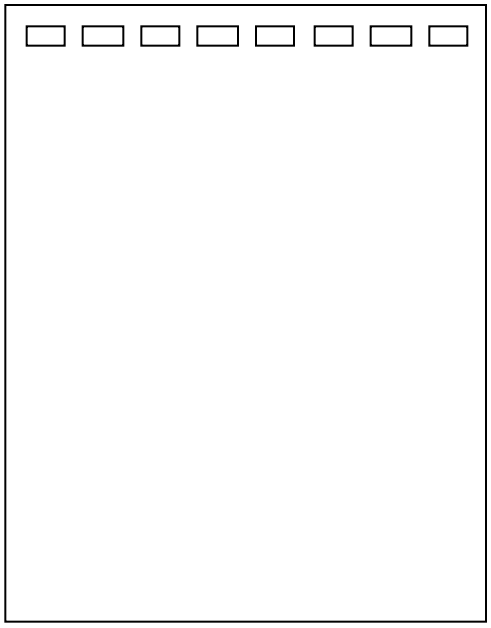
- Label your gels so that you know which sample is in each well.
- Run the gels at 100 volts for approximately 20 minutes.

Draw the results of your analysis below.

Gel 1 (β-Galactosidase)



Gel 2 (Cytosol Aminopeptidase)



Based on your analysis, does it appear that all of the nestlings in this brood share the same father, or do they have different fathers?

Which male is the father of individual N1? N2? N3?