Biology 1

Lab: Who's eatin' Teddy?

Microevolution is a change in a population's alleles over a period of time. It is very difficult to detect changes that occur on the microscopic level. These changes must manifest themselves in the organisms phenotype. Since individuals do not evolve, one must keep a close eye on the individual population to detect any change in genotypic modification. Biologist have a way to help them detect such changes; it is called the **Hardly Weinberg Theorem:**

This idea was developed to determine the allele frequencies of any population. These guide lines are as follows:

The population must be very large in size
It must be isolated from other populations.(No gene flow)
No mutations
Random Mating
No natural selection

Let us take a look at a population with alleles for large and small ears. Let us use L for the dominant allele, large ears, and l for the recessive allele small ears. If we look at that population of people, we can determine the number of individuals with large and small ears. Since each group is a result of the following genotypes: LL Ll and ll, we have 3 groups of possible combinations. These alleles make up the gene pool for that trait. The Hardly Weinberg Theorem states that: $p + q = l$

p = the dominant allele
q = the recessive allele
l = the gene pool of that trait

So all the L alleles added to all the l alleles = 100% of the genes for that trait in that population

Expanded formula: $p^2 + 2pq + q^2 = l$

The p^2 = the genotype LL the $2pq$ = the genotype Ll, and the q^2 = the genotype ll

If the large ear allele has a .8 frequency in the population, the l allele must have a .2 frequency since .2 + .8 = 1. If we substitute these frequencies into the expanded formula we can determine the percent of each of the 3 phenotypes in a give population

p^2=.64 (64%), $2pq$=.32(32%), and q^2=.04 (4%) =1 (100%)

If we know the percent of the homozygous recessive organisms, we can take the square root o f the decimal value and determine the frequency. Wit he the value we can determine the frequency of the dominant allele by subtracting it from 1. So as one can see, the formula can be used if the % is given or the frequency.

Procedure:

1. Read the story and follow directions.
2. Obtain a population of bears, and record in Table 1 the number for each: the total population, the Happy Bears, and the Sad Bears.

3. Eat three Happy Bears. If you don't have three Happy Bears, then eat the number of Happy Bears you have.
4. Get a new generation form the teacher. Repeat steps two and three.
5. Repeat steps two and three for two more generations (four generations total).
6. Use the data from Table 1 to determine the genotypic frequencies of the population. Record in Table 2.
7. Construct a line graph form each genotype (AA, Aa, and aa) using the data provided in the table.

Story:

You are a bear-eating monster. There are two kinds of bears: Happy Bears and Sad Bears. You can tell the difference between them by the way they hold their hands. Happy Bears hold their hands high in the air, and Sad Bears hold their hands down low. Happy Bears taste sweet and are easy to catch. Sad Bears taste bitter, are sneaky, and hard to catch. Because of this, " eat only Happy Bears. New bears are born every year (during hibernation) and the birth rate is one new bear for every old bear left from the last year.

Data:

Table 1: Phenotypic Frequencies

Generation	Happy Bears	Sad Bears	Total Bears
1			
2			
3			
4			

Table 2: Genotypic Frequencies:

Generation	AA(p^2)	Aa (2pq)	aa (q^2)	p	q

Formulas:

$p + q = 1$ $\qquad$ $p^2 + 2pq + q^2 = 1$

Graph the frequencies of the 3 genotypes over the 4 generations. Graph on one graph.

Analysis

1. Explain which trait is not favorable?

2. Which phenotype is reduce in the population?

3. What specifically happen to each genotypic frequency form generation one to generation four?

4. What occurs when there is a change over time of the genotypic frequencies?

5. Explain what would happen if the selection pressure changed and the recessive gene was selected for?

6. What would happen if it were better to be heterozygous (Aa)? Will there be homozygous recessive bears? Explain your answer.

7. What happens to the recessive gene (a) over successive generation?

8. Explain why the recessive gene (a) does not disappear form the population.