Green Genes: a DNA Curriculum

Massachusetts 4-H Program

Activity #4: Call It Probability?

Time: 20 minutes

Introduction: Did you ever wonder what the chances were for you to have been born a boy or a girl, get your dad's hair, your mom's eyes? What is probability? What is the chance of flipping a coin and getting heads? Tails? How can you predict the possible results of a genetic cross? Let's do some experiments. (*Heterozygous means having different alleles and Homozygous means having like alleles. A dominant allele is the one which gets expressed when the alleles are Heterozygous.)*

Goals:
- Introduce probability
- Compare Heterozygous and Homozygous alleles

Group Size: Pairs preferred

Supplies:
- (2) paper lunch bags per group
- (4) marbles, chips or coins (2 or varying color) ex: (2) red chips and (2) white chips
- Pencils and paper/chart for recording (Handout B)

Teaching Tips:
- In Trial 1 you are comparing a cross between two parents who are both Homozygous for a particular allele. In bag #1 the mother is Homozygous for the Tall gene TT represented by two red chips. In bag #2 the father is Homozygous for the short gene, tt, represented by two white chips. Therefore all pairing will be Tt. Since in our scenario the Tall gene is dominant it will express itself and all offspring will be tall.
- In Trial 2 you are comparing a cross between two parents. One is Homozygous for a particular allele and the other is Heterozygous. In bag #1 the mother in Homozygous for the Tall gene TT represented by two red chips. In bag #2 the father is Heterozygous with one tall and one short allele Tt, represented by one red and one white chip. Therefore all half the pairings will be Tt and the other half TT. Since in our scenario the Tall gene is dominant it will express itself and all offspring will be tall.
- In Trial 3 you are comparing a cross between two parents who are both Heterozygous for a particular allele. In bag #1 the mother is Heterozygous for the Tall gene Tt represented by one white and one red chip. In bag #2 the father is also Heterozygous for the Tall gene, Tt, represented by one white and one red chip also. Therefore you will have a variety of pairings from TT, tt and Tt. Since in our scenario the Tall gene is dominant it will express itself the following way:
    - TT- Tall
    - Tt - Tall
    - Tt - Short

Directions:

- Optional: Start by flipping a coin 100 times and count how many heads & tails. Discuss your results.
- Next: Take two small paper bags (lunch size) and then some marbles, plastic chips or other objects you have handy. (You will need several each of two colors) Label one bag #1 for the female and the #2 for the male parent. We will start looking at some of the traits. Gregor Mendel looked at in pea plants.
- Now for each Trial (1-3) take 10 samples of potential crosses by taking one marble from each bag. Record your results and then place them back in the bag and the repeat until 10 samples are done.
- Trial 1: Place two objects of the same color in bag #1 (two red chips) and two objects of another color in bag #2 (two white chips). The red will represent the T gene for Tall that is dominant and the white will represent the t gene for short that is recessive.
- Trial 2: Place two objects of the same color in bag #1 (two red chips) and one red chip and one white chip in bag #2
- Trial 3: Place one red chip and one white chip in bag #1 and bag #2

Reflect: (The youth should be able to relate to the terms Homozygous and Heterozygous.)

- What does trial 1 represent?
- What does trial 2 represent?
- What does trial 3 represent?
- What where your findings?
- Ask if anyone is familiar with a Pugent Square.
- How does this compare to using a Pugent Square? Why?

Apply:

- How could you use this information/ process to determine the alleles of a parent? (Homozygous or Heterozygous)
- Would you need to set up an experiment for co-dominance? What about sex-linked?

CALL IT PROBABLILTY?

Data Table - Name			
Trial - Sample	**Allele from Bag 1**	**Allele from Bag 2**	**Offspring's Alleles**
1-1			
1-2			
1-3			
1-4			
1-5			
1-6			
1-7			
1-8			
1-9			
1-10			
Trial - Sample	**Allele from Bag 1**	**Allele from Bag 2**	**Offspring's Alleles**
2-1			
2-2			
2-3			
2-4			
2-5			
2-6			
2-7			
2-8			
2-9			
2-10			
Trial - Sample	**Allele from Bag 1**	**Allele from Bag 2**	**Offspring's Alleles**
3-1			
3-2			
3-3			
3-4			
3-5			
3-6			
3-7			
3-8			
3-9			
3-10			

Handout B