Genetics WebLAB Name:_____

Mendelian Genetics of the Pea Plant

On the Brooklyn College website (http://www.brooklyn.cuny.edu/bc/ahp/MGInv/MGI.Inv.html) you will find an interesting applet which allows you to selectively breed pea plants with three different traits. You will be asked to elucidate the dominance of these traits, and experiment with different strands of peas to produce various offspring.

Start at the main menu and click on the introduction. From this point you will find that reading the narrative will guide you through the interactive lesson and explain to you how exactly to use the simulation.

Pure Breeding:

Which traits will give consistent results during all genetic crosses? Test for the consistency of the material.

1. Cross Tall plants and tall plants. Collect seeds and plant to see what the offspring's traits are.

record your results — Write down, and record

1. what you did, and
2. What results you obtained.

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

collect data — Using the "tall plants" trait, repeat this genetic cross many times (at least 10 times). Each time record the results below.

answer these questions — What did you find? Were "tall" plants consistent? Did they always give offspring that were 100% tall? Can you depend on this trait?

2. Cross short plants and short plants. Collect seeds and plant to see what the offspring's traits are.

Carry out a series of genetic crosses (10 - 20), as before, record the results and then answer the same series of questions above. Were the "short plants" consistent?

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

The idea behind these two simple activities is to prove without a doubt that you have two different traits that are pure bred, and in turn you will be able to determine their genotype before they are bred again. What you should notice is at the bottom of the screen is a collection of about 6 'special' seeds that have very obvious traits you can use for subsequent pairings.

3. There are two "pure breeding" seeds, including a "pure breeding tall plant". Use this plant in a series of genetic crosses with other tall plants, and see what kind of results you get. Make sure you have clicked on the "Start Again" button, then click on the chosen "special pea". It's traits will appear as one of the parents. If you click once, only one parent receives these traits, but if you click twice, both parents have this trait.

Were the results consistent when pure breeding tall plants were one, or both parents? Record your cross below and detail what the results are.

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

Why is it crucial that you are clear about the genotype of a plant before you cross it? Cite examples from what you have just done.

Do Traits Blend? pangenesis, blending or dominance

Find out if alternative versions of a trait blend together in an offspring, or if the different forms of a trait remain independent and distinct. Using the three traits in the simulation determine if height, pod color, and flower color are discrete traits or can be blended traits. **Detail your what you did and what you got. Then answer the subsequent questions.**

Height	Pod Color	Flower Color

What did you find? Did the flowers of the offspring ever show a 'blended' color (such as pink)? What kind of results did you get; were flowers of the offspring always all one color? How do you explain your results? What patterns of inheritance did you see for these three traits? Which theory (blending inheritance or non-blending inheritance) do your results support? Why?

Patterns of Inheritance: one trait, two generations

What different patterns of inheritance can be seen during genetic crosses, and how can these patterns be interpreted?

First Genetic Cross - to produce F1 hybrids

Select "pure breeding tall plant" from the **Special Peas** menu. This will become "**TRAIT ONE**" of Parent One (or Parent Two).

Select "short plants" from the **Traits** menu. Click on "**TRAIT ONE**" of the other Parent.

You should now have two parent plants. You know that the 'tall' plant is 'pure breeding', but what do you know about the short plant based on what you have done previously?

Write down, and record

1. what you did, and
2. what results you obtained.

Repeat this type genetic cross experiment several times, and then use the other 'special pea' that is 'pure breeding for the purple flowered plant'. The other parent in this cross should hold the 'white flower' trait.

Tall and Short cross for F1 generation

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

Purple and White cross for F1 generation

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

This is now the data for the 'pattern of inheritance' seen as Mendel's transmission elements are passed from the original parent plants into the first generation of hybrids, the **F1** hybrids. What do you observe for the phenotype ratio of these plants? What is the genotype ratio based on the cross?

Second Genetic Cross - to produce F2 hybrids

One of the F1 hybrid plants (produced in the first round of genetic crosses) must be one of the parents in the second round of genetic crosses. To do this, click on the 'special pea' called "an F1 seed from a tall/short cross" and this version of the trait will become one of the parents.

You can now cross this F1 hybrid plant with three other types of plant:

1. another F1 hybrid plant from a tall/short cross. To do this click again on that 'special seed'. Both parents should now be these F1 hybrids.
2. a 'tall plant' selected from the **Traits** menu.
3. a 'short plant' selected from the **Traits** menu.

Repeat these genetic cross many times (at least 10 times each). Record the type of cross and record the results below.

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

Traits:		
1st cross:		
2nd cross:		
3rd cross:		
4th cross:		
5th cross:		
6th cross:		
7th cross:		
8th cross:		
9th cross:		
10th cross:		

What did you find? Which of the 'F1 crosses' produced consistent results? Which of the "F1 crosses' produced inconsistent results? How do you explain your results? For all of the genetic crosses you have carried out in this investigation, calculate the percentages of offspring that show one trait or the other

What results did you get?

Two Factor Crosses

what happens when two traits are transmitted? investigate what happens when two traits are transmitted from parent plants into the **F1** offspring. **What patterns of inheritance are seen during genetic crosses, that involve more than one trait? How can these results be interpreted?**

Two Factor Cross; round One- to produce F1 hybrids

Select "tall plants" from the **Traits** menu. This will become "**TRAIT ONE**" of Parent One.
Select "short plants" from the **Traits** menu. Click on "**TRAIT ONE**" of Parent Two.
Select "green pods" from the **Traits** menu. This will become "**TRAIT TWO**" of Parent One.
Select "yellow pods" from the **Traits** menu. Click on "**TRAIT TWO**" of Parent Two.

You should now have two parent plants, both showing different versions of two different traits. **Write down, recording the crosses you preformed and the** plants produced. Repeat this type genetic cross experiment several times, and then use the other combinations of traits, and record the results.

Traits:				
1st cross:				
2nd cross:				
3rd cross:				
4th cross:				
5th cross:				
6th cross:				
7th cross:				
8th cross:				
9th cross:				
10th cross:				

Traits:				
1st cross:				
2nd cross:				
3rd cross:				
4th cross:				
5th cross:				
6th cross:				
7th cross:				
8th cross:				
9th cross:				
10th cross:				

What did you find? Was the pattern of inheritance seen the 'F1 hybrids' consistent with the results see in previous experiments in which only one trait was followed? Were any patterns in the "F1 hybrids' inconsistent? How do you explain your results?

In your own words, describe how the three traits investigated here are inherited. When there is more than one trait tested what do you notice about the traits that are expressed? Are they blended or independent?

What is interesting about this project that you have walked away with? What other tests would you try?