

# Apple Genetics

Name \_\_\_\_\_

## Part 1: Comparing Royal Gala and Braeburn Apples

	Royal Gala Apple	Braeburn Apple
<b>Look</b>	Explain what you observe on the outside and inside of this particular apple. Write down what you notice, stem structure, seed layout, and coloring.	
Outside of Apple	Red with green speckles, some yellow to green areas, shorter and fatter	Red with green speckles, some yellow to green areas, taller and skinnier
Inside of Apple	White color	White color
<b>Smell</b>	Explain what you observe using your sense of smell.	
Outside of Apple	Little to no smell, smells like apple	Little to no smell, smells like apple
Inside Of Apple	Smells a little like a pumpkin	Nothing distinctive
<b>Touch</b>	Explain what you observe about the texture of the apple. i.e. skin, meat, seed, stem	
Outside of Apple (Texture)	Waxy and smooth	Waxy and smooth
Inside of Apple (Number of seeds and seed shape)	Answers may vary (6-10 seeds is common), teardrop shape	Answers may vary (6-10 seeds is common), teardrop shape
<b>Taste</b>	Explain what you observe when you taste your apple.	
Tartness	Less tart	More tart
Sweetness	More sweet	Less Sweet
Juiciness	Less juicy	Very juicy
Crunchiness	Very crunchy	Very crunchy

## Apple Genetics (continued)

### Part 2: Analyzing the Data:

1. Explain what similarities you found in the Royal Gala and Braeburn apples?

Both had similar exteriors visually, smell. Both were juicy, crunchy apples good for eating.

2. Explain what differences you found in Royal Gala and Braeburn apples?

Gala was sweeter and less tart, less juicy, and smelled a little like pumpkin while the Braeburn was more tart, less sweet, didn't smell like much of anything, and was VERY juicy and crunchy.

### Part 3: Completing Punnett Squares

When making observations in Part 1, you described traits for each apple such as color, juiciness, or sweetness. These traits are determined by the genes in the apple. If we were to crossbreed blossoms on a Royal Gala apple tree with pollen from a Braeburn apple tree, the resulting fruit would look, smell, taste, and feel like a Royal Gala apple, but the seeds inside would possess genes from both of these parents. The seeds could be planted and grown into a new hybrid with fruit that has traits of both the Royal Gala and Braeburn apple.

In this activity, we will imagine that the traits you observed are determined by Mendelian inheritance in which a single gene determines a trait. Each trait is dominant or recessive and the alleles passed down from the parents determine whether the trait will be observed in the offspring. Below are examples of genotypes that the Gala and Braeburn apples may possess. **NOTE: These genotypes are to be used as examples only and do not represent accurate genotypes.** You will use this information to complete Punnett Squares on the following page and calculate probabilities for each genotype.

- a. Tartness is recessive (Gala's genotype is TT, Braeburn's genotype is tt)
- b. Sweetness is recessive (Gala's genotype is ss, Braeburn's genotype is SS)
- c. Juiciness is dominant (Gala's genotype is JJ, Braeburn's genotype is JJ)
- d. Crunchiness is dominant (Gala's genotype is Cc, Braeburn's genotype is CC)
- e. Red skin coloring is dominant (Gala's genotype is RR, Braeburn's genotype is Rr)
- f. Smooth skin texture is dominant (Gala's genotype is Bb, Braeburn's genotype is Bb)

# Apple Genetics (continued)

Complete the Punnett Squares and calculate the probability of each genotype for all traits.

<p><b>Tartness:</b> (Example)</p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 5px;">T</td> <td style="padding: 5px;">T</td> </tr> <tr> <td style="padding: 5px;">t</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Tt</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Tt</td> </tr> <tr> <td style="padding: 5px;">t</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Tt</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Tt</td> </tr> </table> <p>Probability of offspring genotypes:</p> <p>TT= <u>0%</u></p> <p>Tt= <u>100%</u></p> <p>tt= <u>0%</u></p>		T	T	t	Tt	Tt	t	Tt	Tt	<p><b>Sweetness</b></p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 5px;">S</td> <td style="padding: 5px;">S</td> </tr> <tr> <td style="padding: 5px;">S</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Ss</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Ss</td> </tr> <tr> <td style="padding: 5px;">S</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Ss</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Ss</td> </tr> </table> <p>Probability of offspring genotypes:</p> <p>SS= <u>0%</u></p> <p>Ss= <u>100%</u></p> <p>ss= <u>0%</u></p>		S	S	S	Ss	Ss	S	Ss	Ss
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<p><b>Juiciness</b></p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 5px;">J</td> <td style="padding: 5px;">J</td> </tr> <tr> <td style="padding: 5px;">J</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">JJ</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">JJ</td> </tr> <tr> <td style="padding: 5px;">J</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">JJ</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">JJ</td> </tr> </table> <p>Probability of offspring genotypes:</p> <p>JJ= <u>100%</u></p> <p>Jj= <u>0%</u></p> <p>jj= <u>0%</u></p>		J	J	J	JJ	JJ	J	JJ	JJ	<p><b>Crunchiness</b></p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 5px;">C</td> <td style="padding: 5px;">c</td> </tr> <tr> <td style="padding: 5px;">C</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">CC</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Cc</td> </tr> <tr> <td style="padding: 5px;">C</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">CC</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Cc</td> </tr> </table> <p>Probability of offspring genotypes:</p> <p>CC= <u>50%</u></p> <p>Cc= <u>50%</u></p> <p>cc= <u>0%</u></p>		C	c	C	CC	Cc	C	CC	Cc
	J	J																	
J	JJ	JJ																	
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<p><b>Red Skin Coloring</b></p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 5px;">R</td> <td style="padding: 5px;">R</td> </tr> <tr> <td style="padding: 5px;">R</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">RR</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">RR</td> </tr> <tr> <td style="padding: 5px;">r</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Rr</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Rr</td> </tr> </table> <p>Probability of offspring genotypes:</p> <p>RR= <u>50%</u></p> <p>Rr= <u>50%</u></p> <p>rr= <u>0%</u></p>		R	R	R	RR	RR	r	Rr	Rr	<p><b>Smooth Skin Texture</b></p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td> <td style="padding: 5px;">B</td> <td style="padding: 5px;">b</td> </tr> <tr> <td style="padding: 5px;">B</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">BB</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Bb</td> </tr> <tr> <td style="padding: 5px;">b</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">Bb</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">bb</td> </tr> </table> <p>Probability of offspring genotypes:</p> <p>BB= <u>25%</u></p> <p>Bb= <u>50%</u></p> <p>bb= <u>25%</u></p>		B	b	B	BB	Bb	b	Bb	bb
	R	R																	
R	RR	RR																	
r	Rr	Rr																	
	B	b																	
B	BB	Bb																	
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## Apple Genetics (continued)

### Part 4: Jazz Apple Observation: Observe the traits of the Jazz apple.

Jazz Apple Observations	
<b>Look</b>	Explain what you observe on the outside and inside of this particular apple. Write down everything you notice, stem structure, seed layout, and coloring.
Outside of Apple	Red apple with yellow patches and yellow dots
Inside of Apple	White color
<b>Smell</b>	Explain what you observe using your sense of smell.
Outside of Apple	Little to no smell, smells like apple
Inside Of Apple	Nothing distinctive
<b>Touch</b>	Explain what you observe about the texture of the apple. i.e. skin, meat, seed, stem
Outside of Apple	Waxy and smooth
Inside of Apple	Answers may vary (6-10 seeds is common), teardrop shape
<b>Taste</b>	Explain what you observe when you taste your apple.
Tartness	Tart, but not as Tart as Braeburn
Sweetness	Sweet, but not as sweet as Gala
Juiciness	VERY Juicy
Crunchiness	VERY Crunchy

## **Apple Genetics** (continued)

### **Part 5: Comparing Royal Gala, Braeburn, and Jazz Apples**

#### **Similarities and differences found:**

1. Describe similarities you found among all 3 apple varieties.

All apples were good “eating” apples. The apples were crunchy and had very similar exterior characteristics.

2. Describe differences you found among all 3 apple varieties.

Gala was the sweetest while Braeburn was the most tart. Since the Jazz is a cross between the two, it was right in the middle.

#### **Crossbreeding apples**

1. Which of the three apples was your favorite? Why?

Answers will vary.

2. Why do apple breeders crossbreed apple varieties?

It allows breeders to create higher quality, better tasting varieties.