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GIRLS INSPIRING RISING LADIES IN STEM

Name: _____ Date: _____

TOPIC #4: MENDELIAN GENETICS

BUILD A SPUD

SCIENTIST OF THE DAY: NETTIE STEVENS

Nettie Stevens was born in Vermont in 1861. As a young girl she worked hard to save money to pay for her education. While teaching classes to earn a living, she went to college and later went on to earn a PhD. During her lifetime, people did not know what caused a baby to be born a boy or a girl. Many believed it was simply caused by what a mother ate while pregnant. Nettie questioned this idea and began working to uncover the real truth. She studied the sex organs and DNA of butterflies and discovered that males and females have different sex chromosomes. She published her work and made history as a geneticist.

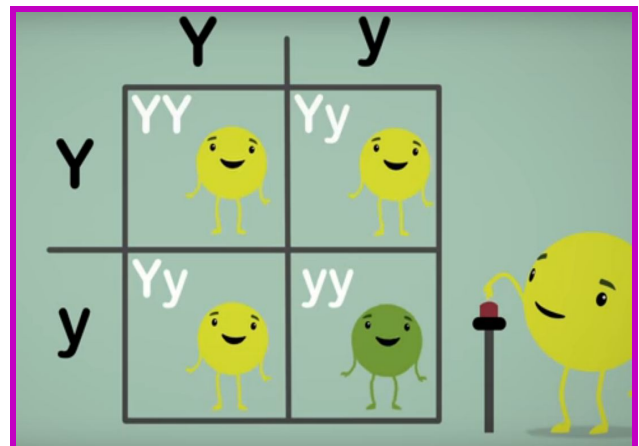


BACKGROUND

Today, scientists know how to calculate the probability of inheriting specific traits according to the information they have from your parents, using **Punnett squares**. To understand how this was discovered we look at Gregor Mendel, who studied the principles of heredity by breeding plants.

For example, he bred a pure yellow plant and with a pure green plant. He wasn't sure what to expect; was he going to get baby plants that were yellow, green, or a mix, as possible **phenotypes**?

The results demonstrated that only yellow baby plants were born and no green. But when he bred two of the baby yellow plants, he obtained 3 yellow baby



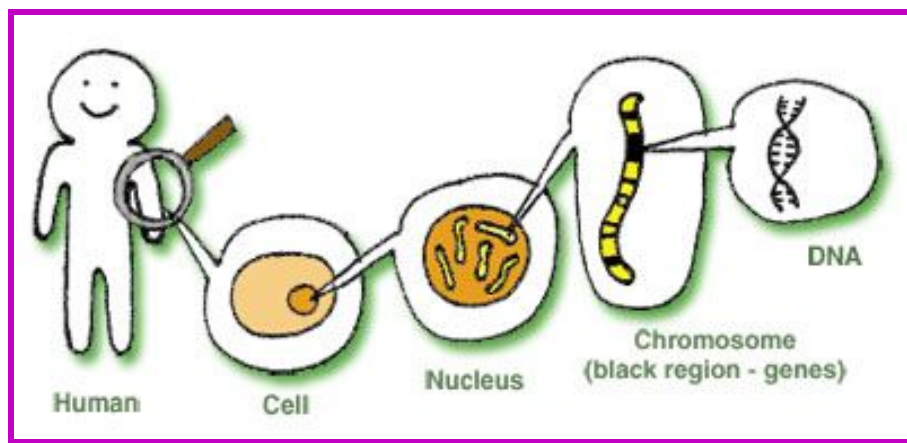
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plants and one green. Thus, Mendel concluded that many different factors known as **alleles** will determine the characteristics of baby plants. Nettie Stevens used Mendel's understanding of alleles and Punnett squares to help discover how an individual's gender is chosen and how certain physical characteristics can be linked to a person's gender.

NEW WORDS

- **Allele:** factors that represent the different variations of a gene.
- **Genotype:** a two letter set of alleles an organism carries for a certain trait, and this determines the phenotype.
- **Phenotype:** an organism's physical properties including everything you can observe from how they look.
- **Homozygous Genotype:** a genotype with 2 identical alleles (YY or yy).
- **Heterozygous Genotype:** a genotype with two different alleles (Yy).
- **Dominant Allele:** an allele that determines an individual's phenotype even when just one allele is present. In Mendel's experiment, yellow (Y) was the dominant allele.
- **Recessive Allele:** an allele that doesn't determine an organism's phenotype unless the individual has this homozygous genotype. In Mendel's experiment, green (y) was the recessive allele.



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TODAY'S EXPERIMENT

The purpose of today's experiment is to create an imaginary buddy called a spudoodle. Your organism will inherit certain genes from a parent spudoodle and based on these genes, your organism's traits will be determined. Remember that once your spudoodle inherits certain genes from his or her parent, no changes are allowed to be made, just like your parents didn't choose if you were going to be boy/girl or short/tall.

SCIENCE CONCEPT: PUNNETT SQUARES

We defined Punnett Squares as diagrams that scientist use in order to determine the probabilities of genotypes and phenotypes. It is important to note that Punnett Squares can only show possible offspring combinations, not actual results. During this experiment you will draw punnett squares for each trait so that you can identify the genotype and phenotypes of your spudoodle.

Let's go through a problem: There is a mother with brown eyes (either homozygote or heterozygote for the dominant trait). She has a child with a man who has blue eyes, a recessive trait. Is there a possibility for their child to have blue eyes. Draw a punnett square and explain (Hint: you will have to draw two punnett squares for each possibility of the mother).



MATERIALS LIST

- ☐ A bag for each trait, filled with different alleles.
- ☐ Sharpie
- ☐ Potatoes

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PROCEDURE

1. You will receive a bag for each trait. Each bag will contain different alleles indicating different genes from a potential spudoodle Mom and Dad (Pink and Blue, respectively).
2. For each container, pick out 2 alleles. You should have one pink and one blue allele. This is the parent spudoodle genotypes that will be used to determine your spudoodle's genotype. Write the 2 genotypes on your sheet.
3. Complete a punnett square to determine the different possibilities of your baby spudoodle inheriting a trait.
4. Roll a dice (1-4) and circle the chosen inherited genotype (5 and 6 get to roll again). Do this for each trait.
5. List the genotype and phenotypes on your worksheet for each trait.
6. Build your baby spudoodle just as your genotype key tells you. No changing! Don't forget to name your baby!

DATA

Genotype key

	Genotype	Phenotype
Gender	XY XX	Male Female
Hair	HH or Hh hh	Has a lot of hair No hair
Tongue	AA or Aa aa	Medium tongue Small tongue
Ears	EE or Ea ee	Medium ears Small ears

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Eyes	BB or Bb bb	Big eyes Small eyes
Nose	NN or Nn nn	Two nostrils One nostril
Spine	DD or Dd dd	5 green dorsal spines 5 pink dorsal spines
Tail	RR or Rr rr	Long curly tail Short straight tail
Feet	GG or Gg gg	2 large feet 3 medium feet

Reporting Genotypes

Gender:

Hair:

Tongue:

Ears:

Eyes:

Nose:

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Spine:

Tail:

Feet:

QUESTIONS

1. What was the genotypes for each trait?

a. Gender: _____

b. Hair: _____

c. Tongue : _____

d. Ears: _____

e. Nose: _____

f. Spine: _____

g. Tail: _____

h. Feet: _____

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2. What was the phenotype for each trait?

a. Gender: _____

b. Hair: _____

c. Tongue : _____

d. Ears: _____

e. Nose: _____

f. Spine: _____

g. Tail: _____

h. Feet: _____

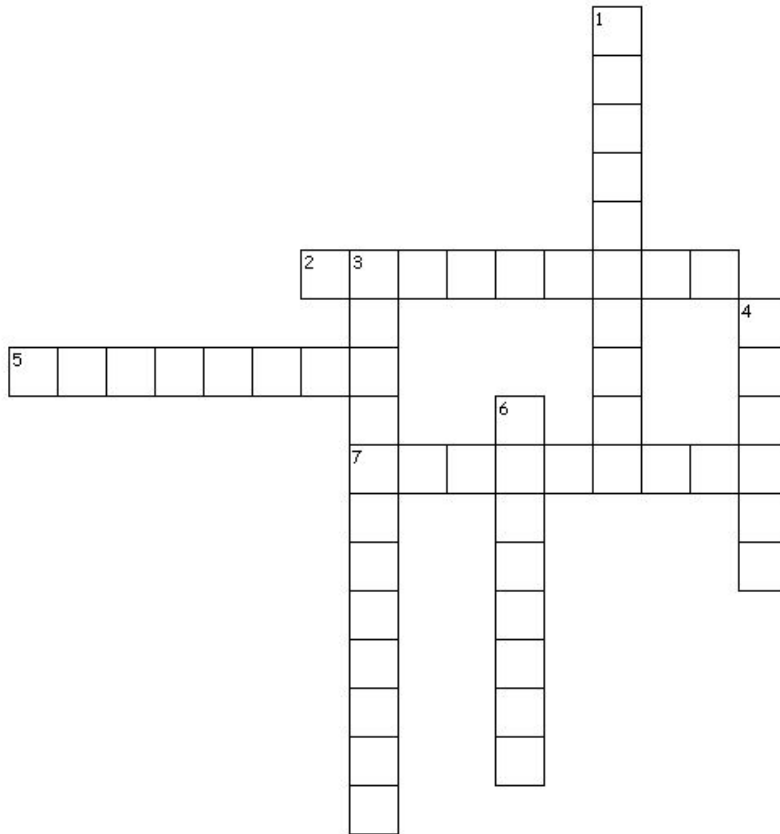
3. Is your spudoodle homozygous or heterozygous for their tongue trait? Also, are they dominant or recessive carriers?

4. What did you name your spudoodle?

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EXIT PASS



Across:

2. An organism's physical properties including everything you can observe from how they look.

5. An allele that determines an individual's phenotype even when just one allele is present. In Mendel's experiment, yellow (Y) was the dominant allele.

7. An allele that doesn't determine an organism's phenotype unless the individual has this homozygous genotype. In Mendel's experiment, green (y) was the recessive allele.

Down:

1. A genotype with 2 identical alleles (YY or yy).

3. A genotype with two different alleles (Yy).

4. Factors that represent the different variations of a gene

6. A two letter set of alleles an organism carries for a certain trait, and this determines the phenotype

EXPERIMENT LINKS

- <http://martysahm.blogspot.com/2011/01/biology-module-8-mendelian-genetics.html>