Cat Genetics

Meow! Investigate how genetics influence a cat's fur and eye color and create your own unique kitten using Punnett Squares.

TEKS:

SCI 4/5.10 B: The student is expected to explore and describe examples of traits that are inherited from parents to offspring such as eye color and shapes of leaves and behaviors that are learned such as reading a book and a wolf pack teaching their pups to hunt effectively.
SCI 7.14 A: The student is expected to define heredity as the passage of genetic instructions from one generation to the next generation.

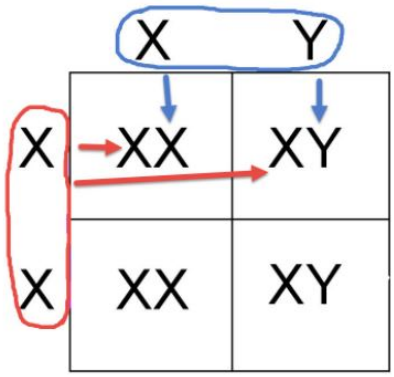
Materials:

- Cat Genetics Activity Supplement – attached
- Coin
- Male and Female Cat Adoption Cards – attached
- Markers, colored pencils, or crayons
- Optional: Modeling clay (Black, pink, brown, white)

How To:

1. Print and cut out the attached Male and Female Cat Adoption Cards. Place all of the Male and Female Cat Adoption Cards face-down in front of you, in two separate piles.
2. Randomly choose one Male Cat Adoption Card and one Female Cat Adoption Card. Congratulations! These are your new cats!
    - The adoption cards show each cat's genotype and phenotype. The **genotype** (the combination of letters in parenthesis) is your cat's genetic makeup that determines its physical appearance, or **phenotype** (how your cat looks).
3. Use the Cat Genetics Activity Supplement to name your new cats and color in the cat outlines, based on the adoption cards.

4. Your two adopted cats have mated, and created a new kitten! We need to determine this new kitten's genotype and phenotype. You will do this using the information on your Male and Female Cat Adoption Cards, and a Punnett square. Complete each "New Kitten Punnett Square" in the Activity Supplement using the following process:
    - Gender: Put one X outside each square on the left side to represent the female cat, and an X and a Y above each of the top squares to represent the male cat. Then fill out the Punnett square as shown below.



    - After filling out a Punnett square, take out a coin. This coin will help us decide what genotype the new kitten will have. The first coin flip will determine the column. If the coin lands on heads the first time, you will use the squares in the first column; if the coin lands on tails you will use the second column. Flip the coin again to determine what row you will use (heads=first row, tails=second row). Example: if both flips are heads, you will use the first row and first column, which means our genotype is the top left square, or XX, meaning our baby kitten is female.
    - Repeat this same process with the Fur Length, Nose Color, and Stripes Punnett Squares to determine what your new kitten will look like!
5. Take some time to draw a picture of your new kitten in the Activity Supplement, and be sure to give your new kitten a name!
6. Read through the STEM Explanation below. Once you've done that, use modeling clay to make a miniature model of your new kitten! While crafting your tiny cat friend, check out this YouTube video to learn even more about cats: https://www.youtube.com/watch?v=G5RErqM1RZk&ab_channel=SciShowKids

STEM Explanation:

Think about the following questions related to genetics:

- **Were all your male and female cats' genes passed on to your new kitten?** For each trait, half of the male cat's and half of the female cat's genes were passed on to the new kitten.
- **Does your new kitten have exactly half the traits of its father (male cat) and its mother (female cat)?** Yes! The new kitten has exactly half of its genes from its mother and half from its father. Depending on the dominance of the genes, the kitten may look more like one parent than the other.

- **If your new kitten were to mate with another cat, would the new offspring have some of the original parents' traits?** Yes, genes continue to be passed through generations. Depending on the dominance of the genes, the new kitten may have special similarities to its "grandparent cats."
- **What are examples of physical traits in humans that are determined by genes?** Dimples, earlobes being attached/unattached, eye color, skin color, gender, cleft in chin, freckles, tongue rolling, and so many more!

Career Connection:

Geneticists are biologists that study genetics: the science of genes and heredity. They explore the genetic information, or DNA, of all species of plants, animals, and bacteria.

Resources:

https://letstalkscience.ca/educational-resources/stem-in-context/science-behind-calico-cats-colours
https://www.youtube.com/watch?v=G5RErqM1RZk&ab_channel=SciShowKids

Male Cat and Female Cat Adoption Cards

Gender: Male (XY) **Nose Color**: Black (BB) **Fur Length**: Short (ll) **Stripes**: Present (kk)	**Gender:** Male (XY) **Nose Color:** Pink (bb) **Fur Length:** Short (ll) **Stripes**: Present (kk)
Gender: Male (XY) **Nose Color**: Black (BB) **Fur Length**: Short (ll) **Stripes:** Not Present (KK)	**Gender:** Male (XY) **Nose Color:** Pink (bb) **Fur Length:** Short (ll) **Stripes**: Not Present (KK)
Gender: Male (XY) **Nose Color**: Black (BB) **Fur Length:** Long (LL) **Stripes:** Present (kk)	**Gender**: Male (XY) **Nose Color:** Pink (bb) **Fur Length:** Long (LL) **Stripes:** Present (kk)
Gender: Male (XY) **Nose Color**: Black (BB) **Fur Length:** Long (LL) **Stripes:** Not Present (KK)	**Gender:** Male (XY) **Nose Color:** Pink (bb) **Fur Length:** Long (LL) **Stripes:** Not Present (KK)
Gender: Female (XX) **Nose Color**: Black (BB) **Fur Length:** Short (ll) **Stripes:** Present (kk)	**Gender**: Female (XX) **Nose Color:** Pink (bb) **Fur Length:** Short (ll) **Stripes:** Present (kk)
Gender: Female (XX) **Nose Color:** Black (BB) **Fur Length:** Short (ll) **Stripes:** Not Present (KK)	**Gender:** Female (XX) **Nose Color**: Pink (bb) **Fur Length:** Short (ll) **Stripes:** Not Present (KK)
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CAT GENETICS

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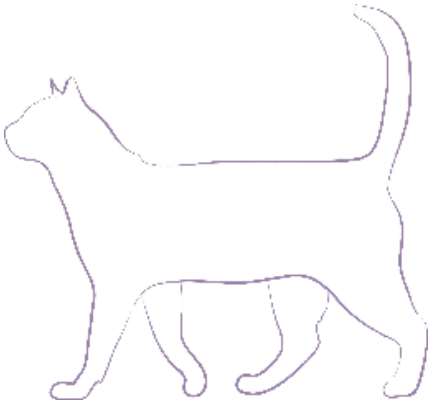
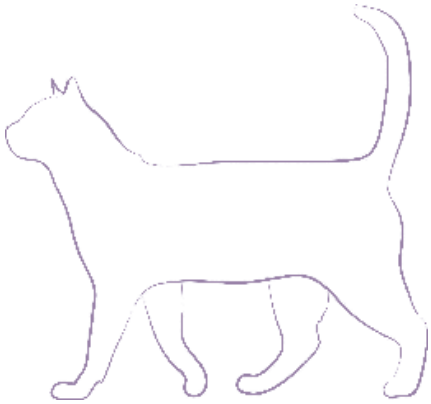
Male Cat: _____



Female Cat: _____



Remember:
When talking about how a living thing looks, we are describing its **phenotype**. A living thing's genetic makeup is its **genotype**. We can see a cat's phenotype (long fur, green eyes) but we cannot see a cat's genotype (genes that cause long fur and green eyes).

New Kitten Punnett Squares

GENDER

XX is female, XY is male

New Kitten Genotype: _____

New Kitten Phenotype: _____

FUR LENGTH

LL is long, ll is short, Ll is medium

New Kitten Genotype: _____

New Kitten Phenotype: _____

Blank Cat Image Source: https://pixy.org/4653806/

NOSE COLOR

BB is black, bb is pink, Bb is spotted

New Kitten Genotype: _____

New Kitten Phenotype: _____

STRIPES

KK is no stripes, kk is stripes, Kk is no stripes

New Kitten Genotype: _____

New Kitten Phenotype: _____

NEW KITTEN NAME:

Use the space to the right to draw your new kitten!

Today you were a Geneticist!

Geneticists are biologists that study genetics: the science of genes and heredity. They explore the genetic information, or DNA, of all species of plants, animals, and bacteria.

Meet Amanda Masino!

Dr. Amanda Masino is a geneticist, environmental educator, and Chair of Natural Sciences at Huston-Tillotson University in Austin, Texas. She earned her Ph.D. in Genetics and Developmental Biology from the University of Texas Southwestern Medical Center, where she investigated the genetics of early heart development. An advocate for diversity in science, Amanda directs the St. David's Foundation Scholars, a pre-health program that seeks to diversify health fields, and in 2019, she was chosen as an IF/THEN Science Ambassador.

Amanda Masino Image Source: https://htu.edu/faculty-directory/dr-amanda-m-masino