Exploring Genetics
7th Grade Unit Plan

Morgan Schwarz & Ashley Martinson

EDUC 340

May 3rd, 2016

Teachers: *Morgan Schwarz and Ashley Martinson*

Content: *Science* ***Area:*** *Life Science*

Unit Topic: *Genetics*

State Standard Strand (or Common Core Standard):
7.4 Life Science

Substrands:
7.4.3 Evolution in Living Systems

Standards:
7.4.3.1 Reproduction is a characteristic of all organisms and is essential for the continuation of a species. Hereditary information is contained in genes which are inherited through asexual or sexual reproduction.
7.4.3.2Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring.

Unit Goals:

- Students will gain an understanding of how genetic material carries information about their observable traits.
- They will be able to show how traits are passed down from one generation to the next.

Materials for Unit:

- Pea and corn seeds
- Magnifying glasses
- Mirror
- 2 small paper bags (per group)
- 1 marking pen (per group)
- 4 green slides (per group)
- 4 yellow slides
- laminated pictures of a plant, a dog, a fish,virus (for demonstration)
- physical traits checklist (each student)
- trait examples handout (from the internet and Carolina Biological Sciences)
- mirror (each group; optional)
- large laminated data table and graphs to collate class data
- magazines for collage (assessment) activity
- Pipe cleaners
- Toothpicks
- Nickels, pennies, and dimes

- Butter knife
- Popcorn or cotton balls
- Erasers
- Push pins
- Green marshmallows and pink marshmallows
- Goofy eyes (big and small)
- Glue
- Orange peanut candies
- Paperclips
- 15-ml culture tubes
- Fresh strawberry
- 12 ml distilled water
- 12 ml detergent solution (25% detergent in distilled water)
- 12 ml salt solution (8% salt in distilled water)
- Cold isopropyl (rubbing) alcohol (90% works best)
- Plastic droppers(labeled “water,” detergent,” and “salt”)
- Test tube holders
- Paper clip
- Plastic weigh dish
- Hand lenses
- Goggles
- Lab procedures handout
- Mitosis slides and identification challenge set up at a microscope station

Vocabulary for Unit:

- Heredity
- Trait
- Genetics
- Recessive
- Dominant
- Homozygous
- Heterozygous
- Gene
- Allele
- Genotype
- Phenotype
- DNA

Pre-Assessment:

K-W-L chart

Have students fill out as a class what they know already and what they want to know.

Lessons: See below

Lesson #1: Heredity and Genetics Scavenger Hunt

Objectives:

- Cognitive: After the class discussion, the students will be able to recall basic genetics terms that accurately relays their previous knowledge.
- Psychomotor: At the completion of this lesson, given the material, students will be able to list the key genetics concepts.
- Affective: During the lesson, given the appropriate instruction, students will be able to identify the classroom/textbook/library location of resources related to heredity and genetics.

Materials:

- Scavenger hunt worksheet
- Laminated pictures of corn and plants (if real plants are unavailable)
- Pea and corn seeds
- Magnifying glass
- Genetics/genomics posters
- Internet access (optional)

Preparation:

1. Set up at least two stations on different sides of the classroom
2. Distribute posters and plant pictures (or plants) to each station
3. Put seeds in a cup and an accompanying magnifying glass

Procedure:

1. Warm Up
    a. "What do you know about DNA, genetics, and heredity?" Using your favorite brainstorming technique (e.g., Circle Map, K-W-L chart, Post-It notes, etc.) ask students to answer this question. Direct the students to share their answers with the class (this will help you gage each student's knowledge base).
    b. A good follow up question: "How have you heard about DNA, genetics, and heredity?" Examples may include: the news, internet, TV shows like CSI, and movies such as The Incredible Hulk.
2. Scavenger Hunt
    a. Handout the Scavenger Hunt worksheet. Ask students to work by themselves or in pairs as they complete the worksheet.The worksheet can be collected and re- distributed later as a study guide for a Genetics Unit Exam.

Assessment(s):

- Using their notebooks, ask students to make a list of questions that came to mind as they were doing the scavenger hunt. Examples might include Why are we different than plants, How does

DNA cause different traits? How similar am I to other students? How big is DNA? How is DNA used in forensics?

- Ask students to repeat the Warm Up questions the following day to gage which genetics topics they easily assimilated on their own and which topics you will need to reinforce.

Differentiated elements of lesson: (A minimum of three lessons should show DI)

(Pick one from each category and you may add a different tool than listed here)

Differentiated for: _____content _____process _____product _____readiness
_____interests _____learning profile _____materials/environment

(Pick one)

- Differentiated elements: _____Tiers _____ Tic-Tac Toe
  _____Menu Board _____Flexible grouping
  _____Learning Station _____Graphic Organizer

Other:

Note: This activity is differentiated by the use of groups and small stations. It will also be done using a Tic-Tac-Toe board for the students to research their information.

Scavenger Hunt Resources

TIC-TAC-TOE

Students must use AT LEAST three resources in a row to help them with the scavenger hunt.

Internet	Textbook	Encyclopedia
Personal Notes	FREE CHOICE	Textbook
Textbook	Online Database/ Journal	Classroom Library

Name_____

Date_____

Heredity & Genetics Scavenger Hunt Worksheet

Use your science textbook and other resources around the room to help you complete the following. After each answer, indicate where you found the answer (e.g. textbook page C43, Genomics poster, etc).

1) What is DNA?

2) What are genes?

3) What are chromosomes?

4) Write a sentence explaining the relationship between the words DNA, genes, and chromosomes.

5) On the back, draw a sketch showing where DNA is located in a cell.

6) Name three examples of genetic traits that you inherited from your parents.

7) Name two traits that you acquire during your life.

8) How are traits passed from parent to their offspring?

9) How many chromosomes do humans have?

10) Why is Gregor Mendel considered to be the “Father of Genetics”?

11) What is the difference between a dominant trait and a recessive trait?

12) What is an example of a dominant human trait?

13) What is an example of a recessive human trait?

14) What is the ratio of people in the room who are female?

15) Rewrite 1:4 as a percent.

16) What percent of the room is male?

17) Is gender an inherited or acquired trait?

18) Using the Student Science Dictionary, what does DNA and RNA stand for?

19) What is the probability/likelihood of the spinner landing on a shaded region? Represent this mathematically in 3 ways.

20) What is the purpose of a Punnett square?

21) If a tall plant (TT genotype) is crossed with a dwarf plant (tt genotype), what is the probability that the offspring plants would be tall?

22) What type of plants would you have to cross to get a dwarf plant?

23) From the “Genomics” poster, what is genomics?

24) On the “Genomics” poster, how many chromosomes and genes does a human have?

25) On the “Cracking the Code of Life” poster, what did Watson and Crick discover in 1953?

26) On the “Cracking the Code of Life” poster, when was the human genome sequence published?

27) What are some differences between the corn and pea plants?

28) What causes these differences between corn and pea plants?

29) What are the large structures shown on “The Human Genome” poster?

30) From “The Human Genome” poster, what are some genes of interest found on chromosome 5?

31) The diameter of the nucleus of a cell is approximately 1/100,000 of a meter.The diameter of Earth is 12,756,000 meters. Write each of these in scientific notation.

32) How many times bigger is Earth than a nucleus.

33) Give an example of a genetic disease.

34) How do people get this genetic disease?

35) What is an example of a genetic disease that can be influenced by human behavior and the environment?

Turn this worksheet into the basket when you are completed.

Lesson #2: A Personal Survey of Inherited Human Traits

Objectives:

- Psychomotor: At the completion of this lesson, given the terms, students will be able to name several physical genetic traits.
- Cognitive: At the completion of this lesson, students will be able to explain the differences between inherited and acquired traits, given the appropriate vocabulary.
- Psychomotor: At the completion of this lesson, given the corresponding materials, students will be able to make a data table and graph comparing their traits to those of the class.
- Cognitive: During the lesson, given the data, students will be able to accurately analyze data and determine which traits are common and which are not.
- Psychomotor/Cognitive: At the completion of this lesson, given prompts, students will be able to give examples of physical human traits that are either dominant or recessive.

Materials:

- laminated pictures of a plant, a dog, a fish,virus (for demonstration)
- physical traits checklist (each student)
- trait examples handout (from the internet and Carolina Biological Sciences)
- mirror (each group; optional)
- large laminated data table and graphs to collate class data
- magazines for collage (assessment) activity

Preparation:

1. Set out materials for each group of students.
2. Display the large data table and graph on the board or classroom wall.
3. Set out magazines on the second day for collage (assessment) activity

Procedure:

1. Warm Up
    a. Introduce the activity with the following scenario: An alien from outer space teleports into the class. Upon seeing the class, the alien concludes that all humans look alike. It is your job as a class to assist the alien in differentiating humans from each other.
    b. Students might not agree that all humans look alike, but to an alien who is comparing humans to other life-forms such as plants, dogs, fish, or viruses humans clearly share more physical similarities to each other than they do with any other species.
    c. To emphasize the relative similarity of humans to each other when compared with plants, dogs, fish etc, it will be helpful to show pictures of each of the individual organisms versus a picture of a human and then compare this with two pictures of humans.

   d. Ask students to create a list of questions that would help the alien learn more about what humans look like. Suggested questions include the following.
      i. Do all humans look alike?
      ii. Are some traits more common than others?
      iii. Do boys have certain traits?
      iv. Are dominant traits more common?
      v. How unique is each human?
      vi. Do humans look like their parents?
      vii. Which traits are inherited?
      viii. Which traits are acquired?
2. Data Collection
   a. Ask students to form teams of four (or assign students to teams)
   b. Distribute the "Traits Survey" to aid students in investigating how similar we really are. Review each trait before students start the survey.
   c. Have (willing) students who have each specific trait stand up to point out the different traits. Have pictures of the traits available in case volunteers are not available.
   d. Ask students to complete their personal survey and then compare their survey with their group. Each student should tally their group's results on their survey.
   e. Ask a volunteer from each group to come to the board and record their group's results.
   f. Once all the results are tallied, ask students to copy the class results onto their surveys.
   g. Ask students to make a graph of the data. Traits in the A column ("yes" answers) should be indicated in one color and traits in the B column ("no" answers) should be indicated in another color. You can make an example using the large laminated graph or distribute pre-labeled graph paper to assist students.
3. Data Analysis
   a. Once students are finished, ask them to look at their data tables and graphs and answer the following:
      i. Which traits (alleles) are most common in your group? In the class?
      ii. Which traits (alleles) are least common in your group? In the class?
      iii. What evidence (data) suggests that humans are similar? Different?
      iv. How do data tables and graphs differ in the way they present data?

Assessment(s):

- Students work individually or with partners to create a collage showing examples of inherited and acquired traits. Students should cut out and paste examples onto construction or other paper. To demonstrate their knowledge, students should label each trait as Inherited vs. Acquired and Dominant vs. Recessive. Students can present their posters to the class and explain their reasoning.

Differentiated elements of lesson: (A minimum of three lessons should show DI)

(Pick one from each category and you may add a different tool than listed here)

- Differentiated for: _____content _____process _____product _____readiness _____interests _____learning profile _____materials/environment

(Pick one)

- Differentiated elements: _____Tiers _____ Tic-Tac Toe _____Menu Board _____Flexible grouping _____Learning Station _____Graphic Organizer

Other:

Note: See next page for menu board.

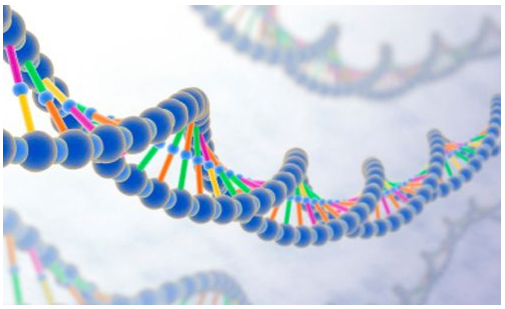
MENU PLANNER

Menu for: _____ Due: _____

All items in the main dish and the specified number of side dishes must be complete by the due date. You may select 1 among the side dishes to complete and you may decide to do some of the desserts items for extra credit, as well.

Main Dishes (complete all)

1. Work individually or with partners to create a collage showing examples of inherited and acquired traits. Students should cut out and paste examples onto construction or other paper.
2. Label each trait as Inherited vs. Acquired and Dominant vs. Recessive.
3. Present posters to the class and explain their reasoning.



Side Dishes (select 1)

1. Complete a pedigree (family tree) for your family.
2. Find two articles from a newspaper and/or magazine and genetics and write an essay on each summarizing the main idea and give your opinion.

Desserts (optional- extra credit)

1. Go to the website: http://learn.genetics.utah.edu/. Explore any section of the site and write a summary of the section and a personal reflection about what you thought of the information you learned. You can do multiple sections for more credit.
2. Watch the movie Gattaca and write a reflection.

Lesson #3: Modeling Mendel- Predicting the Outcome of Genetic Crosses

Objectives:

- Psychomotor: At the completion of this lesson, given the direct instruction and demonstration, students will be able to accurately model the combination of alleles from each parent.
- Cognitive: During the lesson, given the prompts, students will be able to predict the offspring of a genetic cross to 85% accuracy.
- During the lesson, given the prompts, students will be able to predict the offspring phenotype from parents' genotype to 85% accuracy.
- Affective: During the lesson, students will able to demonstrate dominant and recessive alleles.
- Cognitive: During the lesson, given data, students will be able to compare actual data with predicted results.

Materials:

- Students working in groups of 4
    - 2 small paper bags (per group)
    - 1 marking pen (per group)
    - 4 green slides (per group)
    - 4 yellow slides (per group)
    - Data table handouts (optional; per student)
    - Overhead/Smartboard showing Mendel's pea experiment results
    - Slide with "Mendel Warm Up" questions

Preparation:

- Copy handouts (optional) and distribute the materials to each group

Procedure:

1. Discuss with the students the history and background information of Gregor Mendel.
    a. Read the following biography: http://www.biography.com/people/gregor-mendel-39282#synopsis
2. Warm Up
    a. Ask students to read through information online or in their science textbooks on Gregor Mendel. Using their textbooks or internet sources, students should work individually or in partners to answer the following warm up questions (also on board):
        i. Who was Gregor Mendel?
        ii. What type of plants did Mendel study?
        iii. What were the seven characteristics (phenotypes) that Mendel studied?
        iv. Which traits were dominant?
        v. Which traits were recessive?
        vi. Why do some traits disappear in some generations?
        vii. What did Mendel conclude about how traits are inherited in pea plants?

3. Modeling Mendel
    a. Crossing Two Heterozygous Parents for Pea Pod Color
        i. Students place one green slide (G) and one yellow slide (g) in Bag 1, and one green slide (G) and one yellow slife (g) in Bag 2.
        ii. In their data table, students should predict the genotype and phenotype of the offspring.
        iii. After making predictions, students remove one slide from Bag 1 (representing the female parent) and one slide from Bag 2 (representing the male parent).These represent the alleles that the offspring inherit from each parent.
            1. By putting the two slides together, students can also observe the phenotype of the "offspring." In a cross with a heterozygous parent with one dominant and one recessive allele (Gg) and a homozygous parent with two dominant alleles (GG) any of the following geno- and phenotypes could occur.
                a. "gg" genotype: yellow phenotype
                b. "Gg" genotype: green phenotype
                c. "GG" genotype: green phenotype
        iv. After determining the genotype of each offspring, students should put the slides back into the bags and try again.They should repeat the process four times (ie, examine the genotypes of four offspring), recording their results after each trial.
    b. Crossing Two Homozygous Parents for Pea Pod Color
        i. Students label two bags, one as "Bag 1- Allele from Female Parent" and the other as "Bag 2- Allele from Male Parent."
        ii. Students place two green slides (labeled "G") in Bag 1. These represent the dominant green pod color alleles from the female parent (genotype = GG). Note: The dominant allele is always written in uppercase.
        iii. Students place two yellow slides (labeled "g") in Bag 2. These represent the recessive yellow pod color alleles from the male parent (genotype = gg). Note: The recessive allele is always written in lowercase.
        iv. Using the data table or a sheet of paper, students predict what the offspring from a cross green pod female (genotype = GG) and yellow pod male (genotype = gg) will look like.
        v. For each trial cross, students should remove one slide from Bag 1 (female parent) and one slide from Bag 2 (male parent). These represent the alleles that the offspring inherit from each parent. Record the result in the data table. By putting the two slides together, students can also observe the phenotype of the "offspring." In a cross with two homozygous parents, one with two dominant alleles (GG) and one with two recessive alleles (gg) only a heterozygous, Gg phenotype can occur, resulting in a green phenotype.
        vi. After determining the genotype of each offspring, students should put the slides back into the bags and try again. They should repeat the process four times (i.e. examine the genotypes of four offspring), recording their results after each trial.

Assessment(s):

- Reflection: Using their notebooks, ask students to think back on their trial crosses and complete the following individually:
    - What does the bag represent? (parents)
    - What do the slides in each cross represent? (alleles/traits)
    - In humans, how does each parent contribute their allele or trait to the offspring? (female → egg and male → sperm)
    - What does "GG" in the offspring represent? (dominant genotype)
    - What does "yellow" in the offspring represent? (recessive phenotype)
    - What is the difference between homozygous and heterozygous parents? (two of the same alleles vs. two different alleles)
- Modeling: Ask students to design their own model to conduct genetic trials using common objects. They should answer the following questions:
    - How would you represent the parent and offspring alleles?
    - How would you represent homozygous vs. heterozygous parents and dominant vs. recessive traits?

Lesson #4: Extracting a DNA from a Strawberry

Objectives:

- Cognitive: Given their findings, students will be able to describe the look of a strand of DNA confidently.
- Affective: Given their findings, students will be able to explain the significance of genes to inherited characteristics confidently.
- Affective: Given their findings, students will be able to explain the significance of reproduction confidently.
- Psychomotor: Given the materials provided, students will extract DNA from a Strawberry successfully.

Materials:

1. 15-ml culture tubes
2. Fresh strawberry
3. 12 ml distilled water
4. 12 ml detergent solution (25% detergent in distilled water)
5. 12 ml salt solution (8% salt in distilled water)
6. Cold isopropyl (rubbing) alcohol (90% works best)
7. Plastic droppers(labeled “water,” detergent,” and “salt”)
8. Test tube holders
9. Paper clip
10. Plastic weigh dish
11. Hand lenses
12. Goggles
13. Lab procedures handout
14. Mitosis slides and identification challenge set up at a microscope station

Preparation:

1. Divide the strawberry, water, salt, and detergent solutions into the culture tubes.
2. Each group should get a set of goggles, four culture tubes, three droppers, one weigh dish, and a paper clip.
3. It is strongly recommended that the alcohol be at one station and distributed by the teacher only when a group gets to that step. Since cold alcohol works best to precipitate the DNA, it is best to keep it on ice.

Warm Up:

Have students scan through their textbook sections on DNA and do the following:

1. Sketch a DNA molecule
2. List the properties of DNA and also the DNA picture
3. Determine what they think DNA will look like when extracted from cells
4. List the student’s answers on the board or overhead.
5. Review lab safety procedures.

Procedure:

DNA Extraction From Strawberry

Wheat germ was originally used in the genetics kits as it is not perishable. However, strawberry reliably yields much more DNA.

1) Place 1-2 strawberries in a Ziploc bag containing about 50 ml of DNA Extraction Buffer (500 ml water, 50 ml dishwashing detergent 1 teaspoon salt).
2) Gently mash the strawberries for 1-2 minutes.
3) Filter strawberry mix by pouring through a cheesecloth-lined funnel into a beaker.
4) Gently pour an equal volume (If 100 ml of strawberry mix, add 100 ml of alcohol) of iced cold ethanol or isopropanol down the sides of the beaker to prevent mixing.

You will begin to see a white precipitate form in the to alcohol layer. If you were gentle while mushing the strawberry, the DNA will appear as strands. If not, the white precipitate will be more clumpy indicating that you sheared (broke) the DNA strands.

Assessment:

Students will draw a picture in their journal of what the DNA strand looks like.

Lesson #5: Build-a-Spud Workshop

Objectives:

- Cognitive: Given Punnet squares, students will be able to demonstrate how to determine the outcome of inherited genes successfully.
- Affective: Given a selection of alleles, students will be able to describe the significance of alleles and genes to inherited characteristics confidently.
- Psychomotor: Given a selection of alleles, students will be able to assemble a potato baby completely.

Materials:

- Pipe cleaners
- Toothpicks
- Nickels, pennies, and dimes
- Butter knife
- Popcorn or cotton balls
- Erasers
- Push pins
- Green marshmallows and pink marshmallows
- Goofy eyes (big and small)
- Glue
- Orange peanut candies
- paperclips

Vocabulary:

- Alleles
- Punnet squares
- Genotype
- phenotype

Preparation:

1. The teacher will print alleles for each trait on paper of two different colors. One color for the mother's alleles and one color for the father's alleles.
2. Put each trait in a separate bag.

Procedure:

1. Students will draw 2 alleles of each color from each container. They will have a total of 4 pieces of paper from each each container. This shows what genotypes both parents have.
2. On each of the Punnett squares, write the alleles from each parent, placing the father's across the top of the square, and the mother's down the left. Complete the square, showing 4 possible genotypes of the children. These are not definite – they represent the percentage chance of a child being born with these particular genotypes.
3. Roll dice for numbers 1-4 to determine which of the 4 genotypes will be your Baby Spudoodle. Count from the left to right, going across, 1-2-3-4, to see which genotype your Baby Spudoodle will have. Do this for each trait. Fives and sixes will not count, and you should do those over.

Circle the genotype your Baby Spudoodle will have for that trait.

4. On your Report Sheet, write the genotype and the phenotype beside each trait.
5. Build your Baby Spudoodle according to the Genotype Key.
6. Give him or her a name!

Assessment:
Students will introduce their Baby Spudoodle to the class and explain what genes they inheritted.

Differentiated elements of lesson: (A minimum of three lessons should show DI)

(Pick one from each category and you may add a different tool than listed here)

- Differentiated for: _____content _____process _____product _____readiness _____interests _____learning profile _____materials/environment

(Pick one)

- Differentiated elements: _____Tiers _____ Tic-Tac Toe _____Menu Board _____Flexible grouping _____Learning Station _____Graphic Organizer Other:

Students may either record their process and Punnet squares in their journal or use the graphic organizer. They may also color code the alleles inherited by their parent spuds.

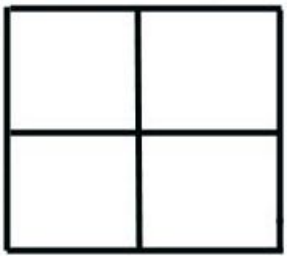
Build-a-Spud Workshop Genotype Key

	Genotype	Phenotype
Gender	XY XX	Male Female (make a pink bow with a pipe cleaner)
Hair	HH or Hh hh	Has lots of hair (20 toothpicks) Mohawk (8 toothpicks)
Tongue	AA or Aa aa	Medium tongue (nickel) Small tongue(penny or dime) (make a starter slot with a butter knife)
Ears	EE or Ee ee	Medium ears (popcorn or cottonballs on toothpicks) Small Ears (erasers on toothpicks)
Eyes	BB or Bb bb	Big Eyes (glue on w/ super glue) One big eye, one small eye (glue on w/ super glue)
Nose	NN or Nn nn	Two nostrils (push pins) One nostril (push pin)
Spine	DD or Dd dd	5 Green dorsal spines (green marshmallows) 5 Pink dorsal spines (pink marshmallows) (use half-toothpicks)
Tail	RR or Rr rr	Curly tail (pipe cleaner) Long slightly bent tail (pipe cleaner)
Feet	GG or Gg gg	2 Large feet (orange peanut candies stuck in w/ toothpicks) 3 Medium feet (large paper-clips) *(Prop the feet like a tri-pod)*

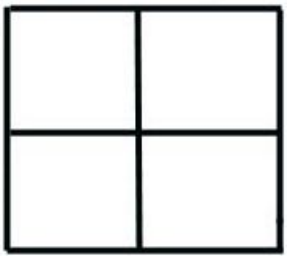
Name: _____

Build-a-Spud Workshop Report Sheet

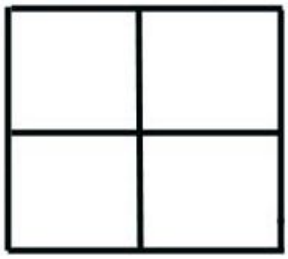
Hair:



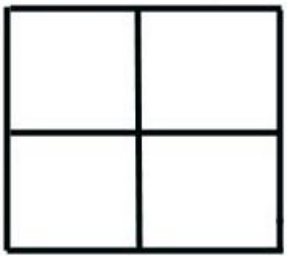
Mouth:



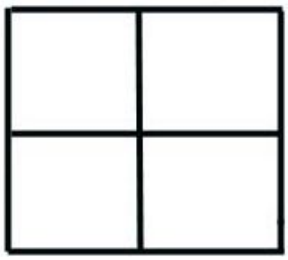
Ears:



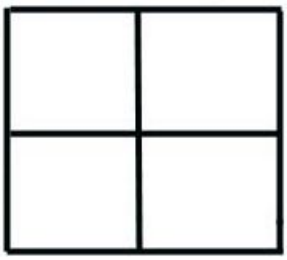
Eyes:



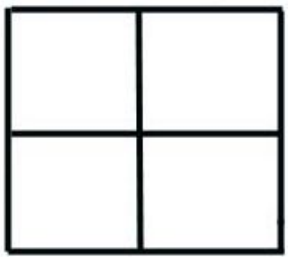
Nose:



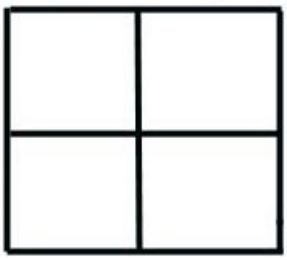
Spine:



Tail:



Legs:



List Genotypes and Phenotypes for each trait:

Gender _____ _____

Hair _____ _____

Mouth _____ _____

Ears _____ _____

Eyes _____ _____

Spine _____ _____

Tail _____ _____

Legs _____ _____

Nose _____ _____

Name your Baby Spudoodle: _____

Summative Assessment:

Students will create either a poster or powerpoint presentation on their own heredity.

This project will include:

1. A picture of yourself from shoulders up.
2. A description of your:
    a. Eye color
    b. Hair color
    c. Hair line
    d. Ear lobes: attached/detached
    e. Thumbs: hitchhiker/or straight
    f. Toes: big toe is longest/second and/or third toe is the longest
3. The poster or presentation will be visually appealing.
4. Students will share their poster or powerpoint with the class in a clear and confident voice.

Criteria	Missing -0-	Partially Present -1-	Fully Present -2-
A picture of student			
A description of inherited genetics (eyes, hair, ear lobes, thumbs, toes, etc)			
Poster/powerpoint uses color and shapes			
Students share poster/powerpoint in a clear and confident voice			