Genetics, Genetics, and More Genetics

Exploring Independent Assortment & Non-Mendelian Genetics

Based on Reebop Genetics by K. Reidell

By Susan Sigler & Dawn Alves

Focus on Inquiry

Students will use appropriate tools (Punnett squares) and techniques to gather, analyze, and interpret data.

Lesson Content Overview

Students will explore various modes of inheritance through a hands-on activity creating offspring of a fictitious organism. Students will complete Punnett Squares for various genetic crosses, and analyze and interpret the results of those crosses. Students will be able to predict the genotype and phenotype of P_1 and F_1 generations using Punnett Squares. Students will be able to identify complex patterns of inheritance such as codominance and incomplete dominance.

Duration	**Setting**	**Grouping**	**PTI Inquiry Subskills**
1-2 class periods	Classroom	2 per group	1.1, 1.3, 3.1, 3.3, 3.7, 4.3, 4.4, 5.2, 5.3, 5.8, 7.3

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	5 min		Computer Internet Access Projector	3	Students will engage in a Think Pair Share Activity reflecting on how are traits are inherited. Students will then observe a short YouTube clip (Intro to Genetics) that introduces students to the incredible biodiversity on our planet and the connection to genes and inheritance patterns.
Explore	10 min	3.1, 3.3, 3.7, 4.3, 5.2, 5.8	None	3	Student will use copies of chromosomes to create an "offspring". They will use independent assortment to separate chromosomes to make gametes. Students will then identify the genotype and phenotype of their offspring. Finally, they will sketch the physical appearance of the offspring.
Explain	30 min	4.3, 4.4, 5.2	None	3	Through a series of guided questions, the students will analyze patterns of inheritance, apply Mendel's Laws, and construct both a mono and dihybrid cross.
Expand (optional)	45 min	1.1, 1.3 3.1, 3.7 4.3, 5.2 5.3	Carolina Biological Lab Kit: Blood Group Genetics	3	Students will engage in a blood-typing lab to further investigate multiple-allelic inheritance patterns.
Evaluate	5 min	7.3		2-3	Students will answer a brief 5 question summative to demonstrate understanding of the lesson & skills.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

Next Generation Science Standards – Inquiry

NGSS Practice 1:Getting Students to Ask Questions
NGSS Practice 2:Develop and Use Models
NGSS Practice 3: Planning and Carrying Out Investigations
NGSS Practice 4: Analyzing and Interpreting Data
NGSS Practice 5:Using Mathematics and Conceptual Thinking
NGSS Practice 6: Constructing Explanations

Next Generation Science Standards – Life Science

HS-LS3-1.: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2.: Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis.

Florida Science Standards – Nature of Science

SC.912.N.1.1: Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: Pose questions about the natural world, conduct systematic observations, review what is known in light of empirical evidence, plan investigations, **use tools to gather, analyze, and interpret data** (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), generate explanations that explicate or describe natural phenomena (inferences), use appropriate evidence and reasoning to justify these explanations to others, communicate results of scientific investigations, and evaluate the merits of the explanations produced by others.

Florida Science Standards – Life Science

SC.912.L.16.1: Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.
SC.912.L.16.2: Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles**.**

Materials and Advance Preparation

Materials List

- Internet access for YouTube Clip https://www.youtube.com/watch?v=B_PQ8qYtUL0
- Projector
- Copies of Activity Packet ("Reebop" Genetics)
- Copies of chromosomes (on blue & pink paper)
- Decoder sheet
- Slide show on "how-to" – can be reviewed prior to completing the activity, if appropriate
- (Optional) Blood Group Genetics Lab Kit from Carolina Biological

Student materials:

- Pencils
- Colored pencils
- Set of chromosomes (1 per team)
- Small plastic baggy (1 per team)
- Activity packet – Reebop Genetics (1 per person)
- Decoder sheet

Blackline Masters

1. **Blackline Master #1** - Reebop Genetics Activity Packet
2. **Blackline Master #2 -** Chromosome Cut-Outs (printed on blue & pink paper)
3. **Blackline Master #3 –** Reebop Genetics Decoder Sheet
4. **Blackline Master #4 -** Individual Student Assessment
5. **Blackline Master #5 -** Reebop Genetics & Assessment Answer Key

Advance Preparation

1. Ensure You Tube Clip is accessible and up and running
2. Make copies of **Blackline Master #1** (1 copy for student)
3. Print, cut and bag up **Blackline Master #2** - 1 set of pink & blue chromosomes per team (30 students – 15 sets)
4. Make copies of **Blackline Master #3** - decoder sheet for each team
5. Consider the level of student need – utilize PowerPoint "how-to" if appropriate

Lesson Information

Learning Objectives

1. Students will analyze patterns of inheritance using Mendel's Laws.
2. Students will identify, analyze and predict traits caused by various modes of inheritance.
3. Students will predict the genotype and phenotype of P_1 and F_1 generations using Punnett squares.
4. Students will construct both a monohybrid and a dihybrid cross and interpret results.

Prior Knowledge Needed by the Students

Introduction to Mendelian genetics, background vocabulary, and practice with Punnett squares. These are standards and content knowledge addressed in middle school standards:
SC.7.L.16.1: Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another.
SC.7.L.16.2.: Determine the probabilities for genotype and phenotype combinations using Punnett Squares and pedigrees.

Students should have also had prior instruction in standard **SC.912.L.16.16:** Describe the process of meiosis, including independent assortment and crossing over. Students should have already learned about the process of independent assortment and homologous pairs so that they can be applied in this lesson.

Background Information

Genetics involve the passing of traits from one generation to the next. Gregor Mendel, an Austrian monk, studied various traits and crossed thousands of pea plants, tracking traits and how they are passed from one generation to the next. Throughout multiple trials in Mendel's famous pea plant experiments, laws were created to allow scientists to predict what traits offspring may possess. This lab focuses on the exceptions to Mendel's Laws. Under certain conditions, incomplete dominance can occur. This occurs when neither allele is fully expressed in the offspring (ex. parent flower colors are red and white, yet the offspring can exhibit a pink flower color). Another exception is codominance, when both alleles can be expressed in the next generation (parent flower colors are red and white, yet one offspring can exhibit both red and white flower colors).

Lesson Procedure

Engage

1. Play the YouTube clip: "Intro to Genetics" (2:57): https://www.youtube.com/watch?v=B_PQ8qYtUL0, which will provide an exciting look at the incredible diversity of life on our planet and the connection to genetics.
    a. ***NOTE:*** *Make sure to fast forward past the advertisements and display the video in "full screen" mode so that the web page advertisements located on the right-hand side and underneath the video will not be seen. In addition, please be on the lookout for "pop-up" ads while the video is playing.*
2. When the video has concluded, present the following question using a "Think–Pair–Share" strategy: How are traits inherited?

   a. Allow students a few minutes to think, a few minutes to pair with their shoulder partner, and then a few minutes to share out to the whole group.
3. Explain to students that today they are going to learn more about the variety of ways that traits are inherited.

Explore

1. Students will work in teams of two. Everyone should have the following materials:
   - A pencil
   - A set of colored pencils
   - 1 set of blue (dad) and pink (mom) chromosomes in a baggie (**Blackline Master #2**)
   - Activity packet – Reebop Genetics (1 per person) (**Blackline Master #1**)
   - Decoder sheet (**Blackline Master #3**)

2. Use the "how-to" slideshow to explain the procedure for the activity, if appropriate. This should take 5-10 minutes
   a. The link to the "how-to" PowerPoint is https://local-brookings.k12.sd.us/biology/ch11genetics/reebopgenetics.ppt
3. Students will determine which team member will represent the mother's & which will represent the father's chromosomes.
4. Next, students will take the chromosomes out of the bag, match up homologous pairs by size and number and place them face down on desk
5. Next, choose one of each size chromosome and put them together on the desk (in a pair, one pink & one blue) – repeat for each of the 6 sizes of chromosomes.
   a. This will represent the traits of the 1st offspring.
6. Remaining chromosomes will be used for the second offspring.
7. Record the offspring's genotype, and draw a picture of both offspring (phenotype) in the activity packet.

Explain

1. Student will continue to work through the Reebop activity packet and answer the questions with their partner.
2. Students will use prior knowledge/learning on Mendel's Laws to and answer questions about incomplete dominance and co-dominant inheritance patterns that are evident.
3. Students will create Punnett squares to represent various traits in the Reebops.
4. The teacher will circulate and assist as needed.

Expand

1. Students will extend their learning by using a blood typing lab kit. Students will further explore multiple-allelic inheritance patterns in human blood.
2. Alternatively, teachers may also choose to show a YouTube Clip - Amoeba Sisters: Multiple Alleles, ABO Blood Types: https://www.youtube.com/watch?v=9O5JQqlngFY and/or Amoeba Sisters: Incomplete Dominance, Codominance, & Polygenic Traits: https://www.youtube.com/watch?v=YJHGfbW55l0
   a. ***NOTE:*** *Make sure to fast forward past the advertisements and display the video in "full screen" mode so that the web page advertisements located on the right-hand side and underneath the video will not be seen. In addition, please be on the lookout for "pop-up" ads while the video is playing.*

Evaluate

1. The student's will complete a 5 question assessment to demonstrate their proficiency in the content and skills taught in the activity.

Supplementary Resources

Teachers

Engage Activity: You Tube Clip – Intro to Genetics

https://www.youtube.com/watch?v=B_PQ8qYtUL0

Explore Activity PowerPoint "How-To": https://local-brookings.k12.sd.us/biology/ch11genetics/reebopgenetics.ppt

Expand Activity #1: You Tube Clip - Amoeba Sisters: Multiple Alleles, ABO Blood Types https://www.youtube.com/watch?v=9O5JQqlngFY

Expand Activity #2: You Tube Clip - Amoeba Sisters: Incomplete Dominance, Codominance, & Polygenic Traits https://www.youtube.com/watch?v=YJHGfbW55l0

Students

Principle of Independent Assortment: http://www.nature.com/scitable/definition/principle-of-independent-assortment-law-of-independent-302

Non-Mendelian Genetics: http://biology.tutorvista.com/cell/non-mendelian-genetics.html

CITATION OF SOURCES.

Riedell, K. (2015). Brookings Honors Biology I & II. Retrieved from: https://local-brookings.k12.sd.us/biology/teacherlinks/reebopgenetics.htm

Riedell, K. (2015). Reebop Genetics How-To PowerPoint. Retrieved from: https://local-brookings.k12.sd.us/biology/ch11genetics/reebopgenetics.ppt

__✓__ Yes, I cited all materials and resources used in this lesson.

S.Sigler & D. Alves

Lesson Author Signature

Blackline Master #1

NAME: _____

REEBOP GENETICS STUDENT HANDOUT

The GENOTYPE for your parent Reebop is:

Bb Tt Ll Aa Hh Ee

This parent is _____ for all of its alleles.

homozygous heterozygous

What is its PHENOTYPE?

_____

Draw a picture of what your parent Reebop looks like:

LAY your parent chromosomes FACE DOWN on your desk.

1. MATCH up your chromosomes BY SIZE (homologous pairs)
2. Do MEIOSIS TO MAKE GAMETES WITH YOUR CHROMOSOMES.
3. Use INDEPENDENT ASSORTMENT to separate chromosomes (one of each kind of chromosome) to make gametes
4. Choose one set of chromosomes to make a baby with your neighbor.

WRITE DOWN the GENOTYPE for your baby.

_____

Use the code to DRAW A PICTURE OF WHAT THIS BABY WILL LOOK LIKE below:

Does this baby have the same GENOTYPE as its parents? YES NO

Does this baby have the same PHENOTYPE as its parents? YES NO

USE THE CHROMOSOMES YOU DIDN'T USE THE FIRST TIME TO MAKE A BABY BROTHER.

BABY BROTHER GENOTYPE _____

DRAW A PICTURE BELOW OF WHAT THE 2nd BABY LOOKS LIKE:

Does the new baby have the same genotype as the parents? YES NO

Does the new baby look exactly like the 1st baby? YES NO

Name Mendel's TWO LAWS that explain why brothers and sisters are not identical even though they come from the same parents?

LAW OF _____

LAW OF _____

* * * * * * * * * * * * *

When 2 alleles BLEND to show an INTERMEDIATE PHENOTYPE (like crossing red and white flowered plants and producing PINK flowered offspring) the gene is said to be INCOMPLETELY DOMINANT.

If a trait shows INCOMPLETE DOMINANCE which genotype must an organism have to show the intermediate blended phenotype?

A. PURE DOMINANT B. PURE RECESSIVE
C. HETEROZYGOUS D. HOMOZYGOUS RECESSIVE

Which trait in REEBOPS appears to blend and show INCOMPLETE DOMINANCE? **_____**

If pea plants showed INCOMPLETE DOMINANCE for HEIGHT, what would a plant look like that had BOTH a tall allele and a short allele? _____

* * * * * * * * * * * * *

When neither of two alleles is dominant over the other, they don't blend but BOTH APPEAR TOGETHER AT THE SAME TIME (like A and B blood type alleles). The gene is said to be CODOMINANT.

Which trait in REEBOPS appears to be CODOMINANT? **_____**

Why do you think so? **_____**

If pea plants showed CODOMINANCE for flower color, what would a plant look like that had BOTH a red flowered allele and a white flowered allele? _____

A Reebop with the genotype T t is _____ for tail genes.
homozygous heterozygous

A Reebop with the genotype L L is _____ for leg genes.
homozygous heterozygous

A Reebop with the genotype e e is _____ for eye genes.
pure hybrid

A Reebop with the genotype A a is _____ for antenna genes.
pure hybrid

What has to be true about the Reebop parents that show a DOMINANT allele for a trait, but have a baby that shows the RECESSIVE trait?

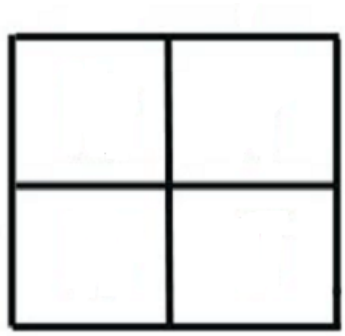
A. both parents are HOMOZYGOUS for the trait
B. both parents are HETEROZYGOUS for the trait
C. both parents are PURE for the trait
D. IMPOSSIBLE; Dominant looking parents can't have a recessive looking offspring

* * * * * * * * * * * * *

MAKE SOME REEBOP CROSSES:

Curly tails (T) is dominant over straight tails (t)

Cross a HOMOZYGOUS CURLY TAILED MOM with a STRAIGHT TAILED DAD



GENOTYPE of offspring = _____

PHENOTYPE of offspring = _____

Could these parents ever have a straight tailed baby? YES NO

Explain why or why not? _____

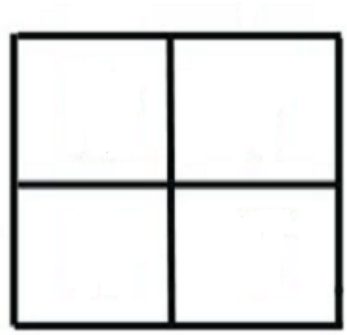
This cross is a _____ cross.

MONOHYBRID DIHYBRID

* * * * * * * * * * * * *

MAKE A CROSS BETWEEN

Cross a PURE STRAIGHT TAILED MOM with a HYBRID CURLY TAILED DAD



What is the probability the offspring will:

Have Curly tails: _____ out of 4 OR _____%

Have Straight tails: _____ out of 4 OR _____%

Be hybrids: _____ out of 4 OR _____%

Be homozygous: _____ out of 4 OR _____%

MAKE A CROSS BETWEEN TWO REEBOPS THAT ARE HETEROZYGOUS FOR EYE GENES.

PROBABILITY	**GENOTYPE**	**PHENOTYPE**
____ out of 4 OR ____ % will be	**_____**	**_____**
____ out of 4 OR ____ % will be	**_____**	**_____**
____ out of 4 OR ____ % will be	**_____**	**_____**

What is the probability that the offspring from this cross will be able to see? _____ %

You are given a Reebop WITH EYES that can see. You would like to start a Reebop ranch and breed this Reebop to populate your ranch, however having blind Reebops is an added expense because they can't find food on their own and you will need to hire more Reebop wranglers to watch them.

What could you do to find out whether this Reebop is EE or Ee ? _____

What kind of Reebop would you breed this one with to find out its genotype? _____

* * * * * * * * * * * * *

<u>REEBOPS HAVE THE SAME A, B, O BLOOD TYPE ALLELES AS HUMANS</u>.

Tell two different GENOTYPES a Reebop could have if it had TYPE A blood. _____ _____

If one of your Reebops WITH AB TYPE blood was injured and needed a blood transfusion, tell all the possible blood types that could act as donors. _____ _____ _____

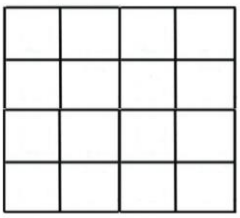
Which blood type is considered to be the "universal donor"? _____

* * * * * * * * * * * * *

A cross between two parent Reebops that are HETEROZYGOUS for TWO TRAITS is called a _____ cross.

MONOHYBRID DIHYBRID

Which of these Punnett squares would you use to show the possible offspring from this cross?



<u>MAKE THE FOLLOWING CROSS</u>: T t B b X T t B b

What are the possible GAMETES this Reebop can produce?

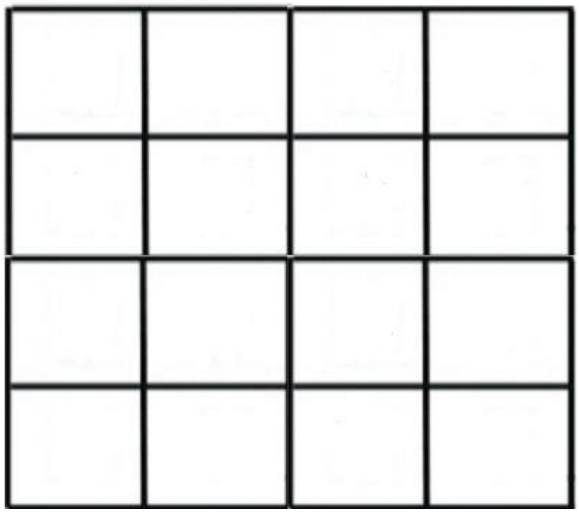
T t B b

_____ _____ _____ _____

What phenotypic ratio would you expect to see in the offspring?

3:1 1:2:1 2:2 9:3:3:1 4:4:4:4

USE A PUNNETT SQUARE TO SHOW THE POSSIBLE OFFSPRING OF THIS CROSS:



What is the probability that an offspring will have 3 BODY SEGMENTS and a CURLY TAIL? _____/16

What is the probability that an offspring will have 2 BODY SEGMENTS and a CURLY TAIL? _____ /16

What is the probability that an offspring will have 3 BODY SEGMENTS and a STRAIGHT TAIL? ____ /16

What is the probability that an offspring will have 2 BODY SEGMENTS and a STRAIGHT TAIL? ____/16

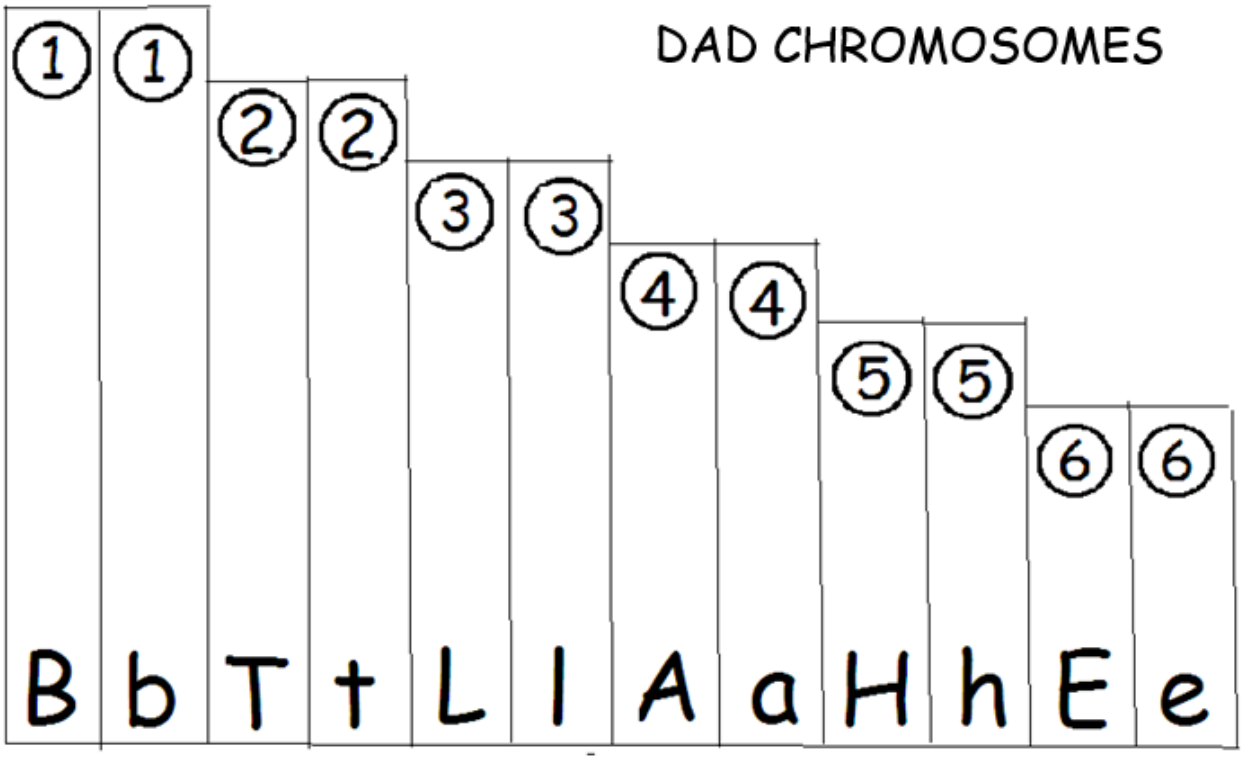
<u>USE WHAT YOU KNOW ABOUT HETEROZYGOUS DIHYBRID CROSSES TO ANSWER THE FOLLOWING</u>:

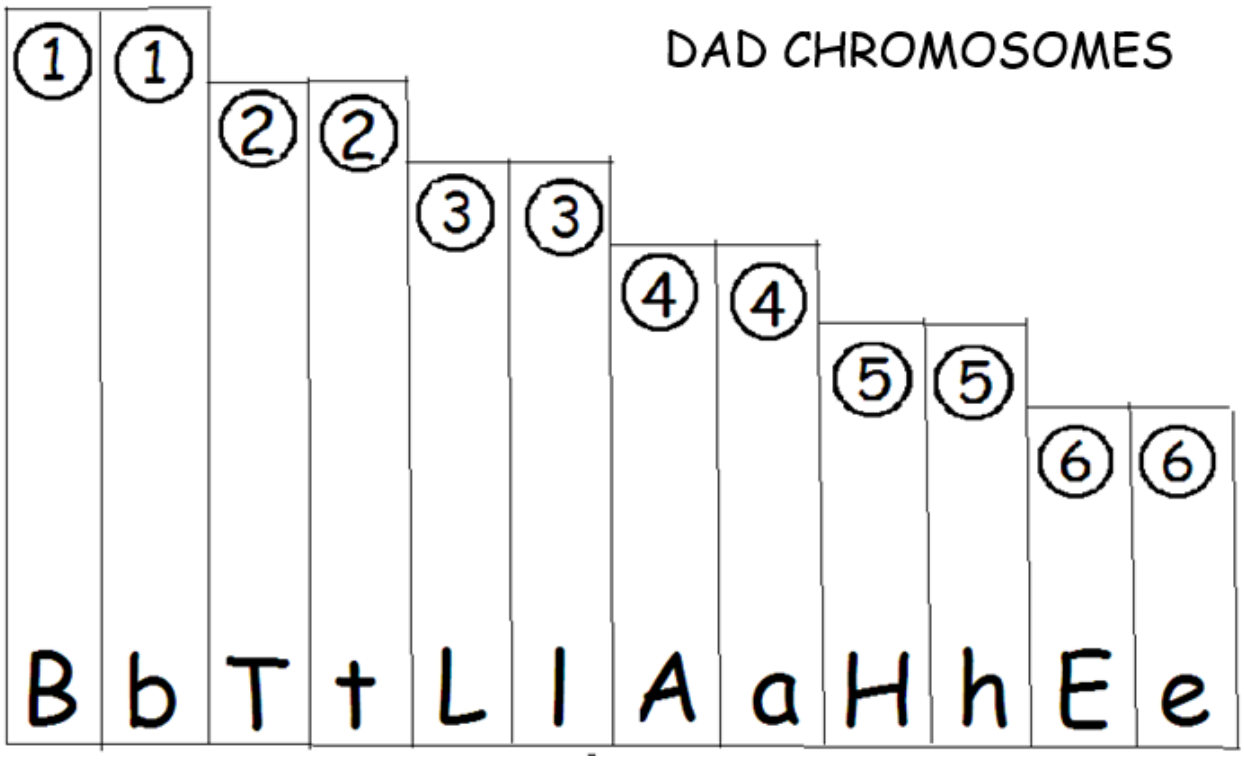
CURLY TAILS = T **TtHh X TtHh**
STRAIGHT TAILS = t
Hover wings = H
NO wings = h
What is the probability that an offspring from this cross will show:

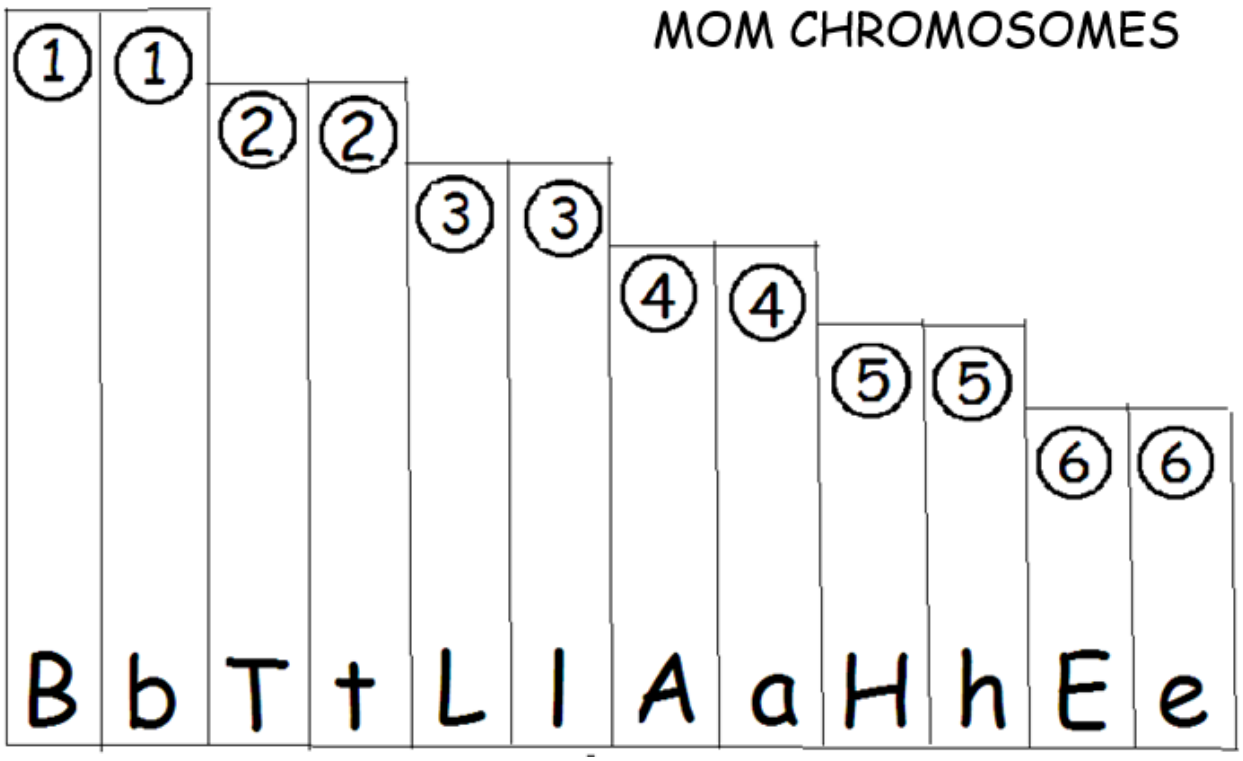
BOTH RECESSIVE TRAITS? _____ /16

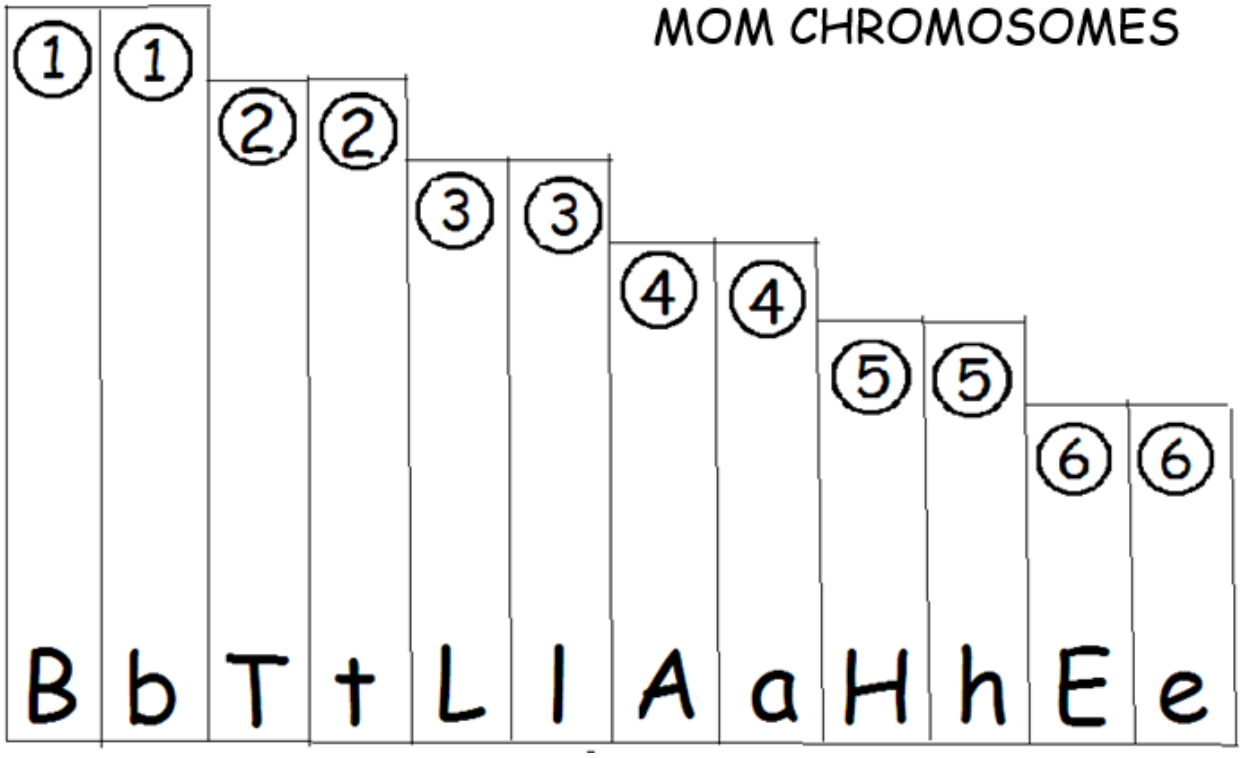
Blackline Master #2

Chromosome Cut-Outs





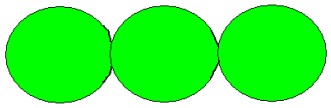

MOM CHROMOSOMES
1 1
2 2
3 3
4 4
5 5
6 6
B b T t L l A a H h E e


MOM CHROMOSOMES
1 1
2 2
3 3
4 4
5 5
6 6
B b T t L l A a H h E e

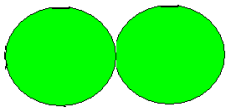
Blackline Master #3

REEBOP GENETICS DECODER

BODY SEGMENTS:

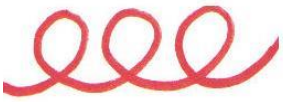


3 body segments = BB or Bb



2 body segments = bb

TAIL:

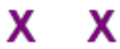


Curly tail = TT or Tt

Straight tail = tt

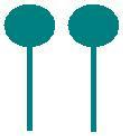
EYES:

2 eyes = EE or Ee



No eyes = ee

ANTENNAE:

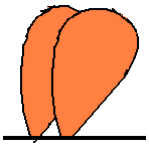


2 Round antennae = AA

2 round and 2 flowered = Aa

2 Flowered antennae = aa

HOVER WINGS:



2 hoverwings = HH or Hh

No hoverwings = hh

LEGS:

BLUE legs = L L

GREEN legs = L l

YELLOW legs = l l

Blackline Master #4

Individual Student Assessment: Complex Patterns of Inheritance

1) After completing the lab activity on Reebop Genetics, explain which genetic trait in Reebops showed ***incomplete dominance***. *(SC.912.L.16.2)*
   a. Antennae
   b. Eyes
   c. Legs
   d. Tails

2) Which one of Mendel's laws explains how the alleles of a gene segregate independently of the alleles of other genes? *(SC.912.L.16.1)*
   a. Crossing over
   b. Dominance
   c. Independent assortment
   d. Segregation

3) After completing the lab activity on Reebop Genetics, explain which genetic trait in Reebops showed ***codominance.*** *(SC.912.L.16.2)*
   a. Tails
   b. Eyes
   c. Antennae
   d. Legs

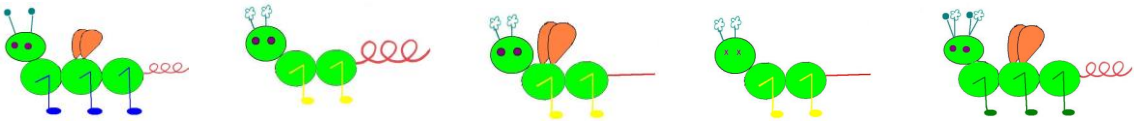
4) Use a Punnett Square to complete the following genetic cross *(SC.912.N.1.1)*:
   TtEe X TtEe

5) What are the possible ***gametes*** that this Reebop could produce? *(SC.912.N.1.1)*
   Tt Ee
   a. TE Tt Ee EE
   b. Te Et TT tE
   c. TE Te tE Et
   d. TE Te tE te

6) Using the above diagram what would you expect to see as the ***phenotypic ratio*** for the offspring? *(SC.912.N.1.1)*
   a. 3:1
   b. 1:2:1
   c. 9:3:3:1
   d. 4:4:4:4

Blackline Master #5 – ANSWER KEYS

Reebop Genetics Answer Key

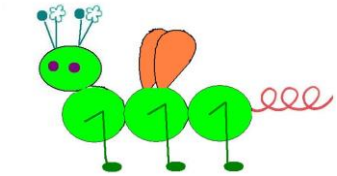


The GENOTYPE for your parent Reebop is:

Bb Tt Ll Aa Hh Ee

This parent is heterozygous for all of its alleles.
What is its PHENOTYPE ?
3 bodied segments, curly tail, 2 round 2 flowered antennae, 2 hover wings, green legs

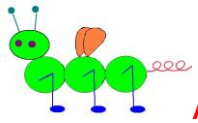
Draw a picture of what your parent Reebop looks like:



LAY your parent chromosomes FACE DOWN on your desk.

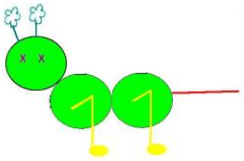
1. **MATCH up your chromosomes BY SIZE (homologous pairs)**
2. **Do MEIOSIS TO MAKE GAMETES WITH YOUR CHROMOSOMES.**
3. **Use INDEPENDENT ASSORTMENT to separate chromosomes (one of each kind of chromosome) to make gametes**
4. **Choose one set of chromosomes to make an offspring with your neighbor.**

WRITE DOWN the GENOTYPE for your baby.
Answers will vary
Use the code to DRAW A PICTURE OF WHAT THIS OFFSPRING WILL LOOK LIKE below:



Answers will vary

Does this offspring have the same GENOTYPE as its parents? YES NO
Does this offspring have the same PHENOTYPE as its parents? YES NO
USE THE CHROMOSOMES YOU DIDN'T USE THE FIRST TIME TO MAKE ANOTHER OFFSPRING.
Offspring #2 Genotype: Bb Tt Ll aa Hh ee (Answers will vary)
DRAW A PICTURE BELOW OF WHAT THE 2nd OFFSPRING LOOKS LIKE:



Answers will vary

Does the new offspring have the same genotype as the parents? YES NO
Does the new offspring look exactly like the 1st baby? YES NO

Name Mendel's TWO LAWS that explain why brothers and sisters are not identical even though they come from the same parents?
LAW OF _____Segregation_____
LAW OF _____Independent Assortment_____
* * * * * * * * * * * * *

When 2 alleles BLEND to show an INTERMEDIATE PHENOTYPE (like crossing red and white flowered plants and producing PINK flowered offspring) the gene is said to be INCOMPLETELY DOMINANT.

If a trait shows INCOMPLETE DOMINANCE which genotype must an organism have to show the intermediate blended phenotype?

A. PURE DOMINANT
B. PURE RECESSIVE
C. HETEROZYGOUS
D. HOMOZYGOUS RECESSIVE

Which trait in REEBOPS appears to blend and show INCOMPLETE DOMINANCE? __legs___

If pea plants showed INCOMPLETE DOMINANCE for HEIGHT, what would a plant look like that had BOTH a tall allele and a short allele? _____medium_____

* * * * * * * * * * * * *

When neither of two alleles is dominant over the other, they don't blend but BOTH APPEAR TOGETHER AT THE SAME TIME (like A and B blood type alleles). The gene is said to be CODOMINANT.

Which trait in REEBOPS appears to be CODOMINANT? _____antennae_____

Why do you think so? __Both traits show up_____

If pea plants showed CODOMINANCE for flower color, what would a plant look like that had BOTH a red flowered allele and a white flowered allele? show both red and white flower

A Reebop with the genotype T t is HETEROZYGOUS for tail genes.

A Reebop with the genotype L L is HOMOZYGOUS for leg genes.

A Reebop with the genotype e e is PURE for eye genes.

A Reebop with the genotype A a is HYBRID for antenna genes.

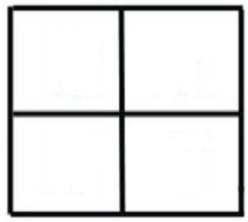
What has to be true about the Reebop parents that show a DOMINANT allele for a trait, but have a baby that shows the RECESSIVE trait?

A. both parents are HOMOZYGOUS for the trait
B. both parents are HETEROZYGOUS for the trait
C. both parents are PURE for the trait
D. IMPOSSIBLE; Dominant looking parents can't have a recessive looking offspring

* * * * * * * * * * * * *

MAKE SOME REEBOP CROSSES:
Curly tails (T) is dominant over straight tails (t)

Cross a HOMOZYGOUS CURLY TAILED MOM with a STRAIGHT TAILED DAD

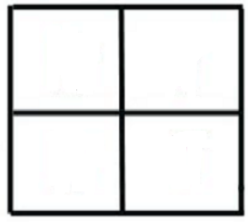


GENOTYPE of offspring = _____Tt_____
PHENOTYPE of offspring = _____Curly tails_____
Could these parents ever have a straight tailed baby? YES NO
Explain why or why not? One parent is homozygous dominant so no offspring can show the recessive trait of tt
This cross is a _____ cross.
MONOHYBRID DIHYBRID

* * * * * * * * * * * * *

MAKE A CROSS BETWEEN

Cross a PURE STRAIGHT TAILED MOM with a HYBRID CURLY TAILED DAD

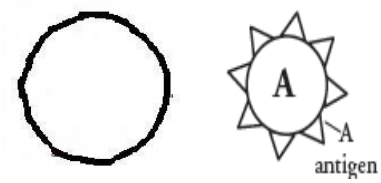


What is the probability the offspring will:
Have Curly tails: _2____ out of 4 OR __50___%
Have Straight tails: __2____ out of 4 OR _50____%
Be hybrids: __2___ out of 4 OR _50____%
Be homozygous: __2___ out of 4 OR __50___%

REEBOPS HAVE THE SAME A, B, O BLOOD TYPE ALLELES AS HUMANS.

Tell two different GENOTYPES a Reebop could have if it had TYPE A blood. __AA__ __Ai__

Draw a picture of a blood cell from a Reebop with A positive blood.



Adding which of the following would cause this Reebop's blood to agglutinate or "clump"?

ANTI-A serum ANTI-B serum ANTI-Rh serum

If this Reebop was injured and needed a blood transfusion, which of these possible blood types that could act as donors.
A B AB O

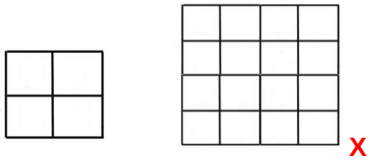
Which blood type is considered to be the "universal donor"? __O___

Which molecules are found on the surface of all body cells and give organisms their blood type? _____antigens_____

* * * * * * * * * * * * * *

A cross between two parent Reebops that are HETEROZYGOUS for TWO TRAITS is called a _____ cross.
MONOHYBRID DIHYBRID

Which of these Punnett squares would you use to show the possible offspring from this cross?



MAKE THE FOLLOWING CROSS: T t B b X T t B b

What are the possible GAMETES this Reebop can produce?

T t B b

_TB____ __Tb___ __tB___ __tb___

What phenotypic ratio would you expect to see in the offspring?

3:1 1:2:1 2:2 9:3:3:1 4:4:4:4

SET UP THE PUNNETT SQUARE BELOW TO SHOW THE POSSIBLE OFFSPRING OF THIS CROSS:

T t B b X T t B b

	TB	Tb	tB	tb
TB	TTBB	TTBb	TtBb	TtBb
Tb	TTTB	TTbb	TtBb	Ttbb
tB	TtBb	TtBb	ttBB	ttBb
tb	TtBb	Ttbb	ttBb	ttbb

What is the probability that an offspring will have 2 BODY SEGMENTS and a STRAIGHT TAIL? _1_/16

What is the probability that an offspring will have 2 BODY SEGMENTS and a CURLY TAIL? _3__ /16

What is the probability that an offspring will have 3 BODY SEGMENTS and a CURLY TAIL? _9__/16

What is the probability that an offspring will have 3 BODY SEGMENTS and a STRAIGHT TAIL? _3_ /16

USE WHAT YOU KNOW ABOUT HETEROZYGOUS DIHYBRID CROSSES TO ANSWER THE FOLLOWING:

CURLY TAILS = T
STRAIGHT TAILS = t
Hover wings = H
NO wings = h

TtHh X TtHh

What is the probability that an offspring from this cross will show BOTH RECESSIVE TRAITS? __1___ /16

Individual Student Assessment: Complex Patterns of Inheritance

1) After completing the lab activity on Reebop Genetics, explain which genetic trait in Reebops showed ***incomplete dominance***. *(SC.912.L.16.2)*
   a. Antennae
   b. Eyes
   c. Legs
   d. Tails

2) Which one of Mendel's laws explains how the alleles of a gene segregate independently of the alleles of other genes? *(SC.912.L.16.1)*
   a. Crossing over
   b. Dominance
   c. Independent assortment
   d. Segregation

3) After completing the lab activity on Reebop Genetics, explain which genetic trait in Reebops showed ***codominance.*** *(SC.912.L.16.2)*
   a. Tails
   b. Eyes
   c. Antennae
   d. Legs

4) Use a Punnett Square to complete the following genetic cross *(SC.912.N.1.1)*:

TtEe X TtEe

	TE	Te	tE	te
TE	TTEE	TTEe	TtEE	TtEe
Te	TTEe	TTee	TtEe	Ttee
tE	TtEE	TtEe	ttEE	ttEe
te	TtEe	Ttee	ttEe	ttee

5) What are the possible ***gametes*** that this Reebop could produce? *(SC.912.N.1.1)*

Tt Ee

   a. TE Tt Ee EE
   b. Te Et TT tE
   c. TE Te tE Et
   d. TE Te tE te

6) Using the above diagram what would you expect to see as the ***phenotypic ratio*** for the offspring? *(SC.912.N.1.1)*
   a. 3:1
   b. 1:2:1
   c. 9:3:3:1
   d. 4:4:4:4