

WHAT IS GENETICS?

“Create your own Bug”

“The study of genotypes versus phenotypes and the probability of an offspring inheriting a specific trait”

Developed by Kim Kidd TIR 2018-19

OVERVIEW:

This lab introduces students to the world of genetics through the study of Mendel’s Laws of Inheritance. The guiding principles of Mendel’s Laws will help students understand how genes and specific character traits are passed on from parent to offspring. Students will explore a model of genetic inheritance (Punnet Squares) to determine the genotypes and phenotypes of potential offspring and the probability of an offspring expressing a given trait. Lastly, students will have an opportunity to create their own unique 3 dimensional bug model. Through this activity students will identify the possible outcomes of a genetic cross between two organisms that are heterozygous for nine different genes.

OBJECTIVE:

To encourage students to examine how the characteristics of an organism are a result of inherited traits and how these traits are determined by the transfer of genetic information, from one generation to the next.

STATE STANDARDS:

Life Science (LS) – Grade 8

Topic: Species and Reproduction

Content Statements:

8.LS.1: Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. The fossil records provide evidence that changes have occurred in number and types of species.

8.LS.2: Every organism alive today comes from a long line of ancestors who reproduced successfully every generation.

8.LS.3: The characteristics of organisms are a result of inherited traits received from parent(s).

TIME: 45 minutes





VOCABULARY: genetics, organisms, species, reproduction, DNA, genes, alleles, dominant, recessive, heterozygous (hybrid), homozygous dominant (pure), homozygous recessive (pure), Punnett squares, genotype, phenotype, Mendel's Laws of Inheritance (3)

MATERIALS:

- Laminated PUNNET Squares
- Overheads: Mendel's Laws of Inheritance
- Definition Cards: Genetics, Organisms, Species, DNA, Genes, Alleles, Genotype, Phenotype, Heterozygous, Homozygous Dominant, Homozygous Recessive, Punnett Squares, Reproduction
- Law of Dominance Demonstration: Yellow Cellophane and Clear Cellophane
- Activity #1: "Punnett Squares" (Understanding Mendel's Laws of Inheritance): Teacher Example and Student Worksheet
- Activity #2: "Alien Genetics": Data Recording Sheet, Feature Chart, Alien Offspring drawing
- Activity #3: "Build Your Own Bug": Data Recording Sheet, Feature Chart, Bug Analysis Worksheet, Bug Supply Kit

INTRODUCTION:

1. **What is genetics?** (Generate responses)

-  **Genetics** is the study of heredity or how the characteristics of living things are passed on from one generation to the next. (Ex. hair color, eye color, body build, etcetera.)
-  Every living thing contains the genetic material that makes up their DNA. **DNA** (Deoxyribonucleic Acid), is the molecule that contains the genetic code of an organism and determines all the characteristics of a living thing.
-  The basic unit of heredity is the gene.
-  The genes of a species, determines an organisms' character traits and overall appearance.

- ✚ The **traits** that are passed on will play a significant role in an **organisms' ability to survive** and **adapt to their changing environment**.
- ✚ **The more diverse a species character traits** the **more likelihood** the organism will **survive** when **environmental conditions change**.
 - **Note:** Throughout history, the **extinction of a species** has occurred when the individual organisms of that species **do not have the necessary traits to survive** and **reproduce** in that **changed environment**.
 - To be **extinct** means to have **no living members** or that **an organism is no longer in existence**.

2. **What is an organism?** (Generate responses)

- ✚ An **organism** is an **individual plant** (Ohio Buckeye, Corn, Butterfly Weed), **animal** (White Tailed Deer, Coyote, Human-being), or **single-celled life form** (Paramecium, Amoeba, Euglena).

3. **What is a species?** (Generate responses)

- ✚ A **species** is a **group of living organisms consisting of similar individuals capable of exchanging genes or reproducing**.

4. **What is reproduction?** (Generate responses)

- ✚ **Reproduction** is the **biological process** by which new individual organisms, "offspring", are created from their "parent(s)".

- ✚ During **reproduction**, genetic information (DNA) is transmitted between parent and offspring.

- ✚ There are **two types** of **reproduction**:

(1) **Asexual Reproduction** - The lone parent contributes DNA to the offspring.

(2) **Sexual Reproduction** - Both parents contribute DNA.

- ✚ Every organism alive today comes from a long line of ancestors who have reproduced successfully every generation.
- ✚ Genetic diversity amongst species is important for survival.

5. What is an example of a species that is genetically diverse?

(Generate Responses)

Note: Genetic diversity serves as a way for populations to adapt to changing environments. With more **variation**, it is more likely that some individuals in a population will possess variations of alleles that are suited for the environment. Those individuals are more likely to survive to produce offspring bearing that allele.

- ✚ Inform the students that they are all looking at one species right now that is genetically diverse and that, due to this diversity or genetic variation, has the ability to adapt to different environments and maintain the survival of the population.

✚ HUMAN BEINGS!!!

- ✚ **Human beings** have physically diverse traits based on the region in which they live. This has allowed humans to successfully live in their environment:

Examples:

1. **Face shape:** Eskimos, an indigenous people inhabiting northern Canada, Alaska, Greenland and eastern Siberia, have adapted to extreme cold by retaining fat in their faces for additional warmth in extremely cold climates.
2. **Skin colour:** Lighter skin allows for the greater penetration of the sun's UV rays. This is very important for humans that live in cold climates. Example: Scandinavian countries
3. **Hair:** Tight Curly Hair keeps the hair off the neck and exposes more areas of the scalp. This helps with the cooling and evaporation of sweat. Longer Straight hair is prominent in colder climates because it keeps an individual's head and neck warm.

- ✚ As humans, our own genetic make-up will determine what character traits will be passed on through the generations. How many people have heard people say you got your eye colour from your father, you have the same build as your mother?

6. How do genes determine the traits an offspring inherits from their parent?

- ✚ Every organism has a set of genes that determines its traits (Eye colour, Hair colour, Dimples, Freckles, Earlobe attachment, Height, etc.).

✚ The different forms of a gene are called alleles.

Example:

Gene = Coca Cola **Alleles** = Regular Coke, Diet Coke, Vanilla Coke

Gene = Eye Color **Alleles** = Blue Eyes, Green Eyes, Brown Eyes

Note: "A gene specifies the trait and the allele specifies the form the gene takes."

An organism will have two copies of an allele for every gene that codes for a trait.

Offspring inherit one allele from each parent.

Individual alleles control or determine what traits an organism inherits. Some alleles are **dominant**, while other alleles are **recessive**.

Geneticists use letters to represent alleles. (Ex. BB, Bb or bb). Uppercase letters represent a dominant allele and lowercase letters represent a recessive allele.

Note:

✚ A dominant allele is one whose trait always shows up in an organism when the allele is present.

✚ A recessive allele is masked or covered up whenever the dominant allele is present.

✚ A recessive allele will only show up if the organism inherits two recessive alleles for that trait.

✚ When an organism inherits two copies of the dominant allele (BB) or two copies of the recessive (bb) allele for a trait, the offspring is referred to as **homozygous** ("homo" meaning "same") **or pure for that trait.**

✚ When an organism inherits two different alleles (Bb) for a given trait, the offspring is referred to as **heterozygous** ("hetero" meaning "different") or a **hybrid.**

7. What are the possible allele combinations that code for a specific trait (Genotypes)?

BB = homozygous dominant (Has two copies of the dominant allele)

bb = homozygous recessive (Has two copies of the recessive allele)

Bb = heterozygous (Has one copy of the dominant allele and one copy of the recessive allele)

8. What is a Genotype?

✚ The genotype is the set of genes in our DNA that is responsible for a particular trait. It is an organisms' genetic make-up or allele combination.

Example: FF is the genotype for black fur

9. What is a Phenotype?

✚ The phenotype is the observable physical properties of an organism; these include the organisms' appearance, development and behaviour.

Example: "What you see" – Black fur is the phenotype.

10. What is a Punnett Square?

✚ Scientists use models of genetic inheritance such as Punnett Squares to show the possible combinations of alleles that an offspring may inherit for a given trait. Punnett Squares can also be used to determine the probability of inheriting a specific trait.

Punnett Square: 2 X 2 SQUARE

*** See next page for visual diagram of a Punnett Square ***

Example:

Note: Mendel's Laws of Inheritance can be used to understand how genes and their alleles are passed down from one generation to the next. When visualized with a Punnett square, these principles can predict the potential combinations of offspring from two parents of known genotype, or infer an unknown parental genotype from tallying the resultant offspring.

11. **What are Mendel's Laws of Inheritance?**

✚ Johann Gregor Mendel (1822 – 1884), known as the “Father of Genetics” discovered the fundamental laws of inheritance.

“Mendel deduced that genes come in pairs and are inherited as distinct units, one from each parent. Mendel tracked the segregation of parental genes and their appearance in the offspring as dominant or recessive traits. He recognized the mathematical patterns of inheritance from one generation to the next.”

-- 2002 - 2011, DNA Learning Center, Cold Spring Harbor Laboratory.

Mendel's Laws of Inheritance

1. **First Law: Law of Segregation of Genes** - For any trait, each parents' pair of genes (alleles) is split. An offspring receives one allele from each parent.

"Organisms inherit two alleles for each trait."

2. **Second Law: Law of Independent Assortment** – The alleles for separate traits are passed on independently of one another from parent to offspring. The biological selection of an allele for one trait has nothing to do with the selection of an allele for any other trait.

"Genes for different traits are sorted separately from one another so that the inheritance of one trait is not dependent on the inheritance of another."

3. **Third Law: Law of Dominance** – An organism with alternate forms of a gene will express the form that is dominant. A dominant trait is a trait whose appearance will always be seen in offspring. Recessive alleles will always be masked by dominant alleles. Therefore, a cross between a homozygous dominant and a homozygous recessive will always express the dominant phenotype, while still having a heterozygous genotype.

"A dominant trait is a trait whose appearance will always be seen in the offspring."

Visual Demonstration (Law of Dominance):

"Traits that are dominant always appear in the Offspring"

 Use color as an example.

1. Inform the students that color is usually dominant over lack of color.

C = dominant allele (color) and **c** = recessive allele (lack of color).

2. Hold two pieces of yellow cellophane together and ask the students what they observe.

3. Next, hold two clear plastic pieces of cellophane up together and again ask the students what they observe.

4. Lastly, hold the yellow cellophane and the clear cellophane together. The students should note that the lack of color is shown only by combining the two

pieces of clear cellophane.

5. Inform the students that **CC** or **Cc** = color and **cc** = lack of color.

ACTIVITIES:

Activity #1: Punnet Squares (Understanding Mendel's Laws of Inheritance)

Punnett Square: Use a Punnett Square to predict the probability of inheriting a specific trait.

Note: This is a teacher-guided activity. Complete the first Punnett Square as a class and then have the students complete the Punnett Square Worksheet to ensure that they understand how an offspring inherits a specific trait.

First, draw a 2 X 2 SQUARE

Example:

Second, identify the gene (trait) and the gene forms (alleles) to determine what traits an offspring will inherit.

Choose a letter to represent the allele. Write the dominant allele with a capital letter, and the recessive allele with the same letter in lowercase.

Example: Gene: Fur Color

Alleles (different forms of the trait):

Black fur = F (Dominant) / Yellow fur = f (Recessive)

Third, determine the genotype for each of the parents:

Parent #1 (Dad) – Genotype = Ff / Parent #2 (Mom) – Genotype = ff

Genotype of Parent

Parent #2 (Mom)

f

f

F

**Parent
#1 (Dad)**

f

Fourth, using Mendel's First Law: Law of Segregation of Genes, each parents' pair of genes (alleles) are split. An offspring receives one allele from each parent.

Alleles inherited from each Parent

		Parent #2 (Mom)	
		f	f
Parent #1 (Dad)	F	Ff	Ff
	f	ff	ff

Fifth, based on the data, determine the genotypes and phenotypes of the offspring and the probability of inheriting a particular trait.

Genotypes of Offspring (Punnett Square)

“The set of genes in our DNA that is responsible for a particular trait.”

		Parent #2 (Mom)	
		f	f
Parent #1 (Dad)	F	Ff 25%	Ff 25%
	f	ff 25%	ff 25%

Phenotypes of Offspring (Punnett Square)

"The observable physical characteristics of that trait."

		Parent #2 (Mom)	
		f	f
Parent #1 (Dad)	F	Ff Black Fur 25%	Ff Black Fur 25%
	f	ff Yellow Fur 25%	ff Yellow Fur 25%

Note: There is a 50% chance that an offspring could inherit either black or yellow fur.

PUNNETT SQUARES (WORKSHEET):

Understanding Mendel's Laws of Inheritance

Activity: Using the information below complete each Punnet Square. Next, Identify the genotype and phenotype of each offspring and the probability of inheriting a specific trait.

Gene: Eye Colour

Alleles:

Blue = E (dominant)

Green = e (recessive)

Parent #1 (Genotype): Ee

Parent #2 (Genotype): Ee

Gene: Nose

Alleles:

Short Nose = N (dominant)

Long Nose = n (recessive)

Parent #1 (Genotype): NN

Parent #2 (Genotype): Nn

Blue Eyes = / 4 = _____%

Green Eyes = / 4 = _____%

Short Nose = / 4 = _____%

Long Nose = / 4 = _____%

Activity #2: Alien Genetics (This is a teacher-guided activity designed to demonstrate the procedure the students will follow to create their own bug in Activity #3.)

In this activity you will draw an Imaginary Alien. The phenotype of your alien will be determined by its genotype. You will consider 5 traits, each of which is determined by a different gene. Each parent is heterozygous, or hybrid for each gene (Ex. **Gg**). The **ALIEN GENETICS: DATA RECORDING SHEET** shows the aliens traits and indicates which allele is dominant for each gene.

Since each parent is heterozygous for each gene, either allele may be passed on to the offspring. To determine whether it is a dominant or recessive allele that is passed on you will roll a dice to represent the random process (1,2,3 = dominant allele and 4,5,6, = recessive allele). You will need to roll the dice twice because each parent passes on one allele for each gene. Record your results on the **ALIEN GENETICS: DATE RECORDING SHEET.**

Based on the data you collected use the **ALIEN FEATURE CHART** to create your "Alien Offspring".

Note: The eyes of the alien are attached to the top of the body and the mouth goes inside the body.

--- "HAVE FUN DRAWING YOUR ALIEN." ---

ALIEN GENETICS: DATA RECORDING SHEET

<u>Traits</u>	<u>Parent 1 Gene</u>	<u>Parent 2 Gene</u>	<u>Offspring Genotype</u>	<u>Offspring Phenotype</u>
Dominant in capitals. (D) Recessive in lower case. (r)	(Check one box for each trait contributed by this parent.)	(Check one box for each trait contributed by this parent.)	(Check one box for each trait for the corresponding genotype.)	(Check one box for each trait for the corresponding phenotype.)
<u>Eyes</u> TWO (D) or one (r)	<input type="checkbox"/> E <input type="checkbox"/> e	<input type="checkbox"/> E <input type="checkbox"/> e	<input type="checkbox"/> EE <input type="checkbox"/> Ee <input type="checkbox"/> ee	<input type="checkbox"/> TWO EYES <input type="checkbox"/> TWO EYES <input type="checkbox"/> one eye
<u>Body</u> ROUND (D) or upside down triangle (r)	<input type="checkbox"/> B <input type="checkbox"/> b	<input type="checkbox"/> B <input type="checkbox"/> b	<input type="checkbox"/> BB <input type="checkbox"/> Bb <input type="checkbox"/> bb	<input type="checkbox"/> ROUND <input type="checkbox"/> ROUND <input type="checkbox"/> Triangle
<u>Mouth</u> SMILE (D) or frown (r)	<input type="checkbox"/> M <input type="checkbox"/> m	<input type="checkbox"/> M <input type="checkbox"/> m	<input type="checkbox"/> MM <input type="checkbox"/> Mm <input type="checkbox"/> mm	<input type="checkbox"/> SMILE <input type="checkbox"/> SMILE <input type="checkbox"/> frown
<u>Arms</u> THREE FINGERS (D) or two fingers (r)	<input type="checkbox"/> A <input type="checkbox"/> a	<input type="checkbox"/> A <input type="checkbox"/> a	<input type="checkbox"/> AA <input type="checkbox"/> Aa <input type="checkbox"/> aa	<input type="checkbox"/> 3 FINGERS <input type="checkbox"/> 3 FINGERS <input type="checkbox"/> 2 fingers
<u>Legs</u> POINTED FEET (D) or rounded feet (r)	<input type="checkbox"/> L <input type="checkbox"/> l	<input type="checkbox"/> L <input type="checkbox"/> l	<input type="checkbox"/> LL <input type="checkbox"/> Ll <input type="checkbox"/> ll	<input type="checkbox"/> POINTED <input type="checkbox"/> POINTED <input type="checkbox"/> rounded
GENOTYPE:	<u>Example</u> = EE, Bb, mm, aa, LL			
PHENOTYPE:	<u>Example</u> = 2 eyes, round body, frown, 2 fingers, pointed feet			

ALIEN FEATURE CHART

“Phenotype – Observable Physical Characteristics”

TRAITS Dominant in capitals. (D) Recessive in lower case. (R)	DOMINANT TRAIT	RECESSIVE TRAIT
<u>Eyes</u> TWO EYES (D) or one eye (R) (attached to the body)		
<u>Body</u> ROUND (D) or upside down triangle (R)		
<u>Mouth</u> SMILE (D) or frown (R) (inside the body of the alien)		
<u>Arms</u> THREE FINGERS (D) or two fingers (R)		
<u>Legs</u> POINTED FEET (D) or rounded feet (R)		

ALIEN OFFSPRING DRAWING

Example:

Genotype = EE, Bb, mm, aa, LL

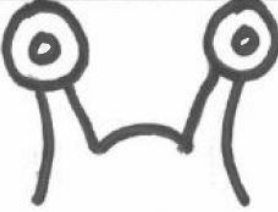









Phenotype = 2 eyes, round body, frown, 2 fingers, pointed feet

ALIEN GENETICS: DATA RECORDING SHEET

<u>Traits</u>	<u>Parent 1 Gene</u>	<u>Parent 2 Gene</u>	<u>Offspring Genotype</u>	<u>Offspring Phenotype</u>
Dominant in capital s. (D) Recessive in lower case . (R)	(Check one box for each trait contributed by this parent.)	(Check one box for each trait contributed by this parent.)	(Check one box for each trait for the corresponding genotype.)	(Check one box for each trait for the corresponding phenotype.)
Eyes TWO (D) or one (R)	<input checked="" type="checkbox"/> E <input type="checkbox"/> e	<input checked="" type="checkbox"/> E <input type="checkbox"/> e	<input checked="" type="checkbox"/> EE <input type="checkbox"/> Ee <input type="checkbox"/> ee	<input checked="" type="checkbox"/> TWO EYES <input type="checkbox"/> TWO EYES <input type="checkbox"/> one eye
Body ROUND (D) or upside down triangle (R)	<input checked="" type="checkbox"/> B <input type="checkbox"/> b	<input type="checkbox"/> B <input checked="" type="checkbox"/> b	<input type="checkbox"/> BB <input checked="" type="checkbox"/> Bb <input type="checkbox"/> bb	<input type="checkbox"/> ROUND <input checked="" type="checkbox"/> ROUND <input type="checkbox"/> Triangle
Mouth SMILE (D) or frown (R)	<input type="checkbox"/> M <input checked="" type="checkbox"/> m	<input type="checkbox"/> M <input checked="" type="checkbox"/> m	<input type="checkbox"/> MM <input type="checkbox"/> Mm <input checked="" type="checkbox"/> mm	<input type="checkbox"/> SMILE <input type="checkbox"/> SMILE <input checked="" type="checkbox"/> frown
Arms THREE FINGERS (D) or two fingers (R)	<input type="checkbox"/> A <input checked="" type="checkbox"/> a	<input type="checkbox"/> A <input checked="" type="checkbox"/> a	<input type="checkbox"/> AA <input type="checkbox"/> Aa <input checked="" type="checkbox"/> aa	<input type="checkbox"/> 3 FINGERS <input type="checkbox"/> 3 FINGERS <input checked="" type="checkbox"/> 2 fingers
Legs POINTED FEET (D) or rounded feet (R)	<input checked="" type="checkbox"/> L <input type="checkbox"/> l	<input checked="" type="checkbox"/> L <input type="checkbox"/> l	<input checked="" type="checkbox"/> LL <input type="checkbox"/> Ll <input type="checkbox"/> ll	<input checked="" type="checkbox"/> POINTED <input type="checkbox"/> POINTED <input type="checkbox"/> rounded
GENOTYPE:	Example = EE, Bb, mm, aa, LL			
PHENOTYPE:	Example = 2 eyes, round body, frown, 2 fingers, pointed feet			

ALIEN FEATURE CHART

“Phenotype – Observable Physical Characteristics”

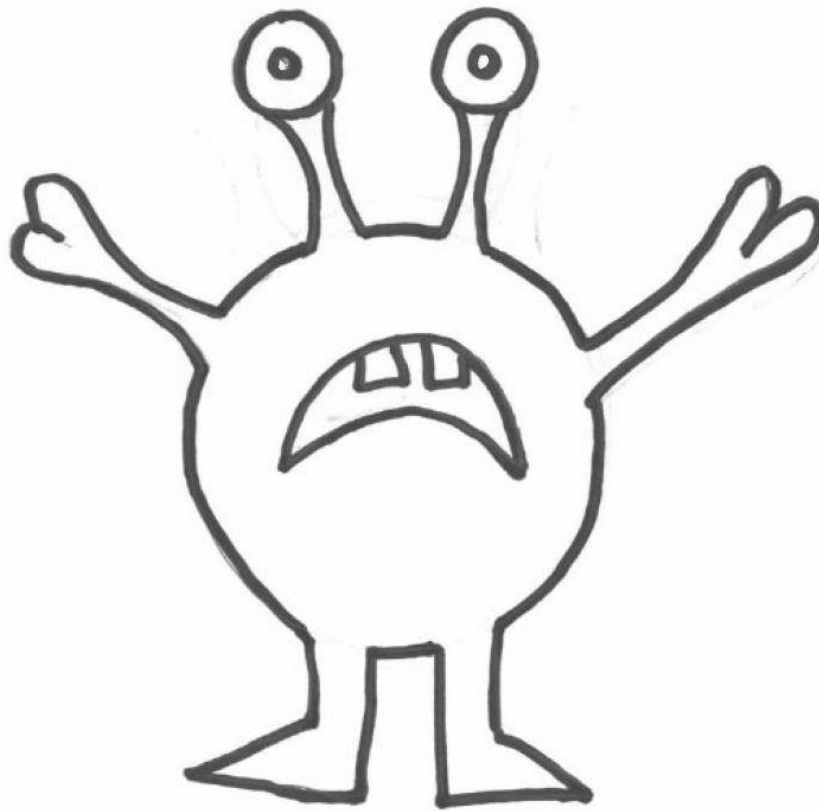
TRAITS	DOMINANT TRAIT	RECESSIVE TRAIT
Dominant in capitals . (D) Recessive in lower case . (R)		
<u>Eyes</u> TWO EYES (D) or one eye (R)		
<u>Body</u> ROUND (D) or upside down triangle (R)		
<u>Mouth</u> SMILE (D) or frown (R)		
<u>Arms</u> THREE FINGERS (D) or two fingers (R)		
<u>Legs</u> POINTED FEET (D) or rounded feet (R)		

ALIEN OFFSPRING DRAWING

Example:

Genotype = EE, Bb, mm, aa, LL

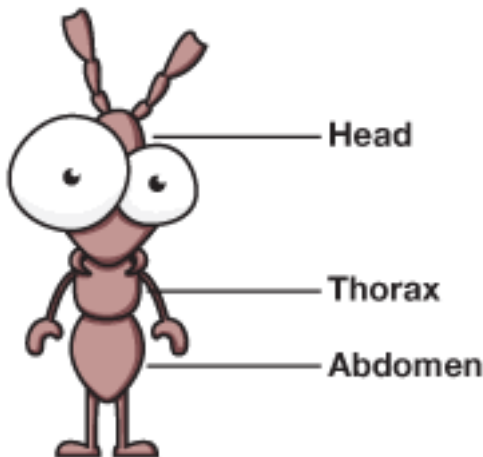
Phenotype = 2 eyes, round body, frown, 2 fingers, pointed feet



CONCLUSION:

Activity #3: Create Your Own Bug

In activity #3, “Create Your Own Bug”, students will have an opportunity to create their own 3-dimensional bug with a partner. Students will need to follow the same procedures outlined in “Alien Genetics”. In the onset of the activity, students need to determine if they are parent #1 or parent #2. Just like in the “Alien Genetics”, both parents are heterozygous for each gene (trait). Both parents (students) will have an opportunity to roll a dice to determine what allele is passed on to their offspring (1,2,3 = dominant / 4,5,6 = recessive). They will need to record their results on their Data Recording Sheet. Once each of the genotypes are determined for a given trait students will need to identify the phenotypes. The phenotypes (observable characteristics) will be used to create their 3-dimensional bug model. The bug models will follow the basic body part structure of a bug.



Note: Parts to be attached to each section of the bug.



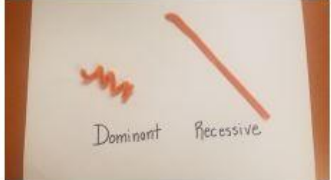
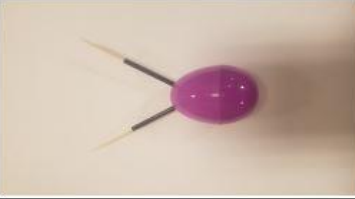

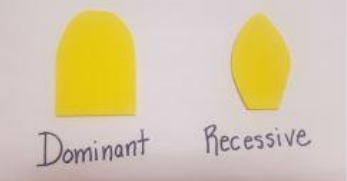
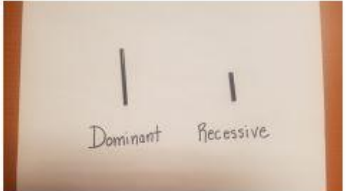
“Create Your Own Bug” – Body Plan		
Head	Thorax	Abdomen
Eyes	Three pairs of Legs	Stinger (if present)
Antennae	Foot pads (if present)	
Mouthparts	Humps	
	Wings	

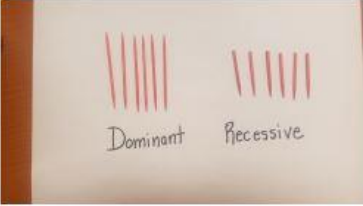
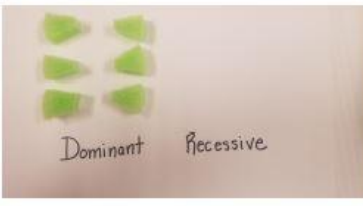
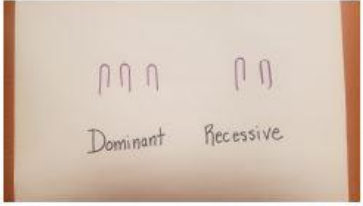

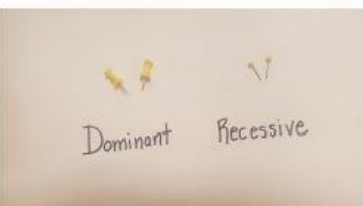
*** This activity has been adapted from the Cornell Institute for Biology Teachers – Insect GENERation (CIBT 2015). ***

“CREATE YOUR OWN BUG”: DATA RECORDING SHEET

<u>Traits</u> Dominant in CAPITALS. (D) Recessive in lower case. (r)	<u>Parent 1: Gene</u> <hr style="width: 80%; margin: 0 auto;"/> (Your Name) Check one box for each trait contributed by this parent.	<u>Parent 2: Gene</u> <hr style="width: 80%; margin: 0 auto;"/> (Partner's Name) Check one box for each trait contributed by this parent.	<u>Offspring Genotype</u> Check one box for each trait for the corresponding genotype.	<u>Offspring Phenotype</u> Check one box for each trait for the corresponding phenotype.
THORAX				
<u>Thorax</u> LARGE (D) or small (r)	<input type="checkbox"/> T <input type="checkbox"/> t	<input type="checkbox"/> T <input type="checkbox"/> t	<input type="checkbox"/> TT <input type="checkbox"/> Tt <input type="checkbox"/> tt	<input type="checkbox"/> LARGE <input type="checkbox"/> LARGE <input type="checkbox"/> small
<u>Legs</u> LONG (D) or short (r)	<input type="checkbox"/> L <input type="checkbox"/> l	<input type="checkbox"/> L <input type="checkbox"/> l	<input type="checkbox"/> LL <input type="checkbox"/> Ll <input type="checkbox"/> ll	<input type="checkbox"/> LONG <input type="checkbox"/> LONG <input type="checkbox"/> short
<u>Foot Pads</u> PRESENT (D) or not present (r)	<input type="checkbox"/> F <input type="checkbox"/> f	<input type="checkbox"/> F <input type="checkbox"/> f	<input type="checkbox"/> FF <input type="checkbox"/> Ff <input type="checkbox"/> ff	<input type="checkbox"/> PRESENT <input type="checkbox"/> PRESENT <input type="checkbox"/> not present
<u>Humps</u> 3 HUMPS (D) or 2 humps (r)	<input type="checkbox"/> H <input type="checkbox"/> h	<input type="checkbox"/> H <input type="checkbox"/> h	<input type="checkbox"/> HH <input type="checkbox"/> Hh <input type="checkbox"/> hh	<input type="checkbox"/> 3 HUMPS <input type="checkbox"/> 3 HUMPS <input type="checkbox"/> 2 humps
<u>Wing Shape</u> Round (D) or pointy (r)	<input type="checkbox"/> W <input type="checkbox"/> w	<input type="checkbox"/> W <input type="checkbox"/> w	<input type="checkbox"/> WW <input type="checkbox"/> Ww <input type="checkbox"/> ww	<input type="checkbox"/> ROUND <input type="checkbox"/> ROUND <input type="checkbox"/> pointy
ABDOMEN				
<u>Abdomen</u> WITH STINGER (D) or without stinger (r)	<input type="checkbox"/> S <input type="checkbox"/> s	<input type="checkbox"/> S <input type="checkbox"/> s	<input type="checkbox"/> SS <input type="checkbox"/> Ss <input type="checkbox"/> ss	<input type="checkbox"/> STINGER <input type="checkbox"/> STINGER <input type="checkbox"/> no stinger
HEAD				
<u>Antennae</u> SPIRAL (D) or straight (r)	<input type="checkbox"/> A <input type="checkbox"/> a	<input type="checkbox"/> A <input type="checkbox"/> a	<input type="checkbox"/> AA <input type="checkbox"/> Aa <input type="checkbox"/> aa	<input type="checkbox"/> SPIRAL <input type="checkbox"/> SPIRAL <input type="checkbox"/> straight
<u>Eyes</u> Long (D) or round (r)	<input type="checkbox"/> E <input type="checkbox"/> e	<input type="checkbox"/> E <input type="checkbox"/> e	<input type="checkbox"/> EE <input type="checkbox"/> Ee <input type="checkbox"/> ee	<input type="checkbox"/> LONG <input type="checkbox"/> LONG <input type="checkbox"/> round
<u>Mouthparts</u> Long (D) or short (r)	<input type="checkbox"/> M <input type="checkbox"/> m	<input type="checkbox"/> M <input type="checkbox"/> m	<input type="checkbox"/> MM <input type="checkbox"/> Mm <input type="checkbox"/> mm	<input type="checkbox"/> Long <input type="checkbox"/> Long <input type="checkbox"/> short

"CREATE YOUR OWN BUG": FEATURE CHART

<p>Styrofoam Ball</p>	<p>Head</p>	
<p>Foam Cylinder</p>	<p>Thorax (blue-large or pink-small)</p>	
<p>Pipe Cleaners</p>	<p>Antennae (spiral or straight)</p>	
<p>Plastic Egg w/ straws and toothpicks</p>	<p>Abdomen (Use the straws and toothpicks to attach the abdomen through the thorax to the head.)</p>	
<p>Flat Thumbtacks</p>	<p>Use to attach wings to thorax</p>	
<p>Foam Cut-Outs</p>	<p>Wings (round or pointy)</p>	
<p>Plastic Straws (black)</p>	<p>Mouthparts (long or short)</p>	

<p>Colored Toothpicks</p>	<p>Legs (short or long)</p>	
<p>Small Triangular Foam Pieces</p>	<p>Feet (present or not present - attached to legs)</p>	
<p>Colored Paper Clips</p>	<p>Humps (two or three - attached to the back of thorax)</p>	
<p>Screw-In Hook</p>	<p>Stinger in the abdomen (present or not present - screwed into the the abdomen)</p>	
<p>Pushpins</p>	<p>Eyes (round or long)</p>	

“CREATE YOUR OWN BUG”: ANALYSIS

1. Write down the complete **genotype** (Ex. TT, Ll, etc.) and **phenotype** (large thorax, long legs, etc.) of your offspring bug:

Genotype: _____

Phenotype: _____

2. How many traits expressed in the bug you built were **dominant** characteristics? _____

3. How many traits expressed in the bug you built were **recessive** characteristics? _____

4. How many of these dominant characteristics were **homozygous dominant** (*pure*) or **heterozygous** (*hybrid*)?

Homozygous dominant (*pure*): _____

Heterozygous (*hybrid*): _____

5. Would you expect more **dominant** or more **recessive** characteristics to appear in the offspring? Explain your answer.

6. Explain how it is possible that an offspring does not have round wings when both parents do have round wings. (Use a Punnett Square to illustrate how this is possible.)

Definition Cards Need to be added to the lab.