# SURVIVOR

### 2018-2019 VINSE/VSVS Rural

**Goal:** To explain how the environment helps determine what traits certain species possess.

**Curriculum Alignment:**

TN State Standards

- *GLE 0807.5.3* Analyze how structural, behavioral, and physiological adaptations within a population enable it to survive in a given environment.
- *SPI 0807.5.3* Analyze data on levels of variation within a population to make predictions about survival under particular environmental conditions.
    NGSS Framework
- *LS4.B Natural Selection*
- *LS4.C Adaptation*

**VSVSer   Lesson Outline**

_____ **I. Introduction**
       a. What is a trait?
       b. What is natural selection?
_____ **II Activity**
       Students will make their creature and will identify its traits.
_____ **III. Activity**
       Students will play the game SURVIVOR (15-20 minutes)
_____ **IV What Creatures Survived?**
       Students will look at score sheet and describe what happened to their creature (5 minutes).
       What traits were most advantageous to survival? (3-5 minutes)
       Instructor will define and explain natural selection (3-5 minutes)
       Instructor will give an example of natural selection (3-5 minutes)
_____    **V. Review**


**LOOK AT THE VIDEO BEFORE YOU GO OUT TO YOUR CLASSROOM**
**https://studentorg.vanderbilt.edu/vsvs/lessons/**
**USE THE PPT AND VIDEO TO VISUALIZE THE MATERIALS USED IN EACH SECTION.**


**1. Before the lesson:**
**In the car ride, read through this quiz together as a team. Make sure each team member has read the lesson and has a fundamental understanding of the material.**
Survivor Lesson Quiz
1.  What is a trait?
2.  What is natural selection?
3.  What is an adaptation?
4.  Give an analogy that explains traits, natural selection, and adaptation.
5.  How do students determine if their creature went extinct at the end of the survivor game?
6.  How will students determine whether individual traits were beneficial or not?


## I.   INTRODUCTION

**Learning Goals: Students understand basic genetics terms and concepts. Also, they are able to understand how this plays into natural selection, what natural selection is, and some examples of natural selection.**

**Why is the science in this lesson important?**

As its name implies, natural selection happens in nature without human interference, but a similar process called artificial selection still relies on the same principles. A rancher in Arizona is breeding his cattle to consume less grass yet still produce more beef. Plants have been bred to create bigger and sweeter fruits. Humans are able to control the prevalence of traits by increasing the fitness of desired traits with selective breeding.

**Ask students what they know about Charles Darwin.**
- English naturalist born in the 1800's
- Studied different forms of life around the world.
- Darwin proposed his theory of **natural selection**
- Concluded that organisms changed over time to better survive in their specific environments.
- "I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection." - Charles Darwin, *On the Origin of Species*

## a.    What is a Trait?

**Ask the class the following:**
1. Why do people look different from each other? *Answer: Because of differences in traits.*
2. Ask students to define the word **"trait".**
   *Answers should include: Traits are mostly physical characteristics or features that organisms have, e.g., hair color.*
   *A trait can be passed on to the offspring.*

**Examples of Traits:**
   Hair color, Eye color, Skin color, Height, Weight,, Hitchhiker's thumb, Left/right handed ,
   Ability to curl the tongue, Morton's toe, Attached/unattached earlobes, Nose shape, Hair texture

3. Ask students, "Why are there variations in a physical characteristic?"
   For example, there are many differences in hair colors (brown, red, blonde, etc.).
   Traits are influenced by genes. Genes carry information about traits which our parents have and pass down to us.
   Different combinations of genes influence an individual's features. These variations help make a person unique.
   For example, there are different versions of a gene which influence hair color. Parents will pass down different variations of a gene to their children, causing each of them to possibly have a different hair color.
- Traits, however, aren't *only* influenced by genes. How we live in the environment also determines our traits. For example, height and weight are influenced both by the genes we have from our parents and by what we eat.

## b. What is Natural Selection?

**Ask students what they know about Natural Selection. Answers should include:**
- It is the process by which an organism's traits are passed on or selected based on their environment.
- Some organisms have traits that allow them to better survive in their environment. For example, an arctic fox is white, which allows it to blend into its surroundings (snowy tundra). This "camouflage" makes it easier for the fox to hunt its prey, thus improving his chances of survival.

- The organisms that manage to survive then reproduce, passing on the genes for their advantageous traits to their offspring.
- If a gene leads to a trait that gives a significant enough advantage to the organism, then the organisms with that gene will eventually out-populate those without the gene
- This is why people describe the theory of natural selection as "the survival of the fittest".

**Examples of Natural selection:**
Tell the students that you are going to show them a real-world example of natural selection.
- Tell students to look at the handout of pictures of the peppered moths
- Prior to the 1800's, the peppered moth, found in England, was mostly light-colored. Dark colored moths were rare.
- The peppered moth liked to hang out on tree trunks. Industrial waste created during the Industrial Revolution darkened tree trunks where these peppered moths lived.
- Light-colored moths were spotted easily by predatory birds on the dark tree trunks and were eaten before they could reproduce.
- In contrast, the dark-colored moths blended in better with the dark tree trunks, making it more difficult for the birds to spot them. Thus, the dark-colored moths survived and reproduced.

**Other Natural selection examples:**
- Some insects have become immune to pesticides e.g. DDT is no longer effective in preventing <u>malaria</u> in some places
- Rat snakes come in a huge variety of colors depending on their environment.
- The most colorful peacock tails are the most effective at attracting a mate, so the tails got larger and more colorful and became what we are familiar with today.
- Deer mice started out dark brown to blend in with the forest, but those mice that moved to sandy desert in Nebraska adapted to become a light brown in order to blend in. The darker mice were killed by predators.
- When nylon was invented in the 1940's, bacteria evolved that were able to eat the nylon.
- All humans used to become lactose intolerant as they became adults. However, when cows were domesticated, most humans acquired the ability to consume lactose in adulthood.

c. **Traits that help organisms to survive in a specific environment are called <u>adaptations.</u>**

An adaptation is an inherited trait that helps an organism survive.

**Examples of adaptations:**
- Lizards with tails that fall off to escape predators
- Bats use sonar to hunt at night
- Milkweed produces a toxic substance to deter predators
- Spiders spin webs to catch prey
- Opossums play dead to avoid predators
- Rosebushes have thorns

## II.    ACTIVITY – STUDENTS MAKE THEIR CREATURES.

**Learning Goals:  Students make creatures with specific genetic variation and see how simple variation can lead to drastically different levels of survival.**

Divide class into 10 groups.
Have class look at the list of Traits and variations. As a class, discuss the benefits and detriments for the first trait – Leg Length. Some examples are given.

| Trait | Variation | Beneficial for: | Detrimental for: |
|---|---|---|---|
| Leg Length | *Long* | Can run fast | Cannot hide in grassland |
| | *Short* | Can hide in grassland | Cannot run very fast |
| Wings | *Wings* | Can fly away | Are easily damaged |
| | *No Wings* | Not in the way when walking through bushes | Cannot fly away |
| Foot Shape | *Talon* | Can climb structures | Cannot swim in water |
| | *Webbed* | Can swim in water | Cannot climb structures |
| Tail Length | *Short* | Allows you to be nimble | Cannot swat flies |
| | *Long* | Can be used to fight the enemy | Makes a lot of noise when sneaking up on prey |
| Arm Length | *Short* | Short arms are stronger | Cannot reach food high off the ground |
| | *Long* | Arms slow you down running thru bush | Can reach food high off the ground |
| "Hand" Shape | *Claw* | Can pick up nuts | |
| | *Paw* | Can dig holes to lie in to keep cool | Cannot pick up nuts |
| Antenna Shape | *Star* | | |
| | *Knob* | | |
| Antenna Length | *Short* | Safe from lightning strikes | Cannot pick up cell phone signals |
| | *Long* | Can detect enemy | Can be struck by lightning |
| Beak Shape | *Crusher* | Can crush hard nuts | Cannot suck up nectar |
| | *Trumpet* | Can suck up worms | Cannot crush hard nuts |
| Ear Shape | *Mouse* | Easy to keep clean | Has lousy hearing |
| | *Elephant* | Has very good hearing | Ears stick out and can be seen by predators |
| Skin Color | *Red* | Can hide in a field of red flowers | Scares off fish |
| | *Blue* | Blends with water so difficult for seagulls to find you for supper | |
| | *Purple* | | Scares off fish |
| Eye Color | *Red* | | |
| | *Green* | | |
| | *Red and Green* | | |

Tell the students that they are going to build a creature that they believe can withstand a variety of environmental changes.
Have each group decide which Trait variation they want for their creature. Circle that variation and give the reason (benefit) for choosing it.

Note: Some possible benefits/detrimental factors are listed on the next page, (if groups need help deciding which variation to choose)
Tell the group to build their creature, using the Trait variations that they have listed

1. There are a few rules:
   a. Creatures can have only ONE variation of a Trait. For example, you cannot have one web foot and one talon foot. Arm lengths, hand shapes, ear shapes etc have to be the same.
   b. You cannot change your creature after the game begins

After the creatures have been built, pass out the SURVIVOR Student Handout worksheet.

## III.   Activity

> **Learning Goals:  Students make creatures with specific genetic variation and see how simple variation can lead to drastically different levels of survival.**

- Students will now play the game of SURVIVOR.
- Explain that this game simulates how different creatures will "survive" in different environments.
- There are eleven scenarios that depict an environmental situation.
- In each situation, one variation of a trait will help some creatures survive and the other variation(s) of the trait will not help the others.

### The Rules:
- All teams start with zero chips.
- A scenario is read by a VSVS member.  Each creature possesses a trait that is either an advantage or disadvantage under the change in the environment.
  - Creatures that possess the advantageous variation will reproduce, represented by a green chip.
  - Creatures that possess the disadvantageous variation will get a red chip.
  - After each scenario, pass out a red or green chip to the groups.
- At the end of the game, students with more green chips than red chips have survived, but those with more red chips than green chips have gone extinct.
- The students will also keep track of the scores of each individual trait on the tally sheet.

#### Scenario #1
A severe drought occurs during the wet season in your environment. Most of your main foods sources have died during the drought, leaving you with tough seeds to eat.
*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*
If you have a trumpet beak, you are unable to break open these seeds. If you have a crusher beak, you are able to break open these seeds, so you can better survive and reproduce.
*Score:  Crusher beaks +1, Trumpet beaks -1*
**Give students the appropriate chips**

#### Scenario #2
The lack of food during the drought has caused many of the creatures to find nourishment by feeding on hard shelled marine animals in the nearby ocean.
*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*
If you have paw hands, you have a difficult time cracking open shellfish to eat. If you have claws, you are able to easily open shellfish to eat, so your creature is more fit and able to reproduce.
*Score: Claw hands +1, Paw hands -1*
**Give students the appropriate chips**

#### Scenario #3
Tall trees in your environment have survived the drought. To eat berries nuts or leaves, you must climb high up into the trees.

*Ask students "what trait is advantageous for survival and reproduction, what trait is disadvantageous"?*

If you have webbed feet, you are unable to climb the tree. If you have talon feet, you are able to climb up the tree.

*Score: Talon feet +1(get green chip), Webbed feet -1(get red chip)*

**Give students the appropriate chips**

### Scenario #4

The next wet season has finally came and brought with it plentiful rain. The rain nourishes a field of purple wildflowers.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have purple skin, you are able to hide in the field of wildflowers from predators. If you have red or blue skin, you are easily spotted and eaten by predators while in the field of wildflowers. The surviving creatures are more able to reproduce than those that do not survive.

*Score:  Purple skin +1(get green chip), Red or Blue skin, -1(get red chip)* **Give students the appropriate chips**


### Scenario #5

Various insects are attracted to star antennae because they mistake them for flowers to feed off of.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have star antennae, you are able to capture and eat bugs easily. If you have knob antennae, insects are not attracted to you and you are unable to catch the insects to eat them. The creatures that eat the bugs are more fit and able to reproduce.

*Score:  Star antennae +1(get green chip), Knob antennae -1(get red chip)* **Give students the appropriate chips**


### Scenario #6

Global warming has caused the sea level to rise. The high water levels have flooded your environment.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have web feet, you are able easily swim to higher ground to dry land. If you have talon feet, you are not able to get to dry land. Those creatures get to higher ground have safer places to reproduce and care for their young.

*Web feet +1(get green chip), Talon feet -1(get red chip)* **Give students the appropriate chips**


### Scenario #7

A new factory is being built in your habitat, destroying much of your resources such as shelter and food.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have wings, you are able to fly to a new habitat to find resources, providing more food for you and your offspring.  If you do not have wings, you must walk a long distance to find resources.

*Score:  Wings +1(get green chip), No wings -1(get red chip)* **Give students the appropriate chips**


### Scenario #8

You have found a new habitat. While searching for food one day, you need to reach high for leaves in the trees. *Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have long arms, you are able to reach the leaves, and stay fit so that you can reproduce. If you have short arms, you cannot get close enough to the tree leaves.

*Score:  Longs arms +1(get green chip), Short arms -1(get red chip)* **Give students the appropriate chips**


### Scenario #9

A large forest fire is engulfing your environment. A member of your clan transmits a high frequency sound to warn you about the danger.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have elephant ears, you are able to clearly hear the warning, and survive on to reproduce. If you have mouse ears, you are not able to hear the warning.

*Score:  Elephant ears +1(get green chip), Mouse ears -1(get red chip)* **Give students the appropriate chips**

**Scenario #10**

The forest fire is quickly consuming your habitat and you must escape.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have wings, you are able to quickly escape the fire and survive on to reproduce. If you do not have wings, you are not able to escape the fire.

***Score: Wings +1(get green chip), No wings -1(get red chip)* Give students the appropriate chips**

**Scenario #11**

An abundance of acorns has fallen to the ground.

*Ask students "what trait is advantageous for survival, what trait is disadvantageous"?*

If you have a crusher beak, you can join in the feast, and you have plenty of energy to reproduce.

***Score: Crusher Beak +1(get green chip), Trumpet Beak -1 (get red chip)* Give students the appropriate chips**

## IV.  WHAT CREATURES SURVIVED?

- Tell students to pair up a red chip with a green chip – they are effectively cancelling 1 advantageous trait with 1 disadvantageous trait.
- Set aside the paired chips.  The remaining chips (all 1 color now) give you your final "score".
- Report these totals to a VSVS member who will write them on the board.

Final # and color of chips (green or red)

| | |
|---|---|
| **Creature 1** | |
| **Creature 2** | |
| **Creature 3** | |
| **Creature 4** | |
| **Creature 5** | |
| **Creature 6** | |
| **Creature 7** | |
| **Creature 8** | |
| **Creature 9** | |
| **Creature 10** | |

- Tell students that if a creature is holding only red chips, (and therefore had a negative final score), it has gone extinct.  One group member should stand holding its extinct creatures for the class to see.
- If the creature is holding only green chips (and therefore had a positive score), that creature survived and reproduced.   One group member should stand holding its survivor creature for the class to see.

**Discovering which Variations Were the Most Advantageous**

a. See if students can determine why some traits were more helpful than others. Students should reach the conclusion that "creatures" went extinct if their traits were not advantageous in the environment. On the other hand, traits which were advantageous helped the "creature" survive.

b. Have students holding creatures with green chips come to the front of the class and hold the creatures so that the class can see.  Have the students determine if there are 2-3 traits common to the surviving creatures.

c. Have students with creatures that have gone extinct come to the front of the class.  The class should determine if there are 2-3 traits common to the extinct creatures.

For example:

When food was scarce, it was helpful to have a crusher beak that allows a creature to eat 'hardy' foods such as seeds and nets.

Having Talon feet allowed a creature to scale certain objects.

Those with wings have greater mobility, allowing them to explore new habitats or escape from predators.

Explain that the students simulated natural selection.

Remind students of the definition of natural selection.

**a.     The environment selects for certain traits. Creatures that had these advantageous traits would survive and reproduce.**

Ask the students which of the creatures do they think will be best suited to survive in the future.

According to natural selection, the creatures whose traits are selected for in the environment will pass their traits on.

Ask the following questions to the class to conclude the lesson:
a.     What is a trait? *Answer: Traits are mostly physical characteristics or features that you have, which can differ between people*
b.     By what is a trait influenced? *Answer: Genes and environment*
c.     What is natural selection? *Answer: The process by which an organism's traits are passed on or selected based on their environment*
d.     How does natural selection work? *Answer: Variations in a trait that allow an organism to survive better are passed down to the organism's offspring*
e.     How does environment influence survival? *Answer: Organisms with traits that help them survive in an environment are selected for, and organisms with traits that do not help them survive in an environment are selected against*
f.     What is an adaptation? *Answer: A trait that helps an organism survive in a specific environment*

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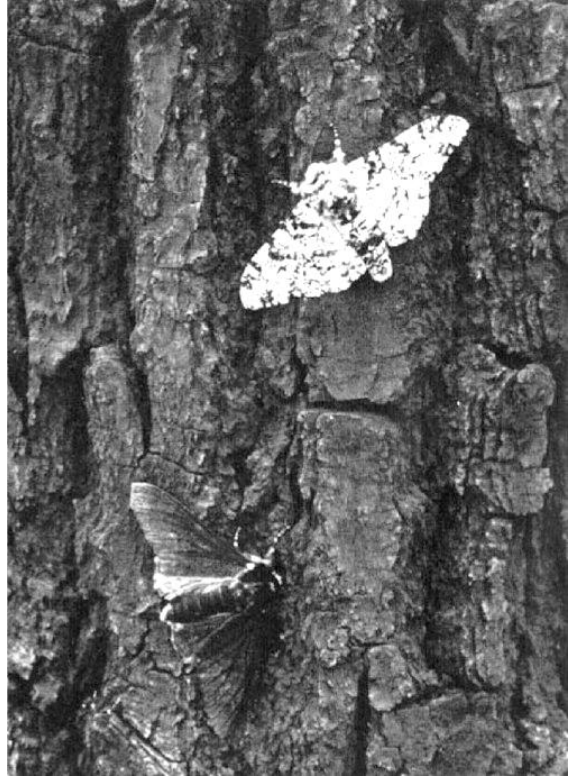Jason Wong, Undergraduate Lab Assistant for VSVS, Vanderbilt Universiy

# Observation Sheet

## Tally Chart

For each scenario, give a +1 or -1 in the tally box for the appropriate trait. At the end add up the net score.

| Trait | Variation | Tally | Net Score |
|---|---|---|---|
| **Leg Length** | *Long* | | |
| | *Short* | | |
| **Wings** | *Wings* | | |
| | *No Wings* | | |
| **Foot Shape** | *Talon* | | |
| | *Webbed* | | |
| **Tail Length** | *Short* | | |
| | *Long* | | |
| **Arm Length** | *Short* | | |
| | *Long* | | |
| **"Hand" Shape** | *Claw* | | |
| | *Paw* | | |
| **Antenna Shape** | *Star* | | |
| | *Knob* | | |
| **Antenna Length** | *Short* | | |
| | *Long* | | |
| **Beak Shape** | *Crusher* | | |
| | *Trumpet* | | |
| **Ear Shape** | *Mouse* | | |
| | *Elephant* | | |
| **Skin Color** | *Red* | | |
| | *Blue* | | |
| | *Purple* | | |
| **Eye Color** | *Red* | | |
| | *Green* | | |
| | *Red and Green* | | |

# Peppered Moths



# Arctic Fox