8-2011

Genetics, Adaptations, Biomes

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UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Genetics, Adaptations, Biomes

Grade Level: 7th

Subject/Topic Area(s): Science

Designed By: Theo Risinger and Stephanie Greathouse

Time Frame: 6 weeks

School District: NorthEast ISD

School: Barbara Bush Middle School

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Brief Summary of Unit (Including curricular context and unit goals):

This unit covers basic **Genetics** (Punnett Squares and terminology), the role it plays in **adaptations** and how it affects **Natural Selection** and **Selective Breeding**. This unit will also tie in the environment (**Biomes**) and how it plays a major role in determining the physical and behavioral characteristics of plants and animals.
Interconnection of these "big ideas" will facilitate better overall understanding of how time and changes in the environment will affect all living organisms.

UbD Adaptations

Stage 1 – Desired Results

Established Goals

7.14a: Define heredity as the passage of genetic instructions from one generation to the next generation

7.11b: Explain variation within a population or species by comparing external features, behaviors, or physiology of organisms that enhance their survival such as migration, hibernation, or storage of food in a bulb

7.11c: Identify some changes in genetic traits that have occurred over several generations through natural selection and selective breeding such as the Galapagos Medium Ground Finch or domestic animals

7.12a: Investigate and explain how internal structures of organisms have adaptations that allow specific functions such as gills in fish, hollow bones in birds, or xylem in plants

7.10a: Observe and describe how different environments including microhabitats in

Transfer

Students will independently use their learning to…

Recognize characteristics and adaptation of a given species and recreate that species as it will be in millions of years due to Natural Selection and a drastic change in its environment.

Meaning

Understandings

Students will understand that….

Organisms are governed by the genetic material found in the cell's nucleus

Change is needed within a species to ensure its survival

Genetic variation is needed to maintain health in a species

Adaptations are the product of time, environment, and Natural Selection

Essential Questions

What is the driving force behind genetic variation?

Why does genetic variation occur?

What does Natural Selection do?

How does Selective Breeding mimic Natural Selection?

How does the environment require that a species adapt?

What is the driving force behind adaptations?

Acquisition

Knowledge

Students will know…

Where genetic information is housed within a cell

Difference between heredity and genetics

How genetic information is passed from one generation to the next

What is the driving force behind genetic variation

The role that dominant and recessive

Skills

Students will be able to…

Compare features of a species that are beneficial to its survival

Relate an organisms structure to its function

Use Punnett Squares to explain adaptations and genetic diversity

Predict possible characteristics of future generations

schoolyards and biomes, support different varieties of organisms **7.14c**: Recognize that inherited traits of individuals are governed in the genetic material found in genes within chromosomes in the nucleus	alleles play within genetics Advantages and disadvantages to Selective Breeding Process of Natural Selection What is an adaptation	Explain the effect of Natural Selection on adaptations

Stage 2 – Evidence

CODE (M or T)	**Evaluative Criteria** (for rubric)	
T M M A A	•Time frame given •Structures match functions •Changes match environment •Biome changes logically •Distinct changes •Written description •Visual representation •Genetic support of outcome •All adaptations must be relevant	**Performance Task(s)** *Students will demonstrate meaning-making and transfer by…* Students will be assigned a species from the present day in its current environment and will be asked to recreate this species as it has adapted over millions of years in the future in an environment that has drastically changed as well (for example, a toucan that lives in the rainforest in present day. Over time the rainforest has become more like the grasslands). Recommended website to use : http://kids.nationalgeographic.com/kids/animals/creaturefeature/ Construct Punnett Squares from knowledge of dominant and recessive traits --- **Other Evidence (e.g., formative)** Pre-Assessment – mythical creature activity Punnett Square Quiz Natural Selection/Selective Breeding Quiz

Stage 3 – Learning Plan

CODE (A, M, T)	**Pre-Assessment** *How will you check students' prior knowledge, skill levels, and potential misconceptions?* Mythical Creature Activity and gallery walk	
	Learning Activities	**Progress Monitoring** (e.g., formative data)
M	•**Day 1**: DNA strawberry lab and questions – S will extract the DNA from strawberries. Inform students that strawberries are octoploid, meaning they have 8 strands of DNA in contrast to our 2 strands (diploid). Have S answer follow up questions after lab, possibly for HW.	Pre-Assessment – creature activity
A	•**Day 2**: Structure of genetic material and location & *Introduce Essential Questions #1 & 2* This is a direct teach piece, using a power point or other system to deliver basic information to students. Teach and discuss.	Punnett Square& EQs 1 &2 Quiz Natural Selection/Selective Breeding & EQs 3 & 4 Quiz
A/M	•**Days 3-4**: Crazy traits B1 – Dominant and Recessive Traits. S will be working in small groups or independently. Key Words for the lesson: trait, gene, allele, dominant, recessive * ISBN 978-1-60431-005-4 *http://www.cposcience.com *www.cpo.com/powerpoint/**crazy**%20**traits**_final.ppt	Species Creation Activity – end of unit project
A/M	•**Days 5-6:** Crazy traits B3 - Crazy Traits, element of chance. S will be working in groups of 4. Key words for the lesson: probability, genotype, phenotype	
A/M	•**Day 7-8**: Crazy traits B4 – Punnett Squares, predictions. S will be working in groups of 4. Key words for the lesson: Punnett Square.	
A	•Punnett Square practice sheets finish for homework	
A/M	•**Day 9-10**: *Introduce EQ #5.* Begin Crazy traits B7 – Adaptations, environments and traits. Students will be working in groups of 4. Key words of the lesson: adaptation.	
A	•**Day 11**: Quiz Punnett Squares and EQ #1&2 - (Genetics, Chance, Punnett Squares and Adaptations Quiz) •Genetic Vocabulary Squares: Heredity, genetics, generation, DNA, inherited, genes, chromosomes, allele, trait, dominant	

A	allele, recessive allele, genotype, phenotype, Natural Selection, Selective breeding/artificial selection, adaptation, genetic diversity, biodiversity, homozygous, heterozygous – finish for homework or when finished with work on other days •**Day 12**: Natural Selection vs. Selective breeding (lecture) <u>*Introduce EQ # 3 & 4*</u> Direct teach using power point notes or other method. Students will be able to recognize the 2 distinct types of selection and be able to discuss key aspects of each.	
M	•**Days 13-14**: Organism comparison (bring in pictures of pets and talk about why suited to certain environment)	
M	•**Day 15-17**: Pre-Assessment: create mythical creature with adaptations for a given environment	
A	•**Day 18**: Quiz Natural selection/ selective breeding and EQ # 3 & 4 (Natural Selection and Vocabulary Quiz)	
A	•Biome discussion, 2 each day. Teach each Biome for 5-10 minutes then give students 15 minutes per Biome to research. Then move on to second Biome for that day. Working in pairs give each S laptops and ask for animal (1 partner) and plant (other partner) adaptations including external feature, behavior, physiological adaptation (6 days) **Day 18**: Tundra & Coniferous Forest (Taiga) **Day 19**: Tropical Rainforest & Deciduous Forest **Day 20**: Grasslands & Savanna **Day 21**: Desert & Marine **Day 22**: Mountains & Fresh water **Day 23**: Gallery Walk – S pick their favorite plant and animal and post on wall. Classmates can then critique whether the plant and animal adaptation given serve a specific purpose in the specified Biome. **if unit needs to be shortened then cover 3 biomes in one day	
T	•**Day 24-29**: <u>*Introduce EQ # 6*</u>. Begin Species Adaptation activity	

	(time line) with biomes creating future characteristics of a given species. Students will be assigned a species from the present day in its current environment and will be asked to recreate this species as it has adapted over millions of years in the future in an environment that has drastically changed as well (for example, a toucan that lives in the rainforest in present day. Over time the rainforest has become more like the grasslands). Each Biome will have another specified Biome that it turns into over the given period of time. •Tundra – rainforest •Taiga – Savanna •Grasslands – Tundra •Savanna – Taiga •Tropical Rainforest – Deciduous Forest •Deciduous Forest – Freshwater •Desert – Marine •Marine – Grasslands •Mountains – Tropical Rainforest •Freshwater – desert	

Name: _____ pd:_____

DNA Extraction Observations

Answer the questions in complete sentences.

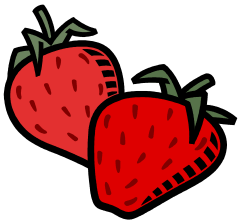
1. What did the DNA look like?

2. How much DNA were you able to extract compared to the size of the strawberry?

3. We use _____ instead of water to suspend the DNA because DNA is soluble in water but not in _____.

4. If DNA was extracted from human cells, would it be the same from every cell type?

DNA Extraction Investigation



Objective: Observe the physical properties of DNA by lysing cell walls and membranes, preparing a filtered extract and isolating DNA molecule from the extract

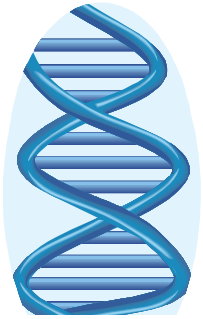
Background:

You can extract DNA from almost any part of any organism, we have chosen ripe strawberries. The ripe fruit produces pectinase and celluloses, both of which are enzymes that break down the cell walls. The enzymes' action work as the fruit ripens. Strawberries have enormous genomes. They are octoploid meaning they have 8 copies of each chromosome (we are diploid; we have 2 copies of each chromosomes).

The dishwashing liquid is added to help disrupt the phospholipid bilayers of the cell membrane as well as the nuclear envelope. Remember you are trying to get the DNA out of the nucleus.

The meat tenderizer denatures (unwinds or unfolds) the proteins. The salt help to bind the proteins to the extract layer so that they don't precipitate with the DNA.

DNA is insoluble (will not dissolve) in ethanol. It will clump together and precipitate away from all other cell debris.



Materials:

- ☐ Zip-lock bag
- ☐ Filter/paper towel
- ☐ Funnel
- ☐ Ice cold ethanol
- ☐ Meat tenderizer
- ☐ Ripe strawberries (2-3)
  - Frozen or fresh
- ☐ Small beaker or small cup
- ☐ DNA extraction buffer (soapy salty water)
- ☐ Glass rod or wooden stick

Method/Procedure:

1. Place strawberry in plastic bag. Seal the bag, squeezing the air out. Gently yet firmly mash the berries for 1-2 minutes.
2. Add DNA extraction buffer to the bag. Seal the bag, squeezing the air out. Mix and Mash the berry and buffer mixture until the mixture is pink and frothy.
3. Add a pinch of meat tenderized to the bag. Seal the bag and shake for 5 minutes.

4. Set up a filter apparatus by placing the filter (or paper towel) into a funnel and placing the funnel over a small cup or beaker.
5. Pour all of the pink froth into the filter.
6. Allow time for all of the filtrate (liquid) to drain into the cup. Once drained, remove the funnel and filter apparatus.
7. Holding the cup at an angle, very gently dribble ice cold ethanol down the side of the cup so that two layers are formed. **DO NOT LET THE LAYERS MIX!!!!!**
8. Look closely. You should now be able to see white threads of DNA held between the two layers of the liquid. Gently use a glass rod or wooden stick to spool the DNA and lift it from the liquids.
9. Clean up your area. Dispose of waste according to your teacher's directions.
10. Record your observations and answer your lab questions.

NAME:_____ DATE:_____ PERIOD:_____

Genetics, Chance, Punnett Squares, & Adaptations Quiz

1. What do genes determine?
   A. Survival
   B. Traits
   C. Behavior
   D. Choices

2. Organisms pass their traits onto their offspring. What is a trait?
   A. An ability to do something successfully
   B. A gene
   C. A characteristic
   D. An instinct

3. Where do offspring with two parents receive their genes from?
   A. Some from mom and some from dad
   B. From your grandparents
   C. Mom and dad each provide one gene for each trait.
   D. Boys from dad and girls from mom.

4. What are different forms of the same gene called? For example the genes for height might be tall and short.

   _____

5. Which of the following statements is true:_____

   I. Dominant and recessive alleles are seen expressed in offspring equal amounts of the time.
   II. Recessive alleles will be seen as long as it is given to the offspring
   III. The only way a dominant trait will be seen is if both alleles given to the offspring are dominant
   IV. When the offspring has both the recessive and dominant allele the dominant allele will be expressed

6. If a parent has the genotype of **QQ** what are the chances it will pass on the dominant allele?

   A. 0% B. 25% C. 50% D. 75% E. 100%

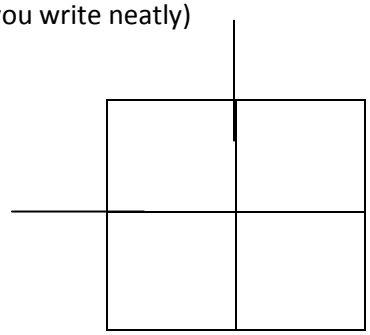
7. If the mother of an offspring has the genotype of **Qq** what are the chances the offspring will inherit the recessive allele.

   A. 0% B. 25% C. 50% D. 75% E. 100%

8. Which can you determine by looking at an organism, the genotype of the phenotype?

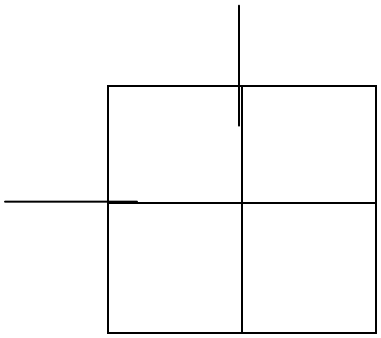
   _____

9. Complete a punnet square showing the possible genotypes of an offspring whose mother is heterozygous and a father is homozygous dominant? (You may chose any letter to represent your alleles, make sure you write neatly)



10. Based on the following punnet square what percent of the offspring will show the recessive trait?

A. 0% B. 25% C. 50% D. 75% E. 100%



11. Identify the following adaptations as either behavioral (B)or physical (Ph)

_____An elephants upper lip and nose is a trunk that is up to 2m long

_____Elephants use their trunk to coat themselves with water and dust, making mud, to protect their skin from the sun.

_____Elephants use their trunks in displays of affection and greetings.

_____Elephants ears are large, thin, and filled with blood vesicles this allows their ears to help in regulating body temperature.

12. Explain how is it possible for the same set of parents to produce offspring that are not the same?

_____

_____

_____

_____

_____

Name: _____ pd: _____ date: _____

Genetics Vocabulary Squares

Vocabulary Word	Definition	Use Vocab word correctly in a sentence	Graphic
Genetics			
Heredity			
Generation			
DNA			
Inherited			

Name: _____ pd: _____ date: _____

Vocabulary Word	Definition	Use Vocab word correctly in a sentence	Graphic
Genes			
Chromosomes			
Allele			
Trait			
Dominant allele			

Name: _____ pd: _____ date: _____

Vocabulary Word	Definition	Use Vocab word correctly in a sentence	Graphic
Recessive allele			
Genotype			
Phenotype			
Natural Selection			

Name: _____ pd: _____ date: _____

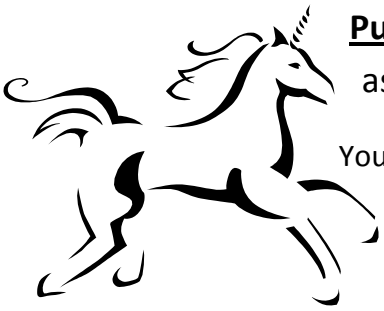
Vocabulary Word	Definition	Use Vocab word correctly in a sentence	Graphic
Selective breeding/ artificial selection			
Adaptation			
Genetic diversity			
Biodiversity			

Name: _____ pd: _____ date: _____

Vocabulary Word	Definition	Use Vocab word correctly in a sentence	Graphic
Heterozygous (hybrid)			
Homozygous (purebred)			

Name : _____ pd: _____

Mythical Creature Adaption Activity



Purpose: To create a mythical creature that would thrive in your assigned habitat.

Your assigned habitat: _____

Instructions:

Create a creature that has developed adaptations allowing it to reign over its habitat. Remember, he is thriving, not just surviving. Be very specific when describing the adaptations (for example, don't say "it has 8 legs" when you can say "it has 8 thin and jointed legs").

Make sure you describe the purpose for each adaptation that your creature has

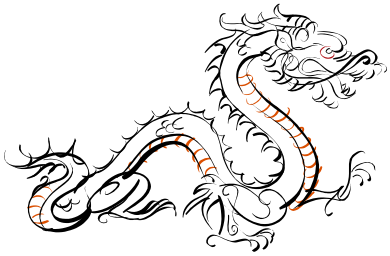
Adaptations to include:

Locomotion – walking, climbing, flying, swimming, etc…..

Feeding – teeth, beaks, pinchers, etc….

Defense – poison, camouflage, armor, etc….

Breathing – lungs, gills, etc….



Gallery walk:

All students will display work in a given area of the room. Students will complete a gallery walk, viewing other classmates work. Here are the rules for the gallery walk:

You must post at least 7 questions or comments throughout the room (use your pad of sticky notes to do so). Please keep comments relevant to their work and be constructive (this means each statement or question has a purpose). Don't be mean, phrasing is everything.

Students will then get 30 seconds each to answer or explain items that were commented on by the other students.

Name : _____ pd: _____

Natural Selection and Vocabulary quiz

1. The main difference between Genetics and Heredity is

A. Heredity is the study of genetics

B. Genetics is the study of heredity

C. They both mean the same thing

D. Genetics has nothing to do with heredity

2. Determine if Selective Breeding (SB) or Natural Selection (NS) applies to the statements below:

_____ Humans determine which traits are desirable

_____ Takes millions of years to produce very small changes

_____ Not always beneficial to survival

_____ Beneficial to an organism's survival

3. Genetic information is found ON _____ which are found IN _____ which are housed in the _____.

4. An adaptation is

A. Any physical characteristic that enhances survival

B. An animal's ability to camouflage

C. The ability to hunt during the night

D. All of the above

5. Genetic diversity refers to

A. Species with similar adaptations

B. Different traits within a species

Name : _____ pd: _____

C. Different species living in the same habitat

D. The number of plants and animals in an area

6. The amount of varying species within an area is called

A. Genetics

B. Adaptations

C. Biodiversity

D. Selective Breeding

7. When individuals that are better adapted to their environment survive long enough to reproduce is called

A. Selective Breeding

B. Asexual Reproduction

C. Heredity

D. Natural Selection

8. The answer from the above question can best be summed up by the phrase _____ of the _____

9. Weeding out the weaker traits from a species helps to ensure that species survival. This is describing _____.

10. Briefly explain how Selective Breeding is like Natural Selection.

_____

_____

Name: _____ pd: _____

Biomes

Biome:	External Feature	Behavior	Physiological adaptation
Plant Name:			
Animal Name:			

Name : _____ pd: _____ DUE DATE! _____

Species Adaptation Project

Purpose: To create a "timeline" of how your species will change and adapt to a changing environment over millions of years.

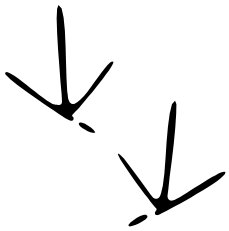
Directions:

1. You will be assigned an existing species

2. Research your species to find out the following information for the project (http://kids.nationalgeographic.com/kids/animals/creaturefeature/) this is a great website to get started!

3. Make sure you include all of the following requirements. The more specific and detailed you are higher your final grade will be.

Phase One:



a. drawing of species in its current form (hand drawn and in color)

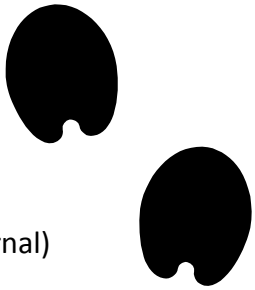
b. current habitat description

c. adaptations (external features, behavioral, physiological, internal)

d. how adaptations match the environment (be specific here. Don't say "fur keeps them warm". Explain what kind of fur, is there and extra fat layer, etc… that keeps them warm)

Name : _____ pd: _____ DUE DATE! _____

Phase Two:



a. drawing of species at midpoint of time frame

b. include how much time has passed since phase one

c. adaptations (external features, behavioral, physiological, internal)

d. how the environment is changing (remember your Biome is slowly becoming another Biome)

e. how adaptations match the changing environment (structure matches function)

Final Outcome:

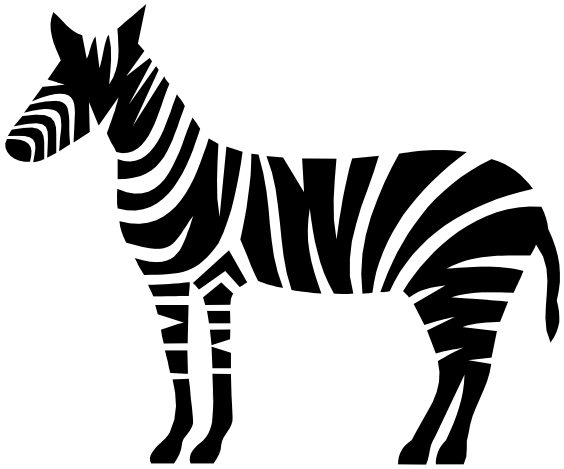
a. drawing of species at conclusion of time frame

b. include how much time has passed since phase one

c. adaptations (external features, behavioral, physiological, internal)

d. how the environment has changed

e. how new adaptations match the new environment (structure matches function)



Animal List for Creature Project from
http://kids.nationalgeographic.com/kids/animals/creaturefeature/

Adelie Penguins	African Elephants	American Alligators	American Bison	American Bullfrog
Anaconda	Ankylosaurus	Atlantic Puffin	Bactrian Camel	Bald Eagle
Beaver	Beluga	Black Rhinoceros	Blue Whale	Blue-Footed Booby
Boa Constrictor	Bottlenose Dolphin	Brachychampsa	Brown Bear	Bull Shark
Canada Goose	Cane Toad	Caribou	Cheetah	Chimpanzee
Clown Anemonefish	Coyote	Duck-Billed Platypus	Dung Beetle	Earthworm
Emperor Penguin	Fennec Foxes	Galapagos Tortoise	Gecko	Giant Panda

Animal List for Creature Project from
http://kids.nationalgeographic.com/kids/animals/creaturefeature/

Giant Squid	Gila Monster	Giraffe	Gray Wolf	Great White Shark
Guanaco	Hammerhead Shark	Harp Seal	Hedge Hog	Hippopotamus
Honeybee	Howler Monkey	Indian Peafowl	Jackrabbit	Jaguar
Jellyfish	Kangaroo	Koala	Komodo Dragon	Ladybug
Leatherback Sea Turtle	Leptoceratops Gracilis	Lesothosaurus Diagnosticus	Lion	Loggerhead Sea Turtle
Mallard Duck	Mammoth	Meerkat	Molas	Monarch Butterfly
Mononykus Olecranus	Mountain Gorilla	Nile Crocodile	Orangutan	Orca

Animal List for Creature Project from
http://kids.nationalgeographic.com/kids/animals/creaturefeature/

Ostrich	Pachycephalasaurus	Peregrine Falcon	Pileated Woodpecker	Poison Dart Frog
Polar Bear	Praying Mantid	Przewalski's Horse	Pufferfish	Raccon
Red-Eyed Tree Frog	Red-Tailed Hawk	Ring-Tailed Lemur	River Otter	Sand Tiger Shark
Scorpion	Sloth	Snowy Owl	Snowy Plover	Spotted Hyena
Spotted Salamander	Stingray	Tarantula	Tasmanian Devil	Thescelosaurus Neglectus
Tiger	Triceratops Horridus	Troodon Formosus	Tundra Swan	Tyrannasaurus Rex
Vampire Bat	Velociraptor	Walrus	Warthog	West Indian Manatee

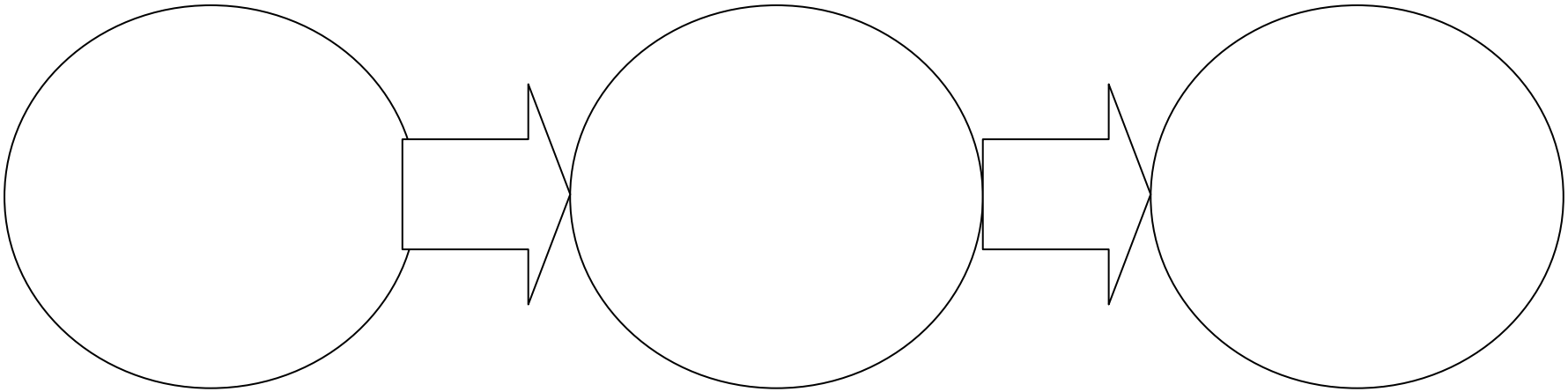
Animal List for Creature Project from
http://kids.nationalgeographic.com/kids/animals/creaturefeature/

Wolverine	Zebra			

NAME: _____ DATE: _____ PERIOD:_____ PROJECT DUE DATE: _____

Species Adaptation Documentation Brainstorm

My animal is _____ It lives in the _____; over the next _____years the environment will become much more like a _____. Below is a prediction of how my _____ will adapt to the new environment.



PHASE 1 - Current	PHASE 2	FINAL OUTCOMES
Adaptations (Physical and Behavioral): Description of Structure and Function:	Adaptations (Physical and Behavioral): Description of Structure and Function:	Adaptations (Physical and Behavioral): Description of Structure and Function:
Description of current habitat:	How is the environment changing: Timeframe of Changes:	How environment has changed: Timeframe of Changes:

NAMEs: _____ DATE: _____ PERIOD: _____

_____

Phase 1 - Current	Vague, Incorrect (0)	Unclear, Somewhat Accurate (1)	Correct & Accurate (2)	Very Clear, Accurate & Detailed (3)
I. Description of habitat/biome	❑	❑	❑	❑
II. Structure and function of adaptations match	❑	❑	❑	❑
III. Adaptations match the environment	❑	❑	❑	❑
IV. Clarity of adaptations	❑	❑	❑	❑
V. Descriptive detail and accuracy	❑	❑	❑	❑
VI. Visual representations	❑	❑	❑	❑
Phase 2	(0)	(1)	(2)	(3)
I. Timeframe	❑	❑	❑	❑
II. How is the environment/biome changing	❑	❑	❑	❑
III. Structure and function of adaptations match	❑	❑	❑	❑
IV. Adaptations match the environment	❑	❑	❑	❑
V. Clarity of adaptations	❑	❑	❑	❑
VI. Descriptive detail and accuracy	❑	❑	❑	❑
VII. Visual representations	❑	❑	❑	❑
Final Outcome of Adaptations	(0)	(1)	(2)	(3)
I. Timeframe	❑	❑	❑	❑
II. How is the environment/biome changing	❑	❑	❑	❑
III. Structure and function of adaptations match	❑	❑	❑	❑
IV. Adaptations match the environment	❑	❑	❑	❑
V. Clarity of adaptations	❑	❑	❑	❑
VI. Descriptive detail and accuracy	❑	❑	❑	❑
VII. Visual representations	❑	❑	❑	❑
Total Points Earned: _____ (59 Possible)	0 Points	____ Points	____ Points	___ Points

Overall Work	Points Possible	Student Evaluation	Teacher Evaluation
Clarity & Detail: How clear are your ideas and descriptions	9		
Creativity: How Original are your ideas and Solution	9		
Effort: Seen in work during class time and overall product	9		
Extra: Went above and beyond necessary requirements	4		
Total Points Possible Earned:	31		
Final Teacher Assessment (90 possible)			

Student Comments:

_____

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Teacher Comments:

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