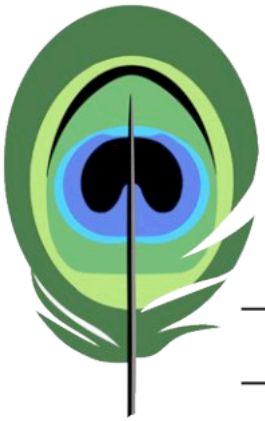
BIO-BOX

Elementary Education

Designed and Produced by the Brigham Young Univerisity
Monte L. Bean Life Science Museum



Monte L. Bean

Life Science Museum

Brigham Young University

A Note From The Director

Greetings!

The M.L. Bean Life Science Museum at Brigham Young University is committed to using its vast biological collections to support the museum's mission to promote world class teaching and research. Furthermore, we are fully dedicated to working closely with our public and private school colleagues to help secondary level students more fully appreciate the patterns and processes of living systems. As part of our commitment, the museum, through its education programs, offers resources to support educators in their efforts to more effectively teach our children. This "Bio-Box" is one element of that program. It has been designed with both educators and students in mind.

We are convinced that you will find that the "Bio-Box" program will provide invaluable support for your teaching efforts. We invite you to take advantage of the other education-related services offered by The Bean Life Science Museum, including exhibit tours, live animal shows (in house and outreach), and Nature Experienceships. Please visit our website (mlbean.byu.edu) for more information on these and other programs.

Best wishes,

Larry L. St. Clair
Director

Using the Guidebook:

Using the Guidebook: This diagram will help familiarize you with the layout and information codes in the "Bio-Box" series guidebooks. The books are intended as idea sources, not lesson plans--and we need your notes and feedback to keep improving them.

Preparation Level

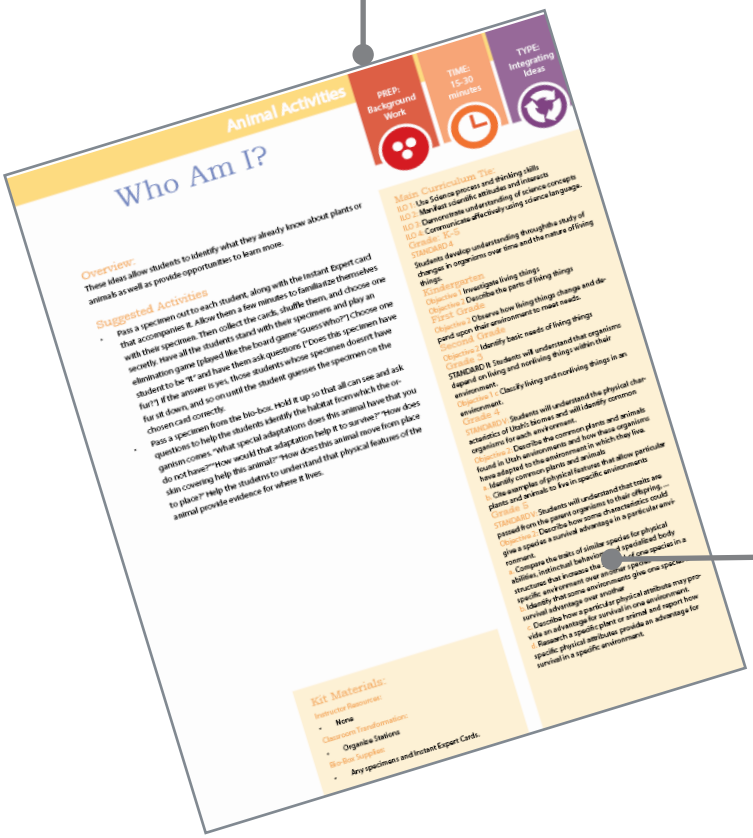
- Minimal prep. time, some materials
- Gathering Materials
- Background reading,Gathering of materials

Time Requirement

- 15-30 minutes
- 20-40 minutes
- 40-60 minutes

Activity Type

- Building/Making
- Exploring/Analyzing
- Integrated



The stripe across the top of each activity page is a color code: Yellow pages are activities that involve animals and Green pages are focused on plants. Teal pages are activties that teach science processes. Blue pages are background information that will help teachers be better prepared to explain concepts and answer questions students may have.

Here you will find a list of all the materials, resources, and specimens you will need for any given activity. Anything you need that is *not* in the box will be clearly indicated under "classroom materials."

Activity Index...

Preparation Level



- We've Got You Covered
- What Can You Learn From my Skin?
- Take Another Look
- How Many Bones Do You
- How Did That Get There Day 1
- Using Some Science Proess Skills
- Why Are You Wearing That?
- Color AdaptatsionWater Adaptaions
- How Did That GEt There Day
- Sprouting Baby Plants
- Growing Baby Plants
- Comparing Plants and Animals
- Develop and Use Simple Classification Systems
- Beaks Benefit Birds
- Fancy Footwork
- Who Am I?
- Well What Do You Know?
- Plants Have Parts Too
- Plant Parts I See Around Me
- Dinner Is Served
- It's All About the Leaves

Time Requirement



- Why Are You Wearing That?
- What Can You Learn From My Skin?
- Who Am I?
- Well What Do You Know?
- Take Another Look
- How Many Bones Do You Have?
- We've Got You Covered
- Beaks Benefit Birds
- Fancy Footwork
- How Did that Get There 1
- Dinner Is Served
- Comparing Plants and Animals
- Develop and Use Simple Classification Systems
- Practicing Some Science Process Skills
- Plants Have Parts Too
- What Parts Do I See Around Me?
- Color Adaptations
- Water Adaptations
- How Did That Get There? 2
- Sprouting Baby Plants
- Growing Baby Plants
- It's All About the Leaves

Activity Type



- What Plant Parts Do I See
- Around Me?
- Color Adaptations
- Water Adaptations
- How Did That Ge There? 2
- Sprouting Baby Plants
- We've Got You Covered
- Why Are You Wearing That?
- What Can You Learn From My Skin?
- Beaks Benefit Birds
- Fancy Footwork
- Take Another Look
- How Many Bones Do you Have?
- How Did That Get There? 1
- Growing Baby Plants
- Practicing Some Science Process Skills.
- Who Am I?
- Well What Do You Know?
- Plants Hae Parts Too
- Dinner Is Served
- It's All About The Leaves
- Comparing Plants and Animals
- Develop and Use Simple Classification Systems

Speicmen Index

Horned lizard

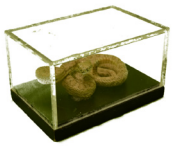
Desert tortoise

Plant specimens

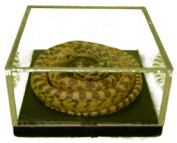
Assorted feathers

Animal apendages

Rattlesnake



Gopher snake



Tarantula hawk

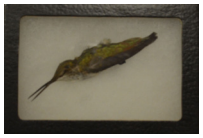
Butterfly

Luna moth

Lichen

Starling head

Hummingbird



Duck head

Egret head

Assorted shells

Tree lizard

Toad

Turtle

Spotted towhee

Shark

Pocket gopher

Salamander

Seeds

Coyote pelt

Leopard pelts

Musk ox pelts

Snake skins

Zebra pelts

Mounatain goat pelt

Coconut

Robin

Duck foot

Coot foot

Eagle talon

Rhinoceros

Muskrat

Zebra hoof

Mountain goat hoof

Hawk wing

Teacher Background: USOE Life Science Core Curriculum

K-2 Standard IV Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1: Investigate living things.

a. Contrast questions, give reasons, share findings about living things, and compare and contrast living things.
b. Compare and contrast young plants and animals with their parents.
c. Describe some changes in plants and animals that are so slow or so fast that they are hard to see. (e.g. seasonal change. "fast" bloomimg flower, slow growth, hatching eggs.

Objective 2: Describe the parts of living things.

a. Differentiate between the five senses and related body parts.
b. Identify major parts of plants, e.g., roots, stem, leaf, flower, trunk, branches.
c. Compare the parts of different animals, e.g., skin, fur, feathers, scales; hand, wing, flipper, fin.

1st Grade:

Objective 1: Communicate observations about the similarities and differences between offspring and between populations.

a. Communitcate observations about plants and animals, including humans, and how they resemble their parents.
b. Analyze the individual similarities and differences within and across large groups.

Objective 2: Living things change and depend upon their environment to satisfy their basic needs.

a. Make observations about living things and their environment using the five senses.
b. Identify how natural earth materials (e.g., food, water, air, light, and space), help to sustain plant and animal life.
c. Describe and model life cycles of living things.

2nd Grade

Objective 1: Tell how external features affect an animals' ability to survive in its environment.

a. Compare and contrast the characteristics of living things in different habitats.
b. Develop, communicate, and justify an explanation as to why a habitat is or is not suitable for a specific organism.
c. Create possible explanations as to why some organisms no longer exist, but similar organisms are still alive today.

Objective 2: Identify basic needs of living things (plants and animals) and their abilities to meet their needs.

a. Communicate and justify how the physical characteristics of living things help them meet their basic needs.
b. Observe, record, and compare how the behaviors and reactions of living things help them meet their basic needs.
c. Identify behaviors and reactions of living things in response to changes in the environment including seasonal changes in temperature and precipitation.

3rd Grade

STANDARD II: Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1: Classify living and nonliving things in an environment.

a. Identify characteristics of living things (i.e., growth, movement, reproduction).
b. Identify characteristics of nonliving things.
c. Classify living and nonliving things in an environment.

Objective 2: Describe the interactions between living and nonliving things in a small environment.

a. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flowerbed) composed of living and nonliving things.
b. Predict the effects of changes in the environment (e.g., temperature, light, moisture) on a living organism.
c. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living and nonliving things in a small–scale environment.
d. Compare a small–scale environment to a larger environment (e.g., aquarium to a pond, terrarium to a forest).
e. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Teacher Background: USOE Life Science Core Curriculum

4th Grade

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 2: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

a. Compare the physical characteristics (e.g., precipitation, temperature, and surface terrain) of Utah's wetlands, forests, and deserts.

b. Describe Utah's wetlands (e.g., river, lake, stream, and marsh areas where water is a major feature of the environment), forests (e.g., oak, pine, aspen, juniper areas where trees are a major feature of the environment), and deserts (e.g., areas where the lack of water provided and where plants needing little water are a major feature of the environment).

d. Locate examples of areas in Utah that have characteristics of wetlands, forests, or deserts.

e. Based upon information gathered, classify areas of Utah that are generally identified as wetlands, forests, or deserts.

f. Create models of wetlands, forests, and deserts.

Objective 3: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

a. Identify common plants and animals that inhabit Utah's forests, wetlands, and deserts.

b. Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).

c. Describe some of the interactions between animals and plants of a given environment (e.g., woodpecker eats insects that live on trees of a forest, brine shrimp of the Great Salt Lake eat algae and birds feed on brine shrimp).

d. Identify the effect elevation has on types of plants and animals that live in a specific wetland, forest, or desert.

e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them.

5th Grade

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Objective 1: Using supporting evidence, show that traits are transferred from a parent organism to its offspring.

a. Make a chart and collect data, identifying various traits among a given population (e.g., the hand span of students in the classroom, the color and texture of different apples, the number of petals of a given flower).

b. Identify similar physical traits of a parent organism and its offspring (e.g., trees and saplings, leopards and cubs, chickens and chicks).

c. Compare various examples of offspring that do not initially resemble the parent organism but mature to become similar to the parent organism (e.g., mealworms and darkling beetles, tadpoles and frogs, seedlings and mature plants, caterpillars and butterflies).

d. Contrast inherited traits with traits and behaviors that are not inherited but may be learned or induced by environmental factors (e.g., cat purring to cat meowing to be let out of the house; the round shape of a willow is inherited, while leaning away from the prevailing wind is induced).

e. Investigate variations and similarities in plants grown from seeds of a parent plant (e.g., how seeds from the same plant species can produce different colored flowers or identical flowers).

Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

a. Compare the traits of similar species for physical abilities, instinctual behaviors, and specialized body structures that increase the survival of one species over another species in a specific environment (e.g., difference between the feet of snowshoe hare and cottontail rabbit, differences in leaves of plants growing at different altitudes, differences between the feathers of an owl and a hummingbird, differences in parental behavior among various fish).

b. Identify that some environments give one species a survival advantage over another (e.g., warm water favors fish such as carp, cold water favors fish such as trout, environments that burn regularly favor grasses, environments that do not often burn favor trees).

c. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another (e.g., heavy fur in arctic climates keep animals warm whereas in hot desert climates it would cause overheating; flippers on such animals as sea lions and seals provide excellent swimming structures in the water but become clumsy and awkward on land; cacti retain the right amount of water in arid regions but would develop root rot in a more temperate region; fish gills have the ability to absorb oxygen in water but not on land).

d. Research a specific plant or animal and report how specific physical attributes provide an advantage for survival in a specific environment.

Teacher Background: USOE Life Science Core Curriculum

UseThis Background

for

- We've Got You Covered
- Why Are You Wearing That?
- What Can You Learn From My Skin?
- Beaks Benefit Birds
- Fancy Footwork
- Who Am I?
- Well, What Do You Know?

Summary: There are five familiar classes of vertebrates: fish, amphibians, reptiles, birds and mammals. All vertebrates have backbones. A simple way to group them is according to their body coverings. One way for students to remember the five main classes is to think of "Mr. Fab" (mammals, reptiles, fish, amphibians, birds).

Fish live in either fresh or salt water, though some fish have life cycles that allow them to live in both saline and fresh systems. Fish usually are covered by overlapping scales. They feel smooth when rubbed toward the tail but rough when rubbed toward their heads. Sharks and rays have special kinds of scales. Fish breathe with gills. They look like tiny pink "combs" and are protected by a gill cover (operculum). As water is drawn in through the mouth of a fish, it passes over the gills and absorbs oxygen which is dissolved in the water. The gills also release carbon dioxide into the water. There is a small line of raised "dots" that run down the center of the fish body from head to tail. This is call the lateral line and it allows fish to detect movement of the water around them. The fish nose is not used for breathing or smell. Fish are "cold-blooded". This means that they are not able to produce their own body heat. Some fish are capable of laying millions of eggs at a time.

Amphibians have smooth, thin, moist skin. Amphibians are born in water and when newly hatched have gills. As they grow they go through metamorphosis, (most) grow legs, and lungs. They are able to spend their lives in both water and on land. Amphibians' skins are very thin and must always be moist. This is because they may use it for breathing while under water or hibernating as well as body covering. Amphibians are "cold-blooded." Amphibian eggs are laid in water and are jelly-like.

Teacher Background: USOE Life Science Core Curriculum

UseThis Background

for

- We've Got You Covered
- Why Are You Wearing That?
- What Can You Learn From My Skin?
- Beaks Benefit Birds
- Fancy Footwork
- Who Am I?
- Well, What Do You Know?

Birds have wings, feathers and scales (on their legs and feet). Not all birds fly, but they all still have feathers. Some flightless birds include ostriches from Africa, cassowaries and emus from Australia, and kiwis in New Zealand. Though most people think of penguins as living only in cold areas, they are also found along the west coast of Chile, southern tips of South America, South Africa and Australia, and in the South Pacific Islands. A small group of penguins live on the famous Galapagos Islands right on the equator. Birds are descended from reptiles. All birds lay eggs with hard outer shells. The convex shape of the eggs allows them to withstand the full weight of the mother without crushing the egg. (An ostrich can weigh over 200 pounds!). Most birds have hollow, light-weight bones to make flight easier. Birds are "warm-blooded". Birds have lungs. They produce their own body heat. Like dogs, birds do not have sweat glands and will pant to cool themselves.

Reptiles are covered with hard, dry scales. Those with feet have claws. Reptiles usually lay their eggs on land, but a few retain the eggs in their bodies. Once they hatch, the babies leave the mother's body so it appears that they are giving live birth as mammals do, but it is not the case. Reptiles' eggs are soft and leathery.

Mammals are warm-blooded. They always have fur or hair-even whales and elephants! They give live birth and feed their babies milk produced from their bodies. (unless a student brings it up, it is not critical to address duck-billed platypus and echidnas at this time). Mammals in cold climates have insulating layers consisting of a thick coat of fur or a thick layer of fat (blubber). River otters also have fur on the bottoms of their feet which provides better traction.

PREP: Minimal Prep

TIME: 20-40 Minutes

TYPE: Exploring/ Analyzing

We've Got You Covered

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest science interests and attitudes

ILO 3: Understand important science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of life science through the study of… the nature of living things.

Objective 2: Describe the parts of living things.

4th Grade

STANDARD V: Students will….identify common organisms for each environment.

Objective 3: Use a simple scheme to classify Utah plants and animals

Kit Materials:

Instructor resources:

- Review the background information "Five Classes of Animals"

Classroom Transformation:

- Organize stations, make a chart on the board.

Bio Box materials:

- Pocket gopher, lizard, fish, small bird, toad, and Feely Boxes

Try this!

Here are some other ideas for amphibian skin if the resources are available to you:

- Balloon with water in/on it
- Cooked Lasagna noodle
- Plastic bag

Overview:

This activity helps students to recognize that body covering is one way that animals can be grouped.

Description:

Create a station for each of the main vertebrate classes. Place an appropriate small specimen from each vertebrate class into one of the "Feely" Boxes. Boxes are labeled 1,2,3,4 and 5.

- Instruct students to GENTLY touch the specimens without looking into the box. Have them use at least three adjectives to describe what they feel in the boxes. (This may be written or oral, depending on the age of your students.)
- Bring the class together. On the board, make a column for each Feely Box. Label columns 1,2,3,4 and 5. Ask the children to list the adjectives for each box in the appropriate column. Have students create the list on a paper of their own.
- Explain to students that the specimens represent the five vertebrate classes. Query to see how many of the vertebrate classes they already know. Once identified, put the name of the group at the column head. Gently remove specimens from the boxes and allow students to study them further. Explain to students that body covering is one of the ways that animals are grouped.

PREP: Gathering Materials

TIME: 15-30 minutes

TYPE: Exploring/ Analyzing

Why Are You Wearing *That?*

Overview

This activity will help students recognize that animals have specialized adaptations that help them to survive in varying environments.

Description:

Divide students into groups. Every student needs a paper and a writing utensil. Have the groups read the questions and discuss their ideas. Come together as a class and share how the body coverings help a particular animal to be specially suited for where it lives.

1. For each station, study the piece of animal skin very closely. Draw as many details as you can.
2. Write down the following questions for each animal pelt. As you answer the questions, record and defend your reasoning:

Questions:

- What type of climate might this animal live in? Why?
- Could a creature with this kind of skin covering live well in cold places? Why?
- How would an animal with this kind of skin do in a desert? Why?
- In what environment(s) would animals with spots or stripes be most successful? Why?

Kit Materials:

Instructor Resources:

- Make sure students have paper and writing utensils. Review the background information "Five Classes of Animals"

Classroom Transformation:

- Organize Stations by placing a set of pelts and a "Why aAre You Wearing That" card at each station.

Bio Box Supplies:

- Animal pelts and hides.

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade 4

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

b. Cite examples of physical features that allow particular …animals to live in specific environments

Grade 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that variations of these traits may help or hinder survival in a given environment.

Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

c. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another.

PREP: Minimal Prep

TIME: 15-30 minutes

TYPE: Exploring/ Analyzing

What Can You Learn From My Skin?

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest science interests and attitudes

ILO 3: Understand important science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of life science through the study of… the nature of living things.

Objective 2: Describe the parts of living things.

Kit Materials:

Instructor resources:

- Review the background information "Five Classes of Animals"

Classroom Transformation:

- Organize stations

Bio-box supplies:

- Pocket gopher, lizard, fish, small bird, toad/salamander, and Worksheet "What Can You Learn From My Skin?"

Overview:

In the following activity students will be using the materials provided to investigate coverings as well as other features found on a variety of animals. Students will then classify animals based on their observable characteristics.

Description:

1. Use the animals provided in the bio box and place them at stations around the room. Provide a number for each sample group.
2. Have students use the worksheet "What Can You Learn From My Skin?" to classify each organism as a fish, amphibian, reptile, mammal or bird.
3. On the work sheet they should specifically identify a characteristic that helped them classify the organism.

PREP: Background Work

TIME: 20-40 minutes

TYPE: Exploring/ Analyzing

Beaks Benefit Birds

Overview:

This activity will help students recognize that bird beaks are adapted to specific habitats. This specificity increases the likelihood of survival in their environments.

Preparation:

Provide a station for each beak. Number each station and place a beak and a "Beak Adaptations" card.

Description:

Assemble students into groups. Each person in a group needs paper and a writing utensil. Distribute students evenly at each station. Have students number their papers beginning with the station they are at. Allow students to study the beaks, discuss, and answer the questions. Bring the class together and have students compare their answers and share their reasoning.

Beaks Benefit Birds

1. Observe as many characteristics or traits as you can for each beak. Draw and record your observations.
2. Predict the type of food each organism may have eaten. Defend your reasoning.
3. Compare and contrast two beaks. When you compare ask, "How are these alike?" When you contrast ask, "How are these different? Create a Venn diagram showing unique characteristics on the outside and shared characteristics in the overlap.
4. Explain how a trait which is helpful in one habitat may not be helpful in another.

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade 4

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

b. Cite examples of physical features that allow particular …animals to live in specific environments (e.g., duck has webbed feet…).

Grade 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

c. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another…

Kit Materials

Instructor Resources:

- None

Classroom Transformation:

- Organize Stations

Bio-box supplies:

- Bird heads: duck, egret, starling, humming bird, Venn-Diagram sheet.

PREP: Background work

TIME: 20-40 minutes

TYPE: Exploring/ Analyzing

Fancy Footwork

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade 4

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

b. Cite examples of physical features that allow particular …animals to live in specific environments (e.g., duck has webbed feet…).

Grade 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

c. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another…

Overview:

This activity will help students recognize that animal feet are adapted to specific habitats. This specificity increases the likelihood of survival in their environments.

Description:

Assemble students into groups. Each person in a group needs paper and a writing utensil. Distribute students evenly at each station. Have students number their papers beginning with the station they are at. Allow students to study the feet, discuss, and answer the questions. Bring the class together and have students compare their answers and share their reasoning.

Observe as many characteristics or traits as you can for each foot. Draw and record your observations.

Fancy Footwork

1. Observe as many characteristics or traits as you can for each foot. Draw and record your observations.
2. Predict the type of habitat each organism may have lived in. Defend your reasoning.
3. Compare and contrast the feet. When you compare ask, "How are these alike?" When you contrast ask, "How are these different? Create a Venn diagram showing unique characteristics on the outside and shared characteristics in the overlap.
4. Explain how a trait which is helpful in one habitat may not be helpful in another.

Kit Materials:

Instructor Resources:

- Make sure each student has paper and a writing utensil.

Classroom Transformation:

- Provide a station for each foot and a "Fancy Footwork" card.

Bio-box supplies:

- Animal Feet: All bird feet, sheep hoof, zebra hoof, rhinoceros foot. "Fancy Footwork" cards, Venn-Diagram

Who Am I?

PREP: Background Work

TIME: 15-30 minutes

TYPE: Integrating Ideas

Overview:

These ideas allow students to identify what they already know about plants or animals as well as provide opportunities to learn more.

Suggested Activities

- Pass a specimen out to each student, along with the Instant Expert card that accompanies it. Allow them a few minutes to familiarize themselves with their specimen. Then collect the cards, shuffle them, and choose one secretly. Have all the students stand with their specimens and play an elimination game [played like the board game "Guess Who?"] Choose one student to be "it" and have them ask questions ["Does this specimen have fur?"] If the answer is yes, those students whose specimen doesn't have fur sit down, and so on until the student guesses the specimen on the chosen card correctly.
- Pass a specimen from the bio-box. Hold it up so that all can see and ask questions to help the students identify the habitat from which the organism comes. "What special adaptations does this animal have that you do not have?" "How would that adaptation help it to survive?" "How does skin covering help this animal?" "How does this animal move from place to place?" Help the students to understand that physical features of the animal provide evidence for where it lives.

Kit Materials:

Instructor Resources:

- None

Classroom Transformation:

- Organize Stations

Bio-Box Supplies:

- Any specimens and Instant Expert Cards.

Main Curriculum Tie:

ILO 1: Use science process and thinking skills
ILO 2: Manifest scientific attitudes and interests
ILO 3: Demonstrate understanding of science concepts
ILO 4: Communicate effectively using science language

Grade: K-5

STANDARD 4
Students develop understanding through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1 Investigate living things.
Objective 2 Describe the parts of living things.

First Grade

Objective 2 Observe how living things change and depend upon their environment to meet needs.

Second Grade

Objective 2 Identify basic needs of living things.

Grade 3

STANDARD II: Students will understand that organisms depend on living and nonliving things within their environment.
Objective 1 c Classify living and nonliving things in an environment.

Grade 4

STANDARD V: Students will understand the physical characteristics of Utah's biomes and will identify common organisms for each environment.
Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.
a. Identify common plants and animals.
b. Cite examples of physical features that allow particular plants and animals to live in specific environments.

Grade 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, ...
Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.
a. Compare the traits of similar species for physical abilities, instinctual behaviors, and specialized body structures that increase the survival of one species over another species in a specific environment.
b. Identify that some environments give one species a survival advantage over another.
c. Describe how a particular physical attribute may provide an advantage for survival in one environment.
d. Research a specific plant or animal and report how specific physical attributes provide an advantage for survival in a specific environment.

PREP: Background Work

TIME: 15-30 minutes

TYPE: Integrating Ideas

Well, What Do You Know?

Main Curriculum Tie:

ILO 1: Use science process and thinking skills
ILO 2: Manifest scientific attitudes and interests
ILO 3: Demonstrate understanding of science concepts
ILO 4: Communicate effectively using science language

Grade: K-5

STANDARD 4
Students develop understanding through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1 Investigate living things.
Objective 2 Describe the parts of living things.

First Grade

Objective 2 Observe how living things change and depend upon their environment to meet needs.

Second Grade

Objective 2 Identify basic needs of living things

Grade 3

STANDARD II: Students will understand that organisms depend on living and nonliving things within their environment.
Objective 1 c Classify living and nonliving things in an environment.

Grade 4

STANDARD V: Students will understand the physical characteristics of Utah's biomes and will identify common organisms for each environment.
Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.
a. Identify common plants and animals.
b. Cite examples of physical features that allow particular plants and animals to live in specific environments.

Grade 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and variations of these traits that may help or hinder survival in a given environment.
a. Compare the traits of similar species for physical abilities, instinctual behaviors, and specialized body structures that increase the survival of one species over another species in a specific environment.
b. Identify that some environments give one species a survival advantage over another.
c. Describe how a particular physical attribute may provide an advantage for survival in one environment.
d. Research a specific plant or animal and report how specific physical attributes provide an advantage for survival in a specific environment.

Overview:

These ideas allow students to identify what they already know about plants or animals as well as provide opportunities to learn more.

Suggested Activities

- Students will need paper and writing utensils. Hold up a specimen of your choice and ask questions based on the Instant Expert card. "To which group of animals does this animal belong?""How does this animal move?""What adaptations does this organism use to help it survive?""In what type of environment do you think this organism lives?" etc. Allow students to share their ideas. Provide clarification if needed.
- Play 20 Questions. Choose a specimen and determine which aspect(s) you want them to know—characteristics, habitat, diet, behavior, etc. Have students ask yes or no questions until they have identified the correct answers. You can reinforce scientific process and thinking skills if you have your students record their right and wrong answers. Explain to them that scientists keep detailed notes of what they learn, and both right and wrong answers provide good information!
- Ask the whole class stand up. Each student will take a turn asking yes or no questions or guessing the identity of the specimen. if they choose to guess and are wrong, they will sit down and be out until the next round (new specimen) starts. The round will end when a student correctly identifies the specimen.

Overview:

These ideas allow students to identify what they already know about plants or animals as well as provide opportunities to learn more.

Suggested Activities

- Pass a specimen out to each student, along with the Instant Expert card that accompanies it. Allow them a few minutes to familiarize themselves with their specimen. Then collect the cards, shuffle them, and choose one secretly. Have all the students stand with their specimens and play an elimination game [played like the board game "Guess Who?"] Choose one student to be "it" and have them ask questions ["Does this specimen have fur?"] If the answer is yes, those students whose specimen doesn't have fur sit down, and so on until the student guesses the specimen on the chosen card correctly.
- Pass a specimen from the bio-box. Hold it up so that all can see and ask questions to help the students identify the habitat from which the organism comes. "What special adaptations does this animal have that you do not have?""How would that adaptation help it to survive?""How does skin covering help this animal?""How does this animal move from place to place?" Help the students understand that the physical features of the animal provide evidence for where it lives.

Kit Materials:

- See previous activity

Teaching Background: Structures of Living Organisms

Use This Background for:

- Take Another Look
- How Many Bones Do You have?

Summary: In order for us to understand living organisms, scientists classify organisms into groups which are then sub-divided into smaller groups in which organsisms share more characteristics with each other.

The specimens in the Bio-box are all vertebrates (animals with a backbone). This group can then be divided into the five classes already discussed in the previous background information, "Five Classes of Vertebrate Animals".

One benefit of classifying animals is that we can compare and contrast structures, behaviors and strategies from one group to another. In several of the Bio-box activities students are asked to identify a group of animal based on their skin, appendages, bones or other structures.

Sensory Organs: All living organisms gather information from their environment. In the Animal Kingdom, this information generally comes from sensory input like sight, sound, touch and smell. While all animals have the ability to gain sensory information, the organs they have and they way they collect and use the information can be a common characteristic in their particular class or adapted for a specific environment.

Eyes are used for gathering information that ranges from detection of light to producing actual images. Some animals are adapted to see wide images; others, like owls, can detect a moving mouse over 150 feet away. Some animals see UV light and heat signatures, Geckos can see color 350 times better than humans, and cats have highly developed peripheral vision to assist them with hunting. Externally, fish and snakes do not have eyelids (all other vertebrates do). There are some fish and salamanders which have skin covering their eyes, making them blind because they live in places where there is no light.

Ears consist of three parts. Outer ear (Pinna) which collects sound, middle ear which has a membrane that vibrates from sound waves, and the inner ear where sound waves are then passed and the vibrations of which stimulate bones

and nerve cells. This information is then interpreted by the brain. Animals in our five vertebrate classes have at least some, if not all, of these parts.

Fish and aquatic amphibians do not have an outer or middle ear because sound travels faster in water than through air. Other amphibians, like frogs, have an external opening leading into the inner cannal. Reptiles have a membrane that is flush with the skin or imbeded in the head. Most other vertebrates have ear openings, but it's usually just mammals that have pinna (external ears).

Noses: Many animals learn about their environment through taste and smells. There are two kinds of olfactory (smell) systems used by most vertebrates. One system interprets smells and the other detects and interprets chemical pheromones. Both are important systems in detecting predators, prey, and other environmental changes. Most vertebrates have external openings called nares or nostrils. Snakes have these openings but they don't use them to smell. Snakes and reptiles pick up scent molecules on their tongues. Then, they insert their tongue into an opening called a Jacobsen's organ on the roof of their mouth. The molecules are then converted and interpreted as smell.

Mouths: All vertebrates have mouths to help them obtain food. Mouths are the external openings for digestive and respiratory organs.

Appendages in vertebrates teach us a lot about evolution and diversity in the animal kingdom. All vertebrates have paired appendages which follow a common pattern of development in bone structure. Genetic studies have shown us that the development of fins, legs, forearms, wings, etc., all follow a pattern established in an ancient common ancestor. The variation in the pattern allows for animals to function in a particular environment while still maintaining their ancient pattern.

PREP: Minimal Prep

TIME: 15-30 minutes

TYPE: Exploring/ Analyzing

Take Another Look

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest science interests and attitudes

ILO 3: Understand important science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of life science through the study of… the nature of living things.

Objective 2: Describe the parts of living things.

Kit Materials:

Instructor resources:

- Read the background Information "Structures of Living Organisms"

Classroom Transformation:

- Organize stations

Bio-box supplies:

- Pocket gopher, turtle, lizard, salamander, two small birds, shark, snake, and "Take Another Look" Worksheet.

Overview:

Scientists learn a lot about organisms by looking for similarities and differences between groups of organisms. When looking at sensory organs, appendages and coverings students can ask themselves "why is this animal builit the way it is? How do certain characteristics provide advantages to the organism?"

Description:

Have students compare the similarities and differences of body parts between various animals.

Allow students time to compare and contrast eyes, ears, noses, mouths, appendages, and body coverings with their own body parts. Collect students and have them report what observations they noted about each organism.

Part I.

Use the "Take another Look" worksheet to fill out observations and gather data.

Part II.

1. Distribute one organism to each group and have them compare and contrast the organism with the observations they made about other specimens.
2. Have students point out at least one difference and explain why. Follow this by asking students to identify at least one similarity and why.
3. For further reinforcement, rotate specimens to different groups and repeat the process of identifying similarities and differences.

PREP: Minimal Prep

TIME: 15-30 minutes

TYPE: Exploring/ Analyzing

How Many Bones Do You Have?

Overview:

The forelimbs of vertebrates are said to be homologous structures. "Homologous" means similar in structure while displaying different functions. In the diagram below you can see the similarity in the bone structure of a bird, bat, whale, cat, horse, and human. This similarity indicates that these organisms all descended from a common ancestor. Through time and evolutionary processes, the ancestral bones have been adapted to aid in a variety of uses such as swimming, running, grasping, and flying.

Description

- How many know there are three main bones in the arms and legs?
- Allow students to feel their own arms and legs. Let them feel their hands and feet and count how many different bones they can identify.
- Pass out the images of the human arms and legs and give children time to study them.
- Refer to the specimens they observed. What differences do they note? Most vertebrates have "arms" and "legs". (Notable exceptions are fish, snakes, and some marine mammals.)
- Give students time to study the skeletal mounts of representative vertebrates. Ask them to point out the similarities.
- Explain that all vertebrates on earth share common ancestors which is why we share common traits. Emphasize that this means we are all related and have a responsibility to care for the earth and all living things.

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest science interests and attitudes

ILO 3: Understand important science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of life science through the study of… the nature of living things.

Objective 2: Describe the parts of living things.

Kit Materials:

Instructor resources:

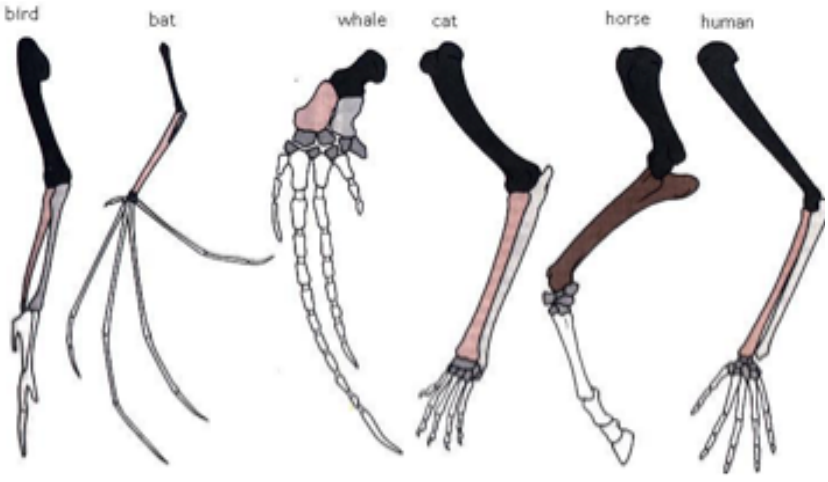
- Review the backgound information "Structures of living organisms."

Classroom Transformation:

- Organize skeletal mounts into stations or plan to pass them around to different groups.

Bio-box supplies:

- Plexiglas mounts of appendage skeletons, and Images of human arm and leg.



Teacher Background: Characteristics of Plants

Most of the plants that you encounter on a daily basis are vascular plants. Vascular plants have tube-like structures that allow them to carry water, food and nutrients. These tubes work much like the arteries and veins in animals. In vascular plants, the xylem tubes carry water through the plants. Phloem tubes carry the sugars the plants make during photosynthesis. Vascular plants have at least three main features: roots, stems, and leaves.

I. Vascular Plants

Vascular plants have tissues that are used for transporting food and water both up and down throughout the plant.

A. **Roots.** There are two main kinds of roots: fibrous and tap. Tap roots have one long main root that can sink deep into the ground. They often have tinier roots that sprout off of them. Fibrous roots are spread out with lots of underground branches. Roots of plants have several functions:

1. They help to anchor and support plants in the soil.
2. Roots also serve to absorb water and inorganic nutrients-- similar to our vitamins. Plants do NOT get food from the soil.
3. Some roots may serve as storage repositories of food, but the food is actually made in the leaves and transported down to the roots. Common storage roots include beets, carrots, and jicama. Potatoes are not actual roots, they are specialized food storage swellings called tubers. Other tubers are sweet potatoes and yams. Flowering tubers include dahlias and peonies.
4. Another function of roots is vegetative reproduction. This process makes new plants without using seeds. These plants are clones of each other. Grass commonly grows this way; the roots spread underground and a new grass plant pops up. One well known plant that uses this strategy is the quaking aspen. In fact, the single largest tree in the world is an aspen grove in Fish Lake National Forest called Pando. This is a single male tree that has spread its roots to cover over 100 acres. It is considered to be over 80,000 years old. Another tree common to Utah that uses this strategy is Gambel oak (sometimes called scrub oak).

B. **Stems.** The main job of stems is to support leaves and move the water and minerals from the ground to the leaves. They do this using their xylem. Stems also move sugar made during photosynthesis to other parts of the plant. This is accomplished with the phloem tubes.

A common misconception is that the air we breathe comes from stripping CO_2 of its carbon molecule. This is wrong!

C. **Leaves.** Leaves are the main site of photosynthesis. Leaves contain molecules called chlorophyll. Energy from the sunlight combines water (from the roots) with carbon dioxide (from the air). The process creates two wonderful byproducts: sugar and oxygen. The sugar is formed when the water molecule (H2O) is split into pieces—hydrogen and oxygen. The hydrogen joins with the carbon dioxide to from sugar. The oxygen is moved out of the leaf to create the air we breathe. The basic reaction is CO2 + H2O using sun ener-

II. Nonvascular Plants

Nonvascular plants do not have true roots, stems or leaves because they do not have tissues to transport food and water. Both kinds of plants use the process of photosynthesis to create their own food.

Nonvascular plants do not produce flowers or seeds for help in reproduction. Instead, they use spores and a complicated reproduction process. Because they have no tubes to transport nutrients and water, they do not grow very tall.

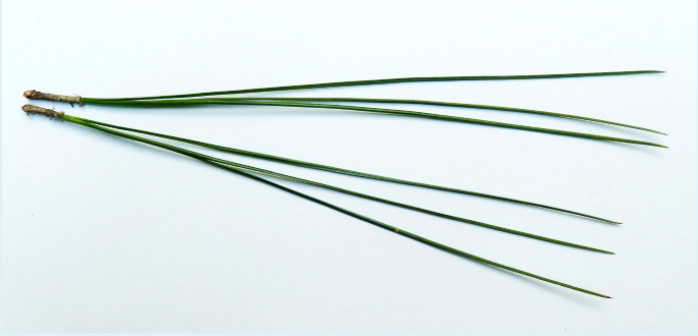
Common nonvascular plants you may know are mosses and algae. Another less common nonvascular plant is the hornwort.

III. Leaf Types—Fun Facts

For simplicity, this includes the common leaf types in the plants we study.

A. **Needle-like leaves** are those frequently seen on "evergreen" trees. If one looks closely, however, it is possible to see much variation in these needle-like leaves. It's common for students and adults alike to lump all trees with needles as pines. In reality, there are three broad groups of needle-like trees locally. These are the pines, firs, and spruces.

1. Pine needles attach to the tree branch in discrete bundles called fascicles. There may be anywhere from one to seven needles in a fascicle. Most pines have from 2-6 needles in a fascicle. Each species of pine has a different number of needles in its fascicle. That's how you can tell one type from another. Another cool thing about pines is that if you remove a fascicle from the branch, the group of fascicles when held together always form a circle! Think of a pie. If you cut a pie into three evenly sized pieces, the pie's border is still round. If you cut a pie in half, the border is still round. Even if you cut a whole pie into 6 slices, the border is round. The same is true of pine needles. The fascicle perimeter will always form a circle. Some teachers remind their students that "pines are like pies."



Source: Wikimedia Commons

2. A fir tree's needles always attach individually to branches. You can tell if you're looking at a fir if when you pluck the needle and try roll it between your fingers it won't roll. The needle is flat. They are also soft. The little reminder you're studying a fir tree is that you can shake hands with a branch because "firs are flat and friendly."

Source: Wikimedia Commons

3. Spruces attach individually to branches, too. However, the spruces are square in cross section and can be rolled between your fingers. They are also sharp and pointy. You know you're studying a spruce if you can say, "spruces are square and sharp."

Source: Wikimedia Commons

B. Simple leaves have one main part or "blade". The blade may have notched edges or lobes, but it has only one main stem (petiole) coming from one main blade that attaches it to the tree or shrub. Common local tree leaves of this type are oaks, maples, elms, and aspens.

C. Compound leaves still have one petiole, but instead of the one main blade, they have multiple leaflets. You might be familiar with honey locust, horse chestnut, box elder, or ash trees.

D. Scale-like leaves are ones you see all the time, but they are quite unusual in that each leaf is only 2 or 3 cm long. The leaves sit flatly against the branches. They are very delicate and attach to tiny woody branches. Common trees in Utah with scale-like leaves include the Rocky Mountain juniper and Utah juniper. Home owners often include scale-like trees and shrubs in their landscapes because they are evergreen. These include arborvitaes and juniper shrubs.

IV. Leaf Shapes and Margins

A true botanist will describe at least 30 different leaf shapes and 15 leaf margins, but our focus is much simpler.

Leaf Shapes

A. Palmate—leaves may be "generally" shaped like a hand. They will have clefts that resemble a thumb and four fingers.
B. Circular— as the name states, they are round, or very close to round.
C. Triangular—the leaf comes to a point with a large, broad base.
D. Lanceolate—much like the top of a spear. The leaf is long and narrow.

Leaf Margins

A. Entire—leaves with entire edges have edges that are completely smooth.
B. Serrate—looking similar to the knives used to cut bread, serrated margins are jagged.
C. Cleft—these leaves have deep indentations that may come almost to the middle of the leaf. The edges of most cleft leaves are pointed, such as in maple trees.
D. Lobed—a lobed leaf also has indentations but usually the edges of the leaf are more rounded. Think of oaks.

See Appendix for a reference sheet.

PREP: Background Work

TIME: 45-60 minutes

TYPE: Integrating Ideas

Plants Have Parts, Too!

Main Curriculum Tie:

Curriculum Connections

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of Life Science through the study of changes in organisms over time and the nature of living things.

Objective 2: Describe the parts of living things. Identify the major parts of plants.

Kit Materials:

Instructor Resources:

- Make sure every student has a paper and writing utensil.

Classroom Transformation:

- Make a station for each of the plant parts. Label them 1-6. Place a Plant Card at each station.

Bio-box supplies:

- Pressed specimens and pictures of roots, stems, and leaves, several seeds, and plastic fruit.

Overview:

This activity will help students to understand that plants have specific structures with specific functions.

Description:

Divide students into six groups. Each student will need a writing utensil and a piece of paper folded in half lengthwise, then fold that into thirds producing 6 squares. Have the students label the squares 1-6. Students will rotate through the stations, beginning with whichever number they are assigned until they have completed all six stations. Allow students time to draw the part of the plant and discuss their ideas with their groups. Bring the class together and compare answers. Provide additional instruction as needed. On the back of their papers, tell students to draw and label an entire plant.

What Parts Do I See Around Me?

PREP: Background Work

TIME: 45-60 minutes

TYPE: Building/ Making

Overview:

This activity will help students to understand that plants have specific structures with specific functions. Students will also be able to observe the many different variations or adaptations that they see in different plants.

Description:

Take students on a plant walk around your school, local neighborhood, or on a field trip to an area with a variety of plants.

Option #1: Have students spread out in an area and identify 3 different plants that they will conduct their research on. Using touch and sight, have students gather and record data about leaves, stems, and flowers. In addition, students should record information about seeds and roots if the information is available. If you have already completed "Plants Have Parts Too," ask students to compare and contrast the plant parts.

Option #2: If this is the students first exposure to plant parts use the following prompts and questions for each plant part:

1. Draw the plant part you see.
2. What is this plant part called?
3. Predict two reasons why the plant may need this part.
4. Compare the same part on two or three different plants and describe any variations you see on the part you are looking at.
5. Predict why these variations exist.

Extensions and additional activities:

Use the following ideas as a follow up or extension to the students' own observations.

- Ask students to observe plants at home and bring back their drawings to discuss as a class.
- Have students bring a sample of a plant to share with the rest of the class and use the questions to prompt discussion.

Main Curriculum Tie:

Curriculum Connections

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of Life Science through the study of changes in organisms over time and the nature of living things.

Objective 2: Describe the parts of living things. Identify the major parts of plants.

Kit Materials:

Instructor Resources:

- Make sure to identfiy an area that has a variety of plants for students to observe. Provide students with the approriate materials to make observations and record data. Identify and warn students about touching any poisonous or dangerous plants.

Classroom Transformation:

- None

Bio-Box Supplies:

- Hand lenses for closer observations of parts. If this is your first time using hand-lenses, refer to "How To Use A Hand Lens" in the appendix.

PREP: Gathering Materials

TIME: 45-60 minutes

TYPE: Building/ Making

Color Adaptations

Main Curriculum Tie:

Curriculum Connections

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

GRADE 2

STANDARD IV: Objective 2: Identify basic needs of living things (plants and animals) and their abilities to meet their needs.

GRADE 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Objective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

c. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another…

Kit Materials:

Instructor Resources:

- Lamp or sunny window, green colored paper, graph paper

Classroom Transformation:

- Organize Stations

Bio-Box Supplies:

- Thermometers

Overview:

This activity will help students understand that plants have evolved structural adaptations that help them survive in many habitats. In this investigation, students will learn how color can affect temperature of the plants. They should be able to hypothesize how change in temperature may contribute to a plants ability to survive in a given habitat. Be sure to emphasize that organisms did not "choose" to adapt. They have a trait or they do not. Those with the traits suitable to the environment live to pass on the traits.

Suggested Activities:

Begin by asking questions relevant to the concepts you wish to teach.

Concept 1: Color has an effect on heat absorption.

Cut two leaf shapes: one from green colored paper, and one from white. Place each leaf under a lamp or in a sunny window. Leaves should be equal distance from the light source. Place a thermometer on each paper. Check at regular intervals and measure the temperature of each. Students should note the darker "leaf" is warmer. Light colored leaves protect plants from overheating by reflecting more sunlight. For more background, research "albedo effect."

Relevant questions: What colors absorb the most sunlight? What evidence can you provide?

Extensions:

#1: Have students graph the temperature at each of the time intervals to compare the absorption rates of the two different colored leaves.

#2: Have students collect different types of leaves. Encourage them to find different colors, textures, thicknesses, etc. Place the leaves under the lights and record temperatures at each time interval. Use the data to graph and analyze why the leaves absorbed heat differently.

PREP: Gathering Materials

TIME: 45-60 minutes

TYPE: Building/ Making

Water Adaptations

Overview:

This activity will help students understand how leaf size can have an impact on water loss in plants. Because of this relationship, plants have evolved structural adaptations to survive in a variety of habitats. For example, in arid habitats, leaves of plants are often reduced in size. **Be sure to emphasize that organisms did not "choose" to adapt.** They have a trait or they do not. Those with the traits suitable to the environment live to pass on the traits.

Suggested Activities:

There is a relationship between leaf size and water loss.

Fill a plastic cup with water. Obtain a piece of aluminum foil large enough to cover the top of the cup and cut a small, leaf-sized oval in the center. Cover the cup of water with the foil piece and invert a second clear cup over the top of the first one and tape the two cups together. Fill a second cup with water. Cover this cup with a piece of foil which has a large, leaf-sized oval in the center. Again, invert a second cup on top and tape it closed. Place both sets of cups side-by-side in a sunny place or under a lamp. Moisture will accumulate with time. Note in which cup the least moisture accumulates. Smaller leaves lose less water which is important for plants with restricted water.

Relevant Questions:

Why do leaves in different biomes have different sized leaves? How can leaf size be an advantage? When is it a disadvantage to having large (or small) leaves? When is it an advantage to have large (or small) leaves?

Additional Investigations:

Waxy cuticles can reduce moisture loss. Obtain two equal-sized pieces of sponge. Soak both in water, and then squeeze out the excess. Sponges should be damp, not dripping. Wrap one sponge with waxed paper. Place sponges side by side in a sunny window or under a lamp. After, compare moisture content of each sponge.

Relevant questions:

What do you know about the interaction of wax and water? What could be the purpose for having waxy leaf surfaces? Which plants would benefit from having a waxy covering? Why? (Desert plant leaves may have a waxy cuticle to reduce water loss, tropical plants have waxy cuticles to protect against molds and mildews.)

Main Curriculum Tie:

Curriculum Connections

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

GRADE 2

STANDARD IV: Objective 2: Identify basic needs of living things (plants and animals) and their abilities to meet their needs.

GRADE 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Obejective 2: Describe how some characteristics could give a species a survival advantage in a particular environment.

C. Describe how a particular physical attribute may provide an advantage for survival in one environment but not in another…

Kit Materials:

Instructor Resources:

- Clear plastic cups, aluminum foil, waxed paper,

Classroom Transformation:

- Organize Stations

Bio-Box Supplies:

- Thermometers, sponges

PREP: Minimal Prep

TIME: 20-40 minutes

TYPE: Exploring/ Analyzing

How Did That Get There? *Day 1*

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

K-2

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Objective 2: Describe the parts of living things. Identify the major parts of plants.

Grade 4

Standard IV: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts, and identify common organisms for each environment.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

Kit Materials:

Instructor Resources:

- Rulers, Also read background information"How to use a Hand Lens" and practice using one so you can teach your students.

Classroom Transformation:

- None

Bio-Box Supplies:

- Seed set, hand lenses

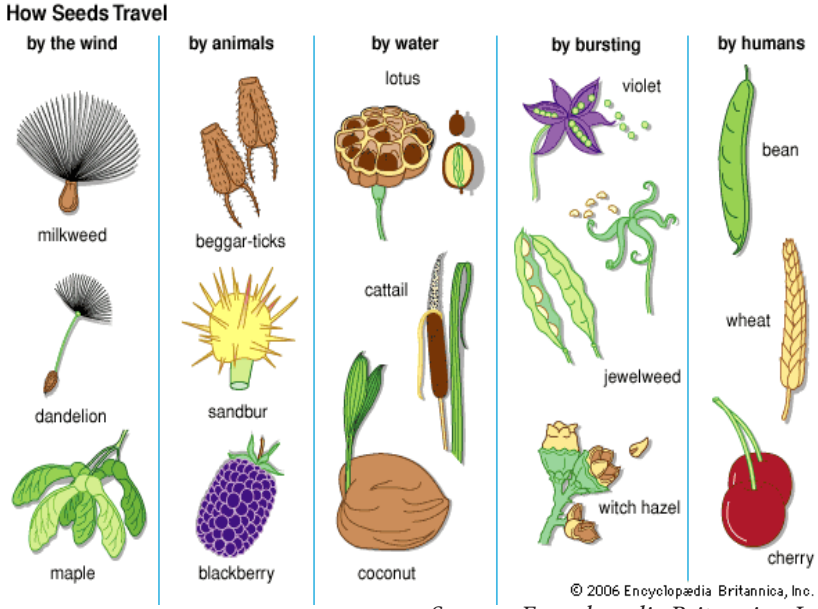
Overview:

Students will use their observational skills to understand how evolution has provided ways for plants to disperse their seeds. They will also describe how these evolutionary features aid in the survival and distribution of the plant species.

Description: Part I

Each student will need paper and a writing utensil. This activity starts with the students at their desks or tables. To begin, instruct students to fold their papers into quarters. Pass out the seed samples and allow students to examine them.

1. Draw four seeds without using the hand lenses.
2. Select one of the four seeds to start with, but complete the following steps with all four seeds.
3. Using the hand lenses and only one lens, look at your seed again. Draw the new details you see.
4. Add a second lens and draw the differences.
5. If you want, add the third lens so you are looking through all three lenses at once. Draw all the extra details you see.
6. Write down ideas about how you think this seed would get from one place to another.
7. Make a prediction about how each seed travels.



Source:: Encyclopedia Britannica, Inc.

PREP: Gathering Materials

TIME: 45-60 minutes

TYPE: Building/ Making

How Did That Get There? *Day 2*

Overview:

Students will use their creativity to develop their own seeds with unique dispersal methods. Students should think about their seed in context of a specific biome. For example, how successful would their dispersal method be in a desert vs. a rainforest?

Description:

Provide students with a variety of craft materials. Some suggested items would include velcro, cotton batting or cotton balls, craft beeds, colored paper, tissue paper, etc.

1. Show the students the variety of materials that they have to use.
2. With a partner, have students create a seed with specific features that would assist in dispersal.
3. Have students write a description of their seed and discuss how specific features will help the seed be dispersed. They should also predict which type of biome their seeds would be most successful in and why.
4. Have students present their models and ideas to the class or other groups of students.

Direct instruction

1. Teach students about wind, water, hitchiker, drop-roll, and mechanical (explosion) dispersal.
2. Hold up each of the sample seeds and ask students to look back at their predictions. Based on what they know now, would they change their answers? Have a discussion and provide students with the correct classification for each seed.
3. Use the video clips and other information provided to help students understand the variety of ways that seeds can be dispersed.

Experiment

Have students design and conduct an experiment to test seed growth based on the environment. Have students collect or provide students with a variety of planting media (potting soil, rocky soil, mud, sand etc.), then have the students choose one soil type and plant a variety of seeds. Or, choose one seed type and plant it in several different planting media. Have students record both qualitative and quantitative data, then form a conclusion about which plants grow best in which soils.

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-2

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Objective 2: Describe the parts of living things. Identify the major parts of plants.

Grade 4

Standard IV: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts, and identify common organisms for each environment.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

Kit Materials:

Instructor Resources:

- Craft materials, seeds, planting media, PBS video series: "The Seedy Side of Plants"

Classroom Transformation:

- Organize distribution of materials

Bio-box supplies:

- Seed Set

PREP: Gathering Materials

TIME: 45-60 minutes

TYPE: Building/ Making

Sprouting Baby Plants

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-5

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time.

Kindergarten

Objective 1: Investigate living things

Objective 2: Describe the parts of living things

First Grade

Objective 1: Observe how living things change and depend upon their environment to live.

Objective 2: Identify basic needs of living things.

Grade 3

STANDARD II: Students will understand that organisms depend on living and nonliving things.

GRADE 5

STANDARD V: Students will understand that traits are passed from parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Kit Materials:

Instructor Resources:

- Dry bean seeds, Bean seeds soaked over night, and toothpicks

Classroom Transformation:

- Organize Stupplies

Specimens:

- None

Bio-box Supplies:

- Hand lens and worksheet, "Collecting Data About Baby Plants"

Overview:

This activity can be used to help students identify what plants need to grow, stages of development, what parts plants have and how the baby plants compare to parent plants.

Suggested Activities:

Part I. Observations

1. Divide students into lab groups and provide each group with dry bean seeds, seeds that have been soaked for 24 hours, toothpicks, and hand lenses.
2. Ask students to make observations, both quantitative and qualitative, about their seeds. Have students record their data in the worksheet "Collecting Data About Baby Plants."

II. Discussion:

Ask the following questions and record student responses so that they can see a comparative list.

1. Start by asking students what they need to live and grow. Ask students to talk in their tables and create a list. Then ask each group to contribute one idea on the board. After each group has had a chance to share, ask if there are any ideas that aren't already on the board and add them to the list.
2. Ask students what animals need to live and grow. Use the same technique as before for creating a class list.
3. Ask students what plants need to live. Expect things like soil, air, light, water, nutrients, etc.
4. Looking at the three lists, ask students to identify the common things that all living things need. You might summarize it as: 1. Place to live (soil, house, wildlife habitat) 2. Water 3. Energy from food or sunlight.

PREP: Gathering Materials

TIME: 45-60 minutes

TYPE: Exploring/ Analyzing

Growing Plants

Overview:

This activity can be used to help students identify what plants need to grow, stages of devleopment, what parts plants have and how the baby plants compare to parent plants.

Suggested Activities:

1. Label ZipLoc bag with students' names.
2. Take a piece of paper towel and fold it into fourths until it fits into a ZipLoc bag.
3. Wet your paper towel with water. The paper should be damp, not dripping.
4. Remove paper towel, open in half, and place five to ten seeds (depending on size) evenly spaced on the the paper towel.
5. Put the paper towel into the ZipLoc bag.
6. Allow time for seeds to germinate.
7. Count the number of seeds that have germinated and record your data.
8. Measure the root length of each seedling.
9. Record physical observations of the seedling's condition such as overall growth, color, and overall appearance of seedling leaves.
10. Tally class averages for germination and root length.
11. Graph your individual and class data.
12. The investigation can stop here or put the seeds back in the bags and let them grow for a couple of more days. Check again and take data of roots and stems as they devlop.

Discussion

Here are some questions and ideas to consider as students make observations:

- What does your seed look like? (Think about its size, shape, and color.)
- How long does it take the seed to germinate?
- What does the plant look like when it first germinates?
- How many leaves do you see?
- Use a ruler to take measurement of different parts of plants.

Extension:

Have students design an experiment to test how water, light or nutrients can affect the growth of plants. Use the sprouts or start again from seeds.

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-5

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1: Investigate living things.

Objective 2: Describe the parts of living things.

First Grade

Objective 2: Observe how living things change and depend upon their environment to satisfy their basic needs.

Second Grade

Objective 2: Identify basic needs of living things (plants and animals) and their abilities to meet their needs.

Grade 3

STANDARD II: Students will understand that organisms depend on living and nonliving things within their environment.

GRADE 5

STANDARD V: Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Kit Materials:

Instructor Resources:

- Dry bean seeds, paper towel, water, ziploc bags, worksheet

Classroom Transformation:

- Organize Supplies

Bio-Box Supplies:

- Hand lens, Graph Paper

PREP: Background Work

TIME: 20-40 minutes

TYPE: Integrating Ideas

Dinner Is Served: *Plant Parts We Eat*

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-1

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 2: Describe the parts of living things. Identify major parts of plants, e.g. roots, stem, leaf, flower, trunk, branches.

First Grade

Objective 2: Identify how natural earth materials (e.g., food, water, air, light, and space), help to sustain plant and animal life.

Kit Materials:

Instructor Resources:

- Knife, examples of plant parts

Classroom Transformation:

- Organize Station

Bio-box Supplies:

- "Plant Parts We Eat" images.

Overview:

This activity will help students to recognize that they eat plant parts every day. All life is dependent on plants as a food source, either directly or indirectly. Students will classify the parts of the plants that they eat as roots, stems, leaves, flowers, seeds or fruit.

Preparation:

Have students bring a plant food to class.

Background:

It is helpful to understand the different parts of plants. Some parts are quite obvious; lettuce and cabbage are leaves. Corn, beans or peas are seeds. Other seeds include the grains: rice, wheat and oats. Asparagus and rhubarb are stems. The fruits of plants are the fleshy parts which hold the seeds *inside* the fruits. Tomatoes, cucumbers, peppers and oranges are examples of fruits. When we have broccoli or cauliflower, we are eating the flowers of those plants. Carrots and radishes are good examples of roots.

Procedure:

1. On the white board, write a simple definition of each plant part. If possible bring in some of the items from the background info to show students as you talk about each part.
2. Make a column on the board with a heading for each plant part.
3. Ask the students to show the foods they brought in and classify them by putting the name of the food in the correct column on the board (You may need to supplement what the students bring in by using "Plants We Eat" images or bringing examples of your own.)
4. Cut the plants in half and look for seeds. Remind students that fruits have seeds inside. Allow students time to reclassify their foods into different columns if necessary.
5. As a class, brainstorm as many different plant foods as they can.

Additional Activities:

- Obtain the day's menu from the school cafeteria and have the students classify the food from the menu. Continue classifying the plant parts from the lunch menu all week if desired. Students may also classify their own sack lunches.
- Have the students create a food diary for the week. Have them write down all the plants they eat during the week. Have them classify which plant parts they eat the most. As a class, tally the amounts for each part and have students graph the results.
- Pass out the "Plant Parts We Eat" images and have the students sort them into the proper categories.

PREP: Background Work

TIME: 45-60 minutes

TYPE: Integrating Ideas

It's All About The Leaves

Overview:

These activities help students to recognize that plants can be recognized by their leaf shapes just as animals are recognized by their body shapes. Leaves have characteristics which make them identifiable to particular trees, shrubs, or herbaceous plants.

Suggested Activities:

1. Take students on a walk around school grounds. Allow them to collect leaves from shrubs and trees on campus. Instruct them to take only a single leaf (include the leaf "stem" or petiole). Return to class and provide students with the guide to Leaf Shapes and Margins. *Note that the name of the plant is not important for this activity. They are just learning general leaf shapes and margins.* Have students trace around, draw, or do a rubbing of the leaves they collected. Have them record the leaf type and margin beside each leaf.
2. Use a key to identify common Utah plants. Arrange students in groups. Provide each group with a copy of a "Key for Native Utah Trees" and complete set of leaves: A-I: maple, quaking aspen, pinyon pine, spruce, oak brush (scrub oak), willow, Utah juniper, fir, cottonwood and fir. Each group should number a piece of paper from A-I. Have students key out the leaves. Once complete, allow students to move to other groups to compare their answers. Check for discrepancies.
3. Leaf scavenger hunt. Provide students with copies of leaf types. Challenge students to find two or more of each leaf type. Press leaves and glue to paper. Have students label leaves by type.
4. Using either leaves in manila folders or leaves collected by students, have them create Venn diagrams of similarities and differences between leaves.
5. Variations in traits. As a class, go to the school yard and have every student gently pick a leaf from the same tree or shrub. Return to class and have each student record data about their leaves. Data may include length, width, color, etc. Compile all the data into a chart or graph. Ask students to analyze:

- Why there are variations on the same plant.
- What they would predict about leaves on the different tree or shrub of the same variety.
- What the effect is of variations in leaves across plants.
- *E.g. needle-like leaves have less wind-resistance and are less likely to blow over in strong winds, they shed snow easier than broad leaves, so branches don't break from heavy snow weight, their sharp needles keep animals from eating them, etc.*

Kit Materials:

Instructor Resources:

- Use the background knowledge "Plant Characteristics," bags for collecting

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade 1

STANDARD IV:

Objective1: Analyze the individual similarities and differences within and across larger groups.

Grade 4

STANDARD V:

Objective 2 a: Identify common plants…that inhabit Utah's forests, wetlands, and deserts.

Grade 5

STANDARD V:

Objective 1a: Make a chart and collect data, identifying various traits among a given population.

Classroom Transformation:

- None

Bio-box Supplies:

- Pressed leaves, Key for Native Utah Trees, Leaf Types guide, and Venn diagram.

TEACHER BACKGROUND: CLASSIFICATION

Classification systems are used by scientists to help us understand the natural world. The classification systems used in biology are based on the similarities in organisms. Scientists use observable characteristics to put organisms into groups. This helps them to see how living things are interconnected. As you teach your students about classifying, it's important that they do not use arbitrary terms such as big or little, short or tall, cute or ugly.

By describing plants using clear and distinct characteristics, scientists can separate them into different species. Anyone with a knowledge of plant characteristics can learn to identify plants using a dichotomous key. A dichotomous key makes you select from two characteristics, then, depending on your choice, makes you select from two more characteristics. These characteristics typically start broad and get more narrow or defined as you go through the key, ultimately identifying the specimen by the list of characteristics you chose.

Certain characteristics make plants classifiable according to their biomes. This is why plants may look similar to each other even if they are in different parts of the world. Tropical plants frequently have very large leaves because they do not have problems obtaining water. Tropical plants look similar whether they live in South Asia, South America, or Africa. Similarly, plants in desert regions worldwide share commonalities as they have evolved in similar climates. While some plants may be found in multiple biomes, some general adaptations include:

- Desert plants—small leaves or spines, waxy coating on leaves, fine hairs on leaves, and light-colored leaves or plants. These all reduce water loss.

- Wetland plants—hollow stems to move air to the roots, narrow leaves that won't easily tear in moving water. These all help to deal with excess water.

- Forest plants—Water is often scarce during the winter because it is in the form of snow and not readily available to plants. Deciduous trees and conifers have evolved different ways to meet the challenge of restricted water. Deciduous trees lose their leaves and so will require less water during the winter to sustain them. Conifers have reduced their leaf size to be needles which lose much less water than a broad leaf such as those of oaks, maples, or quaking aspen. Both strategies conserve water.

Classification of animals is also based on similarities. The broad classification of vertebrates based largely on body coverings is an example. This is covered in more detail in the animal section. As organisms are grouped based on similarities, it allows us to compare more and more characteristics which demonstrate patterns among or between groups.

USOE Intended Learning Outcomes (ILO's)

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of third grade students will be able to:

1. Use science process and thinking skills
    a. Observe simple objects and patterns and report their observations.
    b. Sort and sequence data according to a given criterion.
    c. Make simple predictions and inferences based upon observations.
    d. Compare things and events.
    e. Use instruments to measure length, temperature, volume, and weight, using appropriate units.
    f. Conduct a simple investigation when given directions.
    g. Develop and use simple classification systems.
    h. Use observations to construct a reasonable explanation.

2. Manifest Scientific Attitudes and Interests
    a. Demonstrate a sense of curiosity about nature.
    b. Voluntarily read or look at books and other materials about science.
    c. Pose questions about objects, events, and processes.
    3. Understand Science Concepts and Principles
    a. Know science information specified for their grade level.
    b. Distinguish between examples and non-examples of science concepts taught.
    c. Explain science concepts and principles using their own words and explanations.

4. Communicate Effectively Using Science Language and Reasoning
    a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).
    b. Report observation with pictures, sentences, and models.
    c. Use scientific language appropriate to grade level in oral and written communication.
    d. Use available reference sources to obtain information.

PREP: Gathering Materials

TIME: 20-40 minutes

TYPE: Integrating Ideas

Comparing Plants and Animals of Utah Environments

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-2

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1: Investigate living things.

a. Contrast questions, give reasons, share findings about living thing and compare and contrast living things.

1st Grade:

Objective 2: Living things change and depend upon their environment to satisfy their basic needs.

a. Make observations about living things and their environment using the five senses.

2nd Grade

Objective 1: Tell how external features affect an animals' ability to survive in its environment.

3rd Grade:

Objective 1: Classify living and nonliving things in an environment.

a. Identify characteristics of living things (i.e., growth, movement, reproduction).

b. Identify characteristics of nonliving things.

c. Classify living and nonliving things in an environment.

5th Grade

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts, and identify common organisms for each environment.

Objective 2: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

Overview:

Using the Instant Expert Cards and/or appropriate specimens, observe images of plants and animals your teacher assigns you. With your elbow partner, compare your answers. Explain why you think each plant goes where it does. What characteristics do many of the plants in the desert share? Wetlands? Forests?

Procedure:

Using any of the Instant Expert Cards or specimens from the bio box, ask students to make observations and classify organisms based on shared characteristics. The important thing about this activity is that students can defend their answers based on data they have collected.

Hand out the "Comparing Plants and Animals of Utah Environments" Ffor students to fill out their answers.

Kit Materials:

Instructor Resources:

- Read the background information "Classification"

Classroom Transformation:

- None

Bio-Box Supplies:

- Any Specimens, Instant Expert Cards, and worksheet, "Comparing Plants and Animals of Utah Environments"

PREP: Gathering Materials

TIME: 20-40 minutes

TYPE: Integrating Ideas

Develop and Use Simple Classification Systems

Overview:

Students use classification every single day. Ask students if they can think of examples in their lives. Ideas may include sorting (classifying) clothes, groceries, rocks and minerals, cars, etc.

Procedure:

As a class, select 10 items found in your classroom and ask students to create groups based on whatever criteria they choose. Once they have completed and written justifications for their divisions, give them time to compare their classification schemes with other student groups in the class. Provide time for students to defend their schemes. Explain that Carolus Linnaeus developed a classification scheme based on similarities in the 1700's. We still use his basic scheme today. It allows scientists to know they are talking about the very same organisms.

Create classification schemes for the following items from the Bio-box:

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-2

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1: Investigate living things.

1st Grade:

Objective 2: Living things change and depend upon their environment to satisfy their basic needs.

a. Make observations about living things and their environment using the five senses.

3rd Grade:

Objective 1: Classify living and nonliving things in an environment.

c. Classify living and nonliving things in an environment.

Kit Materials:

Instructor Resources:

- Read the background information "Classification"

Classroom Transformation:

- None

Bio-box Supplies:

- Leaves, pelts, and shells.

PREP: Minimal Prep

TIME: 20-40 minutes

TYPE: Exploring/ Analyzing

Practicing Some Science Process Skills

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade: K-2

STANDARD IV: Students will gain an understanding of life science through the study of changes in organisms over time and the nature of living things.

Kindergarten

Objective 1: Investigate living things.

a. Contrast questions, give reasons, share findings about living things, and compare and contrast living things.

1st Grade:

Objective 2: Living things change and depend upon their environment to satisfy their basic needs.

a. Make observations about living things and their environment using the five senses.

2nd Grade

Objective 1: Tell how external features affect an animal's ability to survive in its environment.

3rd Grade:

Objective 1: Classify living and nonliving things in an environment.

a. Identify characteristics of living things (i.e., growth, movement, reproduction).

b. Identify characteristics of nonliving things.

c. Classify living and nonliving things in an environment.

5th Grade

STANDARD V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts, and identify common organisms for each environment.

Objective 2: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

Overview:

Scientists use ways of thinking called science process skills. These skills help them to collect information about the world around us. Students can use these same skills to enhance their understanding of nature, too. Some of the most basic of skills include observing, classifying, measuring, predicting, inferring, and communicating. Below are some ideas to help students practice a few of those skills.

Science relies on empirical evidence. This means that the evidence comes from the five senses. It never invokes the supernatural or magical. One of the basic tenets of science is that the world is understandable. By studying patterns that occur in nature and across the universe, we can discover and understand our world.

Procedure:

Observe simple objects and patterns and have students report their observations. Students can make two main types of observations: **qualitative and quantitative.**

Qualitative observations are those that rely on the five senses. Observations referring to texture, color, or scent are examples of qualitative observations. Students may use the hand lenses to collect qualitative data.

Quantitative observations are those that use amounts such as mass, temperature, length, or time. You may provide a data table or have students create their own.

Observe and collect data on any of the following from the box:

Sea shells	Leaves	Feathers
Fur	Lichen	Animals

Kit Materials:

Instructor Resources:

- Read the background information "ILOs" and provide students with rulers, scales, or any other measurement tool you have available.

Classroom Transformation:

- None

Bio-box Supplies:

- Sea Shells, Fur, Leaves, Lichens, Feathers, Animals, Hand Lenses, Worksheet "Making Qualitative and Quantitative Observations"

PREP: Gathering Materials

TIME: 20-40 minutes

TYPE: Integrating Ideas

Shrinking Habitat

Overview:

Students will gain a better understanding of how development can affect plant and animal habitat. Habitat loss is one factor that has created threatened and endangered species.

Procedure:

Prior to a morning recess, tell the students that while they are playing there will be some changes made in the classroom. Once all the students have left the room, cordon off two areas of the room with masking tape or string. One area should include several desks, the other part should include the cubby area (or wherever students may leave coats or lunches). Place "DANGER CONSTRUCTION AREA" signs at the perimeter of the taped areas.

As the student return to the classroom, instruct them that they may not enter the restricted areas. This should create a level of excitement that will lead to discussion regarding the impact of man on the habitat. Gather the students into an open area and explain that the taped areas represent new developments: a housing subdivision, store, or factory. Lead the students to understand that man's impact on plants and animals may have consequences that are not immediately apparent. Begin the discussion by asking several questions:

- How did you feel when you came into the room and you could not take your seat?
- What will happen if you are not allowed to get your lunch (or coat, backpack, etc)?

After the discussion, invite students to imagine that they are plants or animals that lived in the area that was developed. Ask new questions:

- What are the consequences to the plants that live in the construction area?
- How does development affect the animals in the area?

It is important that students consider ALL animals in an area including insects, worms, snails or slugs, spiders, etc., not just vertebrates!

Lead the discussion to an understanding of how development affects both plants and animals. Development destroys all the plants in the area which will lead to loss of both food and shelter for animals. Hold up several specimens and ask how their habitats are being lost or seriously encroached upon. Some examples include the desert tortoise, salamanders, the bald eagle, and the june sucker (a fish found nowhere in the world except Utah Lake). Human encroachment into habitat space is why deer and coyotes can be seen in neighborhoods.

- Since people need housing or stores or factories, what are the criteria they should use to determine where development occurs?

Main Curriculum Tie:

ILO 1: Use science process and thinking skills

ILO 2: Manifest scientific attitudes and interests

ILO 3: Demonstrate understanding of science concepts and principles

ILO 4: Communicate effectively using science language and reasoning

Grade 1

STANDARD 4, Obj 2

Living things change and depend upon their environment to satisfy their basic needs.

Grade 2

STANDARD 4, Obj 2

Identify basic needs of living things (plants and animals) and their abilities to meet their needs.

Grade 3

STANDARD 2, Obj 2

e. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Grade 4

STANDARD V, Obj 2

e. Find examples of endangered Utah plants and animals, and describe steps being taken to protect them.

Kit Materials:

Instructor Resources:

- Tape or string

Classroom Transformation:

- None

Specimens:

- Desert tortoise, salamander,

Curriculum Connections

Appendix

Station 1

Station 2

Station 3

Station 4

Station 5

Station 6

Station 7

Station 8

What Can You Learn From My Skin?

Classifying Animals Based on Coverings

Name: Date:

Instructions:

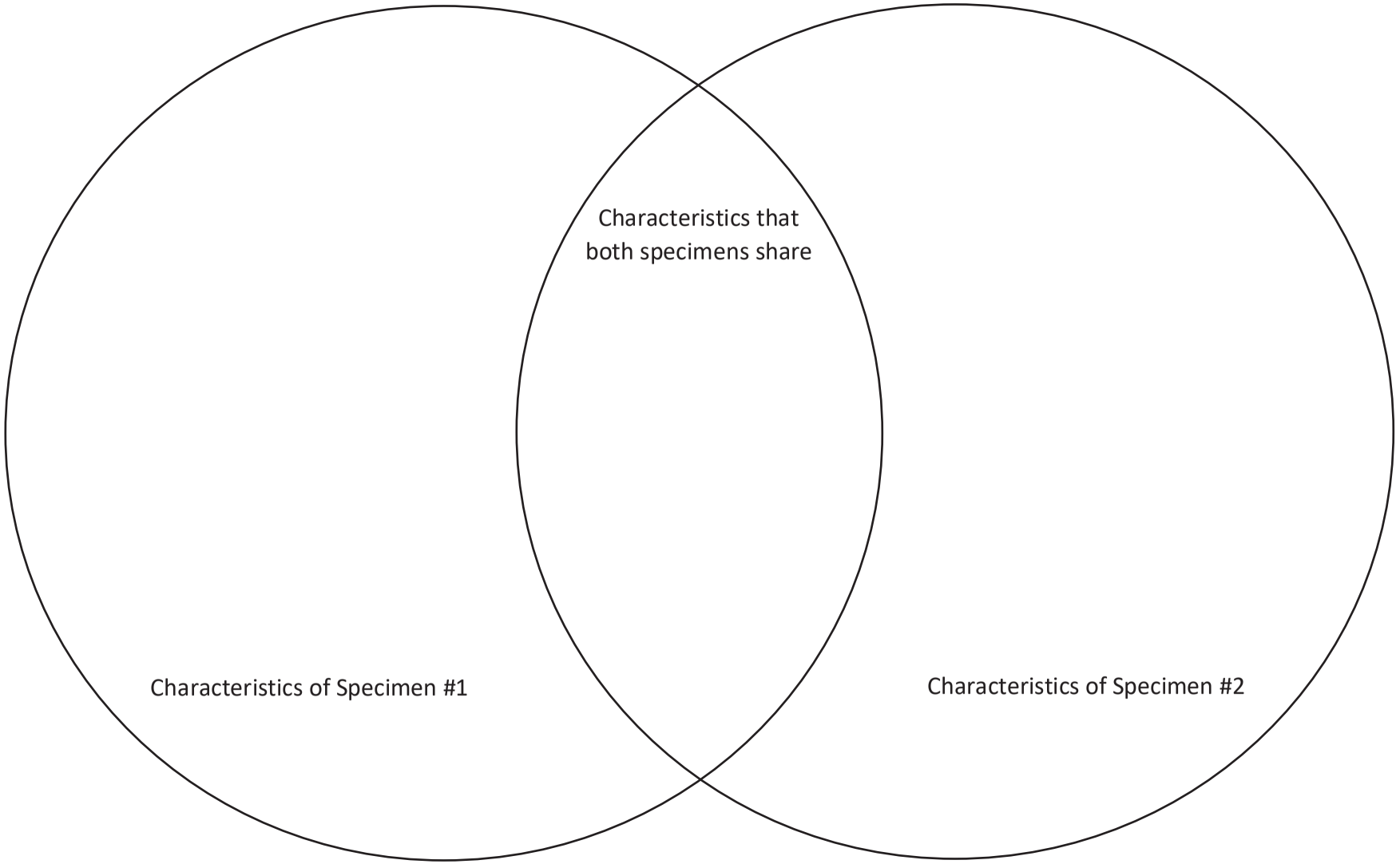
1. Go to a station and write down the station number or the name of the animal at that location
2. Make Observations and document the traits or features your animal has. You can do this by writing or drawing pictures.
3. Finally, decide if the animal is a fish, amphibian, reptile or mammal and record your answer on the column labeled “Fish/Amphibian/Reptile/Mammal/Bird.”
4. Repeat the process for as many specimens as your teacher asks you to look at.

Specimen Name or Station Number	Characteristics	Fish/Amphibian/ Reptile/Mammal/ Bird

Venn Diagram

Student Name:

Date:



Take Another Look

Name: Date:

Instructions:

1. In the table below, write down the name of a specimen.
2. Describe the structures that each specimen has. These observations can be quantitative (measurements and numbers) or qualitative (description of characteristics).

Specimen Name	Eyes	Ears	Nose	Appendages	Body Covering
Maned 3-toed sloth	Large, round eyes. 10 cm in diameter. Brown	Flat to head and hidden.	Black and pointed. Two nostrils, 2 cm in diameter.	4 legs. 3 toes on back, 2 on front. Tail is 5 cm long.	Brown fur/hair. 10 cm long hairs.
1.					
2.					
3.					
4.					
5.					

How to Use a Hand Lens

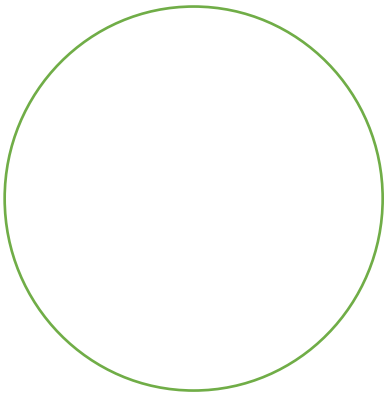
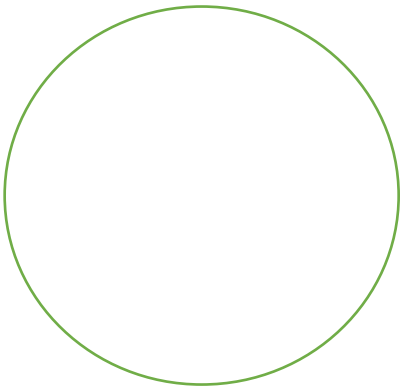
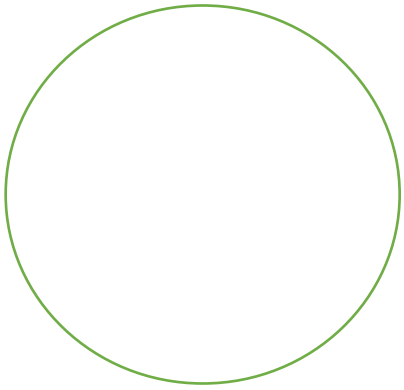
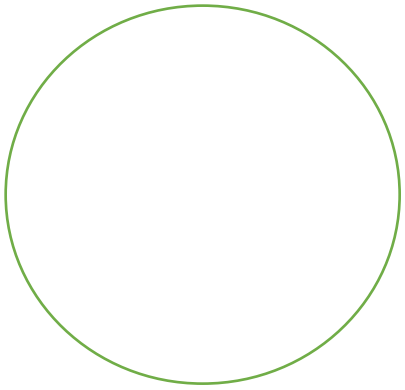
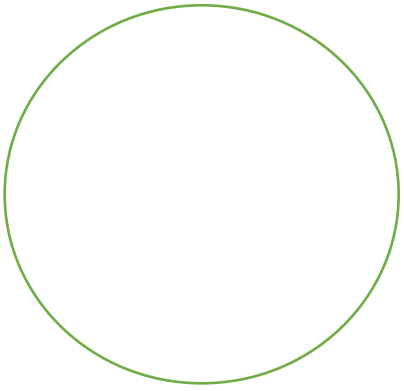
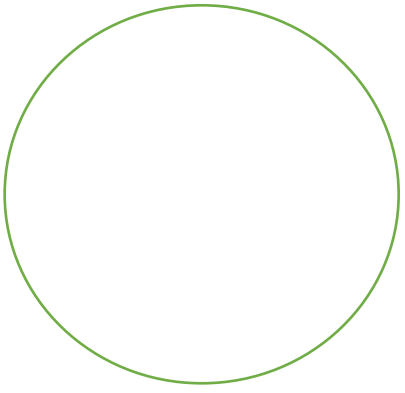
Making good observations is an important skill for every scientist and student to have. In science, we have several special tools to help us see details that we cannot see with our naked eye. Some of these tools include magnifying glasses, hand lenses, microscopes and telescopes. Microscopes help us to see objects that are extremely small and telescopes help us to see objects that are far away in the night sky. Hand lenses help us to study detail of objects you can hold in your hand such as rocks, plants, or small creatures.

It may take a bit of practice to learn to use a hand lens effectively. The first thing you must do is bring the lens right up to your eyeball so it almost touching your eyelashes. This seems a little counterintuitive, but it will give you the best image. Now hold the specimen you want to observe about an inch from the hand lens. You will have to move it forward or backward slightly to get the best focus. If you combine two of the magnifying lenses at once, the specimen will need to be even closer to your eye.

The hand lens will magnify your objects by 10X.

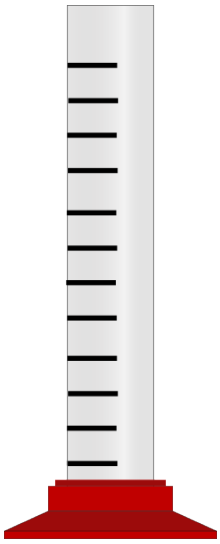
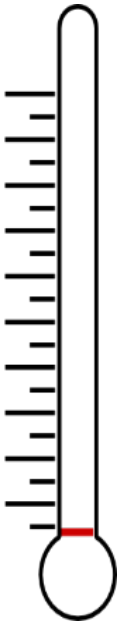
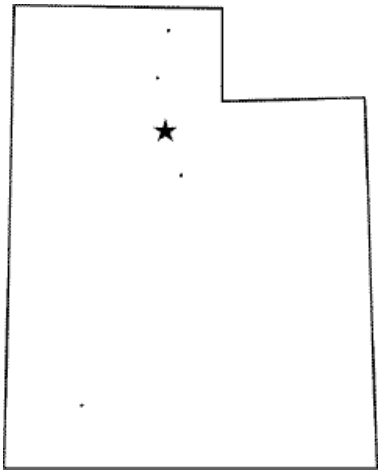
Scientists use tools to help them see small details

Choose specimens to observe. Draw one as it looks using your naked eye, and the other with a magnifying lens. Draw carefully with as much detail as you can.

Specimen Name	Naked Eye	Magnifying Lens
_____		
_____		
_____		

Common Organisms for Utah's Environments

Using information you've learned, identify one of the environments: deserts, forests, or wetlands. Use this chart to make a graphic organizer for that area. It is up to YOU to determine the units on the water gauge and the thermometer.

Ave Water Ave Temp	Typical Organisms	Environment
Water gauge - Label the units, use blue to indicate water  Thermometer - Label the units, use red to indicate temperature 		Use the following key to color each environment: Yellow: deserts Blue: wetlands Green: forests  In the space below, draw how the land would look.

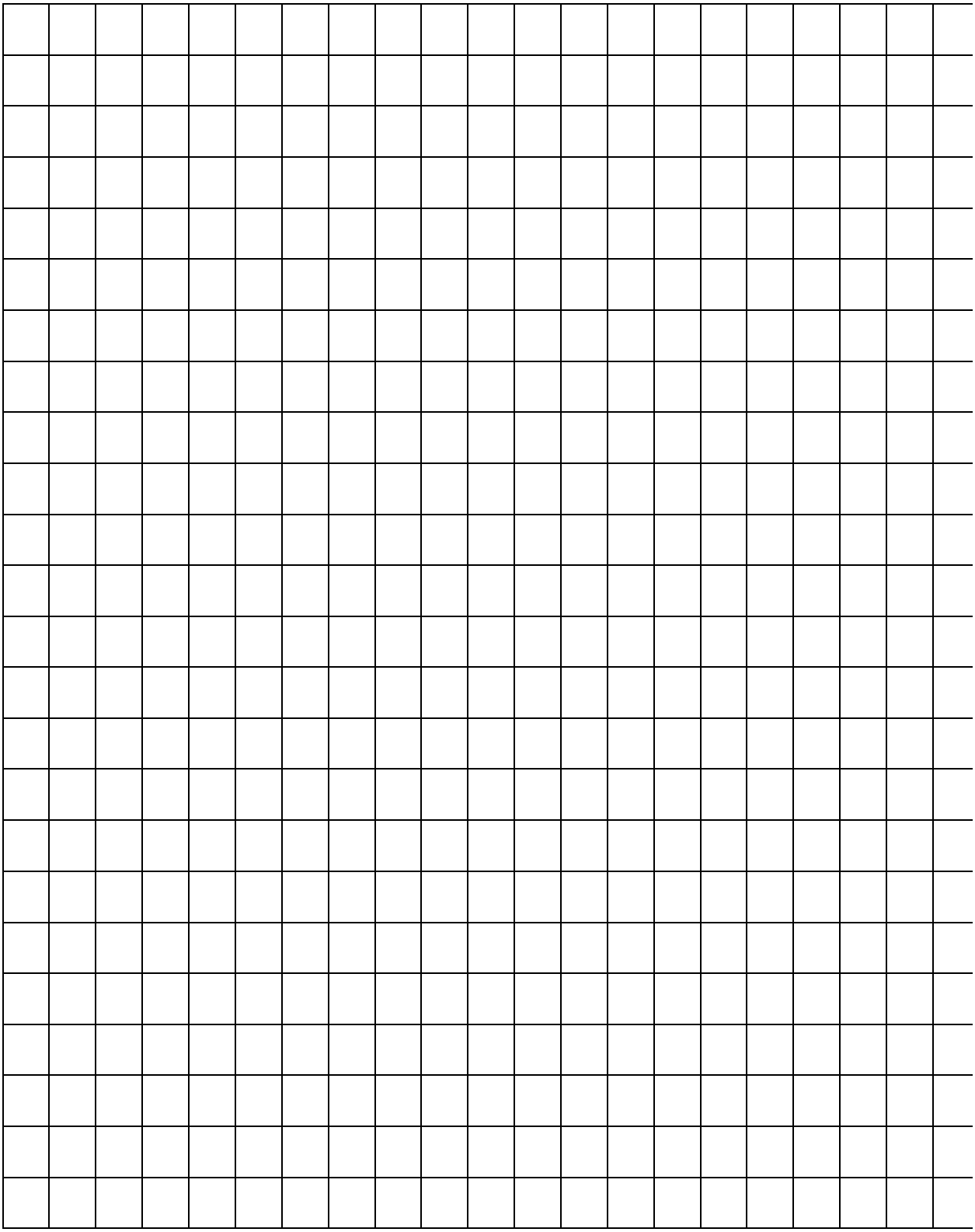
Collecting Data About Baby Plants

Name: Date:

	Dry beans	Soaked beans
1. Make and record observations of the outside of the bean seeds. 1st with your eyes, 2nd with the hand lens.		
		
2. Make and record observations of the inside of the bean seeds. 1st with your eyes, 2nd with the hand lens.		
		
3. Make a drawing of the bean seeds.		
4. Record the number of visible parts of the seeds.		
5. Measure the length and width of the seeds.	Length:	Width:

Graph Title:

Y Axis Labels



X Axis Labels:

Key for Native Utah Trees

1.a Leaves needle-like or scale-like . . . . . go to 2
1.b Leaves not needle-like or scale-like . . . . . .go to 5

2.a Leaves scale-like . . . . . .juniper
2.b Leaves are needle-like . . . . . go to 3

3.a Needles in clusters . . . . . pine
3.b Needles not in clusters . . . . . go to 4

4.a Needles flat . . . . fir
4.b Needles square . . . . . spruce

5.a Leaves 3 or more times longer than wide . . . . . .willow
5.b Leaves not 3 or more times longer than wide . . . . . go to 6

6.a Leaves lobed . . . . . .oak
6.b Leaves not lobed . . . . . .go to 7

7.a Leaves palmate . . . . . maple
7.b Leaves not palmate . . . . . .go to 8

8.a Leaf margin serrated, leaf shape circular . . . . . aspen
8.b Leaf margin serrated, leaf shape triangular . . . . . .cottonwood

Leaf Types

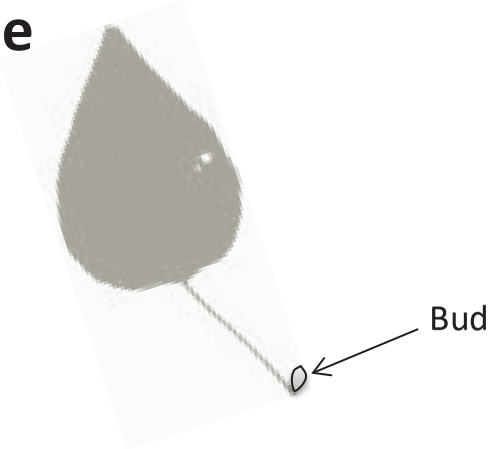
Needle-like

In Clusters **or** **Single**

Cross-section is square 

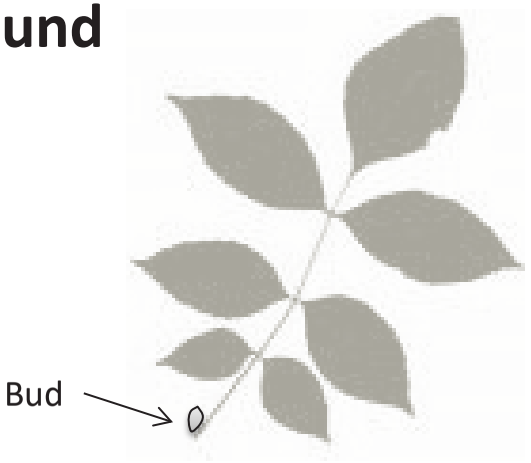
Or flat 

Simple



Scale-like

Compound



Leaf Shapes

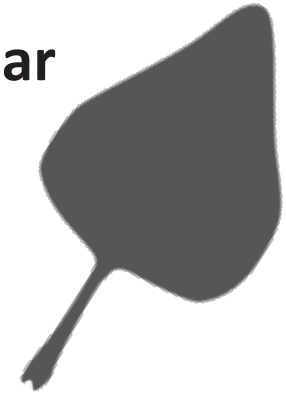
Lobed

(Deeply indented)

Palmate

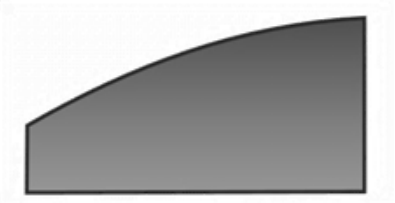
(Like a hand)

Circular



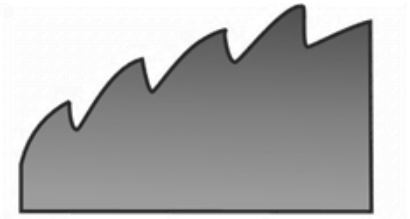
Triangular

Leaf Margins



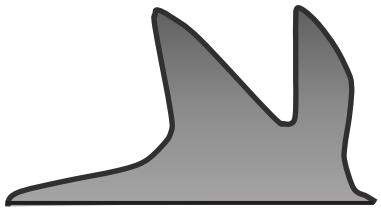
Entire

(Smooth edge)



Serrated

(Like a saw)



Cleft

(Deep cuts)

Answer Key to Pressed Plants

A. Maple

B. Quaking Aspen

C. Pinyon Pine

D. Spruce

E. Oak

F. Willow

G. Utah Juniper

H. Cottonwood

I. Fir

Making Qualitative and Quantitative Observations

Name: **Date:**

Choose an object to observe.

My object is _____

Qualitative Data - this type of data uses descriptions based on one or more of your senses.

Qualitative Observations	Sense You Used
1	
2	
3	
4	

Quantitative Data - this type of data uses measurements with numbers such as length or weight. Now describe the same object using quantitative observations.

Quantitative Observations	Measuring Tool You Used
1	
2	
3	
4	

Comparing Plants and Animals of Utah Environments

Name: Date:

Instructions: Using the Instant Expert Cards and/or appropriate specimens, observe images of plants and animals your teacher assigns you. With your elbow partner, compare your answers. Explain why you think each *plant* goes where it does. What characteristics do many of the plants in the desert share? Wetlands? Forests?

	Plants	Characteristics of this group
Forests		
Wetlands		
Deserts		

With your elbow partner, compare your answers. Explain why you think each *animal* goes where it does. What characteristics do many of the animals in the desert share? Wetlands? Forests?

	Animals	Characteristics of this group
Forests		
Wetlands		
Deserts		

Curriculum Connections

Activity	ILO's				Kindergarten Standard 4						1st Grade Standard 4						2nd Grade Standard					
					Obj 1			Obj 2			Obj 1			Obj 2			Obj 1			Obj 2		
	1	2	3	4	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
We've Got you Covered																						
Why are you Wearing That?																						
What Can You Learn From My Skin?																						
Beaks Benefit Birds																						
Fancy Footwork																						
Who Am I?																						
Well What Do You Know?																						
Take Another Look.																						
How many Bones do you have?																						
Plants Have Parts Too.																						
What Parts Do I See Around Me?																						
Color Adaptations																						
Water Adaptations																						
How Did That Get There Day 1																						
How Did That Get There Day 2																						
Sprouting Baby Plants																						
Growing Baby Plants																						
Dinner is Served																						
Its All About the Leaves																						
Comparing Plants and Animals of Utah Environments																						
Develop & Use Simple Classification Systems																						
Practicing Some Science Process Skills																						
Shrinking Habitat																						

THE MONTE L. BEAN LIFE SCIENCE MUSEUM AT BRIGHAM YOUNG UNIVERSITY

MLBEAN.BYU.EDU

Curriculum Connections

Activity	ILO'S				3rd Grade Standard 2								4th Grade Standard 4					5th Grade Standard 5							
					Obj 1			Obj 2					Obj 2					Obj 3		Obj 1			Obj 2			
	1	2	3	4	A	B	C	A	B	C	D	E	A	B	C	D	E	A	B	A	B	C	A	B	C	D
We've Got you Covered	■	■	■	■														■	■							
Why are you Wearing That?	■	■	■	■											■										■	
What Can You Learn From My Skin?	■	■	■	■																						
Beaks Benefit Birds	■	■	■	■										■											■	
Fancy Footwork	■	■	■	■										■											■	
Who Am I?	■	■	■	■			■						■	■											■	
Well What Do You Know?	■	■	■	■			■						■	■											■	■
Take Another Look.	■	■	■	■																						
How many Bones do you have?	■	■	■	■																						
Plants Have Parts Too.	■	■	■	■																						
What Parts Do I See Around Me?	■	■	■	■																						
Color Adaptations	■	■	■	■																					■	
Water Adaptations	■	■	■	■																					■	
How Did That Get There Day 1	■	■	■	■											■											
How Did That Get There Day 2	■	■	■	■											■											
Sprouting Baby Plants	■	■	■	■				■	■	■	■	■						■	■	■	■	■	■	■	■	■
Growing Baby Plants	■	■	■	■	■	■	■	■	■	■	■	■						■	■	■	■	■	■	■	■	■
Dinner is Served	■	■	■	■																						
Its All About the Leaves	■	■	■	■										■				■								
Comparing Plants and Animals of Utah Environments	■	■	■	■	■	■	■																■	■	■	■
Develop & Use Simple Classification Systems	■	■	■	■																						
Practicing Some Science Process Skills	■	■	■	■	■	■	■																■	■	■	■
Shrinking Habitat	■	■	■	■								■					■									