

# 2/3 Curriculum Contents

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The Olbrich Explorer 2/3 Tropical Ecology Explorer curriculum provides hands-on learning focused on plant adaptations. Olbrich staff provides a program introduction, guided tours of the Bolz Conservatory, and support for adult chaperones as they guide small groups through 4 different hands-on activity stations. Each station has detailed information sheets that instruct the adult chaperones on how to lead the activity. The information sheets will appear on the table at each station but please *read the curriculum and share the Copy Pages with all chaperones prior to your field trip.* Enjoy!

## Conservatory Walk

Olbrich's educators lead students on a trek through the Bolz Tropical Conservatory pointing out plants that demonstrate adaptations to the rainforest environment. Then teachers and adult chaperones lead smaller groups of students through the Tropical Plant Search.

## Explorer Activities

### A Closer Look at Plant Adaptations

- Learn about how plants use their parts and why plants make seeds.

### Meet the Meat-Eaters: plants need nutrients!

- Meet our meat-eating plants and discover how they digest their prey.

### Problem-Solving Plants

- Investigate the unusual plant collection from around the world and learn how they survive in the wild.

### Bottle Biology

- Plant Discovery Cup Gardens with tiny fast growing plants.

**Supplemental activities are included in the curriculum for use in your classroom before and after your visit to Olbrich Botanical Gardens.**

# Rainforest Plants

## Conservatory Walk

**Objective:** Students will encounter some of the diverse plants found in a tropical rainforest. Students learn ways that tropical plants have adapted to survive in the wild.

**Method:** Olbrich educators take students on a tour of the Bolz Tropical Conservatory. As they are introduced to rainforest plants, students learn about the many ways that plants adapt to their environment. Then, students test their knowledge about plant adaptations as they do the Tropical Plant Search.

### Background for Teachers:

The tropical rainforest is an exciting place to explore, especially because many of the plants that grow there are unfamiliar to us in Wisconsin. Plants in the rainforest get much more warmth and rain during the year and they do not go dormant in the winter. This allows many tropical plants to grow larger leaves and bigger fruits. When you enter the Bolz Tropical Conservatory at Olbrich, you will immediately feel the warmth and moisture. Take a deep breath to experience the unusual smells of the flowers and plants. The conservatory has many examples of how tropical plants survive in their environment. Prickly stems keep away predators, good smells attract insects to flowers for pollination, waxy leaves shed extra water, and large leaves catch as much sun as possible. Olbrich educators are trained to make students think about why plants in the rainforest grow the way they do.

### Back on the Bus:

After your trip to Olbrich, ask students what the most interesting thing about their trip was. What was their favorite plant? What was the most surprising thing they learned? What types of plant adaptations do they remember seeing in the Conservatory? Which plant had the most creative way of surviving in the rainforest?

## Chaperones & Teachers:

Please read through these detailed instructions before you begin guiding students through the activity. Feel free to ask Olbrich Educators any questions!

# A Closer Look at Plant Adaptations

Plants adapt, or change, to survive in different environments.



## Do!

Put together the laminated plant.

- Place the root on the table.
  - **What do roots do?** (*Help the plant take up water and nutrients.*)
- Next, attach the stem.
  - **What does the stem do?** (*Gives the plant structure and support.*)
- Finally, attach the leaves, followed by the flower.
  - **Why do plants have so many leaves?** (*The leaves are used to capture the sunlight, which the plant uses to make food.*)
  - **What is the flower for?** (*Flowers attract insects that pollinate the plants, which grows a fruit with seeds.*)

- Give each student a plant picture and tell them not to look at the back. Have students guess which plant part (root, stem, leaf, or flower) is pictured.



## Ask!

- Now, read the backs of the cards.
- **How has each plant modified its parts to suit its needs?**
  - Use the information on the back of the cards to guide your discussion.

Now investigate the Acacia plant on the table. Use the Acacia Plant card to learn about its unusual adaptation.

## Chaperones &

### Teachers:

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# Meet The Meat-Eaters

Plants need nutrients!

Carnivorous plants eat insects for nutrients they can't get from the soil.



1. Encourage the students to explore each plant.
  - **How might each of these plants catch and eat insects?**

Please do not touch the Venus fly trap! Each time the Venus fly trap closes, it uses a huge amount of energy. We will do a demonstration with the whole group at the end.

2. After everyone has guessed, flip the cards over to find out how each plant catches and eats insects.
3. Use the Venus fly trap puppet and dragonfly to demonstrate how one of the carnivorous plants catches its prey.



**What do plants need to live?**

- *Plants need air, water, sunlight, and nutrients*

**Why have these plants adapted to catch insects for nutrients?**

- *Most plants get nutrients from the soil. Carnivorous plants grow in soil that doesn't have many nutrients so they have adapted by getting nutrients from insects.*

**What would happen to a person who ate only junk food?**

- *They would probably get sick without nutrients from healthy food. The insects are like a healthy vitamin for the carnivorous plants.*

## Chaperones

### & Teachers:

Please read through these detailed instructions before you begin guiding students through the activity.

Feel free to ask Olbrich Educators any questions!

# Problem-Solving Plants!

## How Plants Survive in the Wild

The plants at this table come from challenging environments. Each one has a problem to solve. Guess the problem and its solution by looking at the plant.



- Have the students investigate the plants. **What do you see?**
- Set the cards on the table with the *My Problem* side facing up.
- Together, pick one card at a time and read the *My Problem* side.
- Match each card with one of the plants



- **How does each plant solve their problem?**
- Flip the cards over to read *Solutions* side.
- Compare your answers to the Answer Key.

PLANT	PROBLEM (CHALLENGE)	SOLUTION (ADAPTATION)
<b><u>Living Stones</u></b>	I live in a dry area. I am not a cactus. How do I protect myself from thirsty animals that want to drink the water inside of me?	I disguise myself by looking like pebbles or stones on the ground. Since I blend in, animals don't see me very well. My "stones" are actually my tasty leaves?
<b><u>Vanilla Plant</u></b>	Because the rainforest is so crowded with plants, getting enough sunlight can be tough! How do I get up high above the ground so I can get the sunlight I need?	I have special stems that help me to climb up on other plants towards the sun. I am a vine!
<b><u>Bromeliad</u></b>	I grow on the branches of trees, where there is no soil to absorb water and food from. How do I get my water and food?	My leaves form cups that trap water. These tiny pools are a perfect place for tiny animals like fish and tree frogs to live. I receive nutrients from the waste they leave behind.
<b><u>Peppermint Geranium</u></b>	I need to protect myself from small insects that like to eat green leaves. How do I do it?	I give off a strong odor that isn't very pleasant. Also, my leaves are furry and difficult to chew.
<b><u>Thief Palm</u></b>	I need to protect myself from animals that want to eat my long, thin leaves and trunk. How do I keep them away?	I have sharp spikes that prick the noses and mouths of hungry animals.

## Chaperones & Teachers:

Please read through these detailed instructions before you begin guiding students through the activity. Feel free to ask Olbrich Educators any questions!

# Will It Grow?

## Why plants make lots of seeds

In order to grow, a seed needs to land in a place where it can grow. Most seeds aren't able to grow into new plants.



- Hand out felt seeds to each student.
- Stick the seeds on the felt tree.
- Next, have the adult gently twist the tree trunk until all of the seeds have fallen from the tree onto the game board.
- Put the seeds that don't fall on the board into the "Seeds that don't grow" cup.
- Starting with the Lake, follow the directions on the game board to decide whether the seeds will go in the "Seeds that grow" cup or the "Seeds that don't grow" cup.



- For each seed in the Wild Field, roll the dice to find out what happens.
- Compare the number of seeds that made it with those that did not survive. **Is it easy to grow into a new tree from a seed?**
- **What challenges does a seed face?** (*Answers are on the game board!*)
- **Why do most trees make so many seeds? Is this an adaptation?** (*Answer: Yes, it is an adaptation. It is the tree's solution to the problem of poor seed survival.*)

## Chaperones & Teachers:

Please read through these detailed instructions before you begin guiding students through the activity.

Feel free to ask Olbrich Educators any questions!

# Bottle Biology

## Discovery Cup Gardens



### Plant Discovery Cup Gardens

1. Pass out one cup and lid to each child. Have them each initial the bottom of their cup with the marker.
2. Help them carefully place 1-2 tablespoons of damp soil into their cup.
3. Before you plant, ask the students to think about what the environment will be like in the Discovery Cup Garden. **What kind of conditions will these plants adapt to?**

*Much like the tropical conservatory, these miniature gardens will provide warm, moist conditions for the plants.*

  - a. The Spike Moss will turn brown and dry without enough water.
  - b. Liverworts grow in moist places, often on rocks near waterfalls or streams.
  - c. Mosses use water to transport nutrients through the plant and often grow in places with lots of water.
4. Place a small portion of each plant into each discovery cup and snap the lid in place. Remember to save some room for the plants to grow – only small pieces are necessary to start the miniature garden!

## DISCUSSION



**What do the plants in your Discovery Cup Garden need to survive?**

1. Sun
2. Water
3. Soil
4. Food

**How will you take care of your garden?**

- Make sure to water it when it gets dry.
- Place it near a window or light source
- **What about FOOD? Where do plants get their FOOD?**
  - they make food from the sun's energy
  - get nutrients from the soil they grow in

Later, if the children wish to add "food" for their plants, they can collect a dead insect and place it in their cup. The insect will break down slowly in the soil and provide nutrients for the tiny plants inside!

**Once the kids are finished making their Discovery Cup Gardens they can wear them around their necks.**

# Activities to Supplement Your Visit to Olbrich Gardens

## Before your Visit ...

### Schoolyard Observation Walk

Take students on a walk through the schoolyard playing close attention to the plants around them. Have students work in pairs to develop a list of observations about the plants in the schoolyard. Foster the students' imaginations by having them notice colors, shapes, sizes, patterns, plant parts, numbers of plant parts (for example: number of flower petals, number of leaflets per compound leaf).

Encourage students to be alert to the conditions in the area where the plant is growing. Is it rocky, shady, sunny, dry, or wet? Are there any notable adaptations that the plants have made to adjust to their living conditions? While they are at Olbrich, encourage the students to compare their observations of the schoolyard plants with the plants found in the Conservatory.

### Detective Dynamics

When making observations, small details often make a difference in distinguishing between two subjects. To practice observation skills try this game with your students:

1. Split your group into two lines of people facing one another. The person directly across from you is your partner.
2. Have partners examine each other closely during a one-minute quiet period. Notice how they are standing, what they are wearing, etc.
3. After one-minute, everyone will turn away from their partner. While they are facing away from each other, have each person change something about themselves. For example, comb your hair differently, roll up one pant leg, take your necklace off, etc. When everyone is ready, have the partners face each other again to guess how their partner has changed.
4. Have each student present their guess to see if they were good detectives. Tie this into your visit to Olbrich by telling the students they will need to use their observation skills for the visit.

## After your Visit to Olbrich...

### Adaptations in other Biomes

Now that your students have learned about plant adaptations in the tropical environment, have them learn about plants that need to adapt to other environments. There will be some similarities to the rainforest and some differences. Have students select one specific region or biome and research the specific climate conditions found there. What kinds of plants live in that biome? List the problems they may deal with and how they have adapted to survive in these conditions.

Tundra Regions of the Arctic  
 Deserts  
 Alpine / Mountain Regions (high altitudes)  
 Saline / Oceans  
 Freshwater / River, Lakes and Wetlands

### Create Your Own Plant

Imagine a new plant that is adapted for life in a tropical rain forest. Ask your students to design, draw, and name an imaginary plant that would be able to live in a tropical rain forest. They may use the following list of questions as a guide:

- In what layer or layers of the forest does your plant grow?
- Does your plant need sunlight to survive? How does it get the sunlight it needs?
- How does your plant get the water it needs to survive?
- How does it keep water from collecting on its leaves? Why are leaves so important to plants?
- How does your plant get the nutrients it needs to survive?
- How does your plant protect itself against hungry insects and other animals?
- What spreads its pollen and/or seeds, and how is this done?
- Would you find a plant like this in Wisconsin? Why or why not?

After the students are finished create a classroom rainforest by displaying the entire collection on a wall.

## ***Discovery Cup Gardens***

Dear Teacher,

When your class leaves Olbrich Gardens, each student will have a small Discovery Cup Garden to take with them. Discovery Cup Gardens are part of Bottle Biology, a hands-on curriculum that uses recyclable containers to teach about science and the environment. See [www.bottlebiology.org](http://www.bottlebiology.org) for more information.

Having these small “ecosystems” in your classroom can offer many learning opportunities for your students. Just caring for and observing Discovery Cup Gardens can be a great learning experience for your students. If you’d like, take it a step further and do some scientific experiments. Different treatments can be given to the gardens to see what the outcomes are. Below you will find lots of suggestions for ways to experiment with your gardens. Use your imagination and let the students find the answers right before their eyes.

Thanks,  
Olbrich Education Staff

### **Care and feeding of your Discovery Cup Gardens**

If you are not using the Discovery Cup Gardens for scientific experiments, but would simply like to keep them alive to observe, here are some simple things to do to keep them healthy:

- ❑ Water the gardens once every two weeks, just a light mist of water or quick squirt from a water bottle. The trick is to avoid watering the plants too much or too often, as the container will hold in a lot of the water.
- ❑ Keep the gardens in a place where they can get several hours of light each day. Natural light is best (such as in a window) but artificial light will work, too.
- ❑ Keep your Discovery Cup Garden from getting too cold or too hot and your plants should thrive!
- ❑ Finally, keep an eye on the plants, as many will get too large to fit comfortably in their small home over time. These can be transplanted into larger containers or simply removed to allow enjoyment of your other plants.

### **Transplanting**

When the plants have outgrown their original container, transplant them into a spacious new home. Try a two-liter soda bottle or a glass or plastic aquarium. Transplant everything all at once, or give some of the smaller plants in your original container some breathing room by removing and replanting only the larger plants.

## Bottle Biology Extension Activities

### Classroom Observations

Observe the Discovery Cup Gardens for a period of several weeks. Make notes about the gardens. Try experimenting with different conditions in the different cups:

- ❑ Add water to some gardens, but not to others. Use different types of water solutions (try adding vinegar, salt, or water collected from a pond or puddle) and compare them to a bottle that gets tap water.
- ❑ Fertilize one garden with plant food and use plain water on another.
- ❑ Try putting one garden under bright lights, and put one garden in the dark or wrapped in black paper.
- ❑ Take the lids off some of the gardens and leave the lids on some of the gardens. What happens? What is the difference between the two?
- ❑ Add a new plant or organism to one of the gardens and observe how conditions change.
- ❑ Wrap the gardens in different colors of cellophane to observe any effects of different light colors.

### Theme gardens

Now that your class is full of Bottle Biology experts, create new landscapes in small containers (soda bottles, take-out containers, etc.) that tie into other lessons you are doing in the classroom. Plan, design, create, and plant theme gardens that correspond to work that your students are doing in class.

- ❑ While studying dinosaurs, plant a garden of “prehistoric” plants like ferns and mosses. Populate your garden with plastic dinosaurs.
- ❑ World cultures or geography can be studied by planting bottle dome gardens with seeds from exotic fruits from each country or plants native to different regions of the world.
- ❑ TerrAqua columns are great for studying water cycles and watery pond or lake habitat. See [www.bottlebiology.org](http://www.bottlebiology.org) for more information on TerrAqua columns.
- ❑ For a unit on nutrition, plant an edible bottle dome garden with quick-growing vegetables like lettuce or radishes!

### Outdoor Adventures

Tie the mini world in your Discovery Cup Gardens to the world outside your school.

- ❑ Start a new garden (or add to an existing one) with plants or mosses collected outside. What types of plants do well in your container? Which plants don’t seem to thrive?
- ❑ Create a miniature “backyard” in your container. Add things like acorns or small insects- just be sure to add the appropriate food for the insects- to make a microcosm in a bottle. Remember, everything needs food, water, and space to survive.

## Background Information for Teachers:

What are the components that make up an ecosystem? Each Discovery Cup Garden is a tiny ecosystem- complete with plants, soil, and water. These gardens also need sunlight to survive. Much like the tropical conservatory that you visited at Olbrich Botanical Gardens, these miniature versions provide a home for plants that thrive in warm, moist conditions.

How do plants adapt to warm, moist conditions such as those in the Discovery Cup Gardens or in the conservatory? Many larger plants have drip-tip leaves that allow raindrops to fall off the plant, rather than collecting on the surface. Other plants are covered with waxy coatings that protect the plant from too much water. The tiny plants that we use in our Discovery Cup Gardens have other ways to adapt.

Plants also come in all shapes and sizes. The plants that we are using today are all plants that lack true stems, leaves, and roots. This means that they are well adapted to living in moist or wet places where water in the environment helps to move nutrients through the plant. It also means that these plants remain quite small in size because they do not have the structures to grow tall or move nutrients great distances.

Selaginella, also called Spike Moss, has scale-like leaves that will turn completely brown and dry without water. But once moisture returns to their environment, the leaves turn green and unfurl once again. The scale-like leaves of spike moss help protect it against water loss and also prevent too much water from drowning the plant.

Liverworts love to grow in moist places, such as near the waterfall in the conservatory. These plants cannot survive in dry conditions, and are often found clinging to rocks or buildings where a steady supply of water or mist is available to them.

Mosses are a diverse group of plants that depend on external water sources to transport nutrients, while vascular plants have ways to transport water and hence, nutrients, throughout the structures of the plant. For this reason, mosses, like liverworts, have adapted to survive in moist areas. Mosses that thrive in places with periods of drought have evolved to turn brown and brittle during the drought, and then become lush and green again with the return of water.