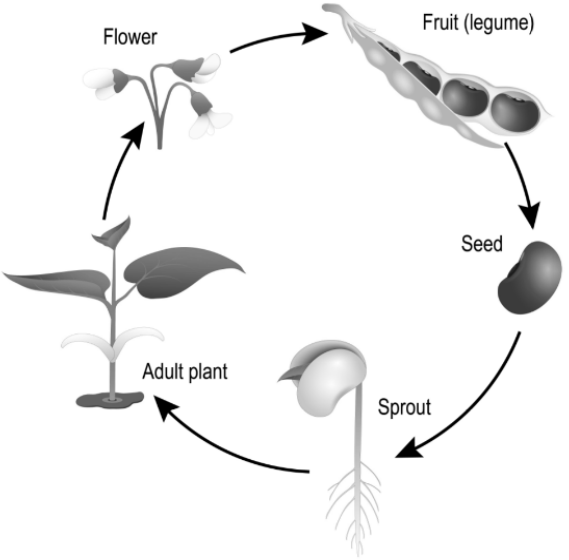
Life Cycle STEAM Kits
Grades 5, 6



Ohio Valley
Museum of Discovery

CENTRAL OHIO
music therapy LLC

GROW & SHARE THE HARVEST
COMMUNITY FOOD INITIATIVES
APPALACHIA OHIO
Sprouts

Welcome!

Welcome to your STEAM (Science, Technology, Engineering, Arts & Humanities, and Math) Life Cycles Kit! Through the activities in this kit, you will learn all about a plant's life cycle through experiments, crafts, music, and more, including growing your own bean plant!

How to use this kit:

- Follow along in the booklet and do the activities step-by-step, with your class or on your own.
- Visit us at **www.ovmod.org/steampacks/** to watch how-to videos, join special people from your school or the museum for online storytimes, and contact us with any questions or comments.
- When you have completed all of the activities in the kit, please take a moment to fill out the survey to help us improve our programming in the future. The paper survey in your kit can be given or emailed to your teacher, or find the link to the online version on the website. Thank you!

Many thanks to the **Athens County Foundation, Foundation for Appalachian Ohio**, the **Board of Directors of the Ohio Valley Museum of Discovery**, our partners **Community Food Initiatives** and **Central Ohio Music Therapy**, as well as all the wonderful **volunteers** who gave their time to prepare the kits.

The Ohio Valley Museum of Discovery (OVMoD) was founded with a mission to inspire confidence in people of all ages to discover the world. The museum provides STEAM (science, technology, engineering, arts, and mathematics) - based interactive, interdisciplinary exhibits, programming, and educational events throughout our community. OVMoD seeks to be a transformative hub for discovery-based, hands-on education, increasing access to and equity in informal learning opportunities by fostering collaborative educational partnerships in Southeast Ohio. For more information, visit us at www.ovmod.org.

Community Food Initiatives (CFI) is a non-profit fostering communities in Appalachian Ohio where everyone has equitable access to fresh, healthy, local food. Through the Sprouts School Garden Program, CFI offers students a space to engage in hands-on lessons both in their school gardens and classrooms. Sprouts offers a unique, multi-sensory, inquiry-based education and a way to reconnect students with the natural world and the true source of their food, empowering them to "grow & share the harvest." For more information, visit www.communityfoodinitiatives.org.

Central Ohio Music Therapy (COMT) was founded with the vision of quality in every life and a mission to empower people and communities through music. COMT provides board certified music therapy services throughout central and southeastern Ohio in schools, mental health facilities, and day rehabilitation centers for children, teens, and adults.. COMT believes in a community-based approach, adapting music therapy treatment to the unique needs of each individual or facility. For more information, visit www.centralOhiomusictherapy.com

Activity 1:
Mini Greenhouse Study

Supplies: (items with * are NOT included in the kit)

Four clear plastic cups
One blue plastic cup
One red plastic cup
Three zip top bags of soil
*Water
*Cup or small pitcher (optional)
*Spoon or scoop (optional)
Bean seeds (in envelope)
Tape
*Scissors (optional)

Mini greenhouse procedure:

1. You will be making three mini greenhouses. You'll use these to observe the differences in how plants grow, depending on what quality of light they are exposed to. First prepare the soil: Your potting soil is in three zip top bags (one for each greenhouse), and it first needs to have a little water added to it. You can use water from the faucet, or put some water into a small pitcher or cup. Pour the water, a little bit at a time, into each bag of soil. After adding a little bit of water, mix it into the soil by kneading the bags a bit. Be sure to not add too much water!

2. When the soil is as wet as a wrung-out sponge, carefully pour (or scoop, with your

hands or a spoon) the soil into three of the clear cups.

3. Now take the envelope of bean seeds and place three seeds carefully on top of the soil of each cup, making sure to space them apart evenly.

4. Gently push each seed down into the soil, just about as far as the first knuckle on your index finger, and then cover each one lightly with soil.

5. Now you'll create the greenhouses. For the first greenhouse, take another clear plastic cup and place it on top of the first one. Tear (or cut) three small pieces of tape and use them to attach the top cup to the bottom cup. Make the second and third greenhouses the same way, instead using the blue and red plastic cups on top.

6. Place the greenhouses near a window and wait for the seeds to sprout. Be patient--this will take a few days.

7. Check your greenhouses every day. While you wait for sprouts, you can go ahead and do some of the other activities in this kit. Make sure to keep these plants to use in Activity 3, Plant Maze.

8. When you see the seeds starting to grow, start drawing or writing what you see. Recording *observations* (things you see happening) is one way scientists learn about the world! Here are some things to think about:

- When did your seeds sprout?
- What do the roots look like?
- Measure how tall your plant is. Do this every day around the same time. How much do they grow each day?

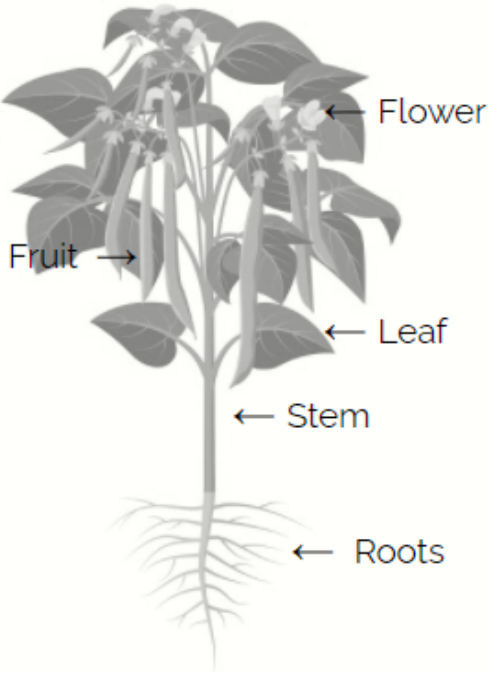
- How many leaves do they have? What shape are the leaves?
- Are your plants growing differently in the different greenhouses? Why? What are the differences?
- Is your soil starting to feel dry? Remember, it should be just a little bit damp, so only add a few drops of water at a time. Record any watering in your journal.
- What colors are the different parts of the plants?
- Draw the greenhouses, plants and all. Label the different parts of the plant (roots, stem, leaves).
- Have you noticed differences in how your plants are growing in the three greenhouses?
- What else are you curious about?

How it works:

Just like humans, plants are made up of different parts and have different things they need to grow. Plants have *roots* that dig deep into the soil to absorb nutrients and water. Plants have *stems* that hold them up, like a human skeleton holds us up. Plants have *leaves* that absorb sunlight. Many plants also grow *flowers* that help them make new seeds inside a *fruit*. In a bean plant, a flower grows into a bean pod (the fruit), where the seeds are found. The bean pod keeps the seeds safe until they can start growing a new plant. Our bean plants probably won't grow big enough to grow bean pods. They will need to be planted in a garden during summertime temperatures to fruit!

A seed needs a few things to *germinate*, or sprout, and start to grow. It needs *nutrients* from the soil, just like humans get nutrients from the food we eat. Plants also absorb water from the soil. When you see the roots and stem starting to grow out of the seed, the plant needs warm temperatures and sunlight. Sunlight is made up of many colors, or *wavelengths* of light. Have you ever seen sunlight break into the colors of the

rainbow when it shines through a crystal, or even through a clear glass of water? These are some of the different *wavelengths* of light. When your bean plant grows in a greenhouse made with a clear cup, all of the wavelengths of light in sunlight reach the plant. When we place a blue cup over the plants, all wavelengths except blue are blocked, so that only blue light reaches the plant, and the same is true for using a red cup for the greenhouse. You will be able to explore how light affects plant growth by comparing growth in your three greenhouses. How do you think blocking different light wavelengths will affect how the plant can make food through photosynthesis? Why?



Plants use the sunlight and nutrients to make their own food by a process called *photosynthesis*. The amount and quality of light that plants are exposed to affects the amount and quality of food they can make. You may have noticed that your bean plants in the blue greenhouse are, on average, shorter, and their leaves are thicker and darker than the bean plants in the clear greenhouse. The bean plants in your red greenhouse may be, on average, taller and have thicker stems than those in the clear greenhouse. Different light wavelengths impact the process of photosynthesis in different ways.

Activity 2:
Life Cycle Agamographs

Supplies: (items with * are NOT included in the kit)

Bean plant life cycle agamograph pages (2 pages total)
*Scissors
*Crayons/colored pencils/markers
Construction paper
Glue or *glue stick

Agamograph procedure:

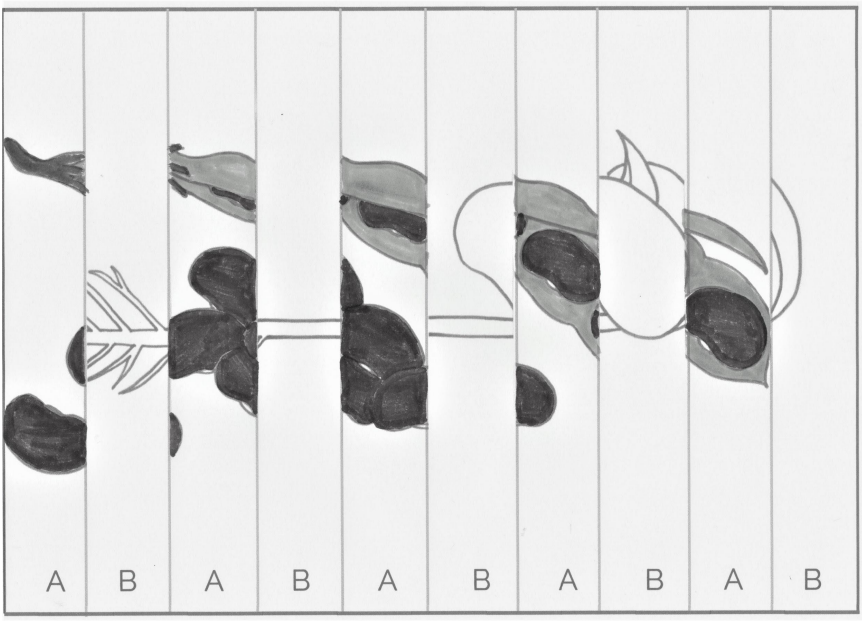
1. We are going to make an *agamograph*, a type of picture that lets you see two different images in one, depending on how you color and fold the paper. Find the images printed on plain white paper in your kit.

2. Start by examining the agamograph images. They are a little strange looking, because there are two pictures in one! One picture is divided into the columns labeled "A" and the second picture is in the columns labeled "B." Four stages of the bean plant's life cycle are hidden in the two pages of images.

3. Color the images in the agamograph pages, keeping in mind which columns are labeled "A" and which are labeled "B." All of the A columns belong to one picture, and all of the B columns belong to another picture, so be sure you're coloring the pictures accordingly.

4. Cut off the extra paper along the long edges of the image (including all of the "A" and "B" column labels). Do not cut the colored picture at all!

5. This agamograph has only one image colored in so far:



6. When you've colored both images, accordion-fold the picture along every straight line. (Accordion fold means that once you've made one fold, you'll turn the paper over and fold it back on itself like a fan or accordion).

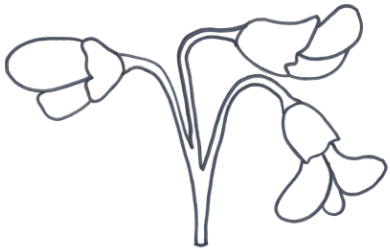
7. Open the picture up a little bit, so you can see each of the two images on the page. Repeat for the second agamograph.

8. Use a few drops of glue, or a glue stick, to attach the extra paper at the short ends of the agamograph image to the construction paper for display.

9. If you wish, add labels and descriptions to your life cycle images. Where are the fruit (with seeds), sprouting seed, plant, and flower?

How it works:

Agamographs were developed by an artist from Israel named Yaacov Agam, and are described as "kinetic art." *Kinetic* means that you have to move to see the effect of the art. When you look at your agamographs, do you see these two images (the *leaves* and the *flowers*) in one creation? Do you have to move to see each of them? How much? What if you made one the size of a house, like Yaacov Agam has done? How much would you have to move to see those images?



Activity 3:
Plant Maze

Supplies: (items with * are NOT included in the kit)

Sprouted bean plant in cup (from Activity 1)
*A sunny location
*Cardboard box (a shoe box works great!)
Black construction paper
Tape
*Scissors

Plant maze procedure:

1. We are going to make a maze for the bean to grow through, demonstrating how plants grow towards light. Start by cutting a hole in the top of a cardboard box- this will be the 'finish line' for your plant.

2. Depending on the shape and opening of your box, you may need to cut one side of the box so that you are able to open and see in (like a small door).

3. Using black paper, make a cut out that is the width and length of the box with a small hole through it. This is the obstacle part of your maze. (It is important that this piece is dark so that the light won't be able to get through and confuse the plant).

4. Place a long piece of tape on both ends of the paper so that it will hold to both sides of the box when you place it in. Depending on the size of your box, you can continue making as many of these 'obstacles' as you want, making the maze harder by alternating which side the holes are on.

5. Place your bean plant in the box, close it up, and place it near a window. Check on it every day to watch it complete the maze!

How it works:

Phototropism is how plants respond (or grow) to the light around them. Plants will always grow towards the sunlight so that they can survive. Without sunlight plants are not able to use photosynthesis and make energy for them to live.

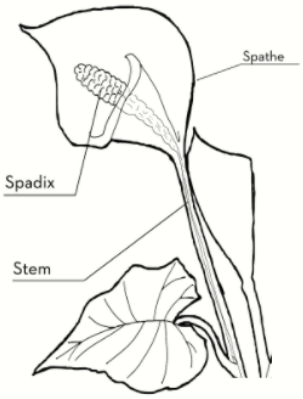
Activity 4:
Crepe Paper Flower

Supplies: (items with * are NOT included in the kit)

Crepe paper
Pipe cleaner
*Scissors
Glue

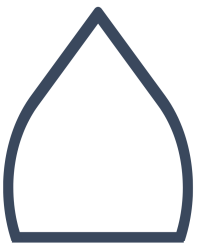
Calla lily crepe paper procedure:

1. Calla lilies are unique flowers, because what looks like a single flower is actually many tiny flowers growing on an axis, which together make up the *spadix.* This is surrounded by a leaf-like structure, which looks like a single, curving petal called the *spathe.* The spathe is formed from what was once a leaf that has changed, through evolution, to be colorful to attract pollinators to the flowers.



2. Begin your calla lily by creating the spadix. Using any color you wish, cut a small rectangle of crepe paper and wrap it around the end of your pipe cleaner. Glue into place.

3. Next, cut a piece of crepe paper into a petal-like shape for the spathe. It should look something like this:



4. Glue your stem onto the center of the spathe.

5. Gently pull one bottom corner towards the middle and glue into place. Do the same with the other bottom corner. This creates the cone-like shape of the calla lily.

6. Cut the green crepe paper into leaf shapes and glue to the pipe cleaner. Leaves can be shaped like this:

Or like this:

7. You can create many beautiful flowers out of crepe paper. Enjoy your calla lily!

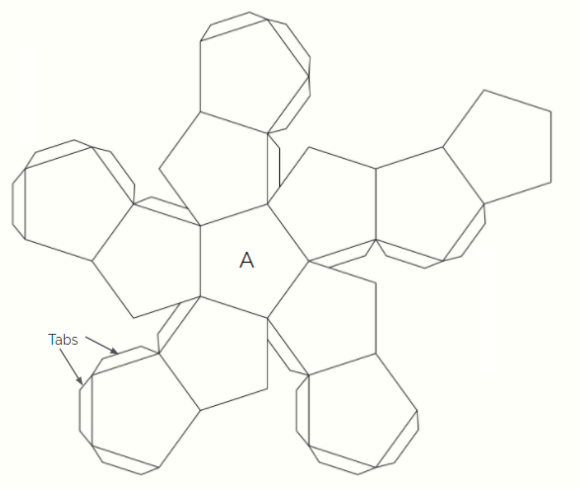
Activity 5:
Polyhedron Pollen Grain

Supplies: (items with * are NOT included in the kit)

Polyhedron printed on cardstock
*Scissors
Glue, tape, or *glue stick

Polyhedron pollen grain procedure:

1. In your kit, find the cardstock printed with a picture that looks like this:



2. You are going to take this flat image and create a *polyhedron*, a 3-dimensional (3D) shape with flat sides (or *faces)*, straight edges, and sharp corners.

3. Begin by cutting out the image. You'll cut all the way around the *perimeter* (edge) of the shapes. Don't cut through any of the lines.

4. Take a moment to examine the flat shape. When it is completed, how many faces will make up this polyhedron? What shape are each of the faces? The final object is called a *dodecahedron.* Can you figure out why it has this name?

5. To begin creating your dodecahedron, you will need to crease all of the solid lines, including the tabs. Fold all of the lines toward the middle, then unfold so each line so it is creased.

6. Now, with the central pentagon, "A," at the bottom, fold the five pentagons surrounding it upwards. Connect the tabs on the sides with a drop of glue or small piece of tape. Repeat with the next five pentagons.

7. Finally, fold down the pentagon that will make the top of the dodecahedron and glue or tape it to the tabs of the neighboring pentagon-shaped faces.

8. You've created a dodecahedron out of a flat sheet of paper! Imagine that the dodecahedron is a gigantic pollen grain!

How it works:

A *dodecahedron* is a type of *polyhedron*, and we can use these shapes to imagine what pollen grains look like. *Pollen* is an important part of a flower, and you can see it as a yellow dust that lands everywhere in the spring! Here is a very close-up picture of what some common pollen grains look like. When pollen grains move (by animals, insects, wind, or water) to another flower of the same kind, they fertilize that flower, which allows a fruit to grow.

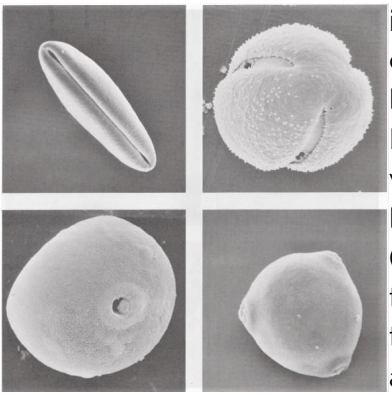


Image from *Morphology and Evolution of Vascular Plants* by Ernest Gifford and Adriance Foster

Activity 6:
Seed Spinners

Supplies: (items with * are NOT included in the kit)

Envelope with maple seeds and paper clips
Paper flyer cutouts on the back of this booklet
*Scissors
*Pencil
*Timer or stopwatch (optional)

Spinners procedure:

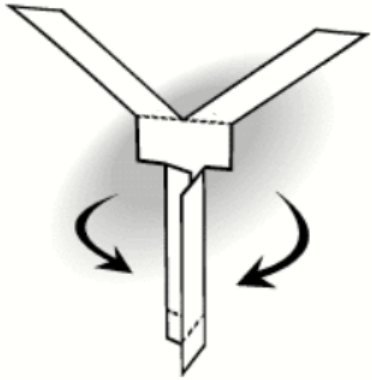
1. Find the pattern for the spinners on the back of this booklet and cut them out. Cut out along the solid lines, then cut the additional 3 solid lines in the template.

2. Fold parts A and B along the dotted lines toward the back, so they overlap each other and are behind the middle (unlabeled) section.

3. Fold part C toward the back. Crease it well so it all stays folded.

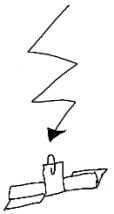
4. Now, fold parts D and E: Fold them along the dotted lines *away* from each other.

5. You've made a paper spinner! Now it's time to test it out!



6. Hold the spinner up as high up as you can drop it. What happens? How does it look when it falls?

Corkscrew?



Zigzag?

Flip over?

Something else?

7. Try dropping one of the maple seeds in the same way. How does it look when it falls? How similar or different are the maple seed and paper spinner flights?

8. Now let's try making some changes to your paper spinners, see how their flights change, and compare to the maple seed. You can try adding a paperclip (or two) to the spinner, or trim the wings to a different shape. How else could you change the spinner? Describe the changes here:

   Flyer 1: _____

   Flyer 2: _____

   Flyer 3: _____

9. How do the spinners' flights change with the changes you made to them?

   Flyer 1: _____

   Flyer 2: _____

   Flyer 3: _____

10. You can also try timing your spinners' flights, and compare to the maple seeds' flights. Use a timer or stopwatch to measure 3 different flights and record their times here. What do you observe? Why?

Spinner:	Time 1:	Time 2:	Time 3:
1			
2			
3			
Maple seed			

How it works:

When you dropped your paper spinners, you may have noticed that the flyer started *rotating* (turning around and around) as it fell. This motion is called *autorotation*. When the paper flyer falls, air pushes up against the blades, bending them up just a little. This tiny change in shape causes the air around the wings to move like a very tiny tornado, that is, the wind spins around just above the wing. This helps the flyer move through the air. You see that making small adjustments to your flyer can make it fly in different ways. What happened when you made changes to your spinners? What else could you change?

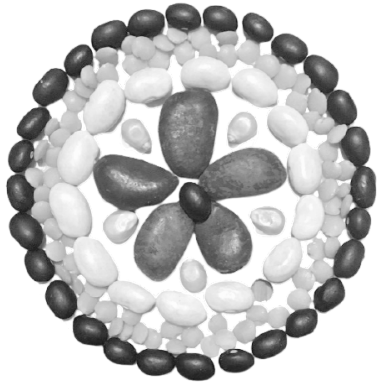
Maple seeds also fly through the air by autorotation! Lots of different seeds move in the air, but maples are the best flyers because of their wings that help carry them far from their parent tree and find a new place to grow and thrive.

Activity 7:
Seed Mandala

Supplies: (items with * are NOT included in the kit)

Zip top bag with seeds of different shapes, sizes, and colors
Paperboard circle
*Plate, newspaper, or other flat object (to catch glue drips)
Glue

Seed mandala procedure:



1. Start by gathering your supplies: Find the bag of seeds and place your cardboard shape on a flat surface that can get messy (newspaper or a paper plate works well). Have your glue within reach!

2. Plan out your design before you begin gluing. Are there certain seeds that are your favorites that you want to be sure and include? If so, use them first. Think about using different colors and shapes to make patterns or a design.

3. Place a drop of glue on each larger seed to begin. For the smaller seeds, it works well to spread the glue directly onto the cardboard and add the seeds to it rather than trying to glue individually. Remember, a little bit of glue goes a long, long way!

4. Continue gluing and placing seeds until the entire shape is full.

5. Set aside to dry, this could take a little while if you have used a lot of glue so be patient!

How it works:

The word *mandala* means "circle" in Sanskrit. The mandala is a spiritual and ritual symbol in Hinduism and Buddhism, representing the universe. The circular designs symbolize the idea that life is never ending and that everything is connected.

In this activity, you are using seeds to create circular patterns. The pattern-making part of the brain is the same part that also helps you recognize things that are similar or different. Look carefully at the seeds you have used. What are some similarities and differences you see? Think about their textures, sizes, colors and shapes. Seeds are also used for food all over the world. Maybe you've eaten seeds like the ones you're using here (but don't eat any of these)! Do you recognize any of the seeds?

Activity 8:
Songwriting

Supplies: (items with * are NOT included in the kit)
*Pencil

Songwriting procedure:

You have been learning all about how seeds grow into plants! Light helps seedlings stretch and grow towards the sun, but you are growing and learning too!

1. Fill in the blanks with what you are proud of learning this year! All blanks will fit one word:

   I can _____ I can _____

   I can _____ I can _____

   I love learning about _____,

   _____, and _____.

2. Place your words from above in the blanks below to complete the song on the next page.

3. Sing along or perform your new song using a karaoke track or the COMT video for “Blinding Lights” by The Weeknd! Find the link with all our resources at ovmod.org/steampacks.

To The Tune of "Blinding Lights" by The Weeknd

I've been learning 'bout plants
Life cycles all day long
Now I know how they grow, hey hey!

Germination starts the growth
Nutrients feed the seeds
And greenhouses are their homes, hey hey!

I look around there's
Plants all around me
Roots, stems, flowers, and leaves,
Now I can see that they grow, like, me

Oooo I can see my light!
I can _____ and **I can _____** today!
Oooo I can see my light!
I can _____ and I **can _____** today!

Learning helps my brain grow
I love learning about _____
And _____, hey hey

I look around there's
Plants all around me
Roots, stems, flowers, and leaves,
Now I can see that they grow, like, me

Oooo I can see my light!
I can _____ and I can _____ today!
Oooo I can see my light!
I can _____ and I can _____ today!

Activity 9:
Nature Scavenger Hunt

Supplies: (items with * are NOT included in the kit)

Bag for collecting nature treasures - ONLY things that are not growing (you can reuse the bag your kit came in!)
Your seed necklace from Activity 6
*Paper and pencil or camera (optional)

Nature scavenger hunt procedure:

1. Outside in nature, plants go through different stages of their life cycles at different times. If you look for different kinds of plants and try to identify each of their parts, you will find lots of stems, many leaves, and some plants will have flowers or fruits on them. Let's go on a scavenger hunt to see what you can find!

2. During a nature scavenger hunt, it's okay to collect some nature treasures in your schoolyard or at home. Only collect things that are not attached to anything or are not growing. Leave growing plants, including flowers, in the ground or on the plant. Instead, you can take pictures or sketch a drawing of the plants you find!

3. As a reminder, go back to the end of Activity 1, Mini Greenhouse Study, to read about a plant's parts. You can also explore your bean plant and identify its parts.

4. Now find a space outside (your schoolyard, along a sidewalk, out in the woods) where you can safely explore. Look for examples of all the parts of a plant's life cycle.

a. Roots

Roots can be hard to find! Can you see them in your bean plant greenhouse? Or have you ever tripped over a tree root outside, in the woods or along a sidewalk?

b. Stems

Stems help hold a plant up. Most plants have stems, but they can look very different from one plant to another. Compare the fleshy stems of this houseplant to the woody stems of a tree and vine in nature. What other stems can you find in nature?

c. Leaves

Leaves are found attached to stems, and sometimes they have their own stem too (the *petiole*). Here are some leaves growing on trees, in the garden,

and even in a pond. Where can you find leaves?

d. Flowers

Spring is a wonderful time to look for flowers! Flowers grow on trees,

below trees on the forest floor,

in grassy yards and meadows, even in the cracks in sidewalks!

Where else can you find flowers in nature?

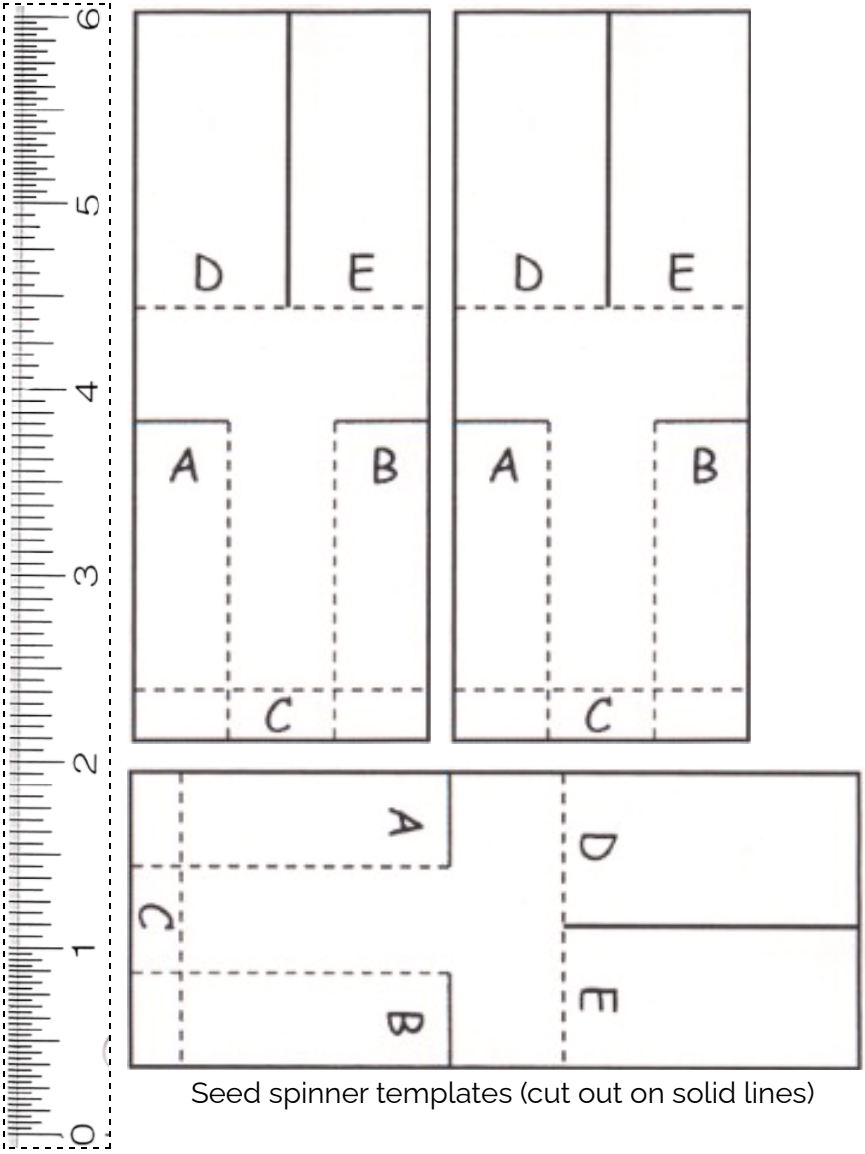
e. Fruits (and seeds)

Fruits contain the seeds that can be used to grow new plants, like a bean pod that contains many bean seeds. Where else can you find fruits or seeds? You probably eat them sometimes,

or you might see them growing on a tree, or above leaves on the water.

Did you know that even grasses, and flowers that grow wild along the roadside, have fruits and seeds? Here is a close-up of what they look like on a grass (look between the leaves) and on a roadside wildflower:

Now examine the seeds you used for your seed necklace. See how different they each are? Lots of these seeds are similar to those we might find in a garden, at the store, or a farmer's market. Fruits and seeds come in lots of shapes and sizes, and this helps them *disperse,* or move to a place away from their parent plant so they can grow and thrive on their own.



Seed spinner templates (cut out on solid lines)