Dig, Plant, Grow!

AN ORGANIC Gardening GUIDE

TO PLANNING YOUR OWN GARDEN CURRICULUM

Dig, **Plant, Grow**!

A GUIDE TO PLANNING YOUR OWN GARDEN CURRICULUM

Organic Gardening's mission is to "live lightly from the ground up." This is especially relevant as the possible threats of climate change and the detriments of unhealthy eating, on both the planet and its people, are at the forefront of current media coverage. Many across the world would agree that the challenges of our planet's ecological situation demand that we find ways to "live lightly" and take action toward a more environmentally minded future.

When J.I. Rodale began *Organic Farming and Gardening* magazine (now *Organic Gardening*) in 1942, he did so with an awareness that heightened use of chemicals in agriculture was already a problem. Today, America's mistreatment of our soil has reached far deeper than J.I. Rodale could have anticipated back then. Damaged soil has led to an increased reliance on chemicals in food production, the grocery-store shelves are packed with ingredients that come more from laboratories than gardens, and diet-related illnesses are on the rise. "Living lightly from the ground up"—and restoring the food system that will support generations to come—is of critical importance.

Yet building a sustainable agricultural future cannot be simply through the soil alone. We need to start with the people "from the ground up," too, and build a community of future leaders who are educated about what it takes to maintain a sustainable environment.

In this curriculum guide, "Dig, Plant, Grow!" we offer some ideas to plant the seeds of garden-based education. Whether used by parents for adventures in at-home gardening or by teachers building a classroom garden, we hope that these ideas will inspire you to bring an understanding of gardening and food systems to the young people who can in turn build a sustainable future "from the ground up."

In each section below are ideas for how to integrate these topics into your curriculum, including:

- **An introduction section featuring background information on the topic**
- **An "In the Classroom" section, including a featured lesson plan and ideas for bringing the topic to life in your own curriculum plans**
- **A section of hands-on garden learning ideas to make the garden your classroom**
- **A "Classroom Library List" of youth resources for further reading on related topics**

While these lessons offer ways to integrate gardening into your teaching, don't forget: The best way to teach gardening is to *garden*! By engaging students in planning, planting, and harvesting, you'll be enriching them with amazing lessons to help them grow!

Topics:

SOIL

EXAMINING WHAT GOES ON BELOW THE GROUND

As you walk through the park or across your yard, look down! What are you walking on? It may look like ordinary grass or dirt, but underneath the ground we walk on is the realm of soil—a part of the earth teeming with organisms that work together to create a fertile place for plants to grow. Home to abundant communities of worms, beetles, and mites, crisscrossed by roots big and small, the realm of soil is where our gardening adventure begins.

Soil is created by the continuous process of erosion, during which the actions of wind, water, ice, and waves break down rocks and minerals into a finer material that serves as the core substance of our soil. Added to this rocky material is organic matter, which originates from the decomposition of animals and plants. Organisms living in the soil, such as earthworms, fungus, and bacteria, feed on this organic matter to help further decay and recycle important nutrients. What results may not look like anything special, but it is more valuable to life on earth than even the prettiest diamond or gold.

Although we often think of soil as brown dirt, soil quality varies widely in character. For example, humus is a dark coffee-colored fertile soil found in the topsoil layer. It is rich in organic matter and high in moisture, making it ideal for planting. Sandy soil, on the other hand, is lighter brown in color. While it drains easily and warms up quickly, it does not hold moisture well, is low in nutrients, and is susceptible to water and wind erosion. The five factors influencing a soil's "character" are parent material, topography, time, climate, and the diversity of organisms present. It is these soil characteristics that ultimately determine the productivity and diversity of plant species growing in your garden.

Most plants begin their lives in soil, and this soil will continue to support them as they grow. Plants need soil to anchor their roots firmly in the earth so that they don't blow away in the wind. In addition, the microbiological activity within the soil provides the nutrients and water growing plants need to survive.

Beginning with the very first agricultural societies, gardeners learned how to improve soil quality to ensure optimal plant growth. The most common efforts revolve around adding minerals to nutrient-poor soil and breaking up the earth to allow for aeration. One of the most effective and popular methods of improving soil's nutrient content is by adding compost. Compost is created by controlling and optimizing the conditions under which biological decomposition occurs. Made of organic matter that has been expertly decomposed, compost is especially rich in nutrients and moisture.

Although the process of creating compost may seem like a science, it is easy to do at home! Composting consists of taking organic waste from your garden or kitchen, placing it in conditions conducive for decomposition, and then watching and waiting as the waste turns into a precious nutrient-rich soil amendment. The basic recipe for compost involves a mix of carbon-rich "brown" material, such as dried leaves, hay, wood shavings, and even paper, plus

nitrogen-rich "green" material, such as grass clippings, fruit and vegetable scraps, eggshells, and coffee grounds, plus oxygen (achieved through turning and aerating the compost pile) and water. It is often recommended that compost be created with a ratio of 20 to 30 parts carbon to 1 part nitrogen, so start saving those browns! As the compost recipe comes together, microorganisms will get to work, too, heating up the pile and breaking down the organic material.

With a little research, you can find the perfect compost setup for your individual situation. Need an outdoor compost bin system? **Build your own!** Have a small indoor space in which to compost? **Try vermicomposting!** Check out the *Organic Gardening Beginner's Guide to Compost* for more details on concocting the perfect compost pile.

http://www.organicgardening.com/learn-and-grow/compost-ingredients
http://www.organicgardening.com/learn-and-grow/ultimate-compost-bin
http://www.organicgardening.com/learn-and-grow/understanding-earthworms
http://www.organicgardening.com/learn-and-grow/composting-101

Dig In: Hands-on garden learning ideas

SOIL TEST

Start with a soil test to help students understand that soil contains nutrients that feed growing plants and help them thrive. When we eat vegetables and fruits from our gardens, we are in turn consuming the vitamins that the plants absorbed from the soil. Therefore, healthy soil not only means healthy plants but healthy people, too! Look at some example soil-test results with your students and see which nutrients they recognize from their daily vitamin bottle.

Collecting soil samples is an opportunity to put the scientific process to work in a real-world application. Most soil tests require mixing samples from 4 to 10 different locations throughout a garden space to get a representative soil sample to send to a laboratory for analysis. Soil samples should be taken from a depth of at least 6 to 8 inches below the soil surface. For older students, have a conversation on why multiple sample spots lead to the most representative sample and the importance of sample depth. This is a perfect example of how your garden can be used as a tool to investigate practical applications of classroom science content. Once you have received your test results, invite students to explore their meaning. How healthy is your soil? Check out these *Organic Gardening* resources for helpful hints on interpreting soil test results.

pH: http://www.organicgardening.com/learn-and-grow/soil-chemistry
More pH: http://www.organicgardening.com/learn-and-grow/understanding-ph

COMPOST, COMPOST, COMPOST

Compost piles vary in size, location, and type, so find the one that best fits your garden needs. Compost can be made in vessels—from trash cans with holes punched in the sides to high-end compost tumblers—or can simply take the form of a giant pile in a corner of your garden. Even the classroom or your kitchen can become a location for thriving compost in the form of a worm bin. Explore options for compost setup and find one that best suits your garden needs. Start small and grow your compost capacity as your garden develops.

Whatever method you choose, compost provides both an incredible source of nutrients for your soil and hands-on understanding of the decomposition process for your students. Like any process in the garden, you can fine-tune your compost skills through trial and error and learn from your mistakes, right alongside your students. Soon, you'll be adjusting your carbon–nitrogen ratio based on the smell of your pile and seeing first-hand which materials break down fastest. Add to this a math discussion of surface area as you learn the value of cutting up organic matter for faster breakdown or a graphing activity to chart the weight of food waste kept out of landfills. You will quickly find that compost is not just for gardeners.

Once you've become a compost master, invite your students to design experiments around the compost pile, too. Consider these questions to spur experimental design:

- **Does pile size affect temperature of a compost pile? Does temperature affect the rate of decomposition? Try this out by building parallel piles of different sizes and monitoring temperature while observing the decomposition process.**
- **Does moisture affect the rate of decomposition? Try treating different piles with different amounts of water on a regular basis and observe the differences.**
- **Which "browns" break down the fastest? Try experimenting with different types of browns, like leaves, twigs, hay, sawdust, and paper.**
- **How does turning a pile affect the rate of decomposition? Invite students to create a varied turning schedule and see the effects of more- or less-frequent compost turning.**
- **Who is helping decomposition? Invite students to observe compost with the naked eye and see what organisms are present. Add a microscope to dig even deeper! This can be varied in scope and procedure depending on the age of your students.**

http://www.organicgardening.com/learn-and-grow/composting-101

http://www.organicgardening.com/learn-and-grow/how-build-compost-pile

http://www.organicgardening.com/learn-and-grow/5-easy-steps-fast-compost

http://www.organicgardening.com/learn-and-grow/compost-questions

SOIL TEXTURE

An important quality of your garden's soil is its texture, which refers to the size of the particles present. Sandy soils have the largest particles, silt soils have medium size, and clay soils have the finest. The best soil for your garden is one that is comprised mostly of silt particles, which best enable the soil to "breathe" and preserve moisture. Sandy soils are coarse and do not retain moisture well, while clay soils are very dense and soggy, preventing healthy plant growth.

A quick, kid-friendly way to assess your garden's soil texture is through a squeeze test. Take a handful of soil from your garden, add a few drops of water, and squeeze the soil. Sandy soils will break apart immediately, crumbling in your hand. Soils with a large silt content will not break apart but will easily clump into a ball. Clay soils, on the other hand, will change shape only with difficulty and will not beak apart. Check out this *Organic Gardening* article for a more in-depth process for assessing your soil's texture and inspiration for your soil texture lessons.

http://www.organicgardening.com/learn-and-grow/evaluating-soil-texture

WORMS COUNT!

Earthworms are every gardener's best friend. These little creatures play a very important role in keeping your garden's soil healthy. As worms burrow through the soil, they loosen the soil to enable better oxygen and water access and liberate vital nutrients needed for plant growth. Additionally, worm casts (their soil-like excretions) are incredibly rich in nutrients and bacteria that further enhance soil fertility. Every year, an average of 15 tons of soil per acre goes through an earthworm's body! The number of worms in your soil can be a very good barometer of soil health and biological activity. A great activity to do with your students is to conduct a "worm census." As inspired by *Start with the Soil*, by Grace Gershuny, here's how to do it:

1. **Find a 1-foot-square plot of soil in your garden.**
2. **Dig 6 inches deep into the soil in the entire square-foot plot, and empty the contents into a container.**
3. **Count how many earthworms are present in the container. If you have 10 worms or more, you have some healthy soil!**

Build a more comprehensive picture of your soil by inviting students to conduct worm censuses at various locations throughout the garden. Don't forget to fill in the holes (and return the worms) when you're done. *(Source: Gershuny, 1993)*

http://www.organicgardening.com/learn-and-grow/understanding-earthworms

CHECK OUT YOUR WEEDS

Although most gardeners bemoan the time spent picking weeds in their garden, the presence of weeds can actually be helpful. Perennial weeds with deep roots can help prep the soil for your vegetables by aerating the soil and surfacing minerals stored deep in the ground.

The type of weeds you observe in your garden space can also provide helpful clues as to what kind of soil is in your garden. The following table lists a few of the most common weeds, related soil conditions, and ways to remediate your soil or suggested plants that will thrive in those specific soil environments. Take a field trip with the students to your garden and bring along a plant guide. See how many weeds you can identify and learn what these weeds might indicate about your soil. *(Adapted from Gershuny 1993)*

WEED TYPE	SOIL CONDITION	REMEDIATION/USE
CHICORY 	COMPACTED AND CRUSTY SOIL	ADD COMPOST AND PLANT A COVER CROP OF WHITE LUPINES AND SWEET CLOVER
CHICKWEED 	CULTIVATED SOIL W/ HIGH FERTILITY	PLANT HEAVY FEEDER VEGETABLES – BROCCOLI, MELON, SQUASH, TOMATOES
DANDELION 	ACIDIC AND HEAVY SOIL	RAISE pH BY ADDING LIMESTONE, OR GROW ACID LOVING PLANTS- HYDRANGEAS, BLUE-BERRIES, POTATOES
HORSETAIL 	SWAMPY SOIL CONDITIONS	LEAVE THE SOIL BE! GROW WATER LOVING PLANTS, SUCH AS WILLOWS AND IRIS
DAISY 	POOR SOIL FERTILITY	ADD COMPOST AND USE COVER CROPS
STINKWEED 	"SWEET" ALKALINE SOIL	ADD PEAT MOSS OR ELEMENTAL SULFUR

SOURCES: ORGANIC GARDENING, GERSHUNY (1993).

In the classroom with: **Soil!**

BURIED TREASURE

Take a variety of plants and fruits/vegetables outside to your schoolyard or garden. Have students make observations, draw pictures, and write descriptions of each specimen. Then bury these items, marking each with a popsicle stick so you can revisit them later on. After a week or two, dig them up and repeat the observation process. Chances are your specimens will look very different after some time underground. Invite students to consider what caused the changes in the specimens. You can also do this with different variables, such as depth of material planted, length of time underground, and outdoor temperature. This allows students to see decomposition in action.

COMPOST CONSERVATORIES

Vermicomposting is a type of composting in which worms break down food scraps to make compost. The worms eat leftover food scraps, and, as a by-product, they produce castings (a term that really means "worm poop"!). These castings are nutrient-rich and provide excellent fertilizer for plans. Give students a chance to see vermicompost in action by creating a classroom worm bin. Or engage students in caring for their own bin by building mini worm bins. Start with recycled clear plastic containers, at least 1 quart in size, and punch some air holes in the top and sides (or use a fine mesh netting held on with a rubber band). Add some shredded newspaper, a spray of water, a tiny pile of food scraps, and a tiny handful of red wigglers ... and observe what happens!

COMPOST COMPARISON

Observe samples of compost and soil first on their own, then under a microscope. Take soil samples from a range of places, such as the dusty top layer of soil in a parking lot, sandy soil from a playground, or more fertile soil from the garden. First, invite students to observe the differences in how the samples look, feel, and smell. Then, if possible, get close up under a microscope. Ask students: What are the main differences? Which seems better for plants? Why?

SOIL LAB

Vary some attribute of soil in an experimental setup to study the effects of soil type on plant growth. At home or in the classroom, students can design their own plant experiment utilizing different types of soil to grow the same type of plant. Consider a comparison between compost and soil, but also:

- **Coffee added to soil**
- **Rocky soil v. nonrocky soil**
- **Watering methods (does soil moisture remain constant or does it dry up?)**
- **Soil samples from different locations in your garden**
- **Soil samples from different depths in your garden**
- **Soil from a bag v. soil from the ground**

CLASSROOM LIBRARY LIST: SOIL & COMPOST

***Compost Stew: An A to Z Recipe for the Earth*,** by Mary McKenna Siddals *(Tricycle Press, 2010)*

***Composting: Nature's Recyclers*,** by Robin Koontz *(Picture Window Books, 2007)*

***Dirt: Jump into Science*,** by Steve Tomecek *(National Geographic Children's Books, 2007)*

***Dirt: The Scoop on Soil*,** by Natalie M. Rosinsky *(Picture Window Books, 2002)*

***Garbage Helps our Garden Grow*,** by Linda Glaser *(Millbrook Press, 2010)*

***A Handful of Dirt*,** by Raymond Bial *(Walker, 2002)*

***Life in a Bucket of Soil*,** by Alvin Silverstein *(Dover, 2002)*

***Wiggling Worms at Work*,** by Wendy Pffefer *(HarperCollins, 2003)*

SEEDS

WHERE IT ALL BEGINS

When holding a seed in the palm of your hand, it may not seem to be capable of anything spectacular. However, every gardener knows how very much alive seeds actually are, just waiting patiently to be put in the right home with plenty of water and sunlight. Every seed shares the same anatomy, consisting of features needed to survive during their long "sleep." To begin with, a seed is protected by the seed coat—a hard outer coating that protects the inner embryo from the outside world. Stored inside the seed coat is the embryo, which houses all of the cells the seed needs to develop. Also located inside the seed is the endosperm, which contains the food that the sleeping seed needs to remain viable.

Water is the element needed to wake seeds out of their rest—as soon as a seed comes in contact with moisture it will begin the process of germination. Germination marks the point at which seeds begin to live, taking nutrients from the soil to generate the energy needed for the first shoots and roots to sprout. While some plants need only moisture to begin germination, others require specific temperature conditions. This is why it is important to pay attention to growth specifications of various seed varieties when planning a planting schedule for a specific location and season.

The first part of the plant to emerge from the seed coat is the primary root, or radical, which grows downward into the soil. The root anchors the seed firmly in the earth and begins to absorb the water and nutrients that the plant needs to grow. Soon afterwards, the plumule, a stemlike shoot, sprouts from the seed and starts growing upwards through the earth towards the light. Once this stem emerges above ground, the germination stage is over and the plant will be able to turn the sun's energy into food through the process of photosynthesis.

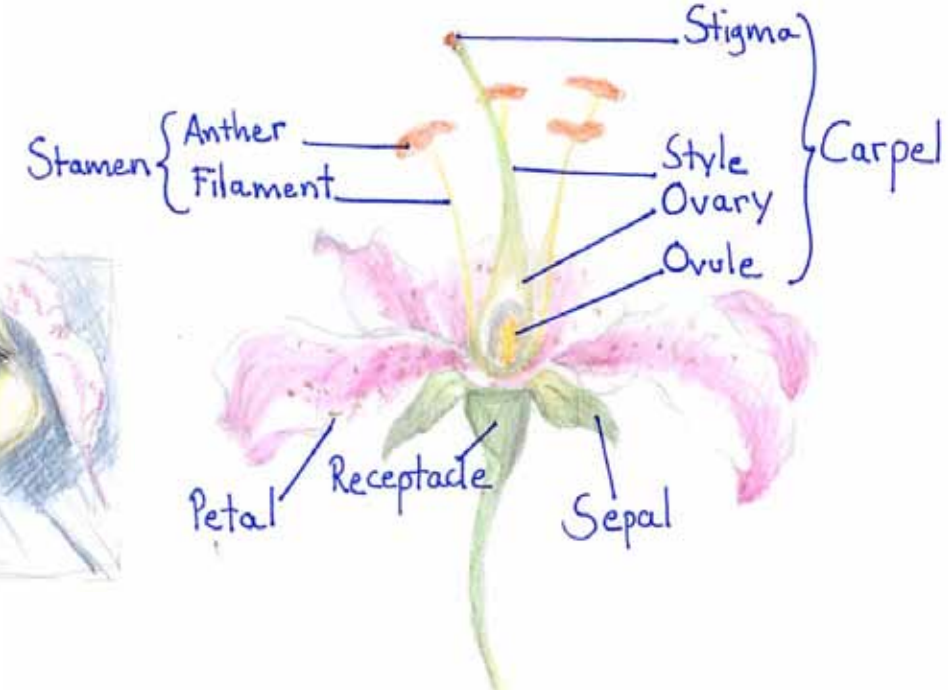
One of the most exciting parts of planning a garden is choosing spring seeds! The information printed on a seed packet provides direct clues about a seed's needs, but the size, shape, and texture of the seed itself also helps to tell its story. These external characteristics of a seed point to how these seeds were originally dispersed and dropped into the soil. Seeds of trees that rely on wind for dispersal often have wings or long feathery tails that enable them to "fly" long distances. Other seeds are light and fluffy, allowing them to drift off in the slightest breeze. The dandelion is a great example of such a plant. Plants that live in or near water often depend on water to transport their seeds. As such, these seeds are usually very light and buoyant. The coconut tree is known for the amazing ability of its fruit and seed to travel extensive distances by floating in the ocean until washing ashore. Nature ensures that animals will be lured to a plant's seeds by embedding the seeds within delicious fruit and berries. The animals that consume this fruit either bury the seeds in the soil (think of squirrels burying acorns) or eat them and then deposit them back into the soil after digestion.

Over time, seeds have developed these unique characteristics in order to adapt to the ecology of their habitat and to ensure the highest possible chance of dispersal. Today, humans have become one of the most important agents of seed dispersal for vegetable and fruit crops. By saving the seeds of the plants we grow each year and sowing them in the ground the following spring, we are ensuring the future survival of these plant species. Some crops actually depend on humans for germination—without humans to manually pollinate them, these plants species would be unable to produce successful offspring. Most of the crops that rely on humans are those that have been genetically altered—meaning that their genes have been manipulated in a laboratory in order to introduce some desirable trait. Examples of "desirable traits" include resistance to pests, better ability to survive in adverse environmental conditions, resistance to chemicals, or the expression of specific nutrients. Scientists have already begun to find that these genetically altered crops can be detrimental to the health of pollinator populations, such as bees and butterflies, which do not have the proper biological adaptions to digest the nectar from these species. *(Sources: Loewer 1995, Davis 2008)*

WHAT IS A SEED?

A seed marks the first stage in the life of every plant. Stored safely inside the seed are all the components a plant will develop as it grows:

- The **plumule** develops into the stem.
- The **radicle** develops into the root.
- The **cotyledon** is the seed leaves where food is stored.



Sowing Your Seeds: Hands-on garden learning ideas

CREATE A SUN/SEED MAP

Creating a sun/seed map is an interactive way to help younger students understand the link between different plant species and their sunlight requirements. Create a large-scale illustration/map of your garden and include sun symbols for areas with full sun, partial sun, or shade. Then disperse seed packets among students and have them sort the seeds by sun requirement, creating symbols to show whether they need full sun, partial sun, or shade. Have students create stickers or signs to label the sun categories, or illustrate the types of seeds and their sun requirements. Together, the class can match each seed type with locations in the garden and create a planting map. If you're missing seed varieties to fit your garden's needs, bring a seed catalogue to class and engage students in selecting the best options.

PLANT SOME HEIRLOOM SEEDS IN YOUR GARDEN

More than 90 percent of the crop varieties used in farming at the turn of the 20th century are no longer commercially available. This represents a huge loss to the diversity and robustness of our food sources. The fewer vegetable and fruit varieties available to farmers, the fewer opportunities there are to plant varieties that can withstand pests, diseases, and climate changes. With this decrease in the diversity of fruits and vegetables grown on farms, our dinner plates are also becoming increasingly monotonous. Most people have no idea that cauliflower can be purple or that tomatoes can be yellow!

Luckily, there is a resurgence of interest in storing and planting heirloom varieties. Just as the word *heirloom* describes valuable possessions that have been passed down through generations, the term *heirloom crops* refers to varieties of fruit and/or vegetables that originated before the introduction of hybrid crops and have been preserved and passed down by family members or small farm communities.

Heirloom crops are almost always "open pollinated," which means that the seeds saved from the plants will reproduce "true"—similar if not identical to the parent generation—but only when they are grown in isolation from other varieties of the same crop to avoid cross-pollination. An open-pollinated variety, also called an inbred variety, originates when a variety with desirable characteristics is intentionally self-pollinated for several generations, or until its distinctive traits remain stable from generation to generation. An open-pollinated variety's stability is dependent on isolation, however; if the variety is grown near other varieties of the same crop, genetic variation can be reintroduced to its offspring from stray pollen. Many of the heirloom vegetable varieties that are still grown today were developed with flavor and culinary uses in mind.

In contrast, many modern crop varieties are hybrids, resulting from the controlled cross of

two distinct parents. Hybridization allows plant breeders to combine valuable traits, such as disease resistance, high yield, and uniformity, in a single variety. Hybrids are also known for "hybrid vigor," their tendency to grow more robustly than open-pollinated varieties. Modern plant hybridizers tend to focus on traits that are less important to home growers, however—things like the ability to withstand mechanical harvest or long-distance shipping, as well as a variety's approximation to a visual ideal—while ignoring flavor and quality. And gardeners who plant hybrids must buy seeds yearly, because seeds saved from hybrid varieties may or may not replicate the traits of the parent generation.

Hybrids can be more productive, less prone to disease, and easier for beginning gardeners; but to limit a garden only to hybrid varieties would mean missing out on the wonderfully diverse and delicious world of heirlooms. Teach your students about the problems with decreased seed diversity and decide to plant some heirloom seeds in your garden. Most garden-supply catalogs list a variety of heirloom seeds that students will enjoy exploring. So get some diversity and color in your garden and go heirloom!

http://www.organicgardening.com/living/conversation-michael-pollan

SAVE AND STORE YOUR SEEDS

Once your crops begin to ripen, you should start thinking about which plants' seeds you might want to collect and save for next year. This can significantly lower the cost of seed spending next spring and allows students to understand the cyclical process of a plant's life. Here are a few important details to keep in mind.

- **Only "open-pollinated" plants will be guaranteed to produce the same crop, so be careful to save seeds only from these varieties.**
- **If you plant more than one variety of a certain crop, there is the possibility of cross-pollination by insects, which might not result in the same plants next year. Therefore, only save seeds from plants of which you have just one variety. Squash, cucumbers, melons, and gourds, for example, can easily cross pollinate with each other, so it's best to avoid saving seeds from these species if they are all planted close to one another.**

The following plants have easy-to-save seeds: peppers, tomatoes, melons, and eggplant.

http://www.organicgardening.com/learn-and-grow/how-read-seed-catalog

http://www.organicgardening.com/learn-and-grow/saving-seeds-for-next-season?page=0,0

Once you collect seeds from your garden, they need to be stored in a specific manner to preserve them until the spring:

- **Spread seeds on newspaper and let dry for a week before storing. Just make sure to label each variety!**
- **Seeds must be kept in sealed containers. Glass mason jars with screw lids are ideal, but resealable plastic bags also work.**
- **Always keep seeds in a cool and dry location. Fridges work well if you have the space.**
- **Make sure to label each seed container with name and date and keep an inventory somewhere you won't forget.**

Visit *Organic Gardening* for more tips on how to save seeds.

http://www.organicgardening.com/learn-and-grow/top-10-tips-storing-seeds?page=0,0

In the classroom with: **Seeds**

SEE THE SEEDS

To get students up-close to the process of germination, help them germinate seeds right inside the classroom. Lima beans from the grocery store work well for this activity, but other seeds can be used, too. Have students work independently or in groups to place a few bean seeds in a resealable plastic bag with a damp paper towel. Seal the bag, leaving a tiny hole in the corner for oxygen. Tape the bag on a classroom window in a location where it will be exposed to sunlight. Starting with initial predictions, have students regularly observe their seedlings and record observations in a lab notebook or dedicated seed journal, including drawings of the seed's growth. When seeds are ready, transplant them into cups of soil for students to take home or straight into your garden!

GO ON A SEED SCAVENGER HUNT

Create a classroom seed station of different types of seeds for students to interact with throughout their seed studies. Begin by taking students on an outdoor walk to find seeds in nature (such as pinecones, acorns, and flowers) and invite them to bring in seeds they find in their lunches and kitchens (such as sunflower seeds, pumpkin seeds, apple seeds, corn kernels, and avocado pits). Have students observe seeds with magnifying glasses and sort them by size and shape. Note: Be mindful of students' nut allergies in displaying students' contributions of seeds found at home.

SEED ART

Use seeds as stamps. Apples (cut in half horizontally to expose a "star" seed pattern), cucumbers, pine cones, dried flower seed pods, and other seeds you may encounter can easily become stamps when dipped into a shallow plate of paint. Stamp to create a fun art project, and then label these different types of seeds. Extend this to math and identify patterns in number and geometric shape.

READ STUDENTS' NATURE STORIES

Start a library in your classroom with picture books centered on the theme of plants, vegetables, gardening, and seeds. Take time during the day to read these stories out loud to you students to ignite their curiosity and imagination as it relates to the natural world.

CLASSROOM LIBRARY LIST: SEEDS

***Bean and Plant*,** by Barrie Watts and Christine Back *(Silver Burdett, 1990)*

***The Carrot Seed*,** by Ruth Krauss *(HarperCollins, 1945)*

***Children of the Forest*,** by Elsa Beskow *(Floris Books, 2005)*

***From Seed to Plant*,** by Gail Gibbons *(Holiday House, 1993)*

***From Seed to Sunflower (Lifecycles)*,** by Gerald Legg *(Franklin Watts, 1998)*

***How a Seed Grows*,** by Helene J. Jordan *(HarperCollins, 1992)*

***One Bean*,** by Anne Rockwell *(Walker Childrens, 1999)*

***Plant Secrets*,** by Emily Goodman *(Charlesbridge, 2009)*

***Planting a Rainbow*,** by Lois Ehlert *(Sandpiper, 1992)*

***The Reason for Flower*,** by Ruth Heller *(Puffin, 1999)*

***A Seed Is Sleepy*,** by Dianna Hutts Aston *(Chronicle Books, 2007)*

***Seeds*,** by Ken Robbins *(Atheneum, 2005)*

***Seeds: Pop, Stick, Glide*,** by Patricia Lauber *(Knopf Books, 1991)*

***Sunflower House*,** by Eve Bunting *(Sandpiper, 1999)*

***The Tiny Seed*,** by Eric Carle *(Little Simon, 2009)*

PLANTS

GROWING UP!

The warmth of the spring sun seeping into the earth is a crucial signal to a seed to begin its journey out of the earth and into the air. Once the stem has emerged from the soil, the plant begins the amazing process of turning energy into food for growth. This is called photosynthesis, which literally means "to put together with light." Photosynthesis occurs in two distinct stages: the light reaction, in which plants turn sunlight into chemical forms of energy called ATP and NADHP; and the dark reaction, during which this chemical energy is turned into sugars. The light reaction of photosynthesis occurs in the plant leaves and stems, specifically in small cellular structures called chloroplasts. Found inside the chloroplasts is a compound called chlorophyll, which has the ability to grasp the sun's energy and harness it for the plant's use. An interesting feature of the chlorophyll compound is that it is always green—therefore, whenever we see green parts of a plant we know chlorophyll is present and photosynthesis can occur. Once sunlight is absorbed by the chloroplasts, it mixes with water and carbon dioxide to form oxygen and chemical energy. As the oxygen is released through the pores of the leaves back into the air, the plant uses the chemical energy to initiate the dark reaction of photosynthesis. In this process, ATP and NADHP are combined with carbon dioxide inside the plant in order to create sugars. These sugars then travel throughout the plant as food.

CHEMICAL REACTION OF PHOTOSYNTHESIS

$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$

Carbon dioxide + Water + Light energy → Glucose + Oxygen

As shown in the formula for photosynthesis (above), plants breathe in carbon dioxide and release oxygen as a byproduct. This is the opposite of human respiration, in which we breathe in oxygen and release carbon dioxide. Thus we can see that humans and plants are in symbiosis; we need each other to make available the elements necessary for survival.

Water is another element that plays a vital role in every stage of a plant's development, beginning with the germination of the seed. Every seed is dormant until exposure to water and sunlight causes the seed to split open, allowing the primary root to begin its descent into earth. The plant roots can then absorb water from the soil through the tiny hairs covering the root's surface. Although it is nice to think of roots "sipping" up water from the soil, the process by which water enters into the plant root is through a process called osmosis. During osmosis, water simply moves into the root hairs because they have a lower concentration of water than the soil in which they are located.

Located inside every plant are special cells called xylem, which transport water and dissolved nutrients throughout the entire plant. Some of this water is released through openings

on the leaf, called stomata. It is actually this emitting of moisture from the leaves that causes lower water pressure at upper ends of the plant in relation to the water pressure at the roots and stem. This results in a low-to-high-pressure gradient that enables water to be "sucked up" via the xylem from the roots into the stem, leaves, and flowers of the plant.

A third requirement for successful plant growth in your garden is nutrient availability. Nutrients like potassium, nitrogen, phosphorous, calcium, sulfur, and magnesium are absorbed from soil via the root hairs, although oxygen and nitrogen are also taken in from the air via the leaves. These nutrients then travel through the plant to where they are used by the plant's cells. If your garden's soil tests came back low in any of the main nutrients, you should probably supplement with an organic fertilizer or homemade compost in order to maximize fruit and vegetable growth. *(Sources: Davis 2008, Gershuny 1993)*

Check out *Organic Gardening*'s Nutrient Deficiency Problem Solver as you read your soil test results or try to troubleshoot the signs of nutrient-deficient plants. Compost is an excellent way to add macronutrients and micronutrients to your soil. You can also add fertilizers to your soil, but be sure that you understand the difference between organic and chemical fertilizers so you can pick something that's safe for the environment. Or, try making your own organic fertilizer:

http://www.organicgardening.com/learn-and-grow/making-your-own-organic-fertilizer
http://www.organicgardening.com/learn-and-grow/organic-fertilizers

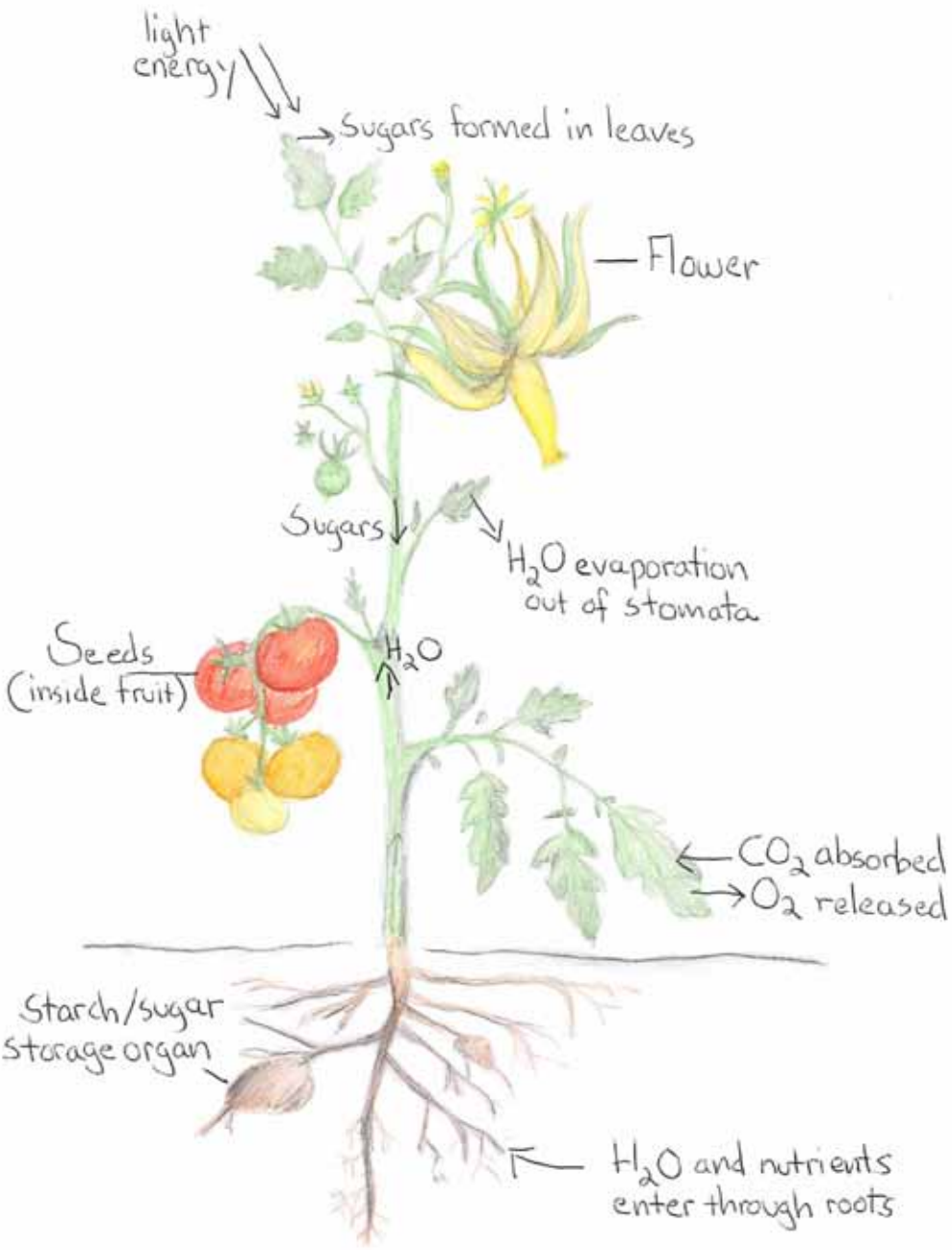
CATEGORY	NUTRIENT	SOURCE
Nonmineral nutrients (these are supplied by air and water)	Carbon (C), Hydrogen (H), Oxygen (O)	Air and water!
Primary macronutrients (plants need large amounts of these)	Nitrogen (N), Phosphorus (P), Potassium (K)	Make your own organic fertilizer and add some compost
Secondary macronutrients (there is usually enough in the soil)	Calcium (Ca), Magnesium (Mg), Sulfur (S)	Add some compost and investigate other organic methods of nutrient addition.
Micronutrients (plants need tiny amounts of these)	Boron (B), Chlorine (Cl), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn)	

OSMOSIS

Osmosis is the process by which water moves across a permeable membrane from an area of high water concentration to an area of low water concentration.

WHAT IS A STEM?

A stem can be considered the pump of the plant, transporting food from the roots to the leaves and glucose from the leaves to the rest of the plant. The stem also provides structural support for the plant, whether it is standing upright or spread along the ground. This helps the leaves to receive as much sunlight as possible for photosynthesis.



WHAT IS THE ROLE OF A ROOT?

Roots have three important jobs: absorbing water and nutrients from the soil, anchoring the plant in the soil (delicate young plants would blow away in the wind), and storing extra food for the future.

Getting Those Plants To Grow: Hands-on garden learning ideas

CREATE A GARDEN MAP

Every species of vegetable and fruit growing in your garden will require a different amount of sunlight each day to optimize growth. Before deciding where to plant your seeds in the spring, you should first visit the garden site with your students to get an accurate picture of light availability. Here are some ideas to consider when assessing ideal light/growing conditions:

- **Visit the garden during different times of the day—ideally the morning, midday, and afternoon.**
- **Bring a compass with you to determine southern/northern exposure and include this on your design (Note: North = less sun and slightly cooler temperatures; South = increased sun exposure and higher relative temperatures)**
- **Point out different structures that might affect light availability, such as tall buildings in an urban plot or large trees. Discuss with your students how these structures can also be helpful to your garden as protection from wind damage and cold.**

Once you have created a map of your garden, it is time to plant! Have students research which of their plant species like full, partial, or little sun. Don't be discouraged if you have a shady spot; there are many vegetables that grow well in shady areas. If there are spots with virtually no sunshine, consider building a rainwater tank, compost pile, or tool shed!

WORKING WITH YOUR CLIMATE ZONE

Get in the ZONE. How and when you plant your garden, and what you plant in it, will depend largely on the climate zone in which you live. A great way to introduce geography into the lesson is to look at a plant hardiness zone map with your students, such as the one provided by the USDA (*http://planthardiness.ars.usda.gov/PHZMWeb/*.) This map will tell you what growing zone you live in, as delineated by the average annual minimum winter temperature. Once you know your zone, it is helpful to look up average first and last frost dates before you create your garden's planting schedule. Every seed packet or plant tag will include information on when it's safe to plant the seed in the earth and how many days it takes for germination. This data can be compiled in a table and students can practice their math skills to calculate exactly when to safely plant outdoors. Follow the link to see an example of a chart that calculates when to start sowing a variety of different vegetable seeds:

http://www.organicgardening.com/learn-and-grow/seed-starting-chart
http://planthardiness.ars.usda.gov/PHZMWeb/

CHECKING YOUR SOIL'S MOISTURE CONTENT

Your garden will need just the right amount of moisture in order to flourish. Before you plant your seeds in spring, it is a good idea to check the moisture levels of your soil. Different locations of your garden might also have different soil moisture levels. This is helpful knowledge that can guide where you plant moisture-loving—and moisture-hating!—plants. It is easy to assess soil moisture with a few simple observations:

- **Look for any surface crusting and cracking as a result of dryness.**
- **See how deep you need to dig before the soil becomes dark from moisture. The farther you need to dig, the drier the soil.**
- **Pick up handfuls of soil and squeeze it. If your hand gets wet, you know that your soil is too moist.**

(Gershuny 1993)

WATCH YOUR WATER!

Gardens need a lot of water in order to grow and flourish, especially in hot and arid climates. It is important to ensure that you are watering your garden enough during long hot days, and equally important to be mindful of wastefulness in watering. Teach your students about limited water availability around the world and share with them the following tips for conserving water in your garden:

- **Place mulch over uncovered soil in your garden. This will help lock moisture into the ground and prevent evaporation on hot days.**
- **If you have available spigots, set up soaker hoses in your vegetable beds. This will allow water as direct a route to plant roots as possible, and thus minimize water wasted on non-planted areas of the garden.**
- **Place your plants as close together as possible (within growing guidelines) in order to lessen the area you need to water.**

http://www.organicgardening.com/learn-and-grow/top-10-ways-to-conserve-water
http://www.organicgardening.com/learn-and-grow/water-wiser

HARVEST THE RAIN!

A fun engineering project to do with students is to build a rainwater harvesting system. This usually entails finding a large container in which to collect the rainwater—a barrel shape is ideal. Check out local stores like pickle companies, local soda distributors, or cheese factories to see if they have any empty barrels to donate. Drill a hole toward the bottom of the barrel and insert a spigot to enable easy access to your water. Sit back on a rainy day and watch your barrel fill! Depending on the size, location, and needs of your garden, use your rainwater to fill watering cans, clean garden tools, and moisten your compost bin; or attach a soaker hose to the spigot.

http://www.organicgardening.com/learn-and-grow/rain-barrels

In the classroom with: **Plants**

HOW DOES LIGHT AFFECT PLANT GROWTH?

Create a classroom experiment to observe how much light plants need to grow. Plant seeds of the same variety in separate containers and then manipulate the amount of light each plant receives over a period of 3 to 4 weeks. For example, one pot might receive as much sunlight as is available, a second only 6 hours of sunlight a day, and a third only 3 hours of sunlight. Place plants under grow lights in an otherwise dark location (such as a closet) to create the most controlled experimental setting. You can use light timers (available at hardware stores) to regulate over the weekend. Regularly observe and measure plant growth and record this information in a data table. Don't forget to have students make hypotheses at the start of the experiment and follow up to see if their scientific guesses were correct!

CHLOROPHYLL DETECTIVES

Help your students investigate which parts of the plants contain chlorophyll. Have students collect different plant specimens from your garden (or potted classroom plants). They should divide their plant material into the following groups: roots, petals, stems, fruit, leaves (alive and dead), and seeds. Using a mortar and pestle, grind up this plant material (separately) to access the inside of the cells. Pour a little bit of acetone (nail polish remover) into each bowl of material and add a piece of filter paper (strips of white coffee filters work well) into the liquid. After 20 minutes, look to see if a green stripe has appeared on the filter paper, indicating that chlorophyll is present. This activity will help the students understand the role chlorophyll plays in photosynthesis and where it can be found in the plant (usually the green parts).

ENERGY TRANSFER ILLUSTRATION

Have the students draw an illustration of the garden's ecosystem and use arrows to show the flow of energy between the organisms they observe. For younger grades, it might be necessary to model this energy flow first on your own illustration. Compare the garden ecosystem to the energy flow in a natural ecosystem. Discuss how the garden does (or does not) mirror a natural ecosystem.

PLANT CYCLES

As you watch plants grow from seed to plant (and later to become compost), create a large-group diagram of the steps of a plant's life cycle. Getting through the compost stage (and using your compost) is a great first-hand way to show the complete transformation of your plants!

RECYCLED PLANTS

Have students create models of plants out of recycled materials, such as plastic bags or cardboard. This is a fun way to create an indoor "garden" (especially in winter!) and make connections to energy use and conservation. Be inspired by artist Lauren Karnitz and this fun idea from *Organic Gardening*!

http://www.organicgardening.com/living/garden-craft-nothing-flowers
http://www.organicgardening.com/living/how-to-make-twist-tie-flowers

COLORING CARNATIONS

In this classic activity, students can witness water transport in plants. Fill clear containers with water and food dye (or alternatively create your own coloring from plants found in the garden). Place one white carnation flower in each container. Over the next few days, students will witness the dye traveling up the stem, until it finally colors the white petals of the flower.

CLASSROOM LIBRARY LIST: SUN

***Autumn Leaves*,** by Ken Robbins *(Scholastic Trade, 2003)*

***Living Sunlight: How the Sun Gives Us Life*,** by Molly Bang and Penny Chisholm *(Blue Sky Press, 2009)*

***Lily's Garden*,** by Deborah Kogan Ray *(Roaring Brook Press, 2002)*

***Seed, Soil, Sun: Earth's Recipe for Food*,** by Chris Peterson *(Boyds Mills Press, 2012)*

***Red Leaf, Yellow Leaf*,** by Lois Ehlert *(Harcourt Brace, 1991)*

CLASSROOM LIBRARY LIST: SEASONS

***Isabella's Garden*,** by Glena Millard *(Candlewick Press, 2009)*

***Our Farm: Four Seasons with Five Kids on One Family's Farm*,** by Michael Rosen *(Darby Creek, 2008)*

***The Reasons for Seasons*,** by Gail Gibbons *(Holiday House, 1996)*

FLOWERS AND FRUITS

WHAT WE'VE ALL BEEN WAITING FOR!

During the Paleozoic Era (approximately 542 to 251 million years ago), the earth resembled a giant swamp and plants relied on water to disperse their seeds in order to reproduce. However, as the earth developed a drier and more seasonal climate, plants needed to find a new way of scattering their seeds. The outcome of this evolutionary change was plants that could disperse their seeds via the wind, insects, birds, and other animal species. These plants are *gymnosperms* (plants that bear naked seeds, mostly species in the coniferous tree family) and *angiosperms* (flowering plants, such as an apple tree). About 75 percent of plants on Earth today and almost all of the vegetables and fruits we see in our gardens are angiosperms.

There are many different ways that plants can be pollinated—and often just the way a plant looks can provide us with useful tips. For example, plants relying on wind for pollination are often structured with exposed, easily moved seeds, in order to maximize accessibility by the wind. Think of wind-pollinated grasses that often have anthers extending from long filaments—literally seeds hanging in the breeze! The stigma (the top part of the pistil) of a wind-pollinated plant is often feathery looking and is not protected by petals in order to best facilitate an easy landing strip for the airborne pollen. Plants that use insects and birds as pollinators, on the other hand, often have brightly colored fragrant flowers and sweet tasting nectar to attract pollinators. Once a pollinator lands on the petals, the pollen on the anthers will rub off on the insect's body; when this insect then flies to the next flower, the pollen will rub off onto that flower's stigma. Once on the stigma, the pollen travels down to the base of the pistil where the egg is located. After the egg is fertilized, the plant's flower begins to fade, and the ovary of the plant will begin turning into fruit. This fruit will serve two important functions: to protect the seed and to be a lure for animals to eat, and thereby distribute, the plant's seeds. *(Source: Loewer 1995, Davis 2008)*

Though we all love eating juicy fruits, there are many other wonderful parts of the plants that we eat and enjoy! As harvest time approaches in your garden, it is important to make your students aware of all the different parts of plants that you can enjoy. A few examples include leaves (salad greens, spinach), roots (carrots, beets), stems (asparagus, celery), and fruit (squash, tomatoes). Encourage your students to be food explorers and cook with them in the classroom. If space and facilities allow it, think about storing, freezing, and canning your harvest to last you through the winter.

http://www.organicgardening.com/learn-and-grow/preserving-tastes-summer?page=0,0
http://www.organicgardening.com/cook/home-canning-basics

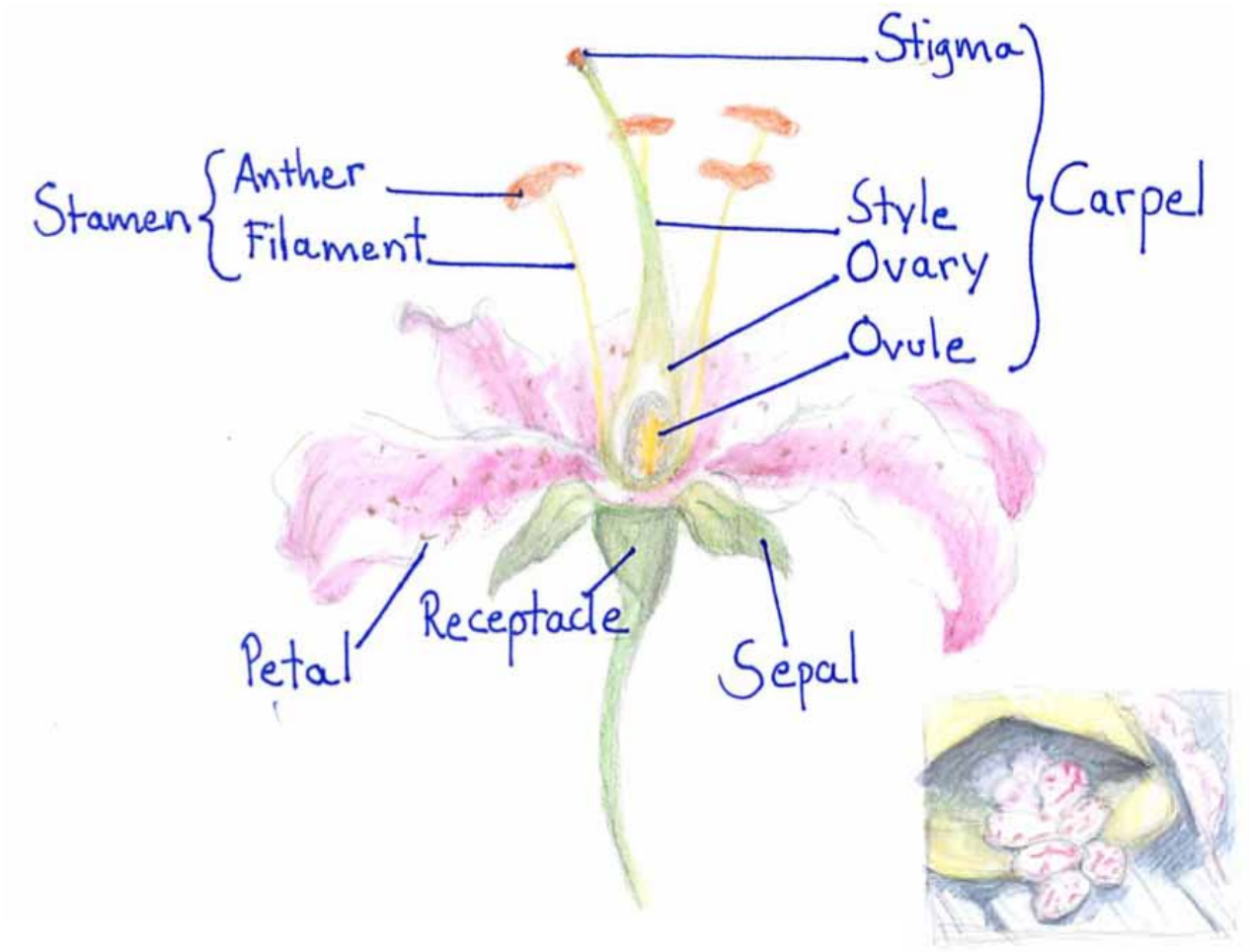
PARTS OF A FLOWER

Calyx: The outermost layer of protection for the flower buds.

Corolla: The bloom, which is usually a collection of brightly colored petals.

Stamen: The male part of the plant, consisting of the filament and stalk. Atop the stalk is the anther, which produces and contains the pollen.

Pistil: The female part of the plant, which houses the ovaries. This is where seeds are formed.



WHAT IS A FRUIT?

A plant's fruit can only be formed once the flower has been pollinated. The main purpose of the fruit is to shelter the seed. Fruits vary greatly in size and shape and can accommodate anywhere from one to one thousand seeds!

Maximizing Your Harvest: Hands-on garden learning ideas

CALLING ALL BIRDS!

Birds are very helpful to your garden because they will eat some of the pests that might threaten your plants. Many types of birds feed on the caterpillars, flees, beetles, and slugs that nosh on your vegetables. Additionally, some birds like finches and sparrows can reduce your weed problem by feasting on their seeds. Spend some quiet time with your students in the garden and see how many different bird species you can identify (having a bird almanac might be a useful tool). Ones to look out for include the chickadee, robin, sparrow, nuthatch, and bluebird. Below are a number of ways you can make your garden more bird-friendly:

- **Plant spiky plants, such as sedges, evergreen shrubs, and climbing plants, which provide a place for birds to perch.**
- **Choose some plants that can provide birds with nourishment throughout the year, such as plants with berries in autumn and winter. A few examples are holly, viburnum, rose, and mahonia**
- **Build a bird feeder with the students and fill it with seeds during the winter months. A bird feeder can be as simple as peanut-butter-covered pinecones rolled in seed and hung from branches or as complex as a classroom carpentry project!**
- **Set out an upturned garbage lid or large bowl to provide a drinking and bathing site for birds.**

http://www.organicgardening.com/learn-and-grow/best-birds-your-garden?page=0,0
http://www.organicgardening.com/learn-and-grow/make-some-feathered-friends

BUZZ, BUZZ, BEES

Bees play a vital role in pollinating our plants and helping our garden thrive. As bees travel from flower to flower, they deposit pollen between plants—without this action, many plant blossoms would never set seed. One of the most important things we can do to help bees flourish is to avoid using pesticides in the garden! Pesticides are often toxic for bees and are believed to be partly responsible for the decline in America's bee populations during the past few years. To attract bees to your garden, make sure to plant a variety of plants that contain pollen and nectar and try to extend your garden's flowering season as long as possible. Planting a section of your garden with herbs is sure to be a hit with the bees (and butterflies). Make sure to include fragrant ones like chamomile, lavender, thyme, sage, stevia, and rosemary. While students might initially become frightened around bees, once they realize that the bees won't sting them if left undisturbed, they will come to appreciate working side by side with these buzzing partners in the garden.
Read up on the link between bee population decline and pesticides in *Organic Gardening*:

http://www.organicgardening.com/learn-and-grow/poisoned-pollen

BUILD A COLDFRAME

Just because the weather turns cold, that doesn't mean that you can't extend your growing season. If you have the materials, a great engineering project is to build a vegetable coldframe. A coldframe is a low-to-the-ground enclosure that provides warmth and shelter for your plants, while allowing sunshine to permeate its transparent roof. Follow these steps to build your own coldframe in your garden plot and enjoy a variety of fresh vegetables later in the fall and earlier in the spring than your garden would normally allow.

- **Decide where to place your coldframe. It should be in an area with bountiful sunlight and facing south. If possible, slant your structure 30 percent from front to back.**
- **Choose what material will be used for the walls of your coldframe. An easy and affordable material is straw bales—as a bonus, when you are ready to dismantle your cold frame in the spring, you can use the straw for mulch. Other options include cinder blocks (with their holes covered), wood paneling, or stone and mortar.**
- **Pick a translucent material to use as a roof. Some options include glass, fiberglass, polyethylene, or flexible greenhouse coverings.**
- **Create a ventilation plan. This can be easily done by manually propping the roof open on warm days. A more expensive but less labor-intensive option would be to include an automatic vent that will open/shut your coldframe when desired temperatures are reached.**
- **Decide if you want to further insulate your coldframe. Numerous options exist, and you should discuss with your students the pros and cons of each method. Some include**
  - **Digging a pit 6 to 8 inches below the structure**
  - **Piling soil, leaves, and wood chips around the frame**
  - **Putting fresh manure inside the coldframe to generate heat**
- **Determine what vegetables you want to grow inside your coldframe. Lettuces and leafy greens work exceptionally well, as do transplanted cauliflower, cabbage, and pepper plants. Especially if you live in a cold climate, try to extend the growing season of plants that can withstand cooler temperatures, like lettuces, kale, and chard.**

http://www.organicgardening.com/learn-and-grow/make-your-own-coldframe

BUG OUT! BUG IN!

Every year you can depend on your garden getting visited by some not-so-nice pests. These visitors come in the form of snails, earwigs, beetles, and aphids, and you can depend on the fact that they will love to chomp away at your growing vegetables! Luckily there are a variety of methods you can use to keep these pests at bay without resorting to spraying chemical pesticides. Here are some ideas:

- **Increase biodiversity in your garden. A mixture of sights and smells will help confuse the insects.**
- **Attract beneficial insects by planting flat-topped plants, such as dill, Queens-Anne's-lace, parsley, and carrots, which provide easy landing strips!**
- **Grow a decoy crop that will attract insects and thus keep them away from your crops. Every morning, vacuum or spray with soapy water as many of the pests as possible to prevent them from migrating.**

- **Keep mulch away from the base of young growing plants. The mulch provides a lovely home for insects like slugs and beetles that like to burrow in the moist earth.**
- **Stretch row covers over growing crops that are most often affected by certain pests. This will also provide a lovely warm and protected habitat in which your young sprouts can flourish.**

http://www.organicgardening.com/learn-and-grow/10-fast-ways-control-pests

http://www.organicgardening.com/learn-and-grow/beneficial-insects-your-garden-s-most-powerful-allies

In the classroom with: **Fruits & Flowers**

PLANTS ON OUR PLATES

As harvest time approaches, it is important to make students aware of all of the different parts of a plant that we can enjoy. Take a field trip to the garden and harvest an array of vegetables and herbs (or take a trip to the grocery store or farmers' market to buy some). Invite groups of students to observe a plate of plants and create a table to classify their parts as roots, stems, leaves, flowers, fruits, and seeds. Extend this activity by inviting students to create a tasty snack using the different parts of the plant.

EXAMINING PARTS OF A FLOWER

Go on a nature walk with students and have them pick a couple of flowers they see. Take them back to the classroom and let students dissect each flower to identify the petals, stamen, sepals, pistil, stigma, ovary, and seeds. Students should then create an artistic diagram of their flower, labeling each part.

FIND YOUR POLLINATOR GAME

Give each student a role—either a specific pollinator or a plant species being pollinated. There are many neat symbiotic relationships between animal and plant species than you can explore with your students prior to this activity. Use these species for the game. Some examples include the fig and the wasp, orchids and crickets, or bats and dyssochroma. Have each student find their "match" by mingling with their classmates and asking each other questions about their identity. Once the students have found their match, have them come up with a skit to demonstrate to the class how their relationship plays out in nature.

FRUIT ANATOMY

Bring fruits and vegetables into the classroom and invite students to investigate where their seeds are located. Ideas include precut apples, melons, squash, corn, cucumber, and oranges. To develop this lesson further, have students investigate both fruits and vegetables containing seeds (like those listed above) and vegetables whose edible portions do not include seeds (potatoes, lettuces, carrots, broccoli, etc.). Ask students to identify the parts of the plant that we eat in these examples.

RAISE PRAYING MANTISES IN THE CLASSROOM

Praying mantises are amazing insects with an exotic appearance and a very predatory nature. They can be very useful to gardeners since these bugs love to munch on common pests, such as beetles, flies, aphids, and insect eggs. Have the students be detectives in the garden to see

whether they can find any praying mantises during their garden trips. If there aren't any present, don't despair, because you can raise these insects in your own classroom! Many garden-supply catalogs sell praying mantis egg cases; each case will hold approximately 300 eggs. To watch the eggs hatch, keep the cases in the refrigerator until 2 weeks before warm weather. Put the eggs into a clean glass jar with a tight-fitting lid punched with air holes. Cut out a piece of nylon stocking to stretch across the mouth of the jar and place the lid on top. This is a very important step, because you don't want tiny praying mantis babies escaping and populating your classroom! Once the eggs have hatched, bring them out to the garden so they can begin their search for food (hopefully those pesky beetles eating your lettuce). Enjoy watching these insects in action throughout the season and expect a new crop of praying mantises to hatch on their own next spring. *(Carlson 1995)*

DRY SOME HERBS

Herbs are a great addition to any garden. Most herb species are perennial, meaning they do not need to be planted each year but will continue to grow for multiple years in a row. Since ancient times, herbs have been used to enhance food flavors, provide sweet-smelling fragrances, and make teas for medicinal purposes. Pick herbs from your garden to dry so that you can enjoy your garden's harvest during the winter months. Some herbs to consider growing and drying include lavender, rosemary, basil, chamomile, mint, and thyme. The traditional method of drying herbs is to tie them in bunches and hang them upside down, but you can also use a microwave as a quicker and less space-consuming option. Check out these tips from *Organic Gardening*:

http://www.organicgardening.com/learn-and-grow/dry-herbs-microwaves

Here are some ideas for projects you can do in your classroom with dried herbs:

- **Combine different herbs to create your classroom's own unique tea blend.**
- **Make herbed butter.**
- **Make sweet-smelling sachets or potpourri.**
- **Explore using your dried herbs in cooking at home or in the classroom.**

CLASSROOM LIBRARY LIST: VEGETABLES

***Blueberries for Sal*,** by Robert McCloskey *(Puffin Books, 1949)*

Flower Garden by Eve Bunting *(Voyager Books, 2000)*

***The Garden of Happiness*,** by Erika Tamar *(Harcourt Brace, 1996)*

***Growing Vegetable Soup*,** by Lois Ehlert *(Voyager Books, 1990)*

***How Groundhog's Garden Grew*,** by Lynne Cherry *(Blue Sky Press, 2003)*

***Jack's Garden*,** by Henry Cole *(Greenwillow Books, 1997)*

***Two Old Potatoes and Me*,** by John Coy *(Knopf Books, 2003)*

***The Vegetables We Eat*,** by Gail Gibbons *(Holiday House, 2008)*

CLASSROOM LIBRARY LIST: GARDENS

***Butterflies in the Garden*,** by Carol Lerner *(Scholastic, 2003)*

***City Green*,** by DyAnne DiSalvo *(Harper Collins, 1994)*

***The Curious Garden*,** by Peter Brown *(Little, Brown Books for Young Readers, 2009)*

***The Gardener*,** by Sarah Stewart *(Square Fish, 2007)*

***The Good Brown Earth*,** by Kathy Henderson *(Candlewick Press, 2003)*

***Miss Lady Bird's Wildflowers: How a First Lady Changed America*,** by Kathi Appelt *(HarperCollins, 2005)*

***A Place for Butterflies*,** by Melissa Stewart *(Peachtree, 2011)*

***The Seasons of Arnold's Apple Tree*,** by Gail Gibbons *(Harcourt, 1984)*

BIBLIOGRAPHY

CARLSON, LAURI. *Green Thumbs: A Kid's Activity Guide to Indoor and Outdoor Gardening*. Chicago: Chicago Review Press, 1995.

DAVIS, TINA. *Sow and Grow: A Gardening Book for Children.* New York: Stewart, Tabori & Chang, 2008.

GERSHUNY, GRACE. *Start with the Soil: The Organic Gardener's Guide to Improving Soil for Higher Yields, More Beautiful Flowers, and a Healthy, Easy-Care Garden.* Emmaus, Pennsylvania: Rodale Press, 1993.

LOEWER, PETER. *Seeds: The Definitive Guide to Growing, History & Lore.* Portland, Oregon: Timber Press, 1995.