

BESTSELLING AUTHOR
OF *WOMEN IN SCIENCE* RACHEL IGNOTOFSKY

WHAT'S INSIDE A FLOWER?

AND OTHER
QUESTIONS ABOUT
SCIENCE & NATURE



CROWN

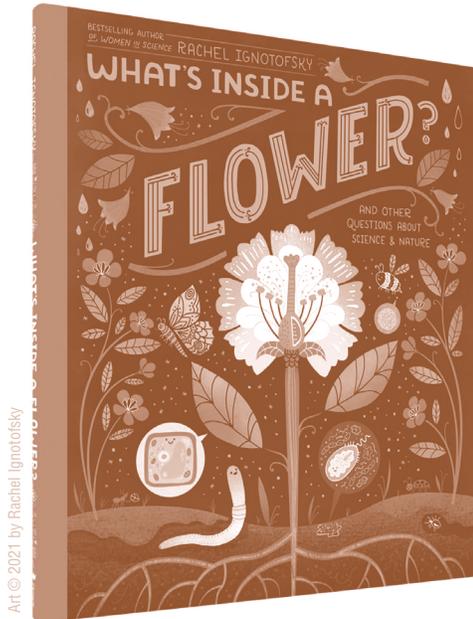


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WHAT'S INSIDE A FLOWER?

AND OTHER QUESTIONS ABOUT SCIENCE & NATURE



ABOUT THIS BOOK

Author-illustrator Rachel Ignotofsky takes readers on a beautiful illustrated journey from roots to seeds to blooms, with detailed stops along the way at photosynthesis, pollination, and seed dispersal. This informational picture book serves as a unique introduction to curricular units on plants and lessons on plant anatomy and life processes for elementary school students.



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ABOUT THE AUTHOR

Rachel Ignotofsky is the author and illustrator of many nonfiction books, including the *New York Times* bestseller *Women in Science* and *The Wondrous Workings of Planet Earth*. Rachel grew up in New Jersey on a healthy diet of cartoons and pudding. After graduating from Tyler School of Art and Architecture, she began creating illustrations that make learning exciting. Rachel hopes this book will inspire kids to ask questions about their world and to explore science and nature! For more educational books and resources, visit her at rachelignotofskydesign.com and on Instagram @rachelignotofsky.

ABOUT THIS GUIDE

Written for educators to help students get hands-on (and hands-dirty!) with flowering plants, many of the activities in this guide are also easily adaptable for at-home learning. To make the most of the suggested activities, read this magnificently illustrated and richly detailed book to kids. Read it through for pleasure, pausing when children have questions or want to point something out or explore an illustration.

When you're ready to read the book again, each section of this guide offers discussion questions encouraging you and your readers to talk about key topics, including soil, seeds, plants, flowers, and fruit. In each section, there are also ideas for how to integrate these topics into your curriculum, including:

- Some background information on the topic
- Video recommendations
- Activities to actively explore the topic
- Writing activities
- Resources to dig deeper



SOIL

**What's that under your feet? It's soil, and it is so much more than just dirt!
Soils are complex mixtures that are full of life—bacteria, fungi, mites, worms,
and many other living organisms. Look on pages 9–12 to find facts about soil!**

Talk about soil

- What is soil?
- What is in soil?
- How is soil different from dirt?
- Why is soil so important to plants?
To people?
- How do plants depend on soil?
How does soil depend on plants?
- Have you ever taken a close look at soil?
What have you observed?



Watch and learn

[Soils Are Living!](#) from Soil Science Society of America

Explore soil

Some students may not have a lot of hands-on experience with soil. Get them thinking about what they know or think they know.

- Ask students to write down sensory words and phrases that describe the soil:
 1. What does soil look like?
 2. How does it sound when they walk on it or crumble it?
 3. How does it feel and smell?
- Have students share their ideas.
- Head outside with resealable plastic bags and tools for digging.
- Help students collect soil samples from a variety of spots on school property. (Or send a note to parents to ask them to help their child collect a soil sample to bring to school or to use to explore soil at home.)
- Depending on the number of soil samples you have, students can work individually, in pairs, or in small groups to place a handful of their soil sample onto a large piece of scrap paper.
- Give students plenty of time and tools, such as magnifying glasses, to explore the soil closely, noting the texture, color, smell, and any organic or living elements.
- Have them write down words that describe this soil and then move to explore another soil sample. Have them compare it to their first sample and note similarities and differences as they describe this soil.

Seal up and save soil samples for further exploration, and have students return to their soil descriptions.

- Ask students to reflect and share how their closer look at soil changed or didn't change how they would describe it.
- Share how soil scientists describe soil types by how much sand (large rough particles), silt (smooth medium-sized particles), and clay (small heavy particles that get sticky when wet) are present.
- Encourage them to use this new vocabulary and the activities below to further explore their soil sample.

Explore more

Soil sieve: Most soils are a mixture of sand, silt, clay particles, possibly a few rocks, and some organic matter. Give students sieves with different-sized openings to sift their soil samples to see and record what makes up their soil.

Soil types: To further explore soil types and textures, just add water!

- Have students take a handful of soil, add a few drops of water, and squeeze the soil. Sandy soils will crumble and break apart. Soils with a large silt content will clump into a ball. Clay soils are hard to squeeze and difficult to shape.
- Have students predict their soil type before adding water, then record their findings.

Writing—Soil composition: There is a huge range of organisms that spend all or part of their lives in the earth's soil.

- Have students choose an organism in the soil to investigate.
- Ask students to create a profile of their organism that includes where in the soil their organism lives, information about its life cycle and food sources, what the organism does for the soil, and what it needs to survive.
- Have students illustrate their profiles and create a display.

DIG DEEPER

Learn the story of your state soil!

You may be familiar with your state flower or state bird, but did you know your state also has an official state soil! Learn and share the story of your unique state soil from the [Soil Science Society of America](#).



SEEDS

Seeds, which come in a variety of shapes, sizes, and textures, are the beginning of life. They are the first stage of future plants! Find facts about seeds, beginning on page 9!



Talk about seeds

- What is a seed?
- Where do seeds come from?
- What do seeds look like?
- What do you think you might find inside a seed?
- What do seeds need to live and grow?
- How do seeds get planted?
- What seeds do you eat?



Watch and learn

[How Does a Seed Become a Plant?](#) from SciShow Kids
[Germination of a Seed \(Time Lapse\)](#)

Explore Seeds

- Take students on collection walks through the schoolyard or neighborhood to find seeds in nature, such as acorns, maple seed “helicopters,” walnuts, etc. (A good time to look for seeds is two to four weeks after periods in which plants have flowered.)
- Ask students to bring in seeds they find in their kitchens or their lunches, such as sunflower seeds, papaya seeds, apple seeds, watermelon seeds, or dried beans, or avocado, peach, or cherry pits.
- As they collect, have students bag and label their seeds with the plant name and a description or sketch of the plant the seed came from.
- Talk with students about how within every seed lives a tiny plant or embryo.
- Set up a hands-on science station where students can sort and dissect seeds.
- Set up an [experiment](#) so the kids can watch seeds grow.

Explore more

Seed dispersal: Use the seeds in your seed science station to explore seed dispersal.

- Have students work in small groups to examine a set of seeds and record a description of each. Is it oval, flat, bean-shaped, winged, prickly, feathery, sticky, etc.?
- Structures on the seed may help it to move to a new location with plenty of sunlight, water, and nutrients—which is what the plant wants its seeds to do. Share page 26 of *What's Inside a Flower?* and talk about how wind, water, gravity, or animals eating the seeds help them travel to another place.
- For each seed, have students predict how it disperses, and then let them test their predictions by putting seeds in water, dropping them in front of a rotating fan, and other tests students devise.

Seed diet: Talk about the seeds we eat and the nutrients they contain.

- As a class, generate a list of seeds that people consume.
- Consider the many different categories of seeds we eat (nuts, legumes, grains, spices) and those seeds we eat in a different form, such as oils and flours.
- Have students take the list home and go on a seed hunt to see how many seeds and seed products they can find!

Writing: Planting seeds

Give students the opportunity to plant some seeds of their own. Whether you have a small garden in the schoolyard, a window box, or individual containers for students, they will enjoy growing seeds. After planting, have students write instructions titled “How to Plant a Seed.”

DIG DEEPER

Suggest families go on their own reading and gardening adventures!

Send home this [Gardening Reading Adventure Pack from Reading Rockets](#).



PLANTS



Plants are really important for people, our planet, and all living things. We need plants to live! They help to clean water and air and provide habitats and food for animals and people. Find out facts about plants! Look on pages 11–18.

Talk about plants

- What is the role of a root?
- What is a stem?
- What do leaves do?
- Why do you think most plants are green?
- What are things plants and people both need?
- How do plants get the things they need?
- How are people helped by plants?
- What has a plant done for you today?

Watch and learn

[Plant Structure](#) and [Photosynthesis](#)
from KET's Think Garden

[What Are Plants?](#)
from Scholastic's Watch and Learn Library

Explore plants

Field journaling gives students the opportunity to use drawing and writing together to show observations, thoughts, events, questions, and memories, and is a great way to get outdoors to explore plant life.

- Students will need empty notebooks to use as field journals, writing and drawing tools, and an understanding that they don't have to draw beautiful pictures—just document their observations and draw what they think is important to remember.
- Head outdoors as a group and have students spend lots of time quietly listening to and looking at what's around them.
- Encourage students to take notes and draw the plants they discover, along with anything else they find interesting.
- To help students get started, offer prompts such as:
 1. I see/hear/smell/feel
 2. I wonder
 3. I was surprised by
- As students become comfortable with their field journals, have them find and sketch plants in your schoolyard or nearby park and log ongoing observations, including measurements of plant growth and change.

Explore more

Plant field guide:

- Have students use their observations and journals to develop a field guide to plants. The information, ideas, and questions they include in their field journal notes and drawings will lead to ideas about what to include in a field guide. The more information they collect, the more helpful the field guide will be!
- Have students choose plants from their field journals and research each plant they decide to include in the field guide, including where it can be found and how to identify it. Creating a field guide will help students develop a deeper understanding of local species of plants.
- Each student should contribute at least one species to the guide.
- Format the guide as a PDF so everyone can have their own digital copy, but also print and bind a copy to include in your classroom library.

Writing: Diary of a plant

Have students develop and write diary entries from a plant's point of view. Tell students: You are a plant.

- What does it feel like to grow?
- What do you see around you?
- What do you like about being a plant?
- What do you not like?
- Write and draw about your life as a plant, including processes such as photosynthesis, pollination, and seed dispersal.

DIG DEEPER

Creating a school garden or native habitat can be a big project, but there's lots of excellent information available online to help you plan, design, raise funds for, and build a great green outdoor learning space:

- U.S. Fish & Wildlife Service [Schoolyard Habitat Project Guide](#)
- National Gardening Association [School Gardening](#)
- [The Edible Schoolyard Project](#)





FLOWERS

Flowers, with their beauty and fragrance, are geared toward reproduction. To make more plants, plants need to develop seeds, and flowers are an important part of seed production.

Find out facts about flowers, beginning on page 18!

Talk about flowers

- What is the purpose of a flower?
- What are the different parts of a flower?
- Why are leaves green but flowers are different colors?
- What kind of flowers do you think attract pollinators?
- Why do pollinators need flowers?
- Why do flowers need pollinators?

Watch and learn

[Pollination: Trading Food for Fertilization \(10 minutes\)](#)
from Cornell University's Naturalist Outreach

[Pollination: Trading Food for Fertilization \(3 minutes\)](#)
from Cornell University's Naturalist Outreach

[The Beauty of Pollination](#) scenes from *Wings of Life*

Explore flowers

Have students get a close look at flowers by dissecting one. Gather flowers from teacher and student gardens or ask a local store to donate flowers for this activity. (The best flower types to use are lilies, tulips, daffodils, alstroemarias, and gladiolus.)

- Let students know they will be examining a flower and all its parts and should be prepared to make diagrams and careful observations.
- Before beginning to examine their flowers, read the relevant parts of *What's Inside a Flower?* aloud again to further familiarize students with the parts of a flower.
- Post or provide vocabulary for students to use in their diagrams and notes.
- Students can work individually or in pairs as you guide them through the examination and dissection of their flower and provide prompts to discuss or answer in their journal.
 1. Have students begin examining their flower at the top of the stem to locate the sepal. Discuss how the sepal protects the bud before it blooms. Ask: What else do you notice about the sepal?
 2. Next have them look at the petals and note what they think their purpose is. Ask: What else do you notice about the petals?
 3. Students should then peel away the petals to get a closer look at the parts inside the flower, paying particular attention to the anther and filament that make up the stamen. Ask: Do you see any pollen? What else do you notice about the stamen? How many are there? When you touch a stamen, is there any powdery pollen? What does it mean for the flower if there is no pollen?
 4. After examining the stamens, students can remove them to better see the central pistil. Have students touch the pistil, especially the part at the end—the stigma. Ask: Is it sticky? Why would the stigma be sticky?
 5. Have students examine the pistil from the stigma down to the ovary at the base of the flower. Students can break open the ovary to examine the ovules inside. Ask: What's inside? How would you know if this flower had been pollinated?



FLOWERS

(CONTINUED)



Explore more

Practice pollination: You and your students can head outside in search of pollinators at work, or you can simulate pollination with this crafty activity.

- Provide students with black and yellow pipe cleaners to twist into simple bees (or other pollinators as desired).
- As students craft their pollinators, talk with them about their own experiences with bees and bugs and the important role insects play in helping produce much of what we eat.
- Then set up your “flowers.” You could create—or ask parents to help create—pairs of flowers from craft material like tissue paper, construction paper, and pipe cleaners. Or you could cut petals from construction paper and tape them to the rims of various bowls and cups to form flowers.
- Place ground chalk, flour, or cornmeal “pollen” in the center of each “flower.”
- Students should take their pollinators and dip their legs into the powder, moving from “flower” to “flower” and observing what happens.

Writing: Pollination poetry

Pair students and ask one to imagine the point of view of a flower that needs to be pollinated and the other student to take the part of a pollinator.

- Have the students work together to create a poem in two voices that tells the story of what happens when the flower and pollinator meet.
- Students should practice and perform their poems for the entire class.

DIG DEEPER

[Pollinator Week](#) is at the end of June, but you and your students can celebrate the vital services provided by bees, birds, butterflies, bats, and beetles anytime to help promote the health of pollinators.



Practice sequence: In order to study or observe changes in something—like growth in a plant—students need to be able to follow along and record changes. Provide students with the individual pages of the mini booklet at the end of this guide. Let them color the pages if they like, then figure out the correct sequence (or order) of the pages to show how a seed becomes a flower. Students can add their own informational text or use the pages to tell a story. Kids might also be inspired to make other sequencing books based on *What's Inside a Flower?*, such as how a flower gets pollinated or how a seed gets dispersed.



FRUIT

Flowering plants make fruits. Flowers start to make fruit after pollination. The fruit is the part of the plant (the ovary) that contains the seeds—the fruit develops to help protect the seeds.

Find out all the fruit facts! Look on pages 27–32.



Talk about fruit

- What is a plant's fruit?
- Why do plants grow fruit?
- What happens to the flower when the fruit starts to grow?
- How do we get the fruits and vegetables that we eat?
- What happens to the plant after its fruits fall or are picked?



Watch and learn

[Pear Flower to Young Fruit Time Lapse](#)

[Why Do Plants Grow Fruit? by Katherine Yang](#)

Explore fruit

Pass around and then cut open several fruits, such as green pepper, zucchini, apple, and pear.

- Look for seeds on the inside and remnants of flower parts on the outside.
- Point out to students how the ovary of the flower swelled to become the seed container.
- Also have students look for traces of flower parts: sepals are at the stem end of the green pepper and flower petals remain on the bottom of apples and pears.

Explore more

Plant parts salad: While we eat the fruits of many plants, we also eat some roots, leaves, stems, buds and seeds of other plants.

- Have students research their favorite salad ingredients and come up with a recipe. Ask them to make their special plant parts salad for their family and report back on how their family members rated it.

Here are a few plant parts to suggest:

- corn, peas, beans, sunflower seeds, walnuts (seeds)
- beets, radishes, carrots (roots)
- asparagus and celery (stems)
- spinach or lettuce (leaves)
- broccoli and cauliflower (buds)
- apple, pear, peach, squash, cucumber, tomato (fruits)

Have students illustrate their recipes or take photographs of their super salads and compile them all in a Plant Parts Cookbook that you send as a PDF to student families.

Writing: Grow story

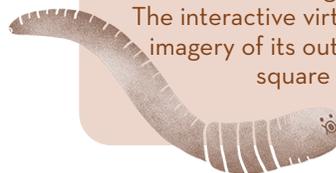
Many familiar fairy tales include magical elements, which often take the form of a flower, fruit, or seed, such as Sleeping Beauty's rose, Snow White's apple, the pea that irritated the princess, or Jack's magic beans.

- Have students use these fairy tales as inspiration for a totally original story that includes whatever fruit, flower or seed they want.
- Have students assign a magical property to their fruit, flower, or seed based on what they know about the plant it belongs to.
- Students can illustrate their stories and read them aloud to the class.

DIG DEEPER

Take students on a virtual tour of the [United States Botanic Garden](#), which is located in Washington, DC, near the Capitol Building. This is the country's oldest garden, currently celebrating its 200th anniversary.

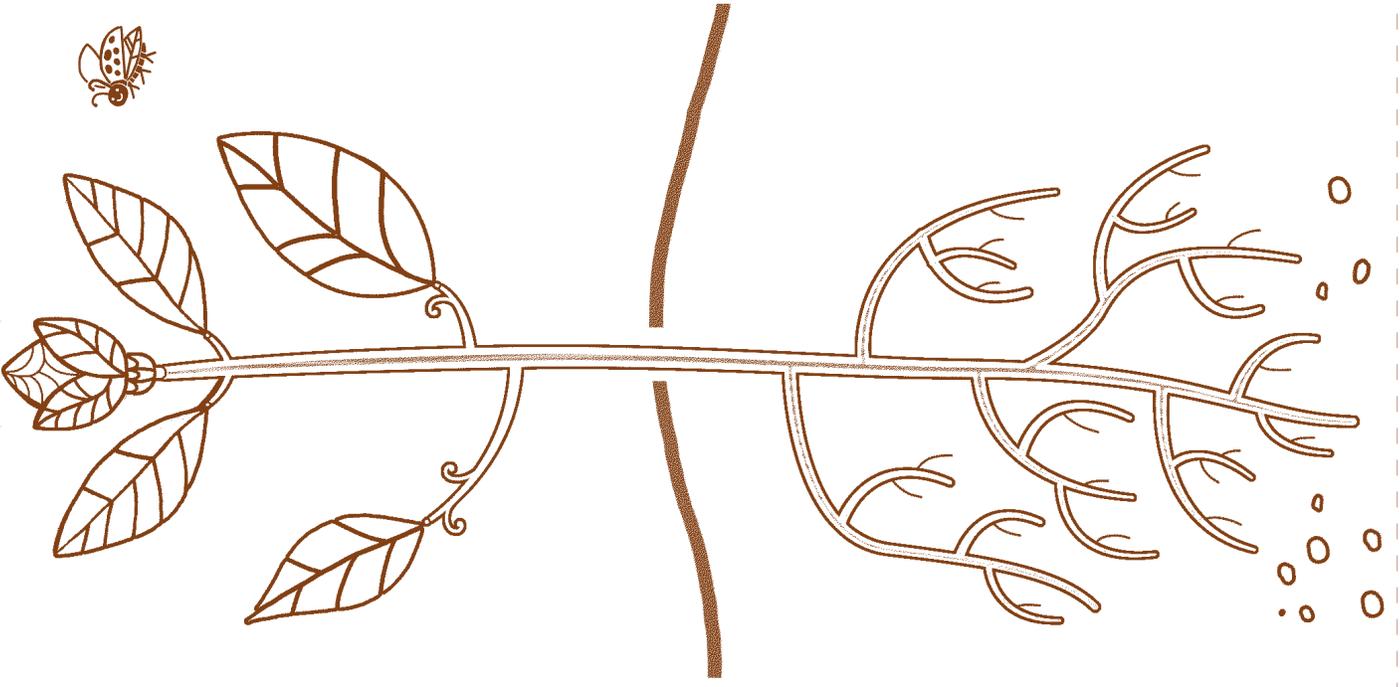
The interactive virtual tour provides 360-degree imagery of its outdoor plants and the 30,000 square foot conservatory.



**Create your own mini booklet
at the end of this guide!**

RACHAEL WALKER (belleofthebook.com) created this guide. She consults on a wide variety of educational programs and multimedia projects, and develops educational materials and reading resources for children, parents, and teachers.

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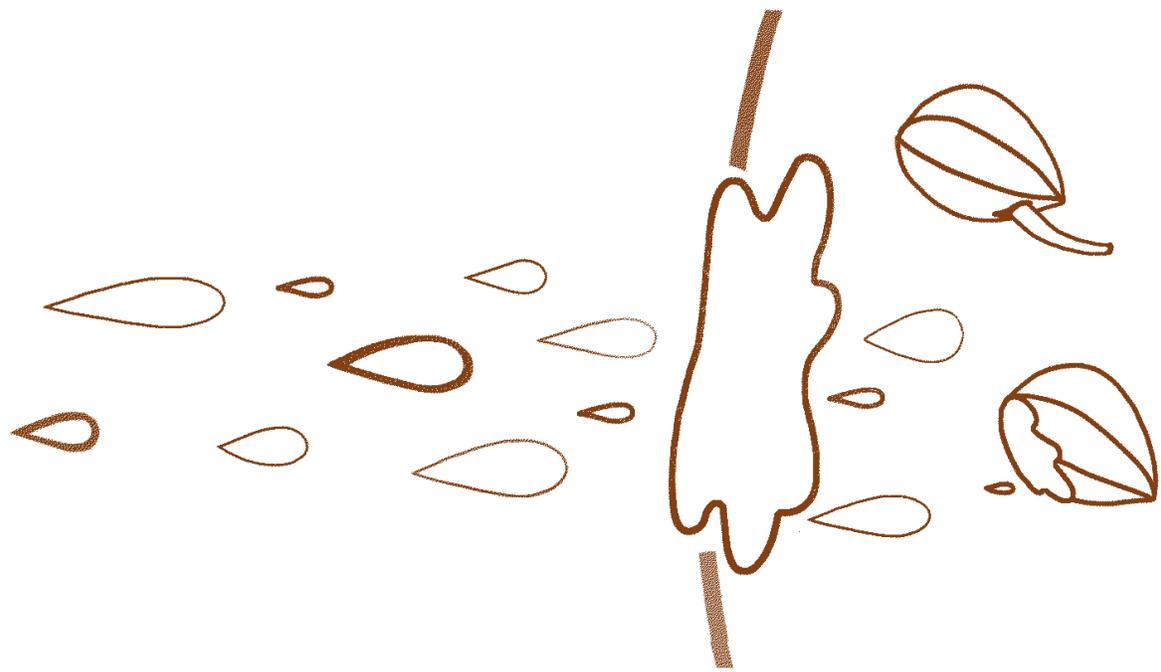
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