Curriculum Connections

Which End is Up?

Consider engaging young students in observing bulbs and predicting which part is the top (produces the shoot) and which is the bottom (produces the root). It's not, after all, obvious to the untrained eye. Once they've made predictions, they can set up investigations to test their ideas.

Lay the groundwork by having the class explore and compare different types of bulbs with their hands and magnifying lenses, and list their observations on the board. You can slice some bulbs in half so they can examine the insides or wait to do this until they've conducted their investigation. Based on their predictions and observations, have students decide how they want to orient their bulbs in pots of soil (or in the outdoor garden). They should label their pots and record how the bulbs were planted. Once some of the bulbs have flowered, students can dig up all the bulbs and compare the routes the roots and shoots took on their journey. (The bulbs that were planted upside down are less likely to bloom because they will have used their stored energy trying to reach the light, leaving little for flowering.)

Discovering a Colorful History

Invite your students to dig into the origins and histories of different types of bulbs. They might mark bulbs' native lands on a world map and dig into what routes they traveled through history to the present day. This could inspire fruitful questions: *How have bulbs been used as food by different cultures throughout history? Do bulbs play a role in cultural myths (that garlic repels demons, for instance) or folklore? How did bulbs get their names?* In Greek mythology, the character Narcissus caught a glimpse of his reflection in a pool and was so smitten with his beauty that he couldn't tear himself away. He soon became weak, fell in, and drowned. Daffodils, with their beautiful nodding blooms, sprang up where Narcissus had sat.

Possibly the most fascinating aspect of the history of flower bulbs is the economics and horticultural background of the industry, *particularly* the tulip trade. These hardy bulbs, which originated in the mountains of Turkey and other parts of central Asia (*not* in Holland, as many believe), were brought first to the Royal medicinal garden in England. As the idea of gardening for decoration — not just for medicines — took hold in the 1600s, Dutch horticulturists began propagating beautiful exotic breeds of tulips. Little did they know what a stir they would create. In the years that followed, wealthy people coveted these beautiful tulip breeds and spent scads of money on them. Illegal traders cashed in on the buying frenzy and earned outrageous sums. One bill of sale, in fact, recorded this transaction for just a single tulip bulb: two loads of wheat, four loads of rye, four fat oxen, eight fat pigs, twelve fat sheep, two barels of wine, four barrels of beer, two barrels of butter, 1,000 pounds of cheese, a marriage bed with linens, and a sizeable wagon to haul it all away! When the craze, dubbed "tulipmania," finally subsided, the markets crashed and filthy rich businessmen were ruined. (Your students might want to research and compare how this investment craze compares with more contemporary ones!) Today, Holland raises and exports billions of flower bulbs each year; U.S. gardeners are the biggest buyers.

Here are some Web sites your students might visit to dig deeper into the histories of these delightful packages:

Bulbs & More: History
History in Bloom
Tulipmania
Tulip History

Exploring Bulbs: From the Inside Out

Contents

Inside a humble bulb is everything needed to produce a flowering plant. Invite students to explore the secret life of bulbs by spitting one (or several) in half. Consider including some of the bulbs we eat, such as onions or garlic. In the center of the bulb, they should notice a baby flower bud surrounded by protective "scales," which contain the food the bud will need to emerge and bloom. The hard flat plate at the bottom supports the bud and scales as well as the roots. The papery outer skin (e.g., the onion skin), called the "tunic," protects the package. (Some bulbs, such as lilies, are called "scaly" bulbs. Instead of the papery tunic, they have fleshy scales that also store food.)

Your students might be curious why certain bulbs need to be chilled. They'll have to go back and consider conditions these plants contended with in the wild. For instance, our spring-flowering bulbs, many of which originated in cold mountainous areas, spent the warm season taking in moisture and making food in their leaves through photosynthesis. If they continued on that track, they would have been killed by the cold, harsh winter. Instead, they evolved an adaptive strategy: As winter approached, the food produced in the leaves got stored in the fleshy bulb, the leaves and roots dried up or dropped, and the plant went dormant. This enabled the bulb to withstand cold, dry months until the warmth and moisture of spring triggered flowering. (Students should be able to grasp the link between the environment in which which these bulbs evolved and the conditions we need to provide to "fool" them into blooming indoors.) Tender bulbs, such as amaryllis, which originated in more tropical areas, do not need to be chilled, but once they've flowered and the leaves have had a few months to produce food, and the bulb to store it, they do require a dormant period. (This may have been necessary in the tropics because light became less available as trees and other plants shaded the amaryllis.)

Grappling with Growth

When you provide the right conditions for bulbs to spring to life in the classroom, they typically take off . . . and fast! In fact, amaryllis grow so fast in a warm environment that students can practically watch them push upward. (Your class might capture this daily spurt using a digital camera and use the images to illustrate presentations about their discoveries.) Challenge your young scientists to consider how to best record growth of their indoor bulbs. *Should we measure the growth of the flower stalk, leaves, or both? How will we ensure that they're measuring from the same point each time?* They might also predict the final height (and tape markers on a wall) and/or the rate of growth. Ask, *How can we assess the growth rate?* (For instance, they might note the angle of the line on a handmade or computer-generated graph or subtract each day's stalk length from the previous day's length.)

If you have more than one container of bulbs (which we strongly recommend), students might want to set up some investigations and comparisons. For instance, they might brainstorm the variables that could affect the growth rate — hours of light, type of light, temperature, and so on — and then design experiments to test their ideas. One school even reports setting up an Amaryllis-growing competition among different classrooms.

Play the Pollinators

Consider playing pollinators! The size and magnificence of amaryllis flowers invites close exploration of flower parts, pollination, and seed and fruit production. Like other lily family members, the flowers have six petals and six stamens surrounding a pistil. Once the flower is open, have students observe the parts carefully to discover signs of the flower's readiness for pollination. (The three prongs of the pistil actually open upward when the flower can accept pollen.) Invite your class to "play the bees," using a cotton swab or paintbrush to transfer pollen from one flower to another. Following successful pollination, a swelling containing ovaries and then seeds will emerge at the base of the flower. It would take 2 to 3 years to grow a flowering plant from these seeds.

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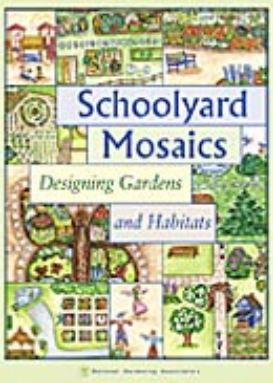

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