Chill Out

Overview: Students will explore the life cycle of true bulbs and bulb-like structures such as corms and discover that many need exposure to cold temperatures to bloom.

Grade Level/Range: Grades 3 to 6

Objectives: Students will participate in a science experiment to learn the cold requirements of spring-flowering bulbs.

Time: 8 weeks

Materials:

- At least 5 tulip bulbs and 5 crocus corms (preferable to have 10 of each)
- Soil
- 5 6-inch pots and 5 4-inch pots
- Ruler
- Paper
- Pencils

Background Information: Hardy spring-flowering bulbs are planted in the fall and bloom in the spring. They are also called hardy bulbs because they survive cold winter conditions (in fact they need exposure to cold temperatures to enable them to flower properly).

Life Cycle of a Spring-Flowering or Hardy Bulb: You plant spring-flowering or hardy bulbs in the fall. The exact timing varies by region, but they need to be in the ground before the ground freezes. When first planted, the bulb begins to develop its roots. It then lies dormant during much of the winter, but draws on stored energy to produce flowers and leaves when the weather begins to warm in spring. Most spring-flowering bulbs must be exposed to a certain amount of cold weather to bloom well. Some bulbs require fewer cold hours and less warming to bloom so their flowers will emerge earlier in the spring (like crocus). Others need longer cooling and warmer weather to emerge so will bloom later in the spring like tulips. If a bulb is not exposed to the cold temperatures it needs, it will usually still send out leaves when the weather warms, but it may not bloom or will have fewer flowers on shorter stalks. There are many areas of the country without enough cold weather to successfully grow all bulbs. For instance, most tulips will not grow and bloom in many southern states unless you provide a supplemental cold treatment by placing bulbs in a refrigerated location before planting (see the information below on forcing bulbs). The Paperwhite narcissus, closely related to daffodils, is a good option for warmer climates because most do not require a long cold treatment. Once the plant grows to a mature size, it focuses on taking in nutrients and producing new food through photosynthesis. The food it does not use for daily life, it stores away in the bulb for next year's growth. Once the bulb has stored away enough energy, the leaves will turn brown and die. The bulb will enter a dormant state through the summer, fall and winter months until it is time to grow again the next spring.

Life Cycle of a Summer-Flowering or Tender Bulb: Summer-flowering bulbs will not survive cold winters so they are planted in the spring (after chance of freezing temperatures pass) and bloom in the summer. There is one notable exception -- there are summer-flowering lily bulbs that will survive some winter conditions. As with spring-flowering bulbs, the summer-flowering bulbs first establish a root system and then develop leaves and flowers. Just like the spring-flowering varieties, after blooming, they work to produce and store food for next year. Most keep their leaves and continue to photosynthesize until the fall when temperatures turn cool again. In northern climates, tender bulbs must be dug up and kept in a dark, cool (but not cold- it just needs to be cool enough to keep them from sprouting prematurely) environment for the winter and then planted again in the spring. There are some southern regions where the winters are warm enough that the tender bulbs will survive and can be left outside all winter. It is important to investigate the hardiness zone of your bulbs to determine the proper treatment. Some examples of summer-flowering bulbs are dahlias, begonias and gladiolus.

Laying the Groundwork:

Explain to students that most spring flowering bulbs need exposure to cold temperatures to bloom. Ask, how could we test a bulb's need for cold temperatures? *(Gather student ideas on experimental design before presenting the activity listed below.)*

Exploration:

1. Using the Background Information, share information about the cold exposure needs of spring blooming bulbs. Tell them you are going to design a scientific experiment to test out this information.
2. Fill the 10 pots with soil. In 5 of the pots (6-inch pots), plant tulip bulbs (one or 2 bulbs for each pot depending on availability – it is best to have 2 in case a bulb has been damaged) and in the other 5 pots (4-inch pots), plant crocus corms (one or 2 per pot).

* Note – bulbs can cause skin irritation for some individuals so make sure students wash hands thoroughly after planting and/or wear gloves while planting.

3. Set 1 pot of tulips and 1 pot of crocus in the window. Place the other pots in a refrigerator. Daily monitor the growth and development of pots in the window and record growth on a chart. An example chart is below:

Plant Name: _____ Length of Cold Exposure: _____

Date	Height	Is it blooming?
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		

4. After 2 weeks, take out another pot of tulips and crocus from the refrigerator and place it in the same window. Monitor the growth of these plants and continue to monitor the existing pots too.
5. After 4 weeks take another pot of tulips and crocus out of the refrigerator. Monitor the new plants and the existing plants. Repeat again after 6 weeks and the take the last 2 pots out after 8 weeks.
6. Monitor the growth of each plant until it blooms or until growth slows.
7. Translate your growth charts into graphs and compare the growth of the plants exposed to the various treatments. How long did it take for each plant to bloom? Did all the plants bloom? What does this tell you about the cold treatment needs of each plant?

Making Connections:

- This lesson tested temperature needs of bulbs. Create additional experiments exploring the effects of other variable such as light (grow in different areas of the room receiving different amounts of light), water and fertilizer. Track and measure differences in growth.
- Another way to experience the impact of temperature and climate on bulbs is to participate in the Journey North Tulip Project *(http://www.learner.org/jnorth/tulip/index.html)*. Journey North is an educational project tracking migrations and seasonal changes throughout the country through the collection of observational data from school classrooms.

Branching Out:

English - Instruct students to keep a daily journal while growing their bulb,s documenting observations in addition to the height data collected. Use journal observations in conjunction with the growth charts to arrive at final conclusions.

Science - Continue to monitor your bulbs after they bloom. Do the flowers make seeds? Most bulb flowers when pollinated will produce seeds and those seeds can be planted to grow new plants. So why do you not see daffodil or tulip seeds at the garden center? The reason it is hard to find bulb seeds is because it takes many years (5 to 7 years – sometimes longer) for the seed to develop into a plant mature enough to produce flowers and most gardeners do not want to wait that long. In addition to reproduction from seed, bulb plants also produce new little bulbs attached to the mother bulb called bulblets or offsets. These baby bulbs will grow over time and once they have enough stored energy can be separated from the mother bulb and grow into a new plant. New plants formed this way mature faster than new plants from seed.