

PLANT PROPAGATION

INTRODUCTION:

Plants, unlike humans, can reproduce asexually as well as sexually. Some plants can be propagated asexually with a mere cutting from the parent plant, which makes a genetically identical new plant. Imagine if you could remove your little toe, stick it in some water, and grow a copy of yourself!

To reproduce sexually, however, plants have to produce flowers. Pollen grains then have to be transferred from one plant to another, where they can fertilize "ovules" and turn them into seeds, a process called "pollination." Inside each seed is a living but dormant plant embryo, in a state of suspended animation until the conditions are right for sprouting.

Sexual reproduction takes a lot of energy, but it brings genetic variation into the population. These offspring plants are not identical to their parent plants, and a wide variety of genes helps a population survive when there are environmental changes, like droughts or new kinds of insect pests.

ACTIVITY: Dissect a bean

TIME: 20 minutes, plus eight hours to pre-soak the beans

SAFETY:

Be careful if you're using a blade to open up the seed coat.

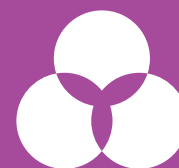


WHAT YOU NEED:

- Three or four large dried beans (kidney or lima beans work well)
- Water
- Small sharp blade (like a paring knife or X-Acto knife)

WHAT YOU DO:

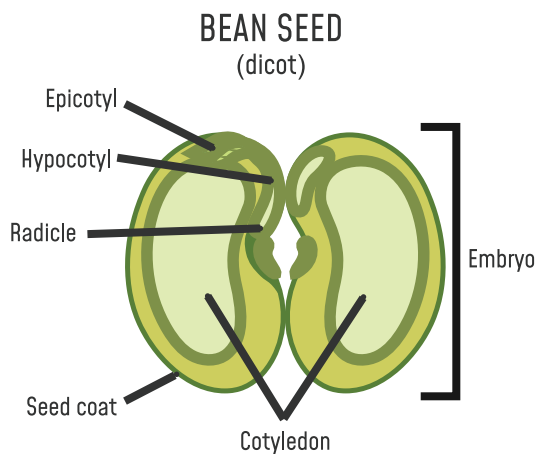
- Soak the beans in water. Within the first few minutes, what changes do you see in the seed coat? After several hours, how has the seed's appearance changed? How do you think water helps with seed germination?
- Soak the beans for about eight hours, or overnight.
- Remove the beans from the water. Take a bean and make a shallow cut in the seed coat, being careful to not damage the seed inside. Use your fingers to gently remove the coat.



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WHAT YOU DO (continued):

- Open up the two halves, known as "cotyledons." Inside, you will find a plant embryo, with two tiny leaves, a small stem and a root. The leaves have not turned green yet, so they're not ready for photosynthesis.
- Where do you think the plant embryo will get the energy it needs to germinate? How does this relate to the nutritional value of beans and other edible seeds?



ACTIVITY: Germinate a bean

TIME: Two to four days

SAFETY:

Some beans are poisonous if you eat them raw.

Sprouts can harbour dangerous bacteria. Please don't eat the sprouts you grow and keep them out of reach of your pets.

WHAT YOU NEED:

- 20 to 25 intact dried beans from a grocery store (garbanzo, romano, black, mung, kidney or lentil — intact only, not split)
- Saucer or small plate
- Paper towel
- Water

WHAT YOU DO:

- Soak your beans for four to eight hours, or until you see the seed coat has softened.
- Fold the paper towel so it's several layers thick, then place it on the saucer. Put the soaked beans on top.
- To "germinate" — transform from seed to plant — beans need oxygen from the air as well as moisture from water. When you add water to the saucer, think of the beans as swimmers — part in the water and part out, and not wanting to drown!
- Still, make sure the seeds don't dry out. Replenish the water when necessary.
- After one to three days, you should see the immature root, called the "radicle," emerging from the seed.



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UNPACKING WHAT HAPPENED:

Dried beans are technically seeds and can be germinated easily. For a bean to germinate, it needs water, oxygen, and the right temperature — not too hot or too cold. Like many seeds, beans have a tough seed coat, which helps protect the fragile plant embryo inside. If the bean is soaked in water, or planted in moist soil, the seed will absorb that water, in a process called "imbibition." Water helps to soften the seed coat, so the radicle can break through.

Other seeds have more complex germination requirements. Some seeds, like wild strawberry seeds, will not germinate unless they have first been exposed to cold temperatures. Others, like chilli pepper seeds, are more likely to germinate if they have passed through a bird's digestive tract. How do you think these adaptations might be helpful to the seeds' survival?

WHY THIS MATTERS:

The study of human-plant relationships is called "ethnobotany." Humans have always used plants for clothing, medicine, housing and food. Many plants produce seeds that are packed with starch, protein and fat. Around the world, human cultures rely on seeds for sustenance. Rice, corn, beans, peas, nuts, teff, quinoa, wheat and oats are all seeds that have become dietary staples through agriculture and selective breeding.

TAKING IT FURTHER: Germination inquiry

TIME: At least two days

SAFETY:

Not all food plants are safe to eat raw.

Sprouts can harbour dangerous bacteria. Please don't eat the sprouts you grow and keep them out of reach of your pets.

WHAT YOU NEED:

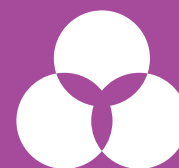
- 20 to 25 seeds (dried beans or peas from your pantry; cumin seeds, dill seeds, caraway seeds or mustard seeds from your spice rack; or tomato seeds, blackberry seeds or squash seeds taken from fresh produce)
- Other materials will depend on what seed and topic you choose

WHAT YOU DO:

Decide what you'd like to grow and measure, and what your success criteria should be. You might want to cultivate plants for your home or garden, or you might want to manipulate a variable to see what happens.

Grow plants for your home

- What is your ultimate goal? What is your timeline? What are your criteria for success?
- What kind of care will your seeds need in order to germinate?



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STRAND: PLANTS: ANATOMY, GROWTH AND FUNCTION; PLANTS AND THE NATURAL ENVIRONMENT

TOPIC: PLANT PROPAGATION

EXPECTATIONS: SBI3U: F2.2, F2.4, F3.3, F3.4;
SBI3C: F2.2, F2.3

VIDEO: youtu.be/6g0TrarKDh4

WHAT YOU DO (continued):

- How many seeds are you starting with? How many of those would need to germinate to achieve your goal?
- What stage of development would you like your seeds to reach? Seedling? Mature plant? Fruit-producing plant?
- How long will it take for your seeds to get there?
- Do some research. How much water and light do your seeds need? Will the sprouted seedlings need to be transplanted? Create a plant care plan, and keep it as a record of your research.

Manipulate a variable

- Maybe there's something you think will affect the seed germination process. Test it out!
- Dependent Variable: the dependent variable is the rate of seed germination. It is up to you to decide how to measure it, but consider a combination of qualitative (descriptive words) and quantitative (numeric) measurements.
- Independent Variable: What factors do you think would affect the rate of seed germination? Independent variables could include light levels, temperature, growth medium, water source, environmental conditions, and more.
- Hypothesis: How do you think your independent variable will affect the rate of seed germination? Do some research so that you can explain how you came up with your hypothesis. Have other scientists performed experiments that support this hypothesis?

- Controlled variables: After you decide on an independent variable, you will need to consider how you will control for other variables, so that your experiment is testing what you want it to test. For example, if your independent variable is exposure to music, you need to make sure that your seeds all have the same watering routine, light exposure, and temperature. What other variables should you control?

TAKING IT FURTHER: Propagating plants from vegetable scraps

Plants can also reproduce asexually from cuttings. Plants contain "meristematic" tissue, which is undifferentiated. Under the right conditions, a plant with meristematic tissue can grow into a whole new plant.

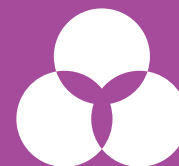
MORE ONLINE:

How to grow vegetables and herbs from kitchen scraps

<https://www.cbc.ca/news/canada/british-columbia/how-to-grow-vegetables-and-herbs-from-kitchen-scraps-1.5553697>

Safeguarding Seeds for the Future

<https://www.seedvault.no/>



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