

Seed Cycle

Purpose: This lesson introduces students to the soybean as a commodity grown by Minnesota Farmers. The soybean seed and its growth are used to demonstrate the life cycle of a plant.

Time: 60 minutes – on-going

Level: 2

Materials:

- Bean book – copies for each student
- Soybeans (these can be obtained from local farmers or regular bean seeds from a garden center can be used)
- Scissors
- Glue
- Stapler
- Permanent marker
- Paper cups with drains holes punched in the bottom
- Soil
- Spray bottles

Optional – soybean plant



Minnesota Science Standards and Benchmarks

2.4.2.1.1 Recognize that plants need space, water, nutrients and air, and that they fulfill these needs in different ways.

2.4.3.1.1 Describe the characteristics of plants at different stages in their life cycles.

Background

Soybeans (sometimes referred to as beans) are bushy green plants from the legume family. Legume plants have the ability to use soil bacteria to form a nodule on their roots by pulling nitrogen from the air and using this nutrient for growth. This is important for growing healthy crops and maintains soil quality. The ability of legumes to “fix” their own nitrogen reduces the cost to farmers and gardeners for fertilizers and can be used in a crop rotation to replenish nitrogen in the soil. The fixating of nitrogen by soybeans also causes the seeds and pods to have a very high protein content.

All members of the bean family (soybeans, lima beans, kidney beans, green beans, etc.) have the same seed anatomy. A seed coat is a very thin layer on the outer most surface of the seed. The seed coat offers protection to the cotyledons and the embryo. The cotyledons or seed leaves are the first leaves visible on a bean plant. These seed leaves are thick and contain stored glucose (food) for the new plant to grow. Before the seed is planted the cotyledons are usually not green, however, chlorophyll is activated and they appear green when the plant sprouts or germinates. The very center of a seed contains the embryo. This embryo is the new or “baby” plant that will sprout out of the soil. If bean seeds are soaked in water for a few hours these major bean seed parts can easily be pulled apart and are visible.

Soybeans are one of the most versatile crops in the world. When crushed and pressed, soybeans produce oil that is used in margarine, cooking oils, salad dressings, mayonnaise and many prepared foods. Soybean oil contains no cholesterol and is low in saturated fat so it is popular with health-conscious people. Soybean oil is also used to make paints, varnishes, soaps, cosmetics, plastics and crayons. Soybean oil is even used to make ink for printing newspapers and magazines. Soy biodiesel is another product made from soybean oil. This fuel is used in cars, trucks and buses which reduces pollution and increases engine performance. After soybean oil is removed in processing, the remaining flakes are processed into food products or protein meal for animals. Soybean meal is an important protein sources for livestock and poultry.

Information from: <http://www.mnsoybean.org/> and Minnesota Ag in the Classroom Soybean Commodity card.

This lesson will allow students to learn about soybean production in Minnesota and also see the steps that a plant takes from seed to plant and back to seed.

Procedure

Activity 1 – Seed Dissection

1. Before class begins, make enough copies of the “Bean Book” information so each student has an instruction sheet, seed coat sheet, seed leaves (cotyledon sheet) and one embryo. There are six embryos per page.
2. One day before class, soak enough soybean (or any other kind of bean) seeds in water so each student can have one seed.
3. Display a soybean plant to the class. Plants can be obtained from area farmers or you can grow your own from a soybean seed. A picture or diagram of a soybean plant would also work. Minnesota Agriculture in the Classroom has free commodity card sets that include the soybean. See <http://www.mda.state.mn.us/kids/commoditycards.aspx>
4. Tell students that soybeans are an important crop grown in Minnesota. If possible bring in products (chocolate, plastic, crayons, vegetable oil, etc.) that contain soybeans and explain to the students that all of these products are made using part of the soybean seed.
5. Use the background information to give a brief explanation of how soybeans are grown. You could also use the video from the Minnesota Agriculture in the Classroom website that shows a soybean farm. The video is one minute and 35 seconds long. <http://www.mda.state.mn.us/kids/videostories/feedus.aspx>
6. Give each student a water-soaked soybean seed. Explain to the students that there are three major parts to a seed: the seed coat, seed leaves or cotyledons and an embryo. Assist your students in dissecting the bean seed:
 - a. Peel off the seed coat – it is a very thin, almost transparent, film on the outer surface of the seed.
 - b. Gently split the seed in half, separating the cotyledons or seed leaves. Explain to the students that these cotyledons provide food for the plant as it is sprouting.
 - c. In the center of the cotyledons should be a small embryo. Explain to the students that this embryo will sprout out of the ground and grow into a plant.

Activity 2 – Bean Book

1. After students have dissected their bean seed have them throw away all seed parts. Then distribute the Bean Book handouts. Read the directions and model to the students what they should do to assemble the book. Assist students in creating their own Bean Book.
2. After the Bean Books are assembled, show students how to use them to read about the seed and illustrate the parts.

Activity 3 – Bean Seed Planting

1. Give each student about 3 bean seeds (not soaked in water). Ask the students what is needed to help these seeds grow (soil, light, water, air).
2. Pass out planting containers (paper or plastic cups with drain holes punched in the bottom work well). Assist students in writing their name on the cups with a permanent marker.
3. Have buckets or containers with soil available. Model to students:
 - a. Fill a cup about ½-¾ full of soil. Have students follow your example to fill their containers.
 - b. Poke three holes, using a pencil or your finger, about one inch deep into the soil.

- c. Drop one seed into each hole. Cover the seeds loosely with soil.
 - d. Use a spray bottle to moisten the soil in the container or pour water on the soil until water flows out the holes in the bottom of the container. Be sure to water over a sink or container.
4. Assist students in planting seeds.
 5. Place containers in a sunny window and water when the soil is dry to the touch.
 6. Discuss with students what they think will happen to the seeds. (sprout, grow into plants, and produce more seeds).
 7. In five to ten days, a plant will emerge in each container. If more than one seed sprouts or germinates, have students carefully pull out all but the healthiest plant.

Additional Activities

- Make a calendar to give to each student to keep records of their plants' growth.
- Invite a local soybean farmer to visit your classroom and share his/her story about raising this important crop.
- Collect labels from the students' favorite foods. Look at the ingredients list and see if any of them contain soy or beans.

Resources

- The book *SOYBEANS in the story of agriculture* is a great read-aloud book or it can be used by the teacher for additional background information.
<http://www.mda.state.mn.us/kids/childrens-lit-bundle.aspx>
- Agriculture By-Products Placemats show the many uses of soybeans and other agricultural products grown in Minnesota. These are available FREE from Minnesota Agriculture in the Classroom.
<http://www.mda.state.mn.us/kids/teachresources/byproducts.aspx>

My Bean Book is from Illinois Agriculture in the Classroom.

In accordance with the Americans with Disabilities Act, this information is available in alternative forms of communication upon request by calling 651/201-6000. TTY users can call the Minnesota Relay Service at 711 or 1-800-627-3529. The MDA is an equal opportunity employer and provider.

The Bean Book

By: _____

Where can you find soybeans?
Almost everywhere! Soybeans
can be found in all of these
products...

plastic	car wax
paint	tofu
chocolate	soap
crayons	insulation
body lotion	glue
cooking oil	makeup
candles	candy
printing ink	cereal
biodiesel fuel	livestock feed

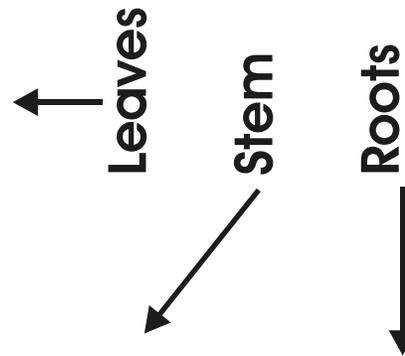
...and so much more! Check
out the ingredients listed on
packages around the house or
school and see what else you
can find!

The bean has a cover
called the **seed coat**.
It protects the seed. ❷

Inside the seed coat
are two **seed leaves**
(**cotyledon**). They
hold the food the new
plant needs to grow. ❸

A baby plant is hiding
between the seed
leaves. It is called an
embryo. ❹

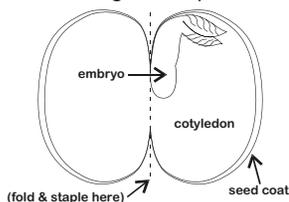
Every kind of seed has
three parts. They are
the **embryo**, **stored**
food (cotyledon),
and a **seed coat**. ❺



Bean Book Instructions:

- Cut out the seed coat, seed leaves, and embryo.
- Cut apart blocks of text, following the dotted lines.
- Fold the seed leaves (yellow) into the seed coat (tan) and tuck the embryo (green) into upper center of seed leaves.
- Attach seed parts by stapling along fold.
- Using the numbers as reference (see below), glue text onto the pages of your Bean Book.
- Write your name on the cover of your book.

Placing of seed parts



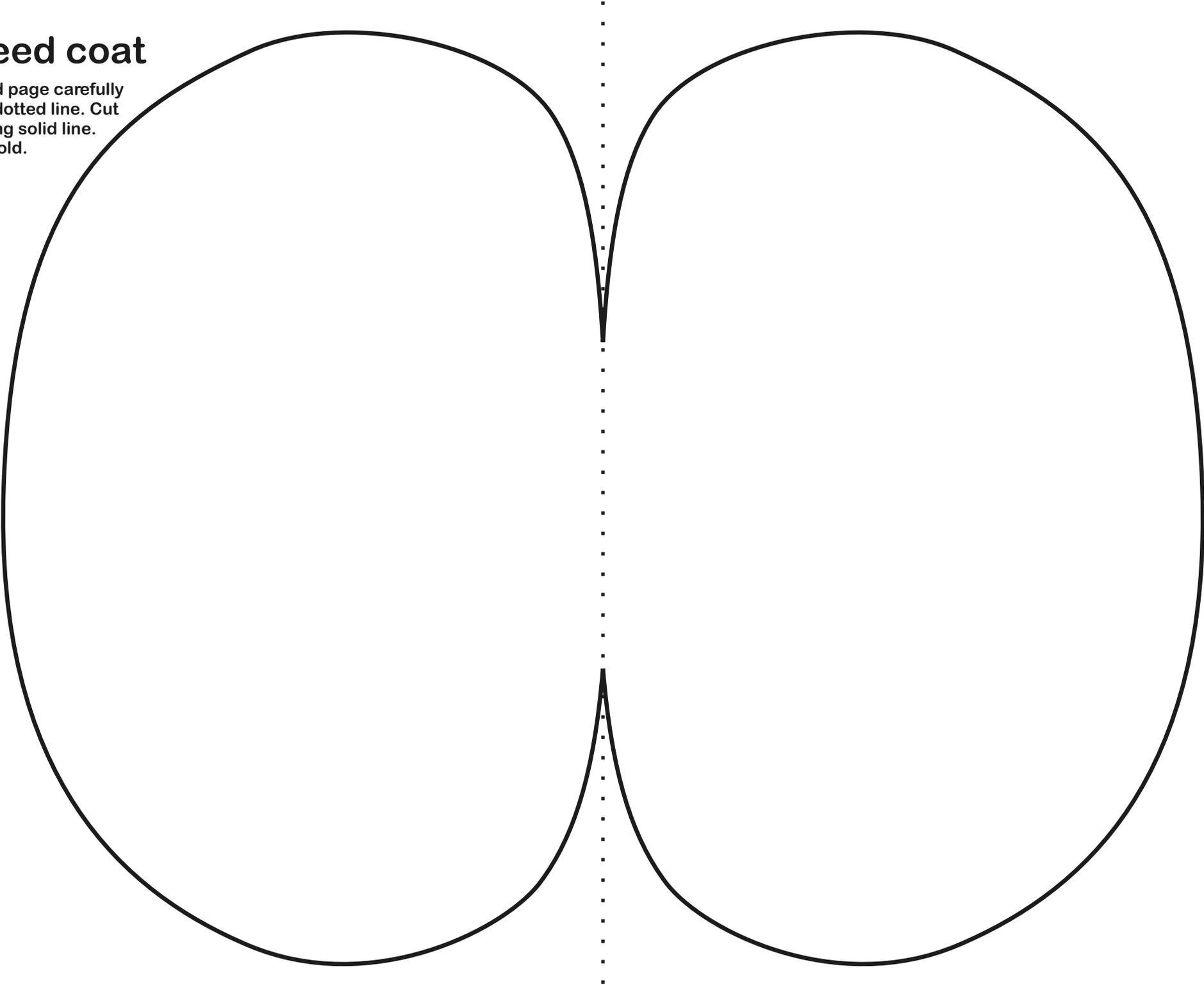
Place Bean Book text in the following order:

- ❶ Front cover
- ❷ Inside front cover
- ❸ Page after inside front cover (first cotyledon)
- ❹ Inside of first cotyledon, next to embryo

- ❺ Inside of second cotyledon, with arrows pointing to parts of embryo
- ❻ Inside back cover
- ❼ Outside back cover

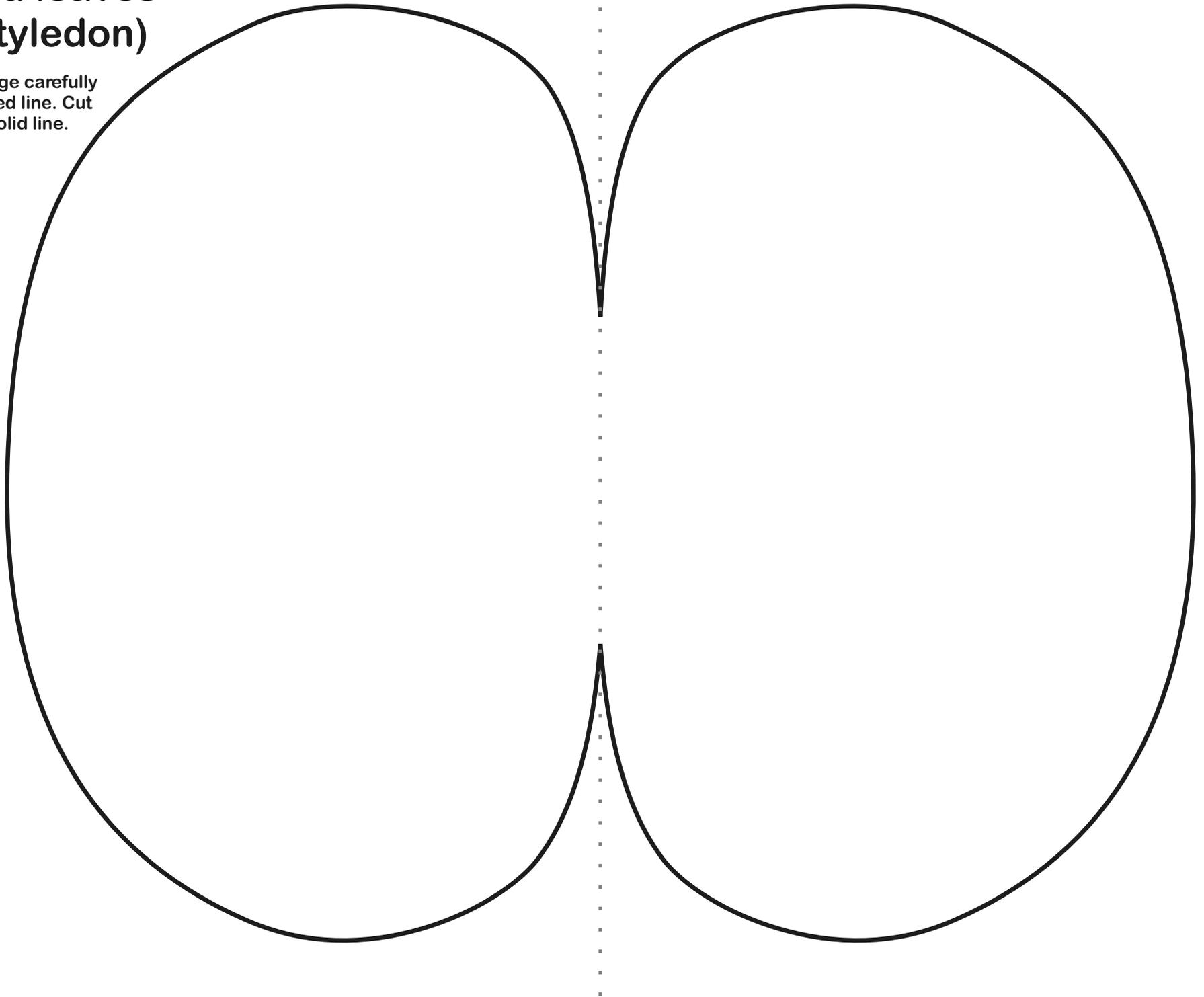
seed coat

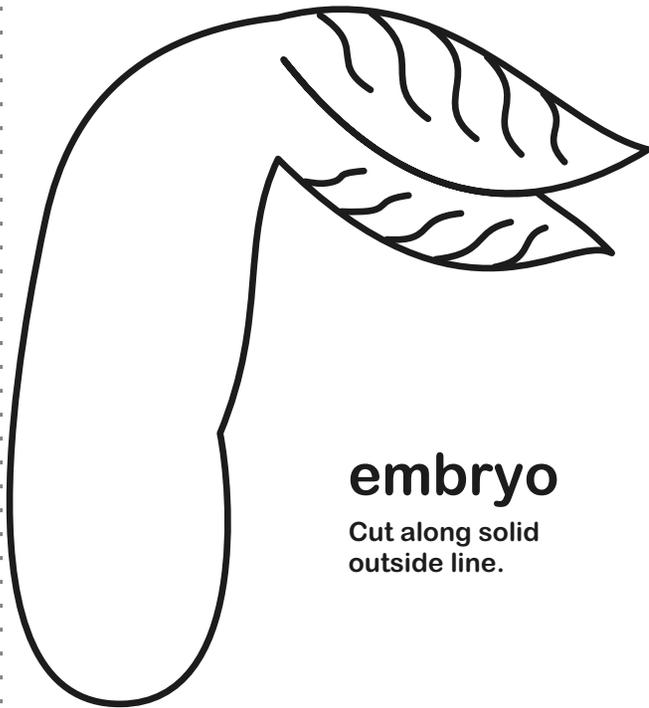
Fold page carefully
on dotted line. Cut
along solid line.
Unfold.



seed leaves (cotyledon)

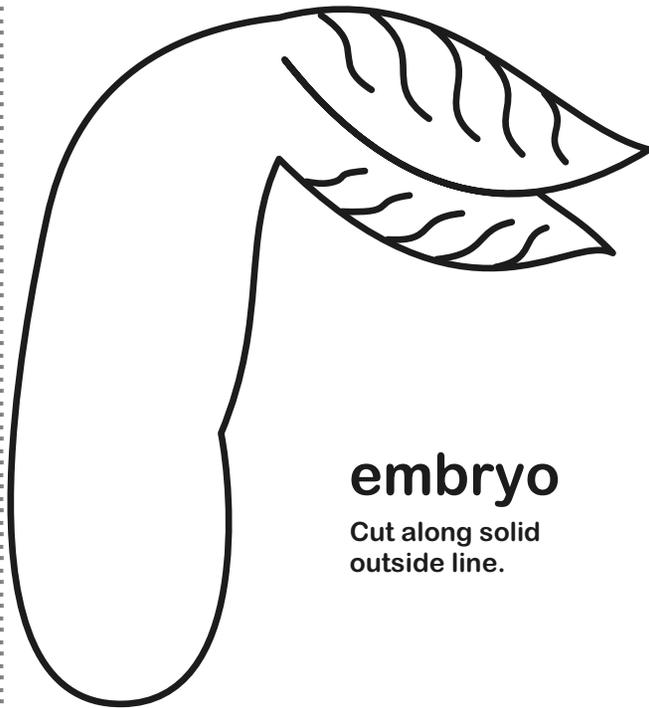
Fold page carefully
on dotted line. Cut
along solid line.
Unfold.





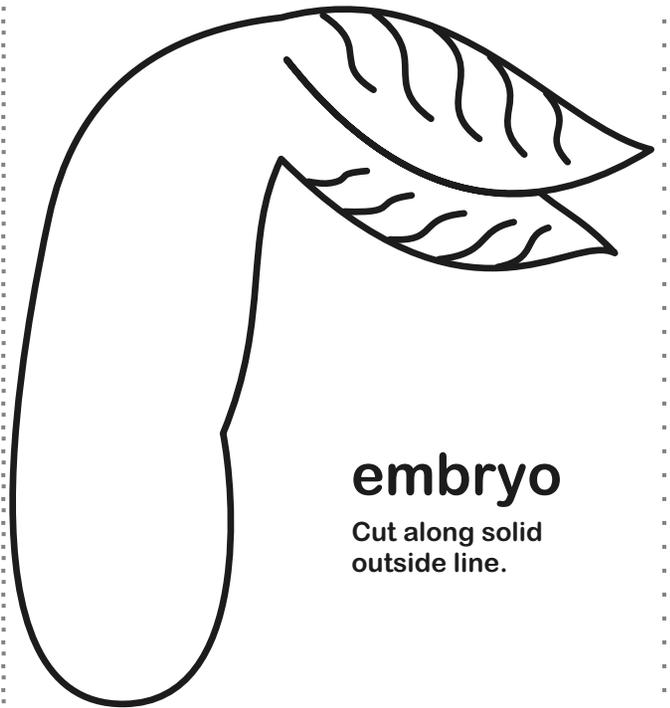
embryo

Cut along solid
outside line.



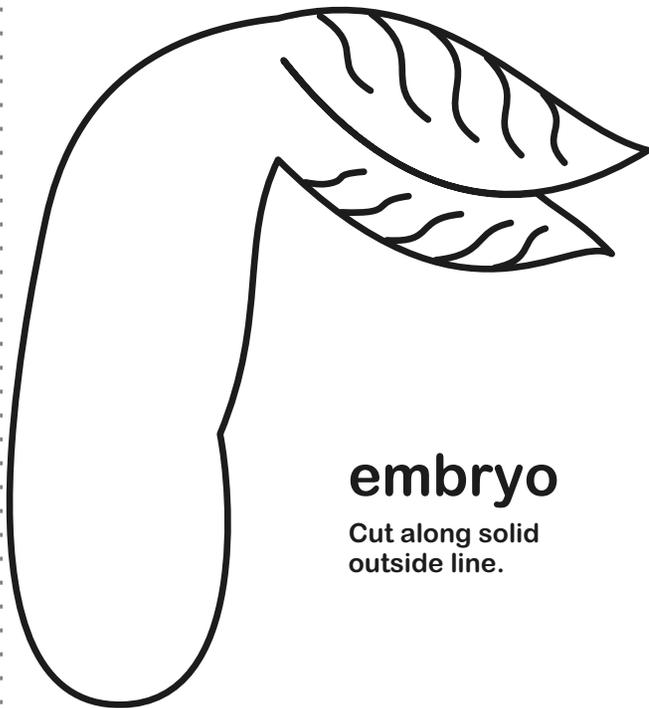
embryo

Cut along solid
outside line.



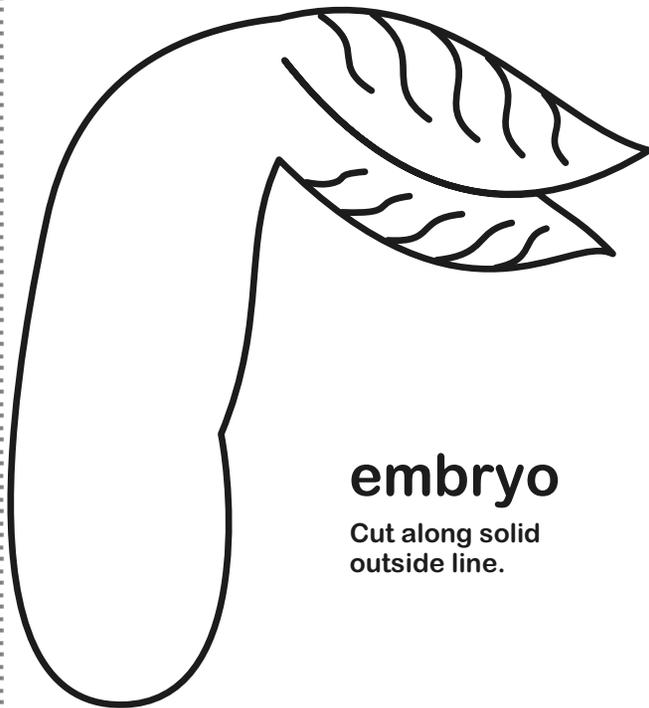
embryo

Cut along solid
outside line.



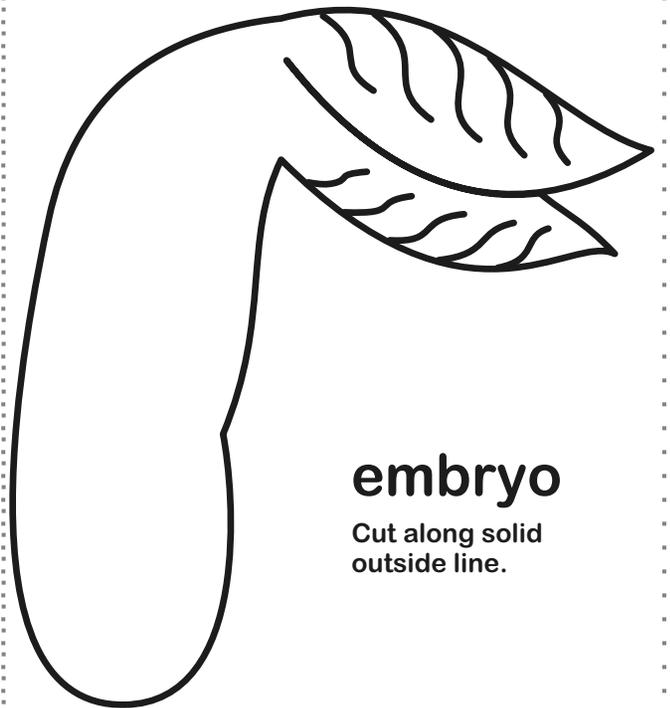
embryo

Cut along solid
outside line.



embryo

Cut along solid
outside line.



embryo

Cut along solid
outside line.