

The Germination Of a Bean

Photographs and article
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Germination is the process in which a seed, spore, or fungi sprouts, or begins growth. Seed germination can occur after a period of dormancy and is affected by available light, water, air, and many other variables.

Germination occurs differently in various plants. For example, plants such as the mangrove, which includes bushes and trees in the *Rhizophoraceae*, *Acanthaceae*, *Lythraceae*, *Combretaceae*, and *Areaceae* families, have premature germination periods. The embryo of these plants develop in the ovule while the plant is still in growth and a root is produced through a still-attached flower. Also, plants such as peas and corn develop cotyledons, or seed leaves, underground while beans and sunflowers develop cotyledons above ground in the light.

Reasons a seed may not undergo germination include lack of water, too much water, extreme heat or cold, or the seed may be planted too deep into the soil.

Green beans are categorized into two varieties: bush and pole. The bush bean grows approximately two feet high and does not require any support. The pole bean produces a vine that requires a support for climbing. The germination period of a bush bean (pictured left) is approximately 7-10 days depending on growing conditions. The germination process of the bean requires water for splitting the bean coat, sunlight, and eventually soil for support and rooting.

Seed Coat Rupture and the Emergence of the Radicle

In the first phase of the germination of a bean seed, available water saturates the seed through the micropyle, shown in Figure A, causing the insides to expand. The micropyle is a small pore located on the seed coat through which water is absorbed.

As water is absorbed and the inside expands, the seed coat becomes brittle and begins to pull away and wrinkle, as shown in Figure B. As the inside continues to expand, the seed coat eventually breaks, allowing the radicle to emerge.

The radicle is the embryonic root of the plant that emerges and grows down into the soil. The tip of the radicle is called the root cap. The root cap protects the root as it pushes its way through the soil.

The section of the root located just above the root cap is the region of meristematic activity. The cells that make up the root in this region divide rapidly and undergo elongation and enlargement. Because of this, the region of meristematic activity is ultimately responsible for growth of the root length-wise.



Figure A

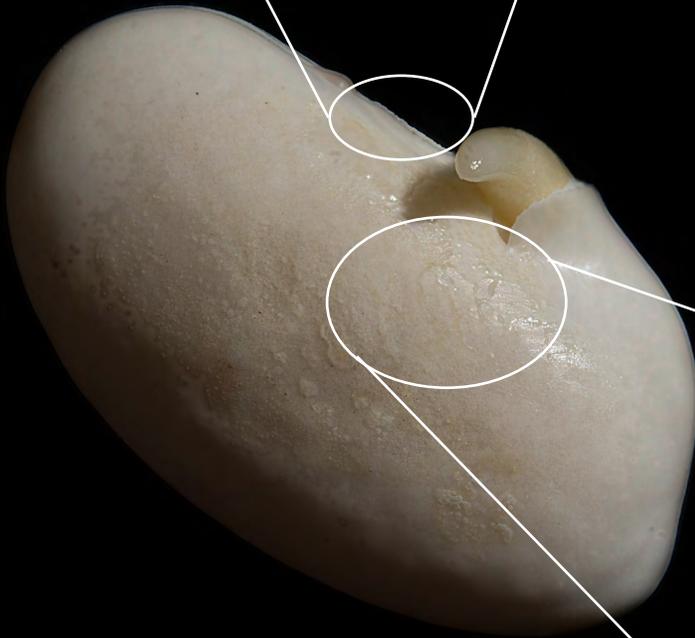


Figure B

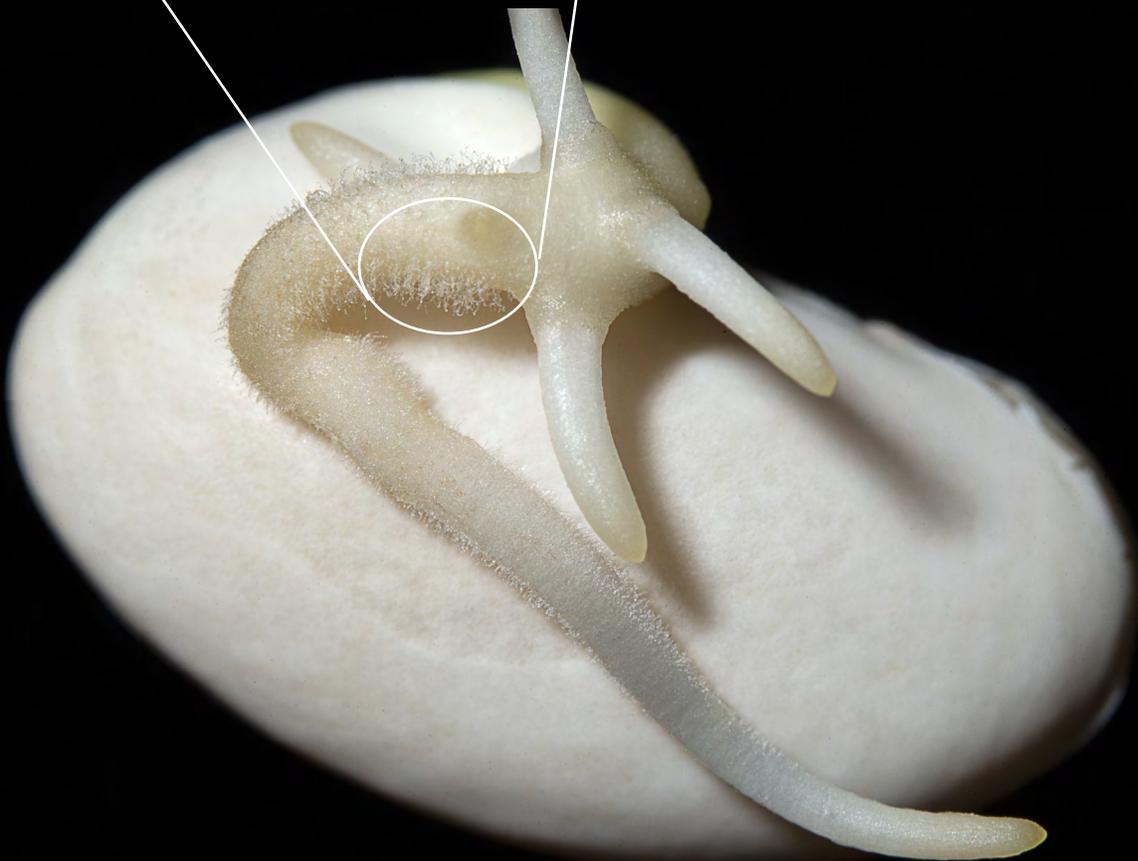
Maturation of the Root System

After the emergence of the radicle, the root system begins to develop. The bean plant grows a fibrous root system, meaning that it has many branches. The different branches of roots occupy a large amount of dirt in a shallow, compact area at the base of the plant.

The main root, or primary root, becomes the longest root and uses a root cap to push through the soil. From the primary root, emerges the secondary root system, sometimes called the lateral system. These laterals provide stability for the plant and absorb water and nutrients from the soil. In a fully mature plant, the roots will extend to approximately 24 inches.

The small, hair-like structures, shown in Figure C, are called root hairs. Like the laterals, they absorb water and minerals to feed the growing plant.

Figure C



Growth of the Hypocotyl



The hypocotyl is the stem of the germinating plant. It is the area of the plant located between the radicle and the cotyledons. The hypocotyl is considered an “extension” organ and pushes the seed coat and cotyledons through the soil and above ground to continue maturation. The stem is influenced by the phenomenon of phototropism, which means that the hypocotyl will grow towards the direction of sunlight.

The hypocotyl will eventually develop into a sturdy plant stem and act as a support structure. The stem is also a vascular structure, meaning that it carries water and nutrients from the roots to shoots of new growth.

The stem is made up of nodes and internodes. The nodes are the buds that will form into flowers. The internodes are the spaces between the nodes. Lastly, stem tissue called meristems generate new plant cells as the plant grows.

Emergence of the First Leaves

In this phase of growth, the first seed leaves begin to mature. The green bean seed is considered a dicotyledon, meaning that it produces two seed leaves within the cotyledons. This part of the germination process of a green bean is also called hypogeal germination. This means that the cotyledons mature above ground rather than below.

The purpose of the leaves is to act as the “first leaves” and provide the growing plant with nutrients through the process of photosynthesis. As the leaves mature and the plant grows, the cotyledons will eventually degenerate and detach from the hypocotyl.

After the emergence of the first leaves, the plant will continue to mature for approximately six weeks. Around that time, the plant will enter the reproductive stage and begin to flower.

Resources:

<http://textbook.s-anand.net/ncert/class-11/biology/5-morphology-of-flowering-plants>

<http://www.ext.colostate.edu/mg/Gardennotes/132>.



Figure D

