Name _____Class _____Date _____

# *Laboratory Investigation 13F*

Chapter 13B: The Environment and Plant Responses

# Plants:
# Tropisms in Seedlings

You may refer to pages 202-206 in your textbook for a general discussion of tropism.
Time required: 25 minutes

**Background Material**

tropism – the growth responses of plants to their environment
a plant's directional growth response to a physical stimulus
the growth of plants in response to external stimuli such as light, gravity, or contact
positive: when the plant grows *toward* the stimulus
negative: when the plant grows *away from* the stimulus

types of tropism:

1. phototropism – light
   plant's response to light
   positive phototropism - turns toward light (stem and leaves)
   negative phototropism - away from light (roots)
2. geotropism – gravity
   plant's response to gravity
   positive geotropism - grows toward the pull of gravity (roots)
   negative geotropism - grows away from the pull of gravity ( stem and leaves)
3. thigmotropism - touch
4. chemotropism - chemicals
5. hydrotropism - water

Plants and Light

Characteristics of light that are significant for plant growth:

1. Intensity
   etiolated - the condition of a plant when grown in the absence of light
   elongated stems with small, pale leaves
2. Duration
   duration - the length of daylight
   affects the photoperiodism of plants
   the chief factor affecting flowering

photoperiodism – the response of a plant to changes in the length of daylight
(the reponses of a plant to changes in light intensity and length of days)
It often determines whether or not a plant produces flowers.
Some plants can accurately measure the length of light and darkness to within minutes so they will flower at precisely the right time of year.

Short-day plants: plants that flower when exposed to less than 12 hours of sunlight
(bloom when the days are short and the nights are long)
examples: chrysanthemums, corn, strawberries, apples, soybeans, violets, ragweed
flower naturally out-of-doors in the early spring or in late summer and fall

Nurserymen can delay the natural blooming schedule by placing the chrysanthemums in a greenhouse and illuminating them for a short period of time during the night. The plants repond to this lighting arrangement just as they would to days consisting of long periods of sunlight. The flowering hormone is not formed, and the flowering of these plants is artificially delayed. When the nurserymen are ready for the chrysanthemums to flower (usually in Oct. or Nov. - in time for football season), they suspend the nightly periods of illumination. This same procedure has been used successfully with other short-day plants such as poinsettia, dahlia, and aster.

Long-day plants: require more than 12 hours of light
bloom with long periods of light and short periods of darkness
generally flower during late spring and summer
examples: clover, gladiolus, sunflowers, beets, lettuce, grains

Neutral-day plants: flower independently of a photoperiod
bloom whenever conditions like moisture and temperature are acceptable regardless of the amount of light or darkness
usually flower continuously if other conditions (temp., moisture, etc.) are favorable
examples: tomato, dandelion, hybrid roses, beans, zinnias, cotton

## Materials

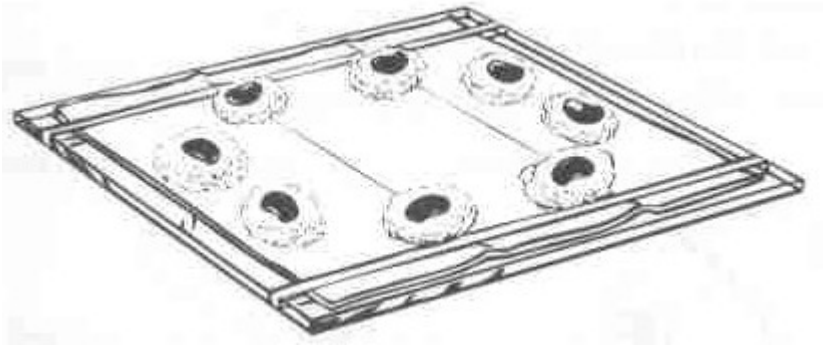
bean seeds, cotton, eyedropper, CD case, lamp, plastic or Styrofoam egg cartons, shoe boxes, cups, soil

## Procedure

***Experiment 1***

**Setting up**

1. Place four cotton balls in the CD case; then place bean seeds in the center of each cotton ball. Be sure that the bean seeds "face" up, right, left, and down, as indicated in the diagram.
2. Slowly wet the cotton.
3. Close the CD case and place it in the holder (egg carton). Make sure the hole to water is on top.
4. Set this assembly in a dark, warm area.



## Procedures and observations

1. Using an eyedropper, daily add water to the assembly.
2. Observe the bean seeds daily.
3. Once the seeds begin to grow, record their growth patterns on the chart. Record the growth of the root and the stem shoots.

## Summing up

1. What is geotropism? _____

2. Did the roots of the bean seedlings exhibit positive geotropism or negative geotropism? _____

3. Did the stems of the bean seedlings exhibit positive geotropism or negative geotropism? _____

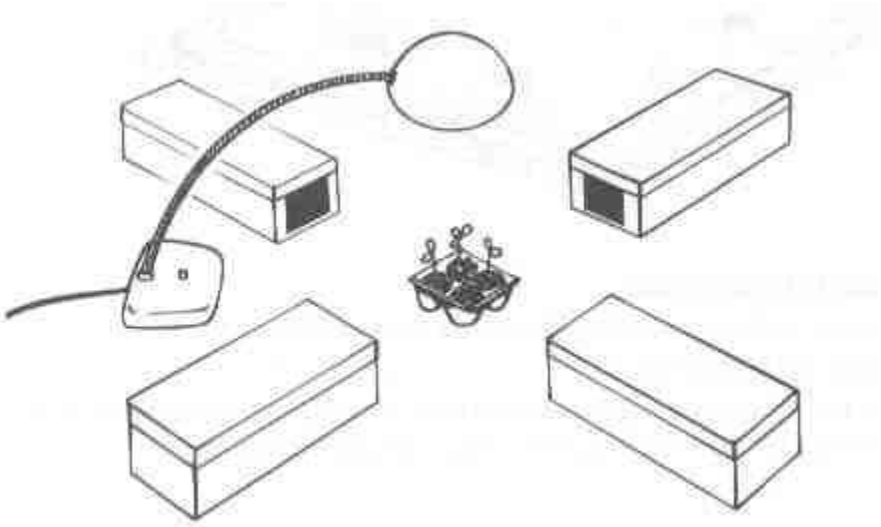
4. Did the way in which the seeds were positioned affect their response to geotropism? If so, what were the differences?

_____

***Experiment 2***

**Setting up**

1. Fill 5 cups with potting soil and plant a 2 bean seeds in each cup.
2. Prepare four shoe boxes by cutting an 8-by-8-cm hole in the end of each. Number the boxes 1-4.
3. Water the seeds. Keep the soil moist, but not too wet.
4. When the first seedlings break through the soil, begin the experiment.



## Procedures and observations

1. Place a cup containing sprouting bean seeds in each of the shoe boxes. The cup should be on the side farthest from the hole. Arrange the shoe boxes around a lamp as indicated in the diagram.
2. Place the *fifth* set of sprouting bean seeds below the lamp.
3. Continue keeping the soil moist but not wet.
4. Observe the seedlings daily for several days. Record your observations in the chart below.

| Date | Box 1 | Box 2 | Box 3 | Box 4 | Center |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Summing up**

5. What is phototropism?

   _____

6. Did the plants in the boxes exhibit positive or negative phototropism?

   Plants in box 1: _____

   Plants in box 2: _____

   Plants in box 3: _____

   Plants in box 4: _____

   Plants in the center section: _____

7. Was there any significant difference in appearance between the five different sets of plants? If so, what was the difference?

   _____

   _____

8. Can you account for any difference in the appearance between the plants that were in the boxes and the ones that were in the fifth section?

   _____