wrong	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		Group Name
right	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45		
score	100	98.4	96.8	95.2	93.5	91.9	90.3	88.7	87.1	85.5	83.9	82.3	80.6	79.0	77.4	75.8	74.2	72.6		

Growth Hormones

Name _____

Today you will investigate the role of gibberellic acid, in causing stem growth.

A. Observations: There are two different types of pea plants. In American gardens we plant mostly dwarf varieties ('Little Marvel' or 'Sugar Bon') that attain a height of less than 1 meter. Gregor Mendel, an Austrian monk, discovered the basis for modern genetics and biotechnology working with tall European peas ('Alaska' or 'Sugar Snap'). Most of these grow to a height of several meters and are trained up poles or fences.

B. Question: Why is the dwarf plant short?

C. Hypothesis: The dwarf plant is short because it cannot produce an essential hormone.

D. Prediction: If the hypothesis is true, then

1. Dwarf plants should grow taller than controls when treated with the missing hormone
2. Tall plants should grow less than untreated controls when they are treated with an inhibitor of the synthesis of the hormone

E. Experiment: Earlier in the term, you treated young dwarf and tall pea plants with various sprays. Retrieve the pots labeled "Untreated Control," "Water Spray," "GA Spray," and "B9 Drench" for each variety of pea. The untreated control plants were not sprayed with anything. The water spray plants were sprayed with distilled water containing a detergent. The GA spray plants were sprayed with distilled water containing a detergent and 10^{-4}M gibberellic acid (GA). The B9 Drench plants were drenched with 75 ml of distilled water containing a detergent and 0.5% B9 (2t/l). The detergent is used in each treatment to help wet the waxy surfaces of the leaves so that the chemical solutions can be absorbed. GA is a natural plant hormone and is routinely used to stimulate grass growth in the "roughs" of golf courses and to cause seedless table grapes to grow to a full size. B9 is a potent inhibitor of the enzymes that make GA in plants and is routinely used to keep tall plants like geraniums, chrysanthemums and poinsettias dwarf without resorting to pruning. You will now observe the growth of the pea seedlings that have been treated with these sprays. You should have thinned the plants to five uniform individuals per pot. If you need to cull each treatment to five plants per pot.

1. Height of plants. Measure the height of the five plants in each pot. Record the heights to the **nearest whole centimeter**. Calculate the mean height for plants in each pot.

	Dwarf Variety					Mean (cm)	Tall Variety					Mean (cm)
Untreated Control						.						.
Water Spray						.						.
GA Spray						.						.
B9 Drench						.						.

2. Number of internodes. Count the number of internodes on each of the plants in each pot. Calculate the mean number of internodes for the plants in each pot.

	Dwarf Variety					Mean	Tall Variety					Mean
Untreated Control						.						.
Water Spray						.						.
GA Spray						.						.
B9 Drench						.						.

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3. Size of leaf. Measure the length of the [ ] leaf on each plant and calculate an average leaf length for each treatment. CAUTION: The leaves are compound and may end in a tendril. Measure to the **nearest whole centimeter**.

	Dwarf Variety					Mean (cm)	Tall Variety					Mean (cm)
Untreated Control						.						.
Water Spray						.						.
GA Spray						.						.
B9 Drench						.						.

4. Return the pots to the designated area.

F. Analysis:

1. For the dwarf variety, compared to the water spray treatment, the GA treatment:

increased	had no effect on	decreased	the plant height
increased	had no effect on	decreased	the number of internodes
increased	had no effect on	decreased	the leaf size

2. For the dwarf variety, compared to the water spray treatment, the B9 treatment:

increased	had no effect on	decreased	the plant height
increased	had no effect on	decreased	the number of internodes
increased	had no effect on	decreased	the leaf size

3. For the tall variety, compared to the water spray treatment, the B9 treatment:

increased	had no effect on	decreased	the plant height
increased	had no effect on	decreased	the number of internodes
increased	had no effect on	decreased	the leaf size

For the following two questions, calculate the effect of each treatment using the formula:

$$\left[\frac{\text{treatment height - control (water spray) height}}{\text{control height}}\right] \times 100$$

Write each value in the large area and check the appropriate checkbox.

	Dwarf Variety	Tall Variety
4. Which variety did GA stimulate most?	☐	☐
5. Which variety did B9 inhibit most?	☐	☐

G. Decision: The hypothesis: "The dwarf plant is short because it cannot produce an essential hormone"

is: rejected not rejected

What is the primary target of gibberellic acid?

leaves
leaf size
internodes
internode length

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