

The Hormonal and Genetic Basis for Stem Growth

There are two different types (morphs) of pea plants. In American gardens we plant mostly dwarf varieties that attain a height of less than 1 meter. Gregor Mendel, an Austrian monk, discovered the basis for modern genetics and biotechnology working with older European varieties. Most of these grow to a height of several meters and are trained up poles or fences. The American dwarfs are mostly simple mutants of the tall European types.

Our model for testing is that the tall varieties produce a growth hormone in abundance and are therefore tall. The genetic dwarfs either do not produce any of this hormone, or they produce an amount insufficient to stimulate much stem growth.

Two weeks ago you planted four pots each of a dwarf variety (Little Marvel or Sugar Bon) and a tall variety (Alaska or Sugar Snap). This quantity of pots allowed you room for a simple experiment with controls.

Last week you and/or your partner sprayed one pot of plants with 10^{-4} M GA_3 (plus detergent) spray, one pot of plants with detergent water spray, and drenched the soil in one pot with 75 mL of a 2T/L solution of B-Nine (plus detergent). B-Nine blocks a step in the biosynthesis of gibberellic acid. I'm sure you know what was the appropriate action for the fourth pot of each variety.

Gather the data necessary to document how the two varieties grow in each condition. How do you assess growth of a plant? How will you measure each component of growth? You will want to be able to compare differences between varieties and between treatments (and controls). You will want to organize your data collection process so that you CAN answer your questions as unequivocally as possible. Be sure to use the metric system!

Use T-tests to make comparisons for analysis.

In your amplified abstract try to elucidate why the dwarf plant is short and the tall plant is tall. Can you manipulate the plants to make the dwarf tall and the tall dwarf? Do you see any potential commercial use for sprays of the type you used (are you entrepreneurial)? What is the genetic basis for dwarf peas? How are tall plants genetically different from the short plants? How could you observe the genetic expression more directly (other than the way you measured it here)?