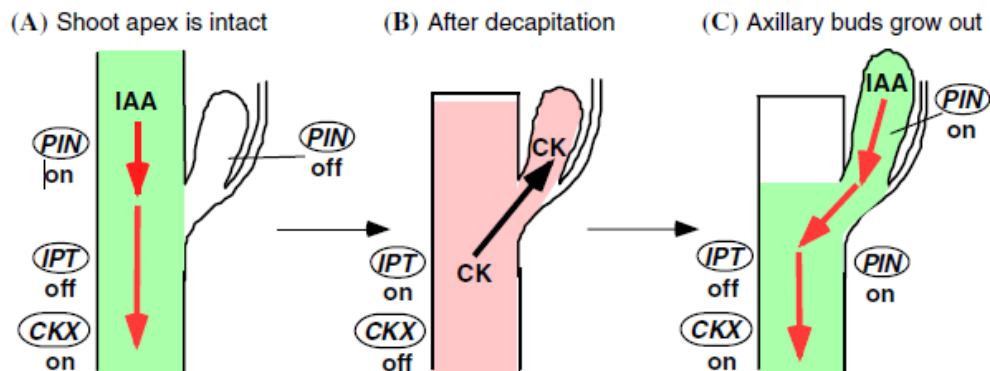


BIOL 442 – Plant Physiology

Lab 12: Apical Dominance

In a properly developing plant, axillary (lateral) meristems near the apex will tend to remain dormant due to the influence of the apical meristem. Auxin, or indoleacetic acid, from the apex is implicated in inhibiting the growth of the axillary meristems (among other things). Cytokinins may provide a signal to stimulate the axillary meristems. The plant nodes probably respond to a combination of these two hormones, rather than the absolute amount of either. One possible model of this process was suggested by Shimizu-Sato *et al.*, (2009):



In this model, auxin (IAA) from the shoot apex is transported towards the stem base (PIN auxin transport protein is active in the main stem, but not in the axillary bud). This auxin keeps the IPT gene associated with cytokinin (CK) synthesis off and the CKX gene associated with cytokinin oxidation on. Following decapitation and loss of the auxin signal, IPT is on and CKX is off, leading to cytokinin transport into the bud. As the bud begins to develop, it becomes a source of auxin which restores the previous state for dominance in the main stem. From this model of the combined effect of these two hormones, we can make some predictions about the effects of exogenous application of these hormones to a decapitated shoot or to the axillary meristems.

This experiment is designed to investigate the phenomenon of apical dominance as a process through which the apex of a shoot exerts control on the axillary buds below it (in a basipetal direction). We will observe the effects of apex removal, the application of the auxin IAA in place of the apex and the application of cytokinin to axillary buds on shoots with an intact apex. We will use bean plants (*Phaseolus vulgaris*).

Objectives:

- Observe the dominance of the apex over axillary meristems
- Observe the interaction between hormone signals on the expression of axillary buds

Materials:

toothpicks

razor blades

2 or 3-week-old bean plants (*Phaseolus vulgaris*)

Indole-3-acetic acid (IAA) or Indole-3-butyric acid (IBA). Both of these compounds work similarly. IAA is naturally found in plants. IBA is a synthetic analog.

6-benzylaminopurine (BA), a cytokinin

Treatments should begin with 2 or 3-week-old plants. You should have prepared three plants per treatment for each of the four treatments (4 pots, 3 plants/pot) previously. Treatments will involve:

- (1) normal intact,
- (2) apex removed,
- (3) apex removed and IAA capped, and
- (4) intact apex, cytokinin applied to axillary buds.

Use a sharp razor blade for apex removal. The hormones will be prepared in lanolin for application. Take a toothpick with a generous amount of the lanolin and apply the lanolin to the stem at the proper place.

Observations and data presentation

Observe your plants weekly. It will not be necessary to make physical measurements of growth changes, but you should make notes of any new growth from axillary buds and the locations and numbers of these new growing shoots. Results can be presented in tabular form. Think carefully about the suggested role for (1) the shoot apex, (2) auxin, and (3) cytokinin in the process of apical dominance.

References

Shimizu-Sato S, M Tanaka, and H Mori. 2009. Auxin-cytokinin interactions in the control of shoot branching. *Plant Molecular Biology* 69:429-435.