

## GENERAL BOTANY Lecture 26 - Plant Growth Regulation

- I. Terminology and classification**
- A. Plant growth regulator - broad category of organic substances that, in minute amounts, promote, inhibit, or otherwise modify physiological processes.**
  - B. Other terms - plant hormones, phytohormones, plant growth substances, and plant growth regulators**
    - 1. PGRs - usually a broad term encompassing plant hormones**
  - C. Classes of PGRs (more specifically, plant hormones)**
    - 1. Auxins (IAA, NAA) - cell enlargement (with cell-wall modification)**
    - 2. Gibberellins (GA) - cell enlargement (less cell-wall modification)**
    - 3. Cytokinins (Kinetin, BA) - cell division**
    - 4. Growth inhibitors (ABA) - leaf abscission & fruit drop**
    - 5. Ethylene (ethylene) - senescence & ripening**
- II. Actions of the five plant hormones**
- A. Auxins (found in meristematic tissue)**
    - 1. Mechanism: IAA - cell-wall softening - extension - membrane RNA synthesis - cell-wall enzymes - new wall material - elongation**
    - 2. Auxin moves to the cells on the lower side of a horizontal organ, stimulating cell elongation and curvature**
    - 3. Actions of auxin**
      - a) Apical dominance mediated by auxin**
      - b) Auxin inhibits axillary buds**
      - c) Auxin stimulates adventitious roots**
      - d) Induction of seedless fruits by auxin (parthenocarpy)**
      - e) High concentrations can lead to distortion - retardation**
  - B. Gibberellins (found in fruit seeds, buds, young leaves, root tips)**
    - 1. Mechanism can be synergistic - works with auxin in cell elongation**
    - 2. Stimulates internode elongation**
    - 3. Can assist germination, sprouting, and flowering**
    - 4. Can lead to seedless fruits - male sterility**
  - C. Cytokinins (found in developing fruits and seeds)**
    - 1. Mechanism is generally cell division ("cytokinesis")**
    - 2. With auxin, cytokinin aids growth AND differentiation of tissue culture**
      - a) Parenchyma cells are generally used for tissue culture**
    - 3. Responses to cytokinin include shoot initiation, leaf enlargement, lateral bud growth, adventitious root formation, delay of senescence, and stimulation of germination**
  - D. Growth inhibitors - abscisic acid - (located near abscission layers)**
    - 1. Mechanism: increased RNA - enzymes - pectin hydrolysis - cellulase - organ "drop"**
    - 2. Also a stress hormone - ABA triggers stomatal closure**
    - 3. Abscisic acid stimulates senescence (aging) and dehiscence (splitting)**
    - 4. Can be used to shorten or retard plant growth**
  - E. Ethylene (present throughout the plant and especially in stressed tissue and in ripe fruits)**
    - 1. Ethylene is a gas which promotes senescence**
    - 2. Ethylene can be closely associated with auxin (With high 2,4-D, high ethylene....death)**
    - 3. Associated with rapid senescence in diseased and injured tissues**
    - 4. Can be used to increase girth in trees**
    - 5. Increases fruit ripening**
- III. Important point: the growth regulators exist and work together to regulate growth & development**