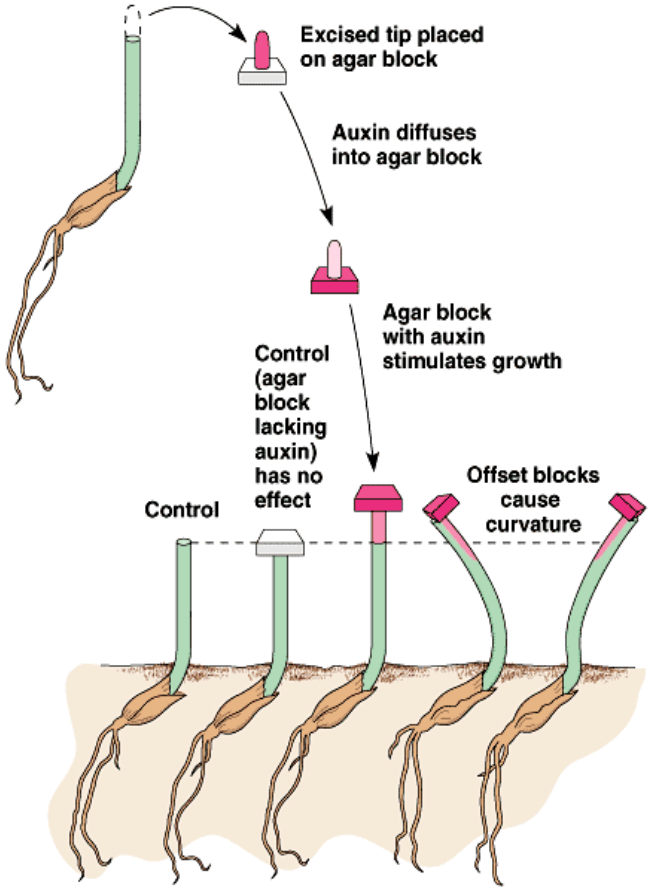
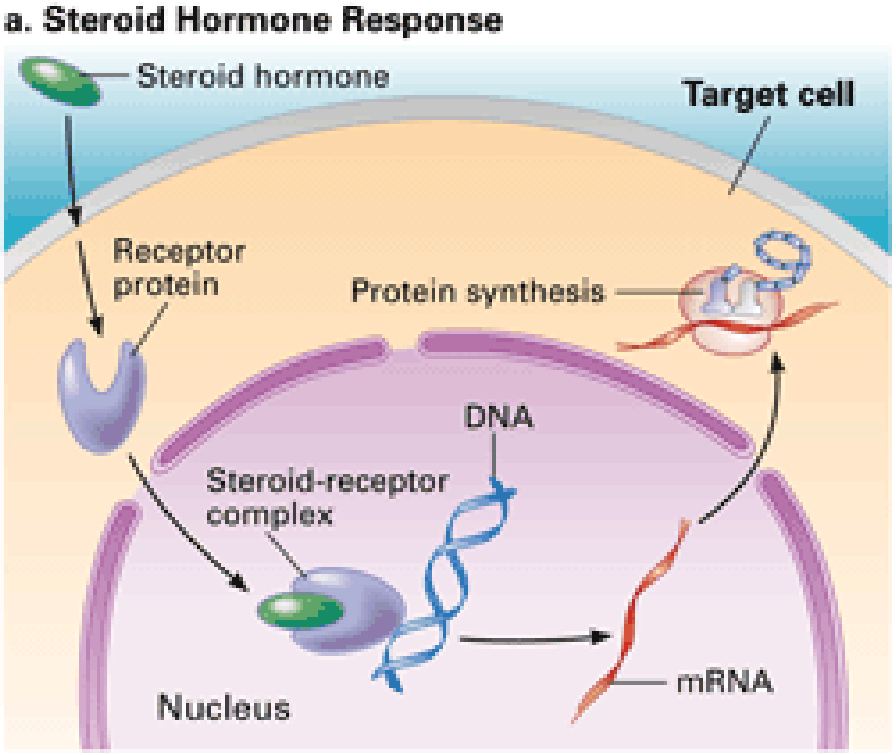
Ch39: Plant Responses

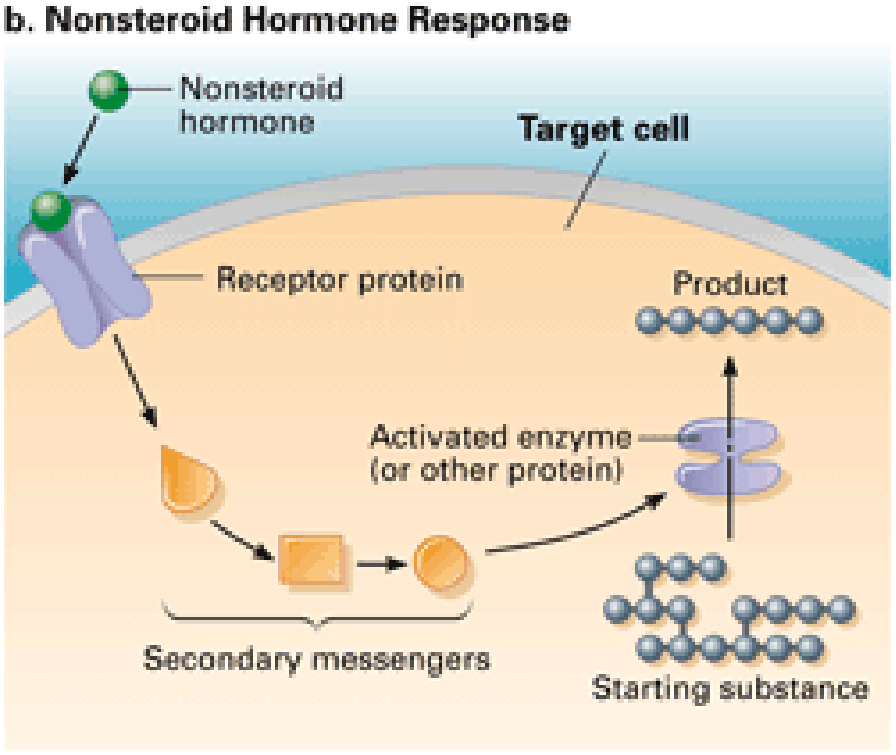
- **Hormone**: chemicals that signal and coordinate parts of an organism
  - produced in one part of the body, then transported to other parts of the body

- **Tropism**: movement toward or away from a stimulus

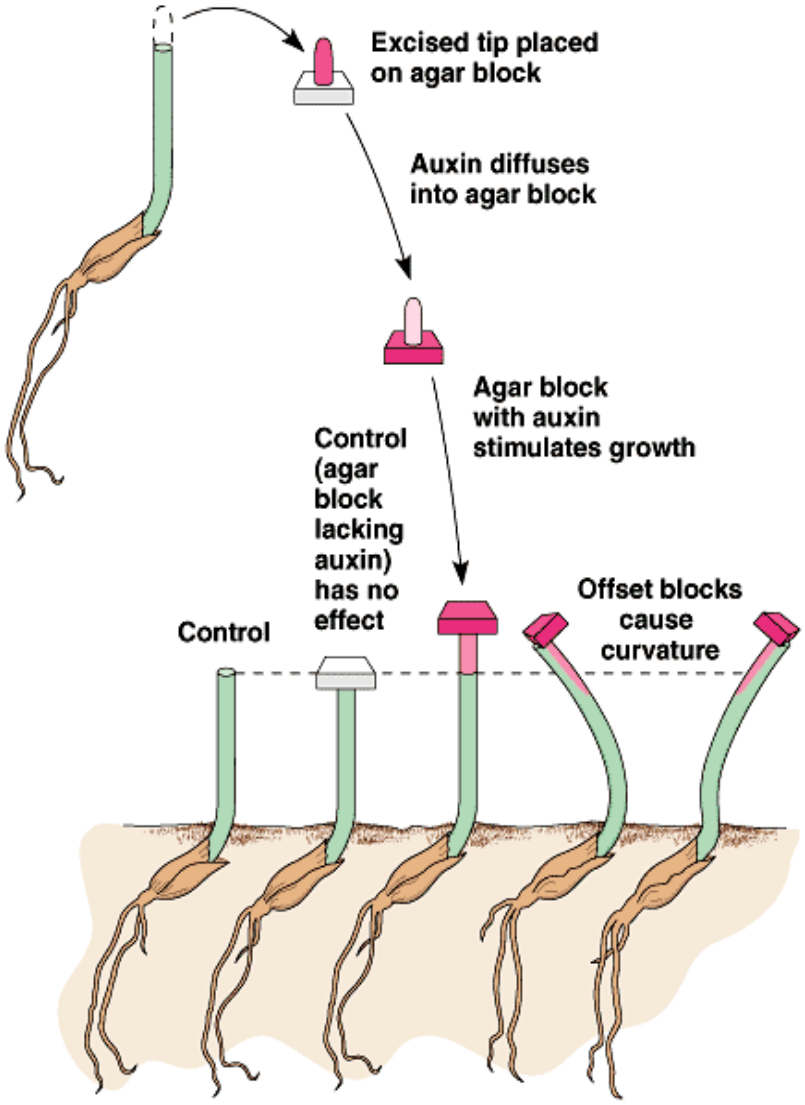


Hormone Pathways





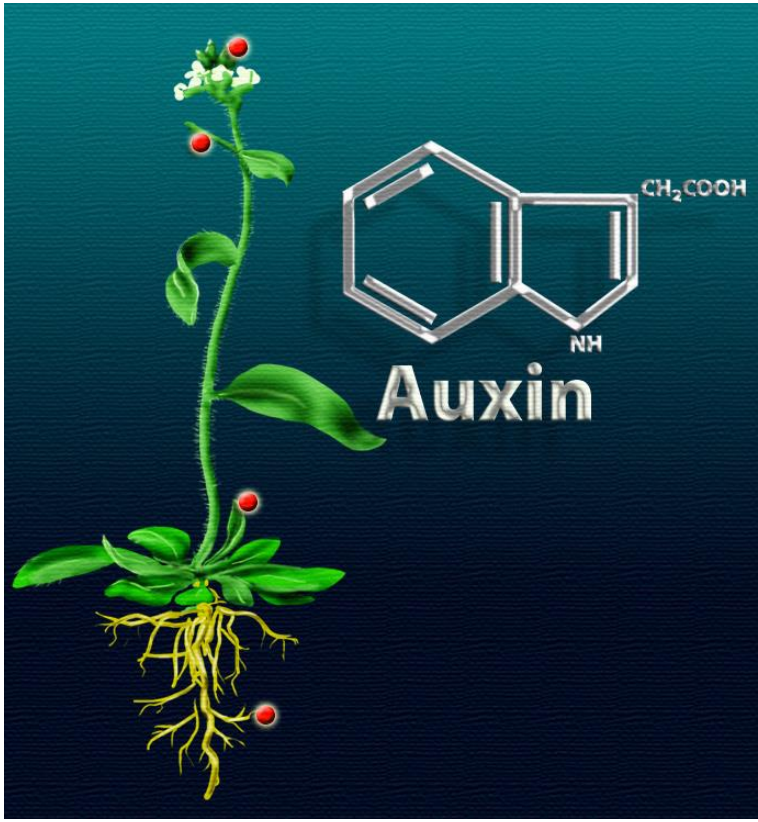
Plant Hormones



Auxin

- Location: ends of stems (apical meristems) and young leaves; seed embryo and fruits

- Function: **stem elongation, tropisms, and apical dominance**; root growth, differentiation, branching; fruit development; can be used as a herbicide at high levels



Cytokinins

- Location: roots (and actively growing tissues)
- Function: **cell division and differentiation;** root growth; germination; delay senescence (aging); apical dominance (w/ auxin)

Gibberellins

- Location: apical meristems and roots, young leaves, embryo
- Function: **germination of seed and bud**; stem elongation (w/ auxin); flowering and fruit development; leaf growth; root growth and differentiation

Brassinosteroids

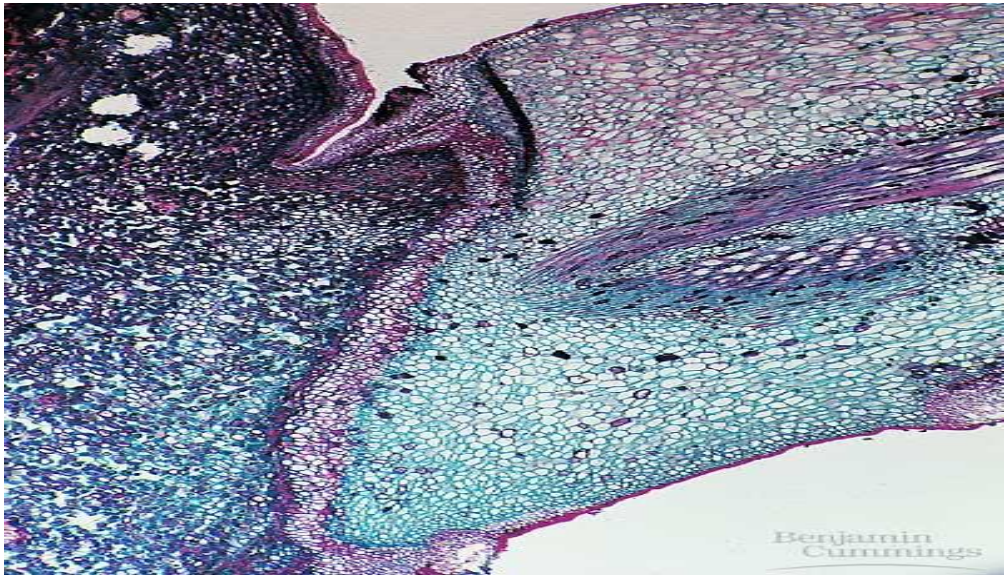
- Location: all plant tissues
- Function: stimulates cell elongation; **inhibits root growth**, retard leaf abscission, promote xylem differentiation
- Once thought of as a type of auxin

Abscisic acid

- Location: leaves, stems, roots, green fruit
- Function: **inhibits growth**; **closes stomata** (openings in leaves for gas exchange) during stress; promotes seed dormancy

Ethylene

- Gaseous hormone
- Location: ripening fruit tissue; stem nodes; aging leaves and flowers
- Function: **fruit ripening**; oppositional to auxin (leaf abscission); promotes/inhibits: growth / development of roots, leaves, and flowers; senescence and apoptosis



Plant Hormone Summary

- Auxin = stem elongation
- Cytokinin = cell division and differentiation
- Gibberellins = germination of seed and buds
- Brassinosteroids = inhibits root growth
- Abscisic acid = inhibits growth and closes the stomata
- Ethylene = fruit ripening

Tropisms – response to stimuli

- **Phototropism**: growth of a shoot in a certain direction in response to light
- **Gravitropism**: plant's response to gravity
- **Thigmotropism**: directional growth as a response to touch

- **Thigmomorphogenesis**: change in form that results from mechanical disturbance


SUN
I love
the light!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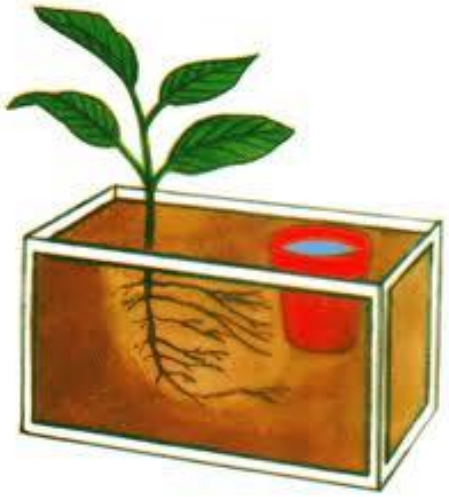
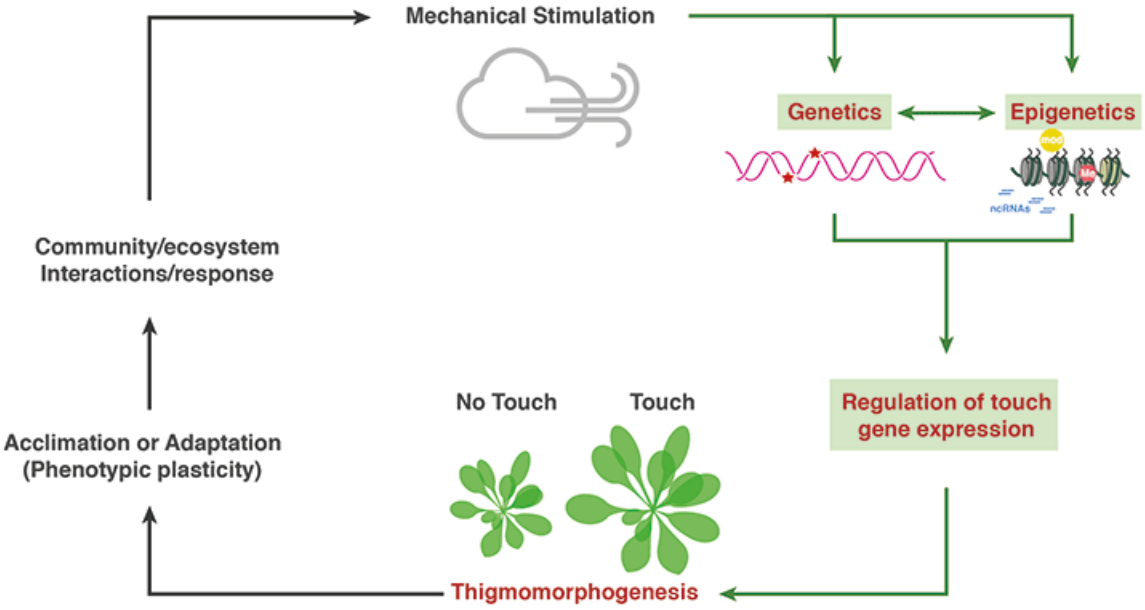



Mechanical Stimulation
Genetics
Epigenetics
ncRNAs
Regulation of touch gene expression
No Touch
Touch
Thigmomorphogenesis
Acclimation or Adaptation (Phenotypic plasticity)
Community/ecosystem Interactions/response

Tropisms – environmental factors

- **Drought**: guard cells lose tugor and stomata close; leaves stop growing and roll up to reduce transpiration
- **Flooding**: certain cells die which creates air tubes and cell respiration can continue
- **Heat stress**: produce heat shock proteins that prevent other proteins from denaturing
- **Cold stress**: plant alters composition of their cell membranes

Daily and Seasonal Light Responses

- *Blue light receptors:* initiate plant responses to light (opening stomata or phototropisms)

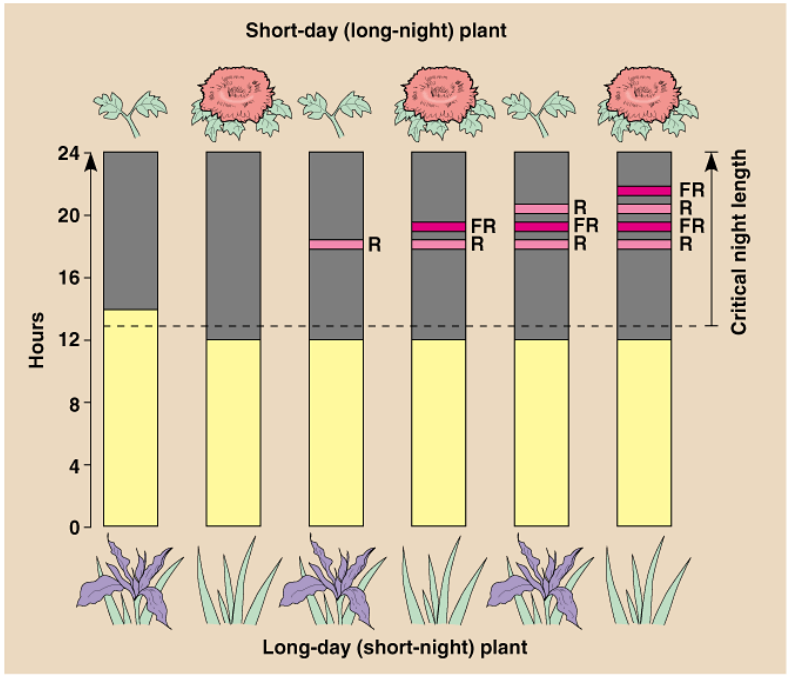
- ***Phytochromes*: light receptor; absorbs red light and triggers plants development due to light**

- *Circadian rhythm:* 24 hour physiological cycles; plants can assess the amount of daylight available
  - Leaves orient toward light during day and relax at night

- ***Photoperiodism:* response to relative lengths of light and dark**
  - *Critical night length:* controls when plants flower

Phytochromes

- Pigments involved in plants response to light
  - Ex: seed germination and shade avoidance
- Measures length of darkness in a photoperiod (red light)



- Short-day plant: require longer period of darkness to flower (flower in late summer, fall, or winter; poinsettias, chrysanthemums)
- Long-day plant: require a shorter period of darkness to flower (flower in late spring or early summer; spinach, radish, lettuce, iris)
- Day-neutral plant: unaffected by photoperiod (tomatoes, rice, dandelions)