

- Control Systems in Plants
 - Types of plant hormones
 - Auxins
 - Stem elongation, differentiation, apical dominance
 - Cytokinins
 - Cell division, germination
 - Gibberellins
 - Seed, bud, fruit development
 - Stem elongation (different than auxins)
 - Abscisic acid
 - Inhibits growth, closes stomata, prevents germination
 - Ethylene
 - Promotes fruit ripening, programmed cell death, leaf abscission, response to mechanical stress
 - Brassinosteroids
 - Normal growth and development, xylem differentiation, pollen tube elongation
 - Strigolactones
 - Apical dominance, germination, attract mycorrhizal fungi to the root
 - Examples of hormone function
 - Auxin in stem elongation
 - Apical meristem produces auxin
 - Transported down the shoot (only)
 - Produces a decreasing concentration gradient
 - High concentrations of auxin inhibit stem elongation
 - Low concentrations of auxin promote stem elongation by activating H⁺ active transport mechanisms
 - Auxin and Cytokinin in Apical Dominance
 - Auxins inhibit lateral shoot development
 - Cytokinins stimulate lateral shoot development
 - High concentration in roots, low concentration in stem
 - Opposite impacts on root branching
 - Key Features
 - Broad effects controlling major physiological processes
 - Most occur in antagonistic pairs
 - Plant Rhythms
 - Some plant processes (flowering, etc.) follow a daily cycle suggesting plants have rhythms
 - How do plants keep track of time?
 - How much of something is degraded or produced
 - Photoperiodism

- Some plants flower only when the days are long
 - Some flower only when the days are short
 - What is the mechanism?
 - Night length is what is critical
 - Plants contain pigments call phytochromes
 - o One part functions as a photoreceptor, the other a protein kinase
 - How does this control flowering?
 - Short day plant (long night)
 - At night Pfr is slowly naturally converted to Pr
 - Light flashes can reverse this process
- Chemical Signaling in Animals
 - o Two major systems
 - Endocrine:
 - Hormones secreted into blood stream
 - Nervous:
 - Neurotransmitters secreted into the synapse (junction) between neurons
 - o Differences
 - Endocrine system:
 - Broadcasts the signal throughout a broad area (via blood stream)
 - Nervous system:
 - Sends the signal directly to a target cell (via neuron/s)
 - o Similarities
 - Many hormones are neurotransmitters
 - Some neurons secrete hormones
 - Both systems involve cells communicating with other cells
- Types of Hormones
 - o Lipid soluble
 - Bind to cytoplasmic receptors
 - o Water soluble
 - Bind to membrane bound receptors
- Speed of Response
 - o Gene regulation:
 - Most often results in a slow response (steroid hormones)
 - o Direct Cytoplasmic Response:
 - Generally a rapid response (water soluble hormones)
- Endocrine Glands
 - o Glands that secrete (release) hormones into the blood stream

- o TABLE 45.1
 - Major ones, kinds, and functions
- o FIGURE 45.4
 - Left side only
- o Hypothalamus:
 - 2 types of hormones
- o Pituitary:
 - Posterior:
 - 2 hormones, secreted by neurosecretory cells in the hypothalamus
 - Anterior:
 - 7 hormones
 - Controls other endocrine glands
 - Portal vessels
 - o Heart → artery → capillary → portal vessels → capillary → vein → heart
- Endocrine System Regulation
 - o Antagonistic pairs
 - o Example: blood glucose levels
 - Glucagon, and insulin
 - Both produced by the pancreas
 - Glucagon
 - o Stimulates the breakdown of glycogen to glucose
 - Insulin
 - o Stimulates the conversion of glucose to glycogen
 - If blood glucose levels rise, what happens?
 - o Insulin released
 - If they fall, what happens?
 - o Glucagon released
 - If you eat a big meal and blood glucose levels rise sharply, what happens?
 - Insulin release increases
 - Six hours after that meal blood glucose levels are dropping, what happens?
 - Glucagon release increases
 - o Negative feedback system
 - Example: thyroid hormones, regulate overall metabolism
 - Hypothalamus → TRH⁺ → anterior pituitary → TSH⁺ → thyroid → thyroxine triiodothyronine → (-) → hypothalamus/anterior pituitary/thyroid
 - What would be expected to happen to the levels of TSH if the TRH receptors in the anterior pituitary are constantly bound and stimulated with TRH like active molecules?
 - Increase