

Endocrine System I

1. Overview

1. metaphor:

1. nervous system like telephone system
 1. only systems "wired up" get signals
2. endocrine system like radio.
 1. signals go everywhere but are received only by those who have receivers (receptors).

2. small & diffuse, yet powerful (0.1 kg of endocrine tissue/adult)

3. speed of action

1. nerves- fast, fractions of a second
2. endocrine- slow, seconds to days

4. range of action

1. endocrine- systemic
2. paracrine- local

2. Hormone Types & Chemistry

1. steroids

1. lipid soluble, therefore diffuse through plasma membranes of target cells
2. enter nucleus
3. bind to receptor
4. bind to specific sites on DNA
5. activate specific genes to transcribe mRNA
6. mRNA translated in cytoplasm

2. peptide or protein

1. overview

1. hormone receptor
2. signal transducer
3. effector enzyme
4. all interact to determine intracellular levels of cAMP

2. water soluble, therefore can't diffuse into cells

3. hormone (1st messenger) binds to receptors on plasma membrane

4. sets off series of reactions that activate or deactivate an enzyme

1. G protein hydrolyzes GTP to GDP
2. delivers signals to adenylate cyclase (ATP to cAMP)
3. catalyzes reaction that produces 2nd messenger (cAMP)

5. 2nd messenger causes changes/responses via protein kinases

1. phosphorylation
 1. activation
 2. inhibition

6. may activate different pathways simultaneously

1. e.g., fat cell response to epinephrine
 1. break down glycogen
 2. break down stored fat

7. amplification through cascade

8. phosphodiesterase degrades cAMP

1. PIP-calcium has 3rd messenger

3. eicosanoids

1. paracrine, local

1. prostaglandins- blood pressure, expulsion, clotting
2. leukotrienes- inflammation, allergic reactions

4. half-life, onset, & duration

1. rate of release
2. speed of inactivation/removal
3. onset- immediate to days
4. duration- 20 min. to several hours

5. control of release

1. endocrine gland stimuli

1. humoral

1. e.g., Ca^{++} in blood monitored in parathyroid

2. neural

1. e.g., sympathetic nervous system stimulation of adrenal medulla

3. hormonal

1. hypothalamus-pituitary-target loop

4. nervous system modulation

1. ability to override "set points"
2. e.g., stress can raise blood sugar