1. Both the _______________ system and the endocrine system affect all body cells.

2. Affect on target cells by the _______________ system is slow. Affect on target cells by the _______________ system is fast.

INTERCELLULAR COMMUNICATIONS

3. Hormones released through gap junctions provide _______________ communication between cells, allowing the cells to work as a unit.

4. In _______________ communication, hormones are released into the extracellular fluid, and travel a ___________ (long or short) distance to nearby cells.

5. In _______________ communication, hormones are released into the extracellular fluid and are taken up by the circulatory system where they travel a ___________ (long or short) distance to affect cells in tissues and organs.

6. In _______________ communication, neurotransmitters cross synaptic clefts to target cells.

7. In all forms of communication, except communication via gap junctions, target cells have specific _______________ for the hormones.

HORMONAL EFFECTS

8. Hormones affect target cells by _______________  _______________  _______________.

OVERVIEW OF ENDOCRINE SYSTEM

9. List the hormones (names and abbreviations) produced by these endocrine glands and tissues.

   Hypothalamus ______________________________________________________
   Pineal _____________________________________________________________
   Anterior pituitary ___________________________________________________
   Posterior pituitary _________________________________________________
   Thyroid ___________________________________________________________
   Parathyroid _________________________________________________________
   Pancreas __________________________________________________________
   Adrenal cortex _____________________________________________________
   Adrenal medulla ____________________________________________________
   Ovaries ___________________________________________________________
   Testes _____________________________________________________________
   Thymus ___________________________________________________________
   Heart ______________________________________________________________
   Kidney _____________________________________________________________
   Adipose tissue _____________________________________________________
   Digestive tract ____________________________________________________
10. Define prohormone._____________________________________________________
Define prehormone._____________________________________________________

STRUCTURAL CLASSIFICATION OF HORMONES - Define and list hormones in each category.
11. Amino acid derivatives_________________________________________________
     From tyrosine _______________________________________________________
     From tryptophan _____________________________________________________
12. Peptide hormones ______________________________________________________
     Peptides/glycoproteins _______________________________________________
     Short peptides ______________________________________________________

13. Lipid derivatives ______________________________________________________
     Eicosanoids _________________________________________________________
     Steroids ___________________________________________________________

MECHANISMS OF HORMONE ACTION - Describe the method of action.
14. G proteins and activation of cAMP second messengers ______________________
15. G proteins and inactivation of cAMP second messengers _____________________
16. G proteins and calcium as second messengers ______________________________
17. Effect of gene activity by steroid hormones ________________________________
18. Effect of gene activity by thyroid hormone _________________________________
CONTROL OF ENDOCRINE ACTIVITY - by hypothalamus (complex reflex)

19. Secretion of regulatory hormones
____________________________________________________________________
____________________________________________________________________

20. Production of ADH and oxytocin
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

21. Sympathetic output to adrenal medulla
____________________________________________________________________
____________________________________________________________________

CONTROL OF ENDOCRINE ACTIVITY - simple reflexes

22. Humoral stimuli
____________________________________________________________________
____________________________________________________________________

23. Hormonal stimuli
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

24. Neural stimuli
____________________________________________________________________
____________________________________________________________________
1. nervous
2. endocrine; nervous
3. direct
4. paracrine; short
5. endocrine; long
6. synaptic
7. receptors
8. activating genes to produce proteins; opening or closing ion channels; changing rate of metabolism
9. Hypothalamus - releasing hormones (RH); inhibiting hormones (IH):
   - antidiuretic hormone (ADH); oxytocin
   - Pineal - melatonin
   - Anterior pituitary - thyroid stimulating hormone (TSH); adrenocorticotropic hormone (ACTH);
     follicle stimulating hormone (FSH); luteinizing hormone (LH);
     growth hormone (GH); prolactin (PRL);
     melanocyte stimulating hormone (MSH)
   - Posterior pituitary - stores ADH and oxytocin
   - Thyroid - thyroxine (T₄); triiodothyronine (T₃); calcitonin (CT)
   - Parathyroid - parathyroid hormone (PTH)
   - Pancreas - insulin; glucagon
   - Adrenal cortex - cortisol/cortisones; aldosterone; androgens
   - Adrenal medulla - epinephrine (E); norepinephrine (NE)
   - Ovaries - estrogen; progestins; inhibin
   - Testes - testosterone; inhibin
   - Thymus - thymosins
   - Heart - atrial natriuretic peptide (ANP); brain natriuretic peptide (BNP)
   - Kidney - erythropoietin (EPO); calcitriol
   - Adipose tissue - leptin; resistin
   - Digestive tract - many hormones to be discussed in ch 24
10. prohormone - precursor to hormone; has minimal activity until converted to hormone
    prehormone - inactive molecule secreted by a gland; gets converted into active hormone
11. Amino acid derivatives - small molecules formed from the amino acids tyrosine and tryptophan
    (from tyrosine - T₃; T₄; E; NE; dopamine);
    (from tryptophan - melatonin)
12. Peptide hormones - chains of amino acids forming polypeptides, small proteins, glycoproteins
    (glycoproteins - TSH, FSH, LH, EPO, inhibin)
    (short peptides - RH and IH (regulatory hormones): ADH and oxytocin; ACTH, GH, PRL, MSH;
     ANP, BNP; insulin, glucagon; PTH; CT; leptin; resistin; digestive)
13. Lipid derivatives - eicosanoids (from arachidonic acid) and steroids (from cholesterol)
    (eicosanoids - leukotrienes, prostaglandins)
    (steroids - testosterone, estrogen, progesterone, mineralocorticoids, glucocorticoids,
     calcitriol)
    The activated G protein activates an enzyme (adenylate cyclase). This enzyme activates cAMP (second messenger)
    that opens ion channels (producing action potentials) or activates other enzymes (products synthesized).
15. The activated G protein activates an enzyme (phosphodiesterase [PDE]). This enzyme inhibits adenylate cyclase, resulting in increased cAMP breakdown.

16. The activated G protein causes opening of calcium ion channels or release of stored calcium. Calcium binds to calmodulin (a protein), activating other enzymes.

17. The steroid hormone diffuses across the plasma membrane into the cell and binds to a receptor. The steroid-receptor complex moves into the nucleus and binds to DNA. Specific genes are activated, and transcription and translation occur, forming proteins.

18. Thyroid hormone acts as a fat soluble steroid and crosses the plasma membrane into the cell where it binds to receptors on mitochondria and in the nucleus. The hormone-receptor complex in the nucleus affects protein synthesis. The hormone-receptor complex bound to mitochondria increases production of ATP.

19. Releasing and inhibiting hormones from hypothalamus target anterior pituitary, causing or inhibiting secretion of hormones.

20. Hypothalamus produces ADH and oxytocin which are stored in the posterior pituitary. Humoral stimuli cause ADH release from posterior pituitary. Neural and hormonal stimuli cause release of oxytocin from posterior pituitary.

21. Autonomic centers in hypothalamus directly stimulate adrenal medulla, causing release of catecholamines.

22. Humoral - changes in blood levels of ions (e.g. calcium) and nutrients (e.g. glucose) stimulate release of hormones from endocrine glands

23. Hormonal - hormones from endocrine glands (e.g. RH and IH from hypothalamus) stimulate release of hormones from other endocrine glands (e.g. GH, PRL, TSH, ACTH, FSH, LH from anterior pituitary)

24. Neural - neurotransmitters from sympathetic nervous system stimulate hormone release from adrenal medulla