I. DEFINITIONS
   A. Endocrine Gland
   B. Hormone
   *Chemical messenger produced by a ductless gland or tissue and carried in the blood*
   C. Neurohormones
   *Chemical messenger produced by a nerve but may or may not carried in the blood to a target organ*
   C. Receptors
   Where hormones bind to (at the tissue or target cells)

II. Control systems for hormone secretion and regulating reproduction

   Nervous system job: Translation of external stimuli into neural/chemical signals which affects activities of reproductive organs and tissues

   Adapted from Pathway to Pregnancy and Parturition (Senger©)

III. Endocrine and Neuroendocrine System

   Hormones are released from glands instead of nerves

   Hormones must reach to the target tissue via blood circulation to cause a physiological change

IV. Characteristics of Reproductive Hormones

   a) Hormones are released in small amounts, b) They have a short half-lives; c) They must bind to receptors to cause an action

V. TYPES OF HORMONES

   A. Proteins & Peptides (Figures 5-7 and 5-8)
      1. Made of amino acid chains
      2. Water soluble
3. Not orally active

**Peptide** - Few to Several amino acids e.g. GnRH, oxytocin

**Protein** - Long chains of amino acids e.g. prolactin

B. Steroids (Figures 5-9 and 5-10)
   1. Made from cholesterol
   2. Water insoluble, attach to proteins in blood
   3. Are orally active
   4. All have 4-carbon ring structure

Examples: Testosterone, Estrogen, Progesterone

C. LIPIDS (Figure 5-11)
   1. Prostaglandins

VI. Hormones Receptors

They are two types of receptors

1) **Plasma membrane receptors** (Fig 5-14)

Protein hormones usually bind to this kind of receptors at the cell membrane

Mode of action: *(2nd messenger system)*

Peptides/proteins $\rightarrow$ bind cell membrane receptor $\rightarrow$ activate adenyl cyclase $\rightarrow$ [ATP $\rightarrow$ cAMP]
$\rightarrow$ cAMP $\rightarrow$ protein kinase (enzyme) $\rightarrow$ protein phosphorylation $\rightarrow$ protein synthesis

Adapted from Pathway to Pregnancy and Parturition (Senger©)

2) **Nuclear receptors** *(Cytoplasmic receptors, intracellular receptors)*
   (Fig 5-15)

The receptors are inside of the cell either in the cytoplasm or in the nucleus

Mode of action: (involves nucleus directly)

steroids $\rightarrow$ bind to cytoplasmic receptors $\rightarrow$ translocate to nucleus $\rightarrow$ bind to chromatin $\rightarrow$ initiate transcription $\rightarrow$ RNA synthesis $\rightarrow$ protein synthesis

Adapted from Pathway to Pregnancy and Parturition (Senger©)
III. PROTEIN HORMONES

A. Control of Pituitary Hormones
   1. The hypothalamus (Figure 5-5 and 5-6)
   2. Uses controlling substances GnRH
      Causes the release of **Luteinizing Hormone and Follicle-Stimulating Hormone**
   3. Uses the pituitary portal system (text Fig. 5-4)
   4. Controlling substances altered by feedback loops
      a. Long loop feedback X involves distant target organ
      b. Short loop feedback X retrograde blood flow
      c. Ultra short loop feedback X controlling substances inhibits itself

B. Pituitary Gland: 2 parts (Figure 5-5 and 5-6)
   1. Anterior pituitary
   2. Posterior pituitary

C. Anterior Pituitary Hormones
   1. **Luteinizing Hormone (LH)**
      a. Ovulation
      b. Corpus luteum formation & function
      c. Testosterone production
   2. **Follicle-Stimulating Hormone (FSH)**
      a. Follicle growth
      b. Estrogen release
      c. Spermiogenesis
   3. **Prolactin**
      a. Protein synthesis by mammary gland, control CL function in some species
   4. **Adrenocorticotropic Hormone (ACTH)**
      a. Glucocorticoid release at parturition or stress situation

IV. CONTROL OF ANTERIOR PITUITARY HORMONES (TABLE 5-2)

A. LH & FSH
   1. **Gonadotropin releasing hormone (GnRH)**
      a. Causes LH/FSH release
      b. 10 amino acids long (synthetic available)
      c. Active in very small amounts
      d. Uses in reproduction:
         (1) cystic follicles
(2) out-of-season breeding
(3) contraception

2. Inhibin
   a. From testes & ovaries
      (1) Sertoli cells
      (2) granulosa cells
   b. Inhibits FSH release

B. Prolactin
   1. Under inhibitory control
      a. Dopamine
   2. Prolactin releasing hormone
      a. Thyrotropin releasing hormone: causes TSH release

C. ACTH
   1. Corticotrophin releasing hormone

V. POSTERIOR PITUITARY (TABLE 5-1, 5-6)
   A. Site of Hormone Release, NOT Synthesis
   B. Has Neural Connections to Brain i.e. hypothalamus
   C. Hormones Made in Hypothalamus & Released at Posterior Pit
   D. Control of Hormone in Brain
   E. Reproductive Hormones
      1. Oxytocin
         a. Milk letdown
         b. Uterine contractions X parturition & sperm transport
         other hormone is Anti Diuretic Hormone (ADH)

VI. OTHER PROTEIN HORMONES (TABLE 5-2)
   A. Inhibin: inhibits FSH release
   B. Relaxin
      1. Important in parturition
         a. Pelvic expansion
         b. Cervical dilation

VII. STEROID HORMONES (TABLE 5-2)
   A. Made at Many Different Sites
   B. Estrogens (estradiol): secreted from ovarian follicles and placenta
      1. Estrus: mating behavior
2. Mammary growth & development
3. Secondary sex characteristics

D. Progestins (progesterone): secreted from CL and placenta
   1. Maintain pregnancy
   2. Mammary growth

C. Androgens (testosterone): secreted from Leydig cells of the testis
   1. Male behavior
   2. Spermatocytogenesis
   3. Maintain accessory sex glands

E. Glucocorticoids (cortisol)
   1. Parturition
   2. Milk synthesis

VIII. LIPID HORMONES (FATTY ACIDS) (TABLE 5-2)

A. Prostaglandin F2a: secreted from Uterus (Endometrium)
   Target: Hypothalamus, Somniferous tubule, Accessory sex glands, uterus a, and CL

B. In Female
   ✔ Control of estrous cycle and luteolysis
   ✔ Communicates with the ovary as to presence of embryo
   ✔ Determines the life of the corpus luteum (CL)