Sex Hormones and the Menstrual Cycle

Sex Steroids

- Sex steroid hormones are lipid molecules derived from cholesterol.
- Three classes of sex steroids regulate sexual functions:
  - Progestins
    - Menstrual cycle
  - Estrogens
    - Feminizes body
    - Growth inhibitor
    - Menstrual cycle
  - Androgens
    - Masculinizes body
    - Libido
    - Anabolic (growth) effects
Testosterone

• Testosterone is a sex hormone found in both men and women.
• It is secreted by the gonads (testes in men, ovaries in women) and by the adrenal cortex.
• Leydig cells in the testes and thecal cells in the ovaries secrete testosterone.

Testosterone (cont’d)

• In men, testosterone levels in the blood peak every 2–4 hours; mean levels are higher during the night and in the morning than in the afternoon and evening.
• In women, testosterone levels vary over time, with the highest levels at ovulation.
• Women, during peak times, have about one-tenth the average testosterone level of men.
• Sertoli cells (in testes) convert testosterone to DHT, which aids in the maturation of sperm.
  – Also involved with development of male external genitalia.
5.2 Testosterone cycles in a man

![Testosterone cycles graph]

- Estradiol is synthesized from testosterone in both sexes by the enzyme aromatase.
- Estradiol feminized body at puberty, increases bone density, ends growth of limbs at puberty, involved with menstrual cycle.
- In men, Leydig cells (in testes) are the main sources of estradiol.
- In women, granulosa cells produce estradiol within ovarian follicles.
- Cells in the central nervous system also possess the enzyme aromatase and are able to convert testosterone to estradiol.
5.3 Estrogen factory

- Progesterone is essentially a female hormone secreted by the follicular granulosa cells.
- It is present at high levels during the luteal phase of the female menstrual cycle and at even higher levels during pregnancy.
- After ovulation, the ruptured follicle becomes the corpus luteum, which secretes progesterone into the bloodstream to make the endometrial lining of the uterus suitable for implantation and pregnancy.
Protein and Peptide Hormones

- Protein and peptide hormones are polymers of amino acids; proteins are longer polymers, peptides are shorter.
- Oxytocin and gonadotropin-releasing hormone (GnRH) are two peptide hormones synthesized by neuroendocrine cells in the hypothalamus.
- Oxytocin is released from the pituitary gland during orgasm, breast-feeding, and childbirth.

Testosterone in Men

- In men, testosterone supports the growth of genital tissues, influences the erectile capacity of the penis, influences the central nervous system, promotes the formation of red blood cells and musculature, and stimulates sexual feelings and behavior.
- GnRH from the hypothalamus stimulates secretion of the gonadotropins from the anterior pituitary.
- LH and FSH stimulate the testes to produce hormone secretion and to manufacture sperm.
Testosterone in Men (cont’d)

- The effects of GnRH on LH secretion (positive), of LH secretion on testosterone secretion (positive), and of testosterone on GnRH and LH secretions (negative) control testosterone levels to keep them in the normal range.
- Inhibin from the Sertoli cells of the testes depresses FSH production by the pituitary to regulate sperm production.

Estradiol in Men

- In men, estradiol facilitates the maturation of sperm, terminates the growth of the limb bones at the conclusion of puberty, and maintains normal bone density.
- Estrogen receptors are distributed throughout the body, thus likely impacting the function of many tissues and organs.
Menstruation and the Menstrual Cycle

- Menstruation is the sloughing off of the endometrial lining of the uterus; it lasts from 2 to 6 days and involves a total loss of 2–6 ounces of blood and endometrial tissue discharged through the vagina.

- The menstrual cycle begins at puberty and varies in length from 20 to 36 days between women. The menstrual cycle may vary from one cycle to the next in the same woman; it ceases during pregnancy and for some time during breast feeding.

- The three phases of the menstrual cycle are the menstrual phase (when menstruation occurs), the follicular phase (between menstruation and ovulation), and the luteal phase (after ovulation to the beginning of the next menstruation).
Menstruation and the Menstrual Cycle (cont’d)

- The menstrual phase is triggered by a drop in progesterone and estrogen levels and a rise in LH and FSH levels.

- In the follicular phase, the ovarian follicles mature, one follicle becomes dominant, and ovulation releases the ovum from the ovary.

- High estrogen levels trigger an LH surge, leading to ovulation.

Menstruation and the Menstrual Cycle (cont’d)

- During the luteal phase, the corpus luteum forms from the remains of the dominant follicle and secretes progesterone, which causes the endometrium of the uterus to thicken and prepare itself for implantation. If implantation does not occur within about 14 days, menstruation begins and the cycle repeats itself.

- Although women experience sexual feelings and engage in sexual behavior at all phases of the menstrual cycle, interest in sex tends to peak in the late follicular phase when testosterone levels are high.
• Progesterone influences body temperature, mood, and fluid retention in the body. The fall in progesterone levels toward the end of the luteal phase may result in premenstrual syndrome (PMS) in some women.