Sex Hormones
Female Reproduction
Male Reproduction

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The earliest hormonal change heralding the onset of puberty is increased secretion of androgens (dehydroepiandrosterone, dehydroepiandrosterone sulfate) from the adrenal cortex. The level of these hormones increases progressively from the age of 6 to 8 years.
Melatonin
Melatonin

GnRH rises and puberty occurs as melatonin declines.
Male Reproductive Function
Testosteron-Dependent Changes at Puberty

- Penis and testes enlarge and become pigmented
- Growth of facial, pubic and axillary hair. Hair appears also on chest and extremities.
- Increase of rate of long bone growth (3 inches per year).
- Deepping of voice because of vocal cords and larynx enlargement.
- Increase of muscle mass and thickness of skin.
Function of Sertoli cells

- **maintenance of blood-testes barrier** which prevents many substances from entering or leaving the seminiferous tubules.
- **removal** of any damaged germ cells.
- **keep** the sperm in the tubules from diffusing into the blood.
- **production** of seminiferous tubular fluid
- **nourishment** of developing germ cells
- **synthesize of ABP** (androgen binding protein)
- **synthesize of Inhibin**
Capacitation is associated with removal of adherent seminal plasma proteins, reorganization of plasma membrane lipids and proteins.
Man

- lifetime of sperm after ejaculation- max. 72 h
- duration of spermatogenesis (the production of mature sperm)- about 63 days
- average volume of ejaculate- 3-5 ml
- average number of sperm cells in 1 ml of ejaculate- 40 -120 mln / 1ml
Female reproductive function
External female genitalia

(a) Inferior view
Female reproductive tract
Female reproductive tract
Pattern of gonadotropin secretion during different stages of life in women. The secretory patterns of LH during day (clear area) and night (stippled area)
Succession of Appearance of Secondary Sexual Characteristics in Girls

- **ADRENARCHE** - increased production of adrenal androgens
- **TELARCHE** - development of the breast buds
- **PUBARCHE** - development of pubic and axillary hair
- The peak of growth rate / about 12 years age /
- **MENARCHE** - the first menstrual flow.
Phases of ovarian cycle

• FOLLICULAR PHASE- development of follicles, selection of the dominant follicle=Graafian follicle, degeneration of the rest follicles

• OVULATION

• LUTEAL PHASE (lasts 14 days !!!)
Ovary - at ovulation, 1 rupture & 1 egg ready
Risk of Ovarian Cancer

• The results showed that women who had ever taken OCs (oral contraceptives) were
• 27 percent less likely to develop ovarian cancer.
• The longer OCs were used, the greater the ovarian cancer risk reduction,

20 percent for each five years of use.

• Duration of the protective effects:
• For each five years of use, risk of developing ovarian cancer was reduced

29 percent in the first 10 years after stopping.
• The risk reduction was still significant (19 percent) for years 10–20, and (15 percent) 20–29 years after discontinuation.

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Phases of endometrial (uterine) cycle

- **Menstruation** = menstrual bleeding - desquamation of uterine epithelium
- **Proliferative phase** = increase endometrium in thickness
- **Secretory phase** = accumulation of nutrients, mainly glycoproteins
Numbers to remember

WOMAN

- lifetime of the ovum after ovulation- max. 24 h (possibility for fertilization)
- average duration of reproductive cycle- 28 days
- ranges of reproductive cycle duration- 21-35 days
- menstrual bleeding- duration - 3-7 days / , loss of blood and serous fluid < than 100 ml)
- Lasting of luteal phase- 14 days
Positive feedback days 12-14

Hypothalamus
    ↓
    GnRH
    ↓
    Anterior pituitary
    ↓
    LH/FSH
    ↓
    Ovary
    ↓
    Estrogen and progesterone
    ↓
    Uterus

Negative feedback over most of cycle
Estrogen

- 17 β estradiol
- estrone
- estriol

The estrogenic potency of β - estradiol is 12 times that of estrone, and 80 times that of estriol
Estrogen

• changes the vaginal epithelium from a cuboidal into a stratified type

• causes the proliferation of the endometrial stroma and endometrial glands and increases the number of cilia in the fallopian tubes.

• initiate growth of the breast and they are responsible for the characteristic appearance of the mature female breast.

• cause increased osteoblastic activity and they are responsible for the peak of growth rate during puberty.
Estrogen

- cause uniting of the epiphyses of the long bones and this in turn ceases the growth about the time of menarche.
- cause deposition of fat in the subcutaneous tissue, breasts, buttocks and thighs - that give the characteristic female shape.
- affect hair development in the pubic and axillary regions.
- acts on the skin and makes it soft and more vascular which increases the warmth of female skin.
Effects of Estrogen

**Brain**
Estrogen helps to maintain body temperature.
Estrogen may delay memory loss.
Estrogen helps to regulate parts of the brain that prepare the body for sexual and reproductive development.

**Heart & Liver**
Estrogen helps to regulate the liver’s production of cholesterol, thus decreasing the build-up of plaque in the coronary arteries.

**Ovary**
Estrogen stimulates the maturation of the ovaries.
Estrogen stimulates the start of a woman’s menstrual cycle – an indication that a girl’s reproductive system has matured.

**Vagina**
Estrogen stimulates the maturation of the vagina.
Estrogen helps maintain a lubricated and thick vaginal lining.

**Breast**
Estrogen stimulates the development of the breasts at puberty and prepares the glands for future milk production.

**Uterus**
Estrogen stimulates the maturation of the uterus.
Estrogen helps to prepare the uterus to nourish a developing fetus.

**Bone**
Estrogen helps to preserve bone density.
Menopause

- At the age of 40 to 50 years the sexual cycles usually become irregular, and ovulation fails to occur during many of the cycles.
- The menopause is defined as the final episode of menstrual bleeding in women.
- However, the term is used commonly to refer to the period of several years before and after the menopause.
Symptoms of Menopause

- depression !!!
- hot flushes / due to vascular instability /
- psychic sensations of dyspnea
- irritability
- fatigue
- anxiety
- atrophy of the urogenital epithelium and skin
- decreased size of the breasts
- osteoporosis
Osteoporosis

• Deficiency of estrogen in old age is the cause of the osteoporosis which leads to bone fracture.

• To prevent these changes many postmenopausal women are treated with replacement estrogens (HRT).