PENGANTAR 
FISIOLOGI REPRODUKSI

Kuliah 1

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Reproduction is process to maintain continuation of species by which:

- new individuals of a species are produced
- genetic material is passed from generation to generation

Cell division in a multicellular organism is necessary for growth and it involves passing of genetic material from parent cells to daughter cells.

Performed by reproductive system.
The Reproductive System

- does not contribute to homeostasis
- is not essential for survival of an individual
- But still plays an important in a person’s life, e.g. the manner:
  - in which people relate as sexual beings contributes in significant ways to psychosocial behavior
  - how people view themselves
  - how people interact with others
Reproductive function also has a profound effect on society:

- universal organization of societies into family units provide a stable environment that is conducive for perpetuating our species

- on other hand, population explosion and its resultant drain on dwindling resources have led to worldwide concern with means by which reproduction can be limited
Reproductive capability depends on intricate relationship among hypothalamus, anterior pituitary, reproductive organs, and target cells of sex hormones.

These relationship employ many of regulatory mechanisms used by other body systems for maintaining homeostasis, such as negative-feedback control.
Sexual behavior and attitudes are deeply influenced by emotional factors and socio-cultural mores of the society in which the individual lives.

However, Reproductive Physiology will concentrate on basic sexual and reproductive functions that are under nervous and hormonal control, and will not examine physiological and social ramifications of sexual behavior.
The organ of male and female may be grouped by function

Testes and ovaries (gonads), function in production of gametes: sperm and ova

Gonads also secrete hormones

The ducts of reproductive systems transport, receive, and store gametes

Accessory sex glands produce materials that support gametes
In females, the breasts are also considered accessory reproductive organs.

The externally visible portions of reproductive system are known as external genitalia.

The production of gametes and fluid, and their discharge into ducts classify the gonads as exocrine glands.

Whereas the production of hormones classify the gonads as endocrine glands.
Secondary sexual characteristic are many external characteristics not directly involved in reproduction.

That distinguish male and female.

Development and maintenance governed by testosterone in males and estrogen in females.

Progesterone has no influence on secondary sexual characteristic.

Axillary and pubic hair growth is not secondary sexual characteristic.
In some species, secondary sexual characteristic are great importance in courting and mating behavior (e.g. to attract female’s attention).

In humans, attraction the opposite sex not only influenced by secondary sexual characteristic but also strongly affected by the complexities of human society and cultural behavior.
The essential reproductive functions of male are:

1. **Production** of sperm (spermatogenesis) by testes (in skin-covered sac: scrotum)

2. **Delivery** of sperm to female – semen by
   - male reproductive tract: epididymis, vas deferens, ejaculatory duct
   - urethra (in penis)

3. Male **accessory** sex glands: providing bulk of semen: seminal vesicle, prostate, bulbourethral gland
Figure 28.1 Male organs of reproduction and surrounding structures.
Female’s role in reproduction is more complicated:

1. **Production** of ova (oogenesis) by ovaries
2. **Reception** of sperm: vagina-cervix
3. **Reception of sperm and ovum to a common site for union (fertilization or conception):** Fallopian tube
4. **Maintenance** of the developing fetus until it can survive in outside world (gestation or pregnancy), including formation of placenta (organ exchange between mother and fetus): uterus
5. **Giving birth** to the baby (parturition)
6. **Nourishing** the infant after birth by milk production (lactation): mammae
Product of fertilization: **embryo**
During first 2 months of intrauterine development when tissue differentiation is taking place

Developing living being is recognizable as human: **fetus**
- no further tissue differentiation
- tremendous tissue growth and maturation
Overview of Functions and Organs of Female Reproductive System.....

Female reproductive tract consists of:

- **Ovaries**
- **Oviducts (Fallopian tubes)**
  - pick up ova on ovulation and serve as fertilization site
- **Uterus**, thick-walled hollow: responsible for
  - maintaining fetus during development, and
  - expelling it at the end of pregnancy
- **Cervical canal**
  - small opening of cervix
  - pathway for sperm to uterus then to oviduct
  - passageway for delivery of baby from uterus
- **Cervix**
  - lowest portion of uterus which projects into vagina
Overview of Functions and Organs of Female Reproductive System......

- **Vagina**
  - expandable tube
  - connects uterus to external environment

- **Vaginal opening**
  - located in perineal region
  - between urethral opening and anal opening

- **Hymen**
  - thin mucus membrane partially covering vaginal opening

- **Labia minora and labia majora**
  - skin folds surrounding vaginal and urethral openings

- **Clitoris**

Female external genitalia collectively: **vulva**
Figure 28.12 Uterus and associated structures. In (a), the left side of the figure has been sectioned to show internal structures. In (b), part of the posterior wall of the uterus has been removed.
Question: Which male structures are homologous to the ovaries? Clitoris? Paraurethral glands? Greater vestibular glands?
Sex Determination and Differentiation

- Reproductive cells each contain a half set of chromosomes
- Gametogenesis is accomplished by meiosis
- The sex of and individual is determined by combination of sex chromosomes
- Sexual differentiation along male or female lines depends on the presence/absence of masculinizing determinant
(a) Synapsis and tetrad formation
(b) Crossing-over
(c) Genetic recombination
(a) Mitosis

2n → 2n → 2n

(b) Meiosis

2n → Reduction division (Meiosis I) → n → Equatorial division (Meiosis II) → n

n → n → n → n
Parents with diploid (46 chr) somatic cells

Mother
- Meiotic division of germ cells
  - Haploid Ovum

Father
- Meiotic division of germ cells
  - Haploid Sperm

Fertilization
- Diploid fertilized Ovum

Mitosis
- Offspring of diploid somatic cells
Ovum with X sex chromosome

Fertilized by Sperm with Y sc

Embryo with XY sc

Sex-determining region of Y chr (SRY) stimulates Production of H-Y antigen In plasma membrane of undifferentiated gonad

H-Y antigen directs differentiation of gonads into testes

Genetic sex

Fertilized by Sperm with X sc

Embryo with XX sc

No Y chr, so no SRY and no H-Y antigen

With no H-Y antigen, undifferentiated gonads develop into ovaries
Testosterone promotes development of undifferentiated external genitalia along male lines (e.g. penis, scrotum).

Testes secrete hormones and factors:
- **Testosterone**
- **Mullerian-inhibiting factor**

Testosterone is converted to **Dihydrotestosterone (DHT)**, which:
- Promotes development of undifferentiated external genitalia along male lines (e.g. penis, scrotum)
- Degenerates Mullerian ducts
- Transforms Wolfian ducts into male reproductive tract (e.g. epididymis, ductus deferens, ejaculatory duct, seminal vesicle)

Phenotype sex
Müllerian ducts differentiate into female reproductive tract

Wolffian ducts degenerate

Undifferentiated reproductive system

Müllerian ducts degenerate

Fimbria

Epididymis

Ovaries

Oviducts (Fallopian tubes)

Uterus

Vagina

Testes

Ductus deferens

Seminal vesicles

Müllerian ducts differentiate into male reproductive tract (shown before descent of testes into scrotum)
Absence of testosterone leads to undifferentiated external genitalia along female lines (e.g. clitoris, labia).

Absence of Mullerian-inhibiting factor leads to degeneration of Wolfian ducts and Mullerian ducts develop into female reproductive tract (e.g. oviducts, uterus).

Phenotype sex
Errors in Sexual Differentiation

- Genetic sex and phenotype sex are usually compatible.

- Occasionally, discrepancies occur between genetic and anatomic sexes because of errors in sexual differentiation.
1. If testes in a genetic male fail to properly differentiate and secrete hormones, the result is the development of an apparent anatomic female in a genetic male, who, of course will be sterile.

Similarly, genetic males whose target cells lack receptors for testosterone are feminized, even though their testes secrete testosterone.
2. Testosterone acts on Wolfian ducts to convert them into a male reproductive tract;

If testosterone derivative dihydrotestosterone (DHT) that responsible for masculinization of external genitalia because of genetic deficiency of the enzyme which converts testosterone into DHT, results in a genetic male with testes and a male reproductive tract but with female external genitalia
3. Adrenal gland normally secretes a weak androgen, dehydroepiandrosterone in insufficient quantities to masculinize females.

   If, pathologically excessive secretion of this hormone in a genetically female fetus during critical developmental stages imposes differentiation of reproductive tract and genitalia along males lines
Sometimes, the discrepancies between genetic sex and apparent sex are not recognized until puberty, when discovery produces psychologically traumatic gender identity crisis.

For instance: a masculinized genetic female with ovaries, but with male type external genitalia may be reared as a boy until puberty. When breast enlargement and lack of beard growth signal an apparent problem.
Less dramatic cases of inappropriate sex differentiation often appear as sterility problems.

Therefore, important to diagnose any problems in sexual differentiation in infancy. It can be reinforced, if necessary, with surgical and hormonal treatment, so that psychosexual development can proceed as normally as possible.
Thank You
1. Hubungan sistem limbik (*limbic system*) dengan pengaturan fungsi seks

2. Hubungan kelenjar pineal (*pineal body*) dengan pegaturan fungsi seks