

## Unit 1:

# Reproductive Hormones and Sexual Maturation

# The Endocrine System

- **Endocrine system:** made up of glands that release their products (hormones) into the bloodstream to deliver messages throughout the body
- **Hormones:** chemical signals that are produced in one body region but affect a different body region (bind to specific receptors on **target cells**)

# Glands

- **Gland**: an organ that produces and releases a substance (secretion)
- **Endocrine glands** release hormones directly into the bloodstream
- **Exocrine glands** release secretions into a duct, directly into the organ that uses them

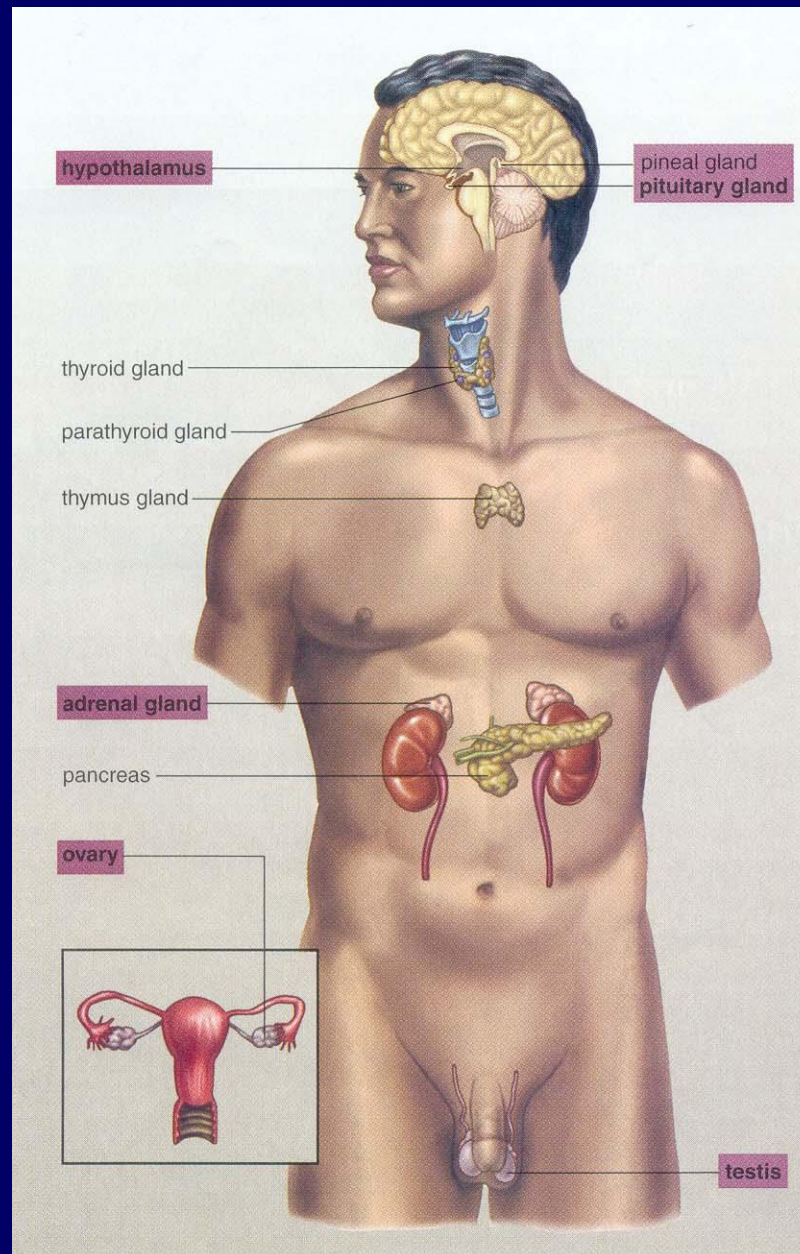


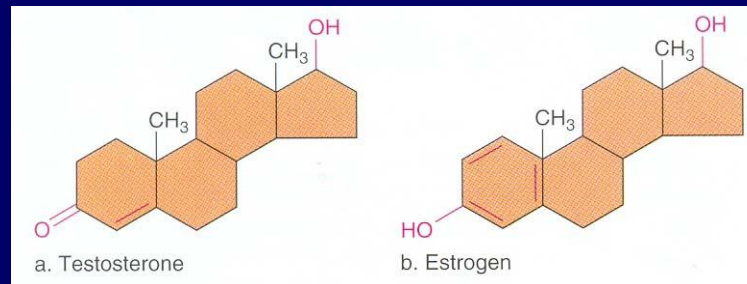
Fig 5.1 The endocrine system

- Endocrine system is slower than nervous system - it takes time for hormone to travel to reach its target organ
- Only certain cells respond to one hormone and not another
  - have specific receptor proteins on their surface that react with the hormone
  - "lock and key" system

# Two Classes of Hormones

## 1. Steroid Hormones

- Can be taken orally (birth control pills)



## 2. Peptide/Protein Hormones

- Cannot be taken orally (will be broken down in stomach)

# Steroid Hormone Action

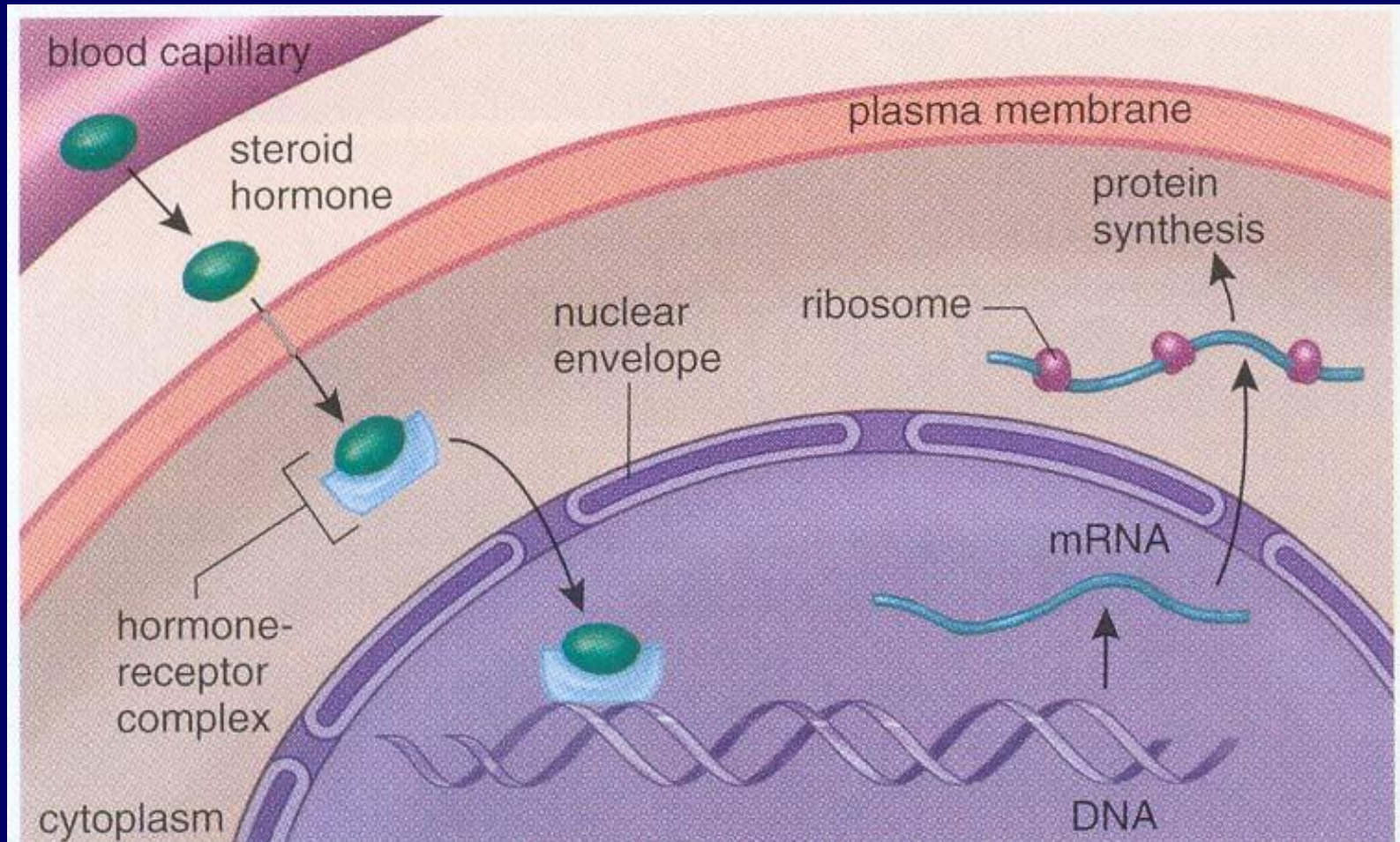


Fig 5.2 Cellular activity of hormones

# Peptide/Protein Hormone Action

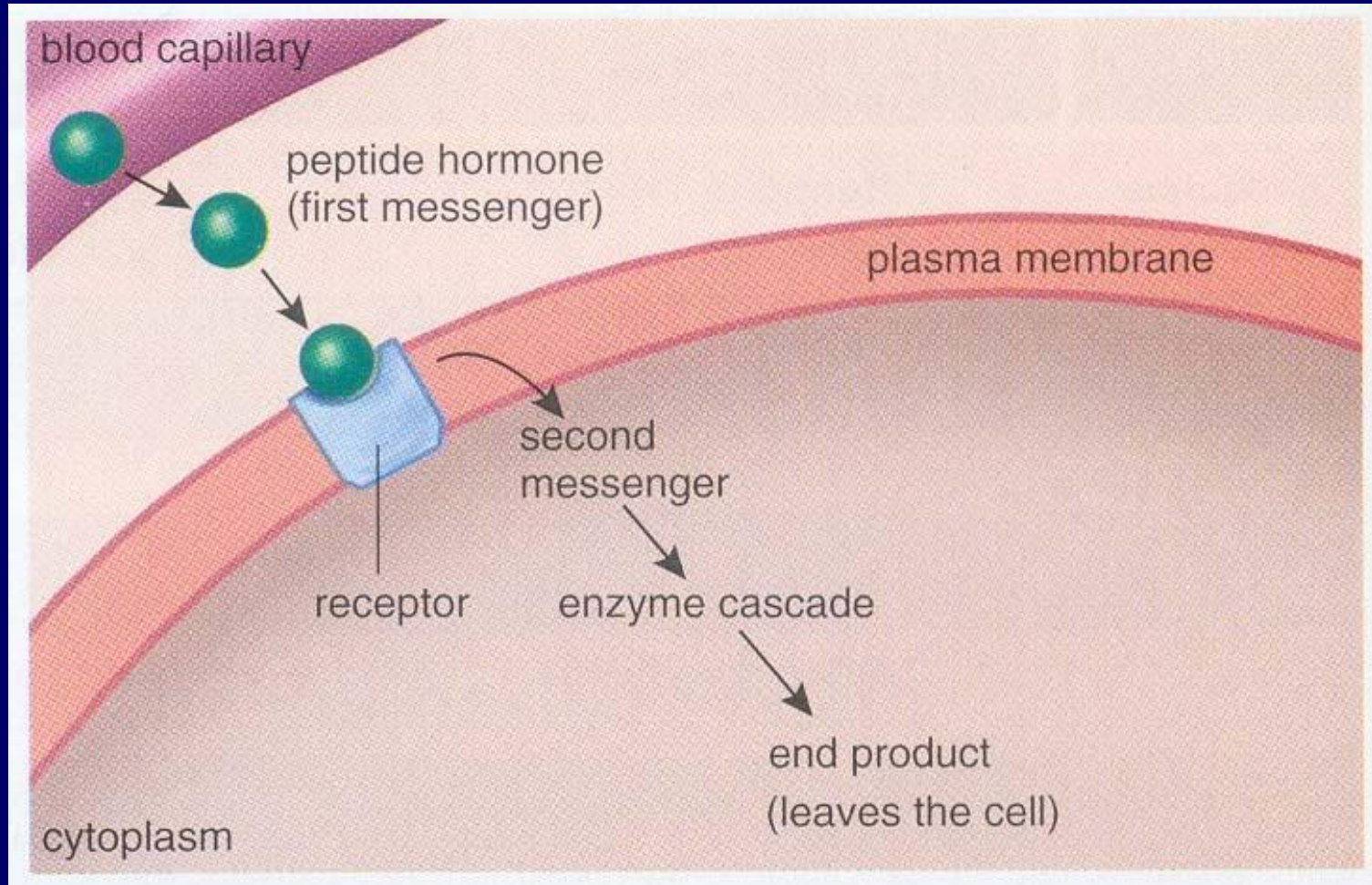
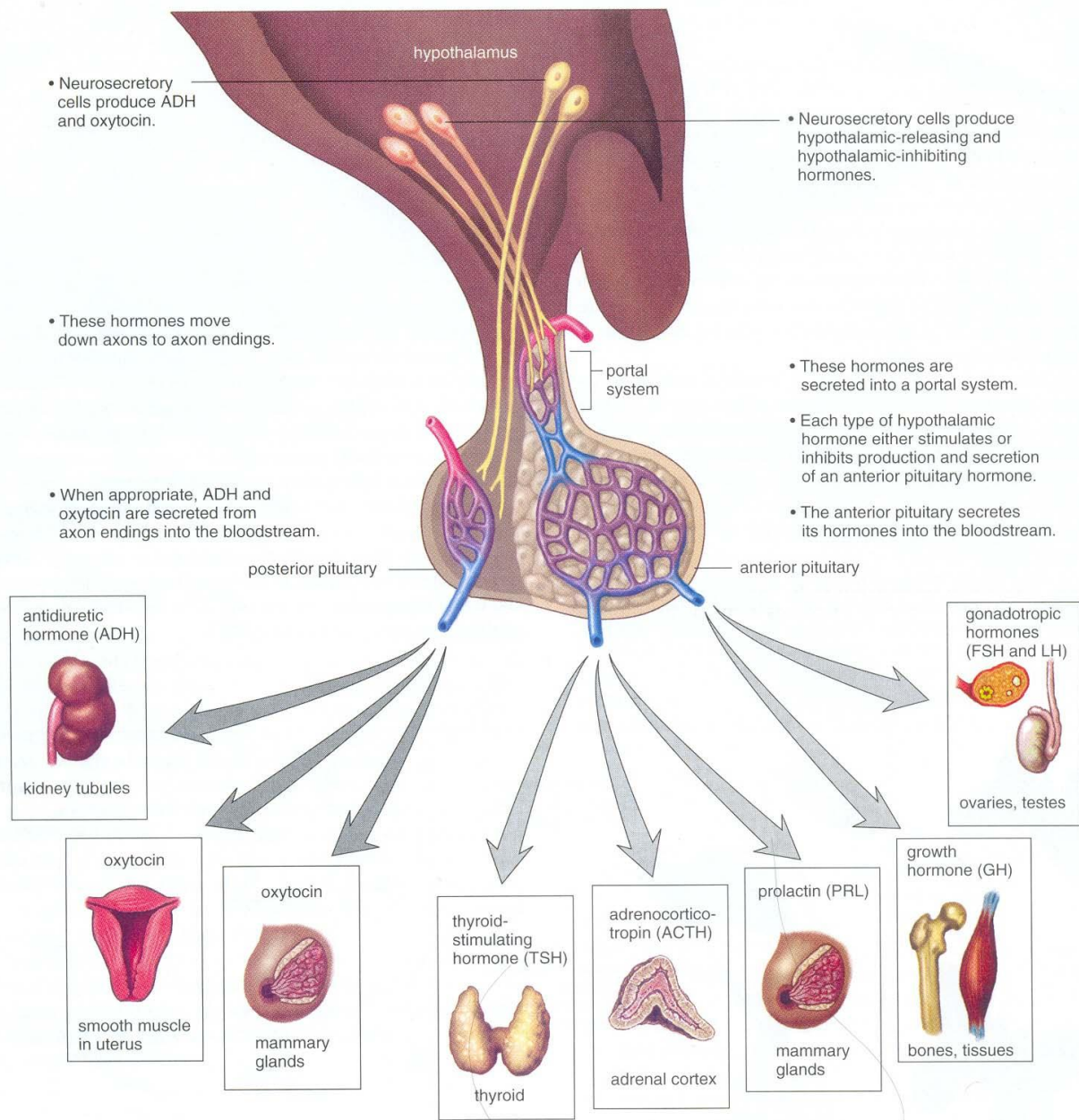


Fig 5.2 Cellular activity of hormones





# Reproductive Hormones

## 1. Hypothalamus

- region of the brain
- controls the secretions of the pituitary gland

## 2. Pituitary Gland

- also in the brain
- made up of two parts

### Posterior Pituitary

- oxytocin:
  - works on the uterus to induce labor contractions
  - works on the mammary glands to release milk

## 2. Pituitary Gland

### Anterior Pituitary

- prolactin:

- works on the mammary glands to produce milk

## 2. Pituitary Gland

### Anterior Pituitary

- gonadotropins:
  - follicle-stimulating hormone (FSH)
  - luteinizing hormone (LH)
  - peptide hormones; stimulate the gonads to make gametes and the sex hormones

Controlled by a 3-tier system:

1. **GnRH** (gonadotropin-releasing hormone)  
made/released in the hypothalamus



2. **FSH & LH**  
made/released in the ant. pituitary



3. **Estrogen, Progsterone & Testosterone**  
made/released in the ovaries/testes

### 3. The Gonads

#### Ovaries

Estrogen (E)

Progesterone (Pr)

#### Testes

Testosterone (T)

- maintain structure/function of gonads
- secondary sex characteristics

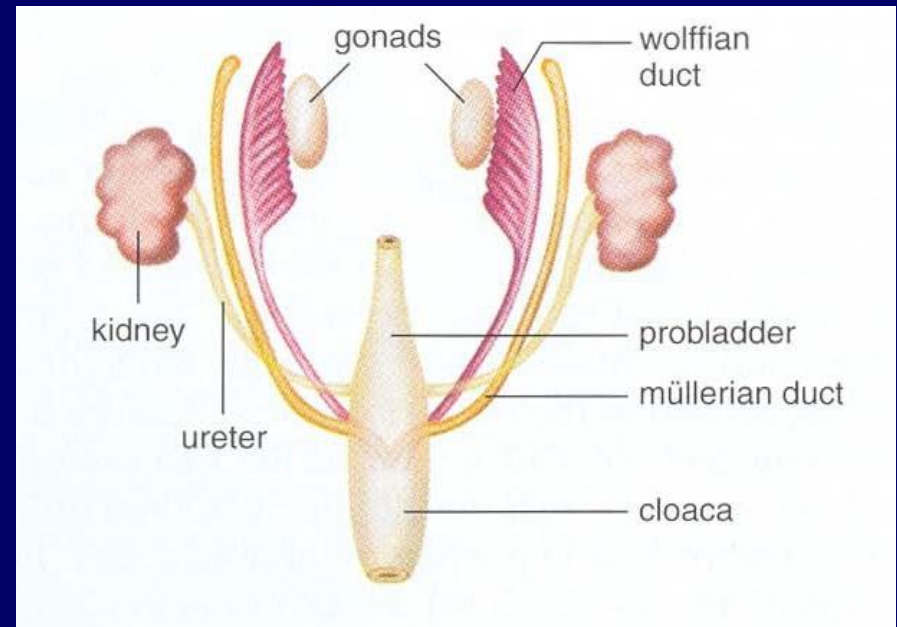
# Regulatory Control of Sex Hormones

- Positive feedback:
  - Oxytocin causes uterine contractions, which signals the brain to release more oxytocin for more intense contractions
- Negative feedback:
  - High levels of testosterone in the blood tell the brain to stop making testosterone
  - When levels start getting low, it signals the brain to turn on production of testosterone again



# Development of Male and Female Sex Organs

- Sex is determined at moment of fertilization
- During first several weeks of development, embryo has **indifferent** gonads



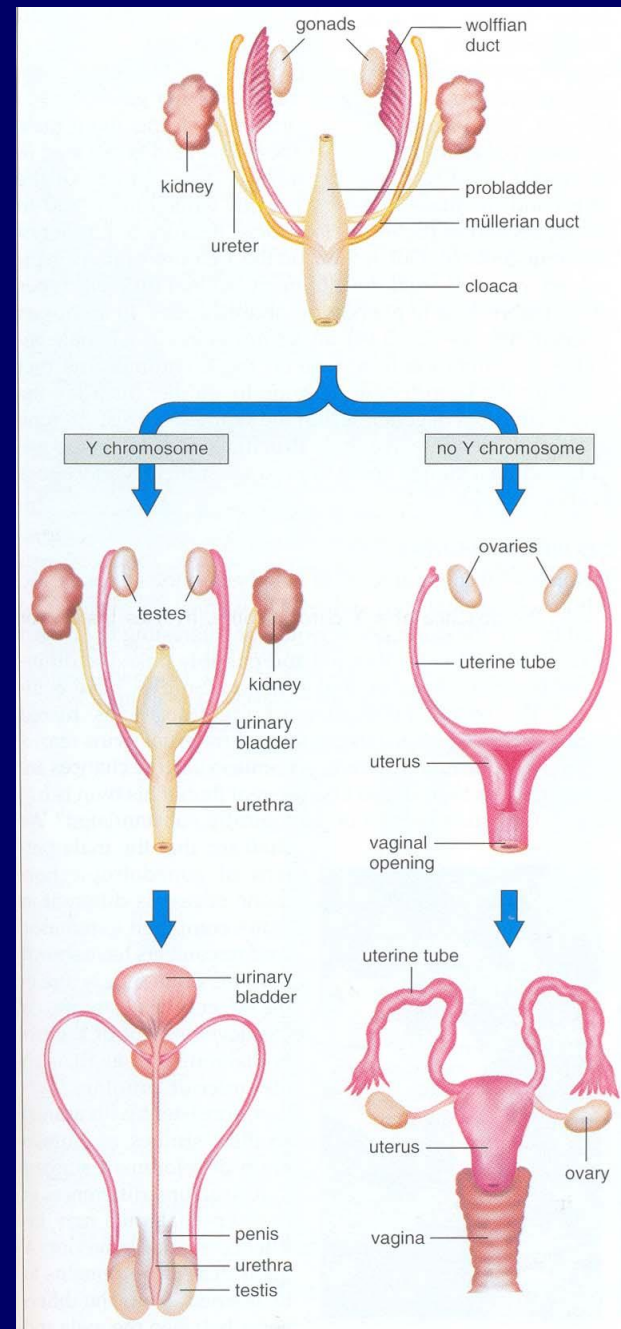
6 weeks

- If a Y chromosome is present, testosterone stimulates

1. Gonads to become testes

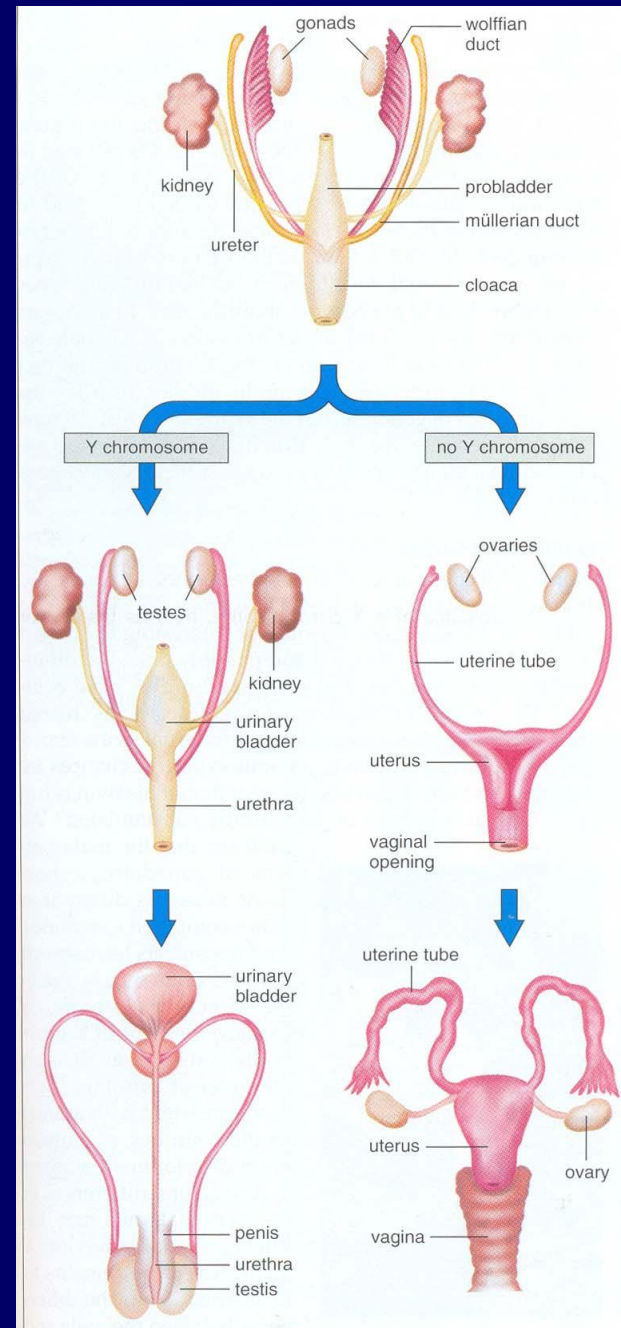
2. Wolffian ducts to become the male genital ducts

3. Mullerian ducts regress

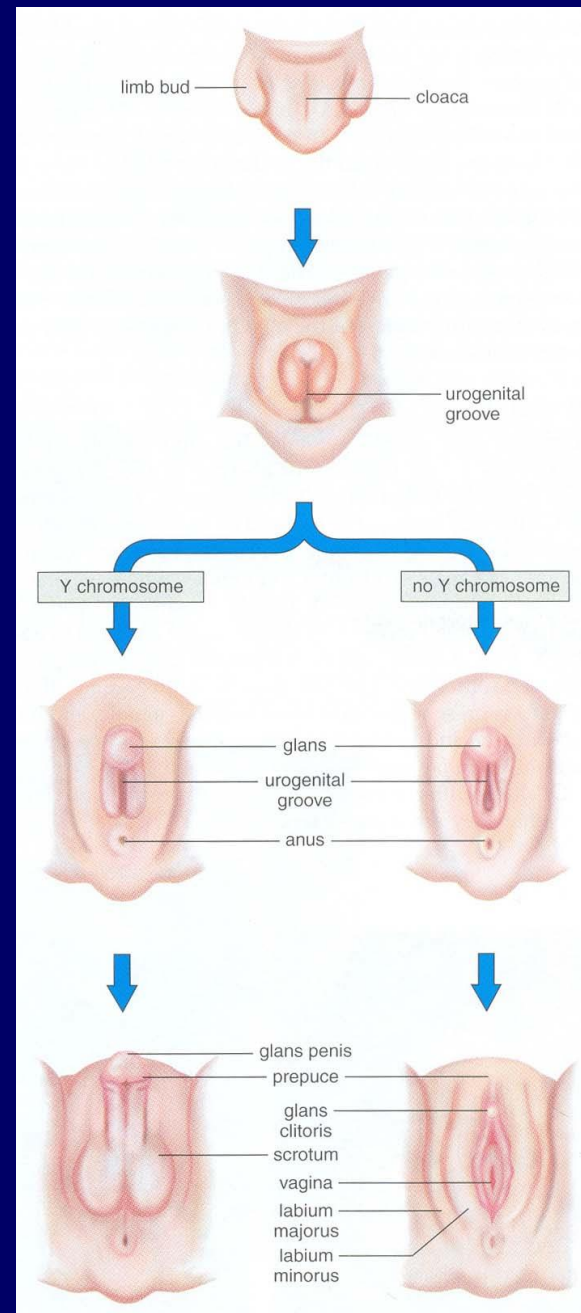


- If there is no Y chromosome,

1. Gonads become ovaries
2. Wolffian ducts regress
3. Mullerian ducts become uterus and uterine tubes



- External genitalia also start out as indifferent, develop into male or female, depending on the presence or absence of Y chromosome



# The X and Y Chromosomes

- X chromosome = 1400 genes, most of them have nothing to do with sexual differences
- Y chromosome = 26 genes, most are concerned with sex differences between male and female

# The X and Y Chromosomes

- Most genes on Y are also found on X, except for one... called the **sex-determining region of the Y (SRY)**
- If the **SRY gene** is present, the individual becomes male, and if it is absent, the individual becomes female
- There is no gene for femaleness...

# Intersex

- Intersex is a group of conditions where there is a discrepancy between the external and internal genitalia
- Can be divided into 4 categories:
  - 46 XX Intersex
  - 46 XY Intersex
  - True Gonadal Intersex
  - Complex or Undetermined Intersex

## 46 XX Intersex

- Chromosome of a woman
- Ovaries of a woman
- External genitals appear male
- Due to exposure of male hormones during development



## 46 XY Intersex

- Chromosome of man
- Testes may be normal or malformed
- External genitals are incompletely formed
- Due to problems with making or using testosterone

# True Gonadal Intersex

- Chromosomes could be XX or XY
- Have both ovarian and testicular tissue
- External genitals are ambiguous
- Cause is unknown

# Complex or Undetermined Intersex

- Due to a chromosomal disorder
  - 45 XO (Turner's Syndrome)
  - 47 XXY (Klinefelter's Syndrome)
  - 47 XXX (Poly-X Syndrome)
- There is normal anatomical development, but problems with sex hormone levels or sexual development

# Sex Chromosome Disorders

## Turner Syndrome

- XO (only 1 X chromosome)
- Female
- Ovaries, uterine tubes, and uterus are small and underdeveloped
- Do not undergo puberty or menstruate

Short stature

Low hairline

Shield-shaped thorax

Widely spaced nipples

Shortened metacarpal IV

Small finger nails

Brown spots (nevi)

Characteristic facial features

Fold of skin

Constriction of aorta

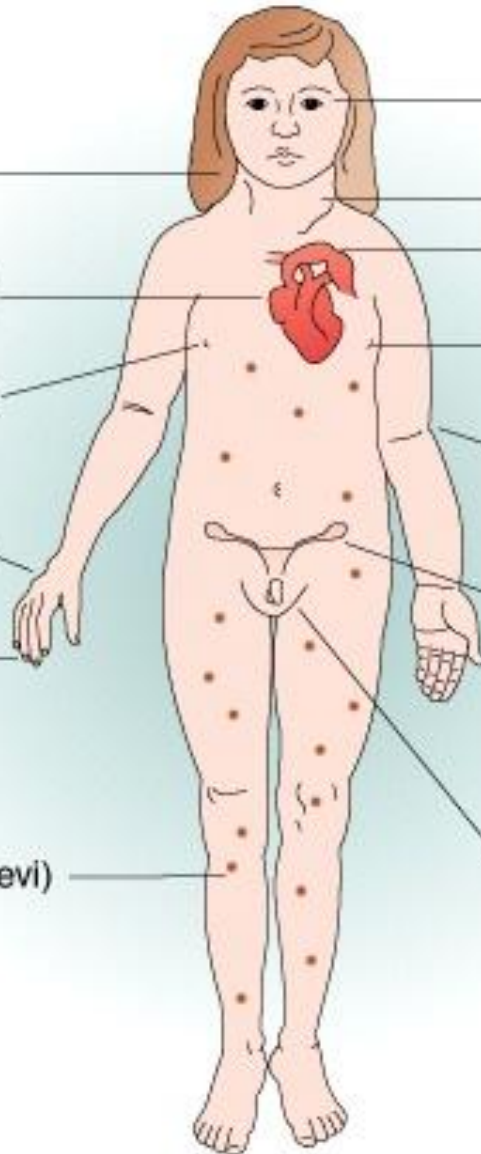
Poor breast development

Elbow deformity

Rudimentary ovaries

Gonadal streak (underdeveloped gonadal structures)

No menstruation



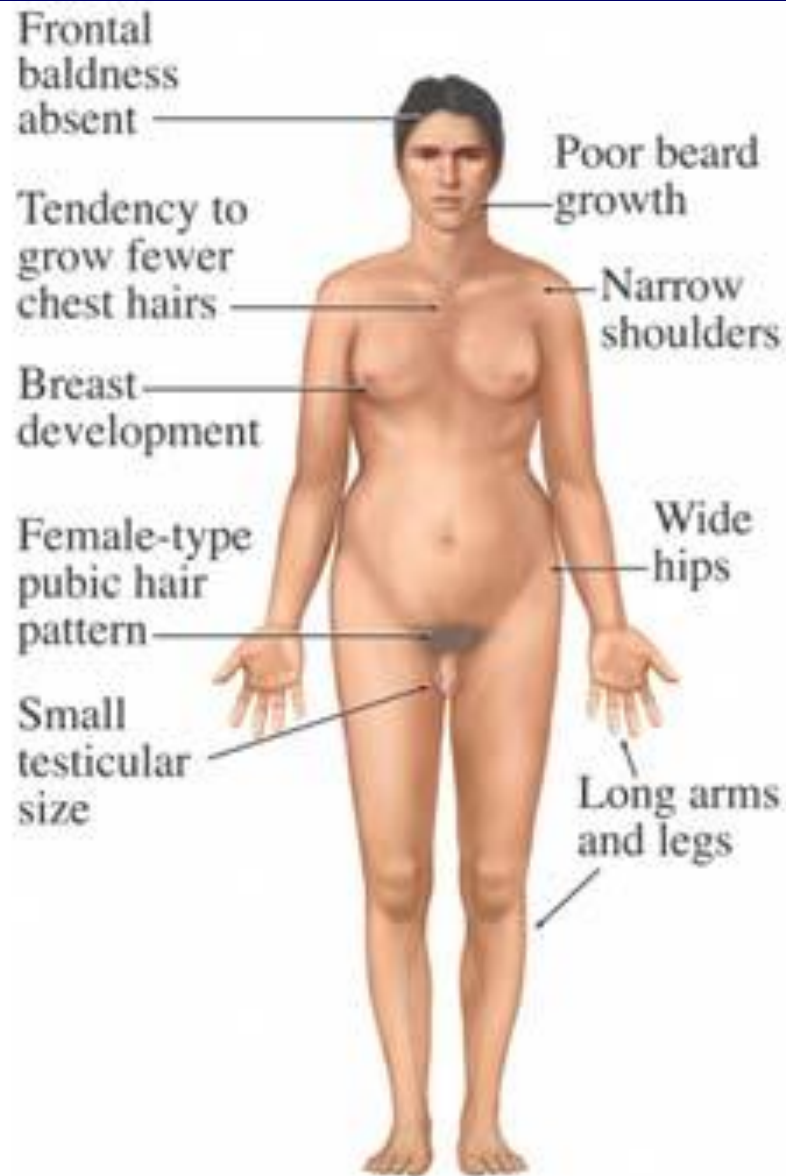
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# Sex Chromosome Disorders

## Klinefelter Syndrome

- XXY
- Male
- Testes are underdeveloped;  
no facial hair
- Some breast development





# Complex or Undetermined Intersex

- Due to a chromosomal disorder
  - 45 XO (Turner's Syndrome)
  - 47 XXY (Klinefelter's Syndrome)
  - 47 XXX (Poly-X Syndrome)
- There is normal anatomical development, but problems with sex hormone levels or sexual development

# Sex Chromosome Disorders

## Poly-X

- XXX (or more)
- Female
- Menstruate regularly and are fertile
- Mental retardation occurs with XXXX

# Sex Chromosome Disorders

## Jacobs Syndrome

- XYY
- Male
- Taller than average, persistent acne, speech and reading problems
- Thought to be criminally aggressive

# Secondary Sex Characteristics

- Those differences between the sexes that usually allow us to tell males from females
- Begin appearing at the time of puberty (9-14 years old)

# Today's Activator...

What is a secondary sex characteristic that happens in males but not in females?

# Male Secondary Sex Characteristics

- Changes in body hair
- Changes in skin
- Change in voice
- Change in muscle strength
- Change in the skeleton

# Female Secondary Sex Characteristics

- Development of breasts
- Change in fat deposition
- Change in body hair
- Change in pelvic girdle
- Change in skeletal growth
- Change in skin