

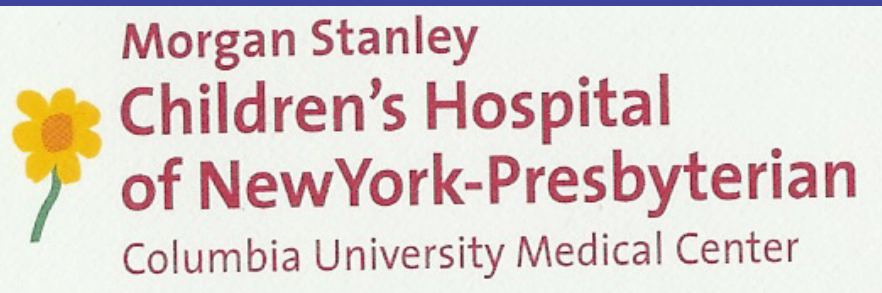
UROGENITAL TRACT

Male Development

RICHARD SCHLUSSEL, M.D.

DEPARTMENT OF UROLOGY

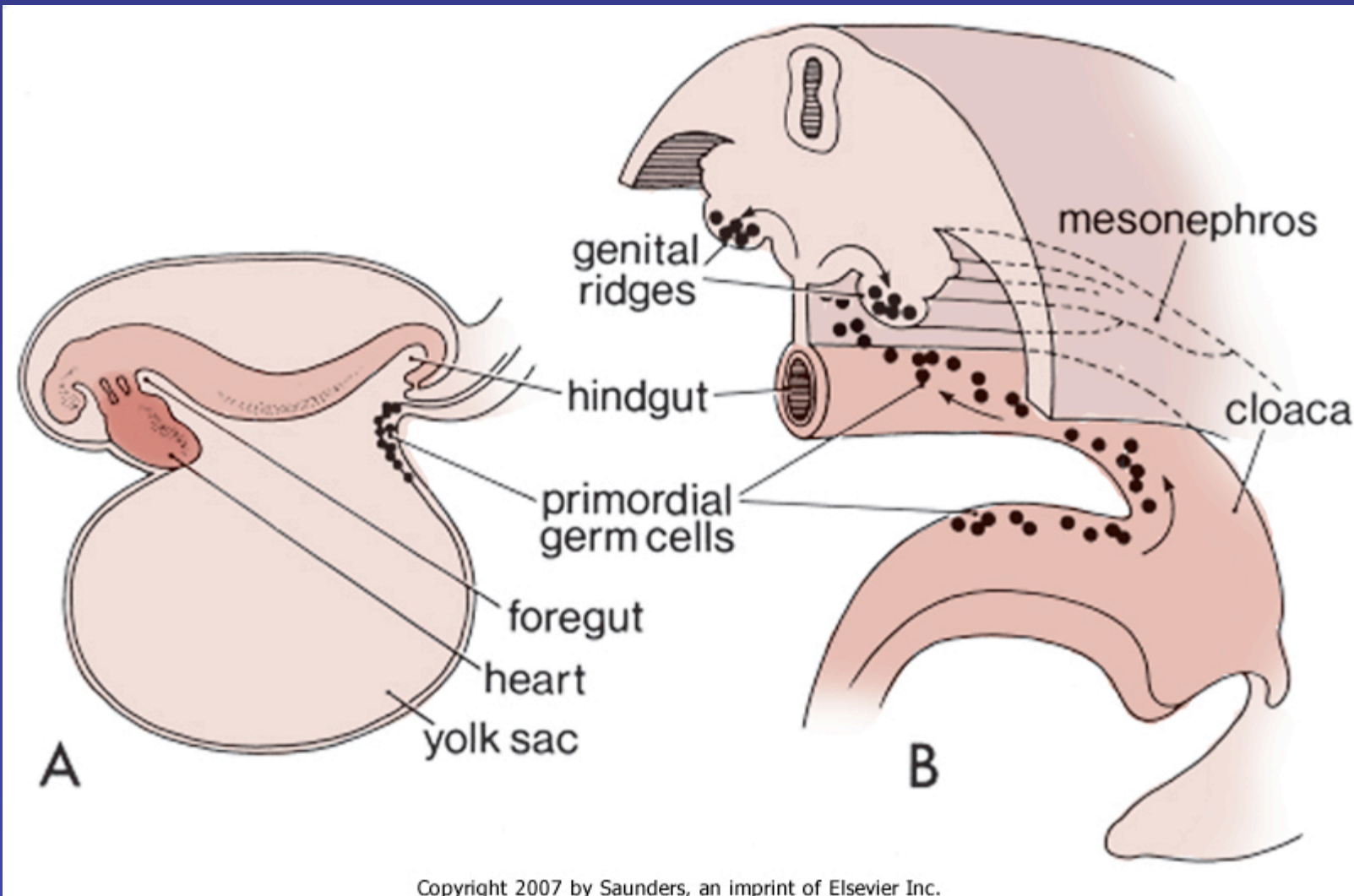
DIVISION OF PEDIATRIC UROLOGY

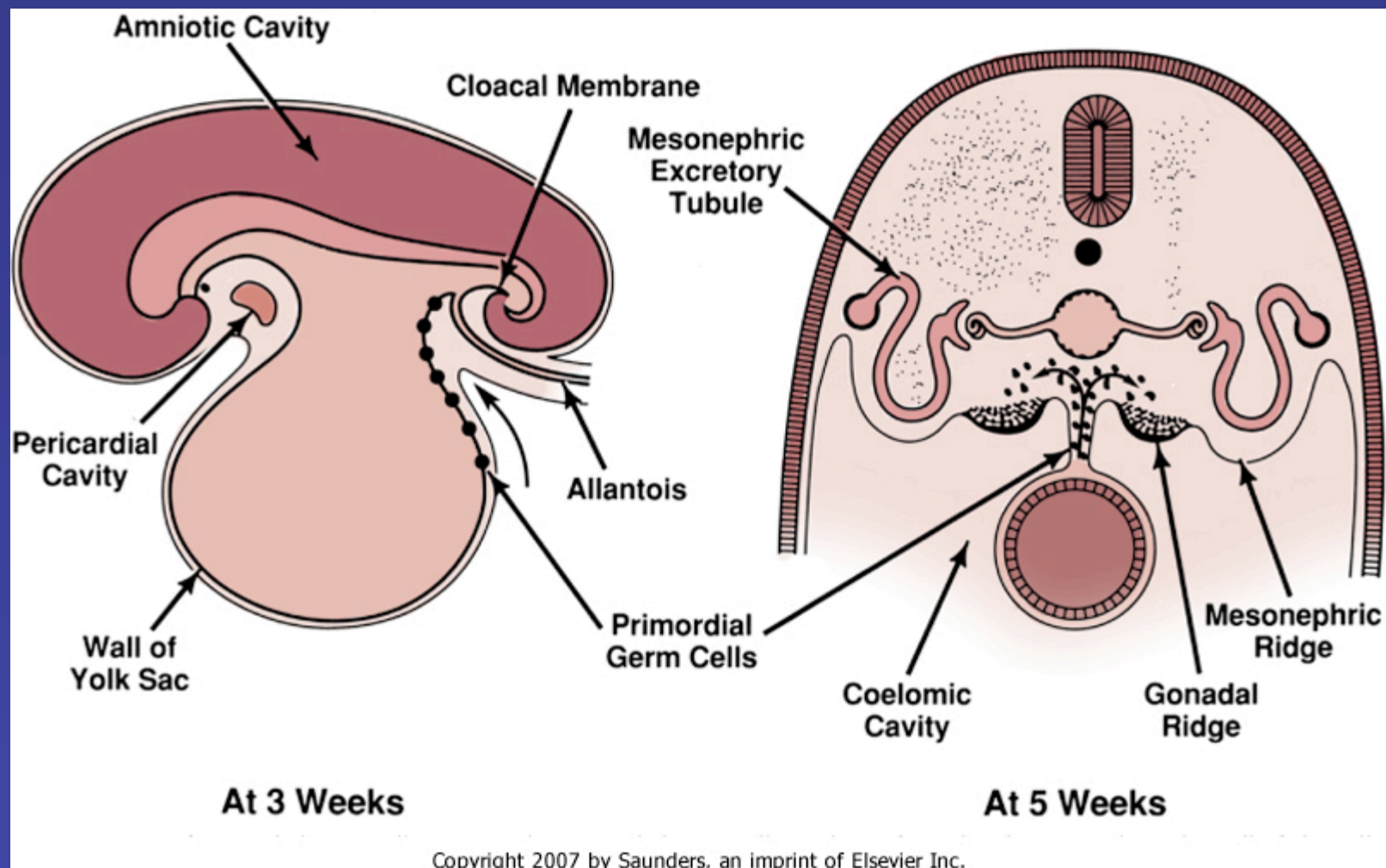


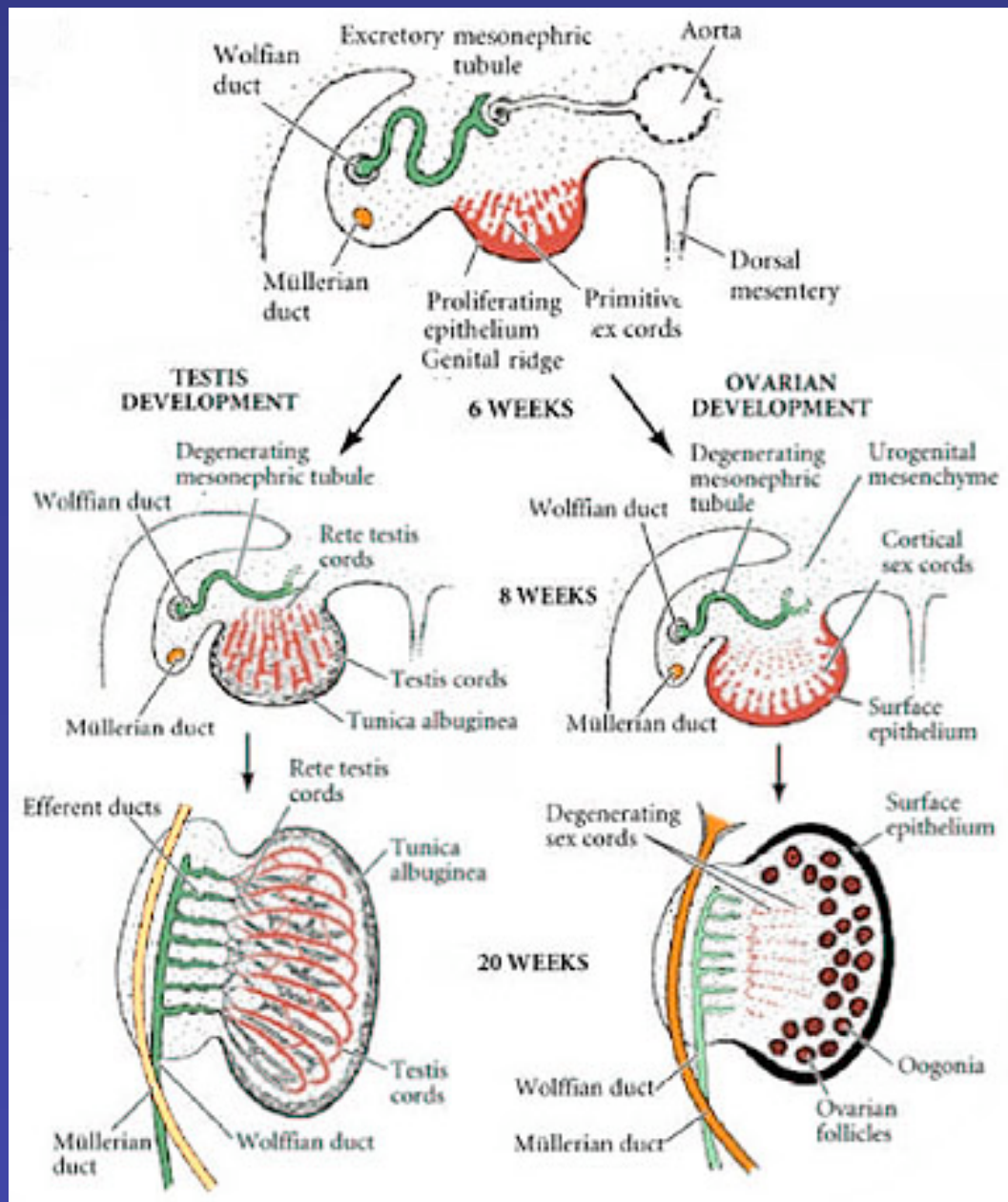
Genital Development

- Chromosomal sex
- Gonadal sex
- Phenotypic sex

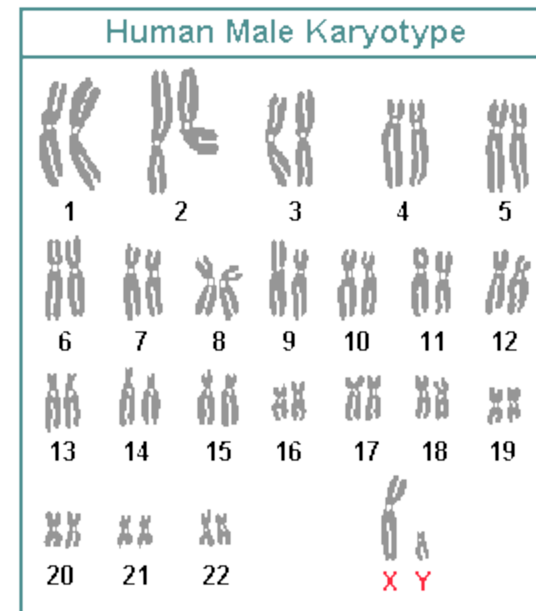
Week 5







- ***Chromosomal sex***
- **Gonadal sex**
- **Phenotypic sex**



Chromosomal sex

- **SRY gene**
Sex determining
Region of the
Y chromosome

- *transcription factor*



SOX 9

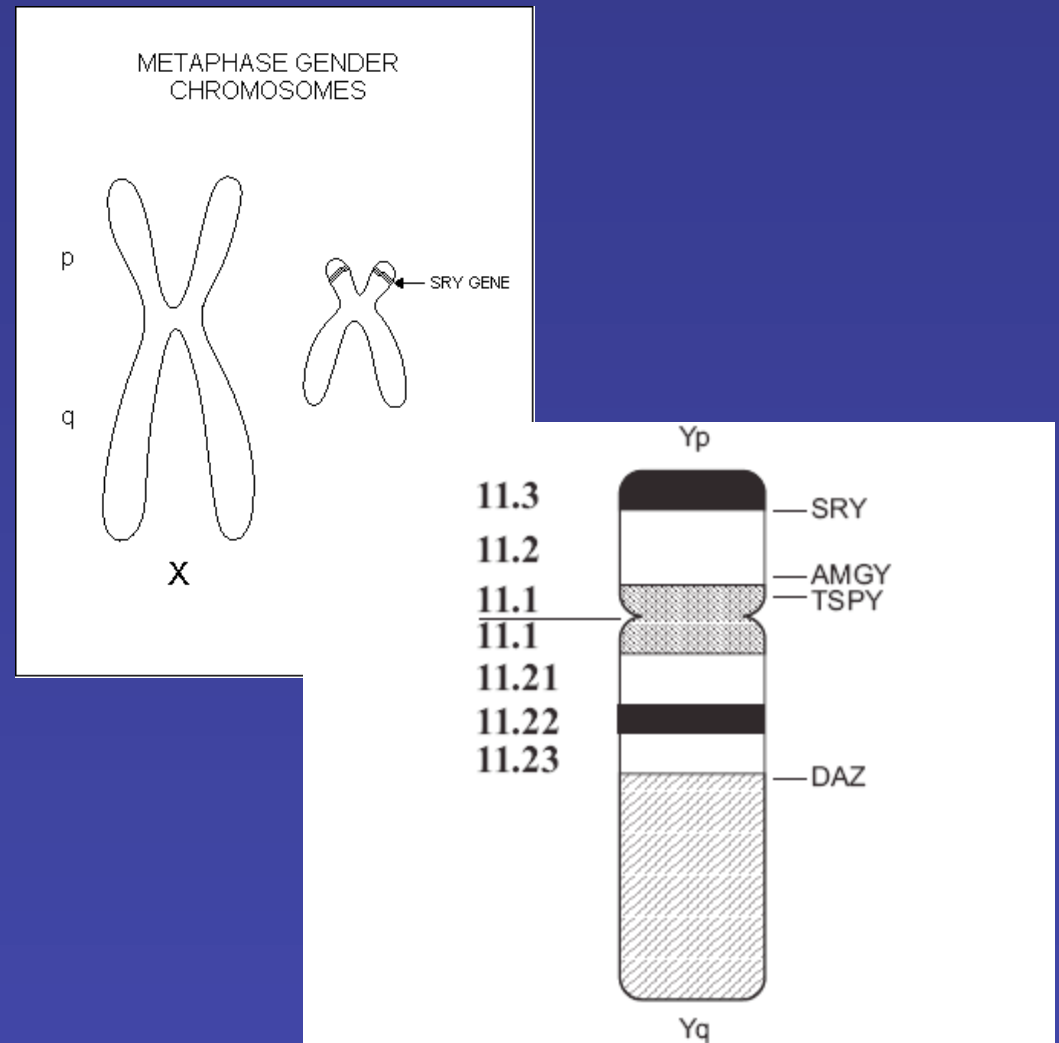
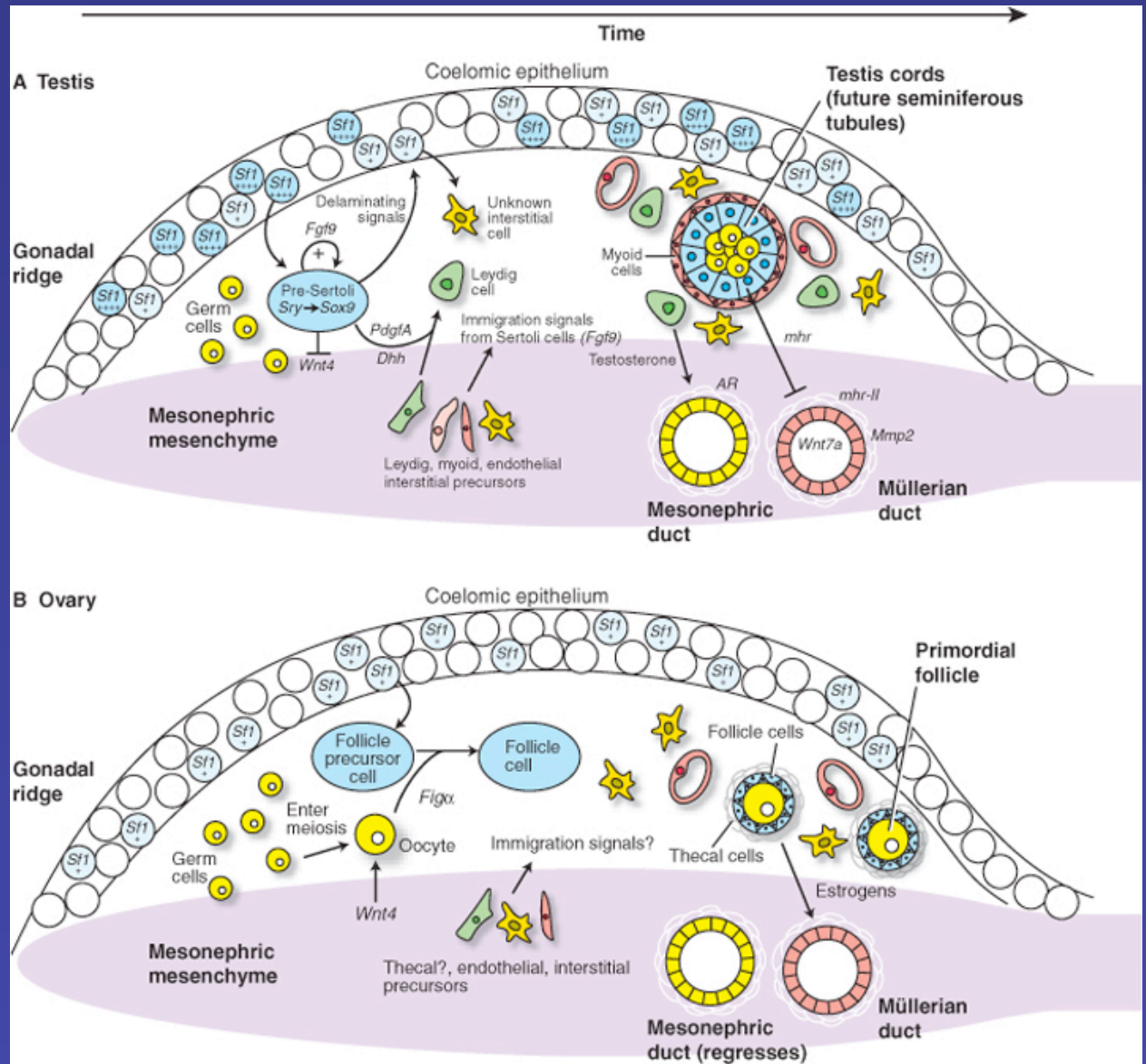


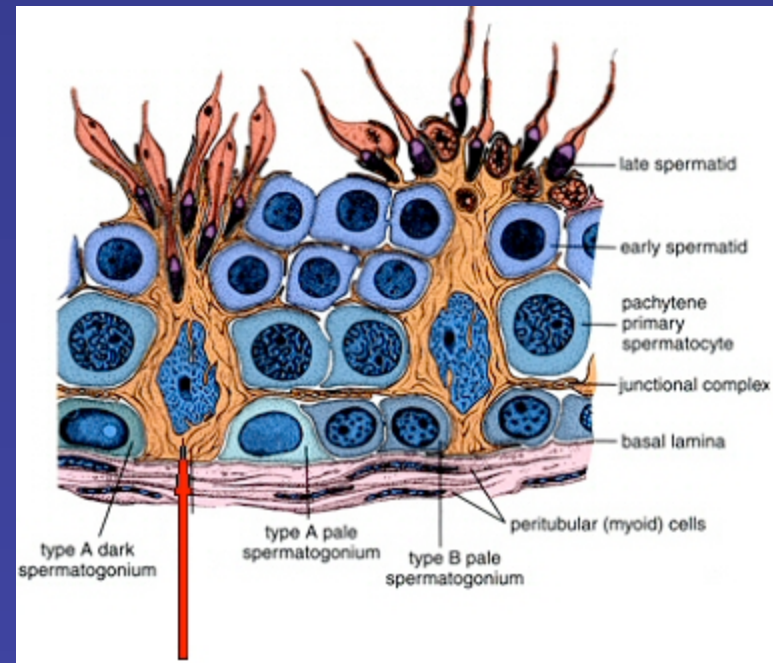
Figure 1 - Schematic representation of Y chromosome showing gene sequences studied by PCR⁽⁸⁾

Gonadal sex



Gonadal sex

- Sertoli cells
 - **Forms week 6**
 - Organizes testis into cords
 - Secrete AMH week 8
Anti Mullerian Hormone
 - Leydig cell development

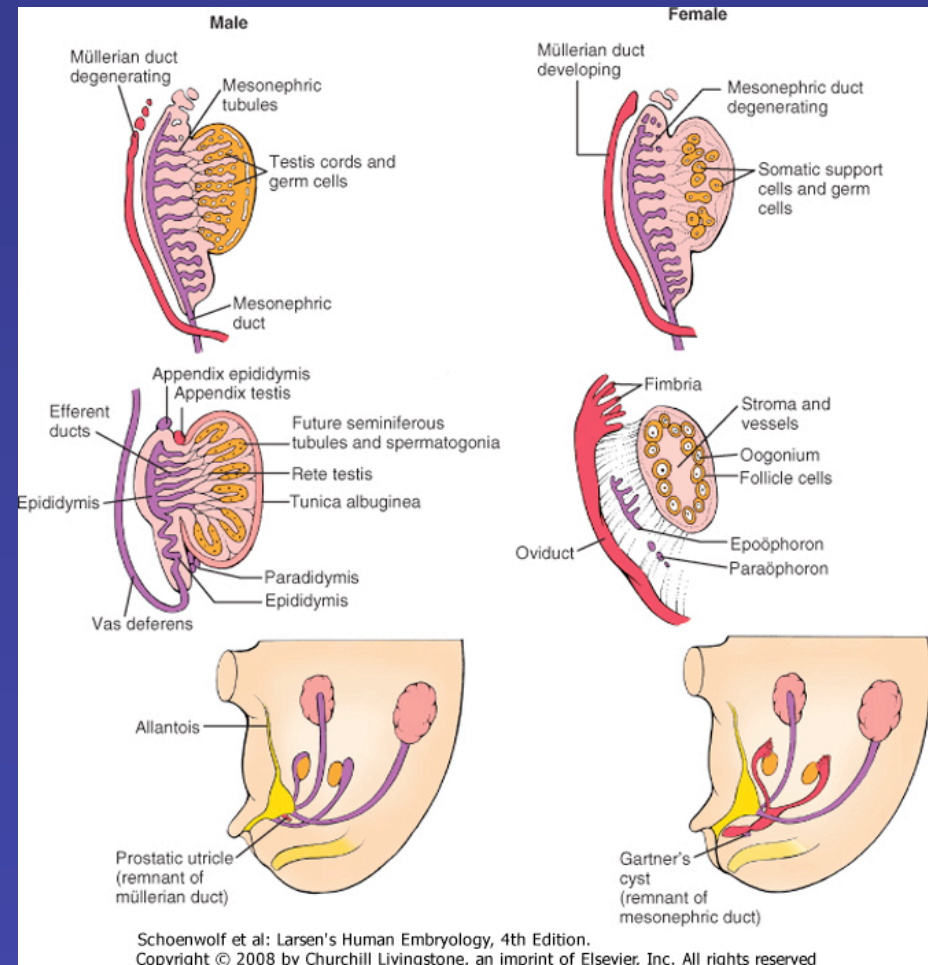


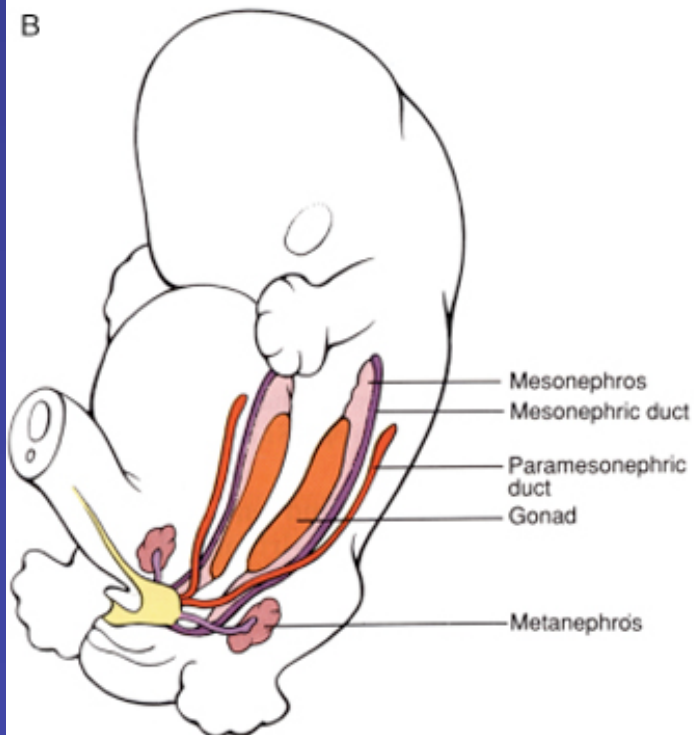
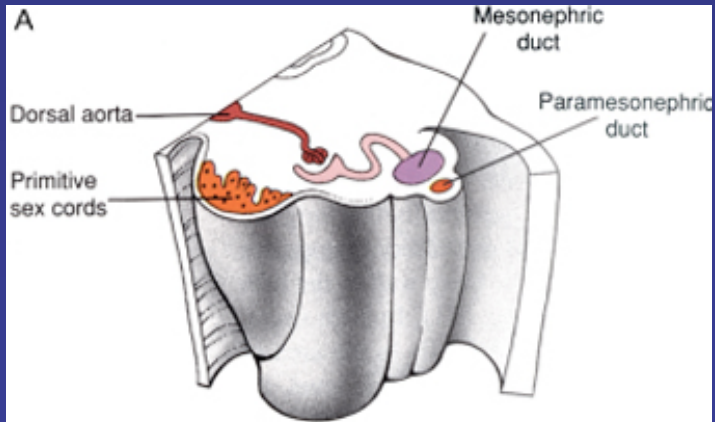
Gonadal sex

- Sertoli cells
 - Forms week 6
 - Organizes testis into cords
 - Secrete AMH week 8

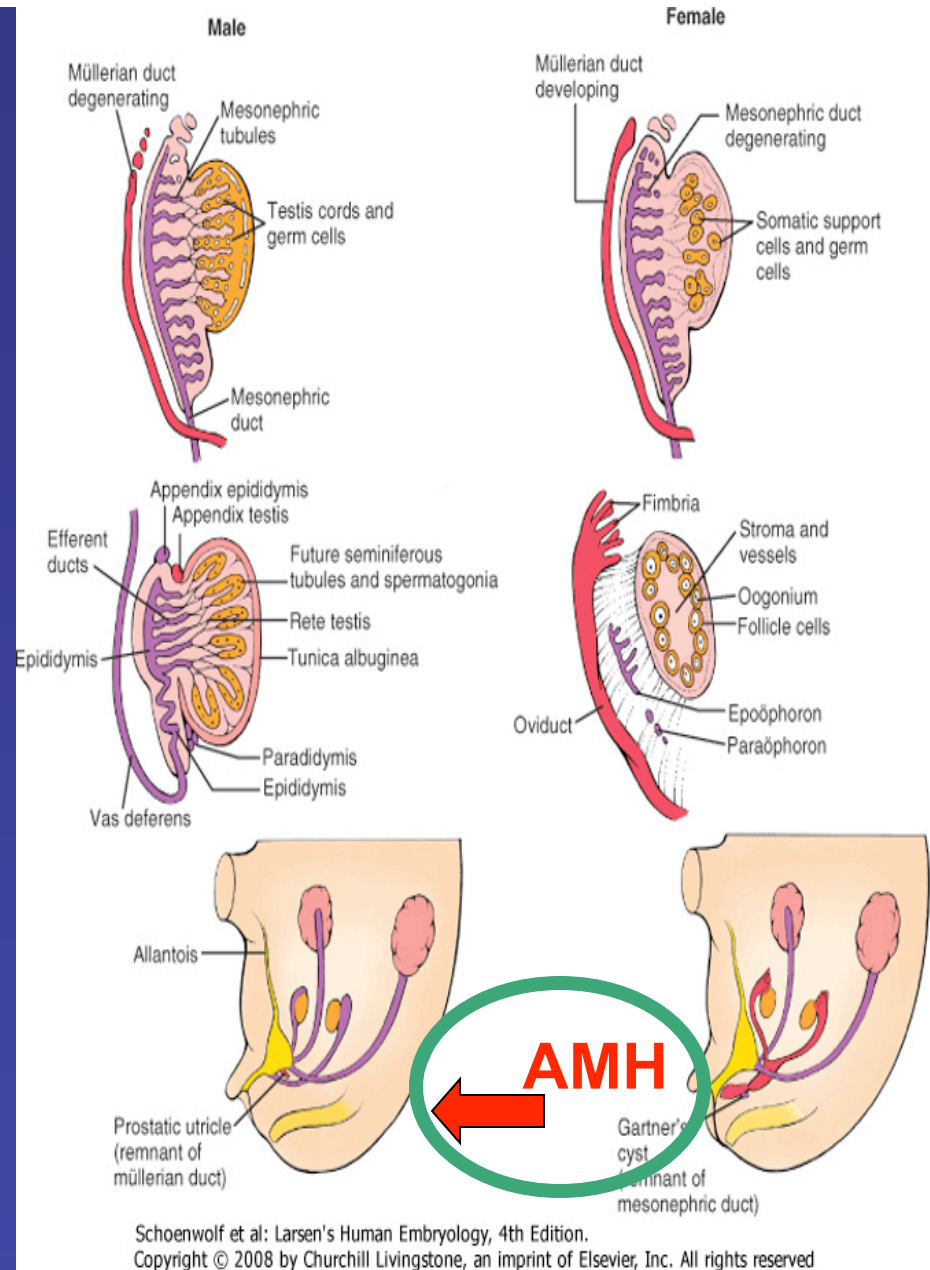
Anti
Müllerian
Hormone

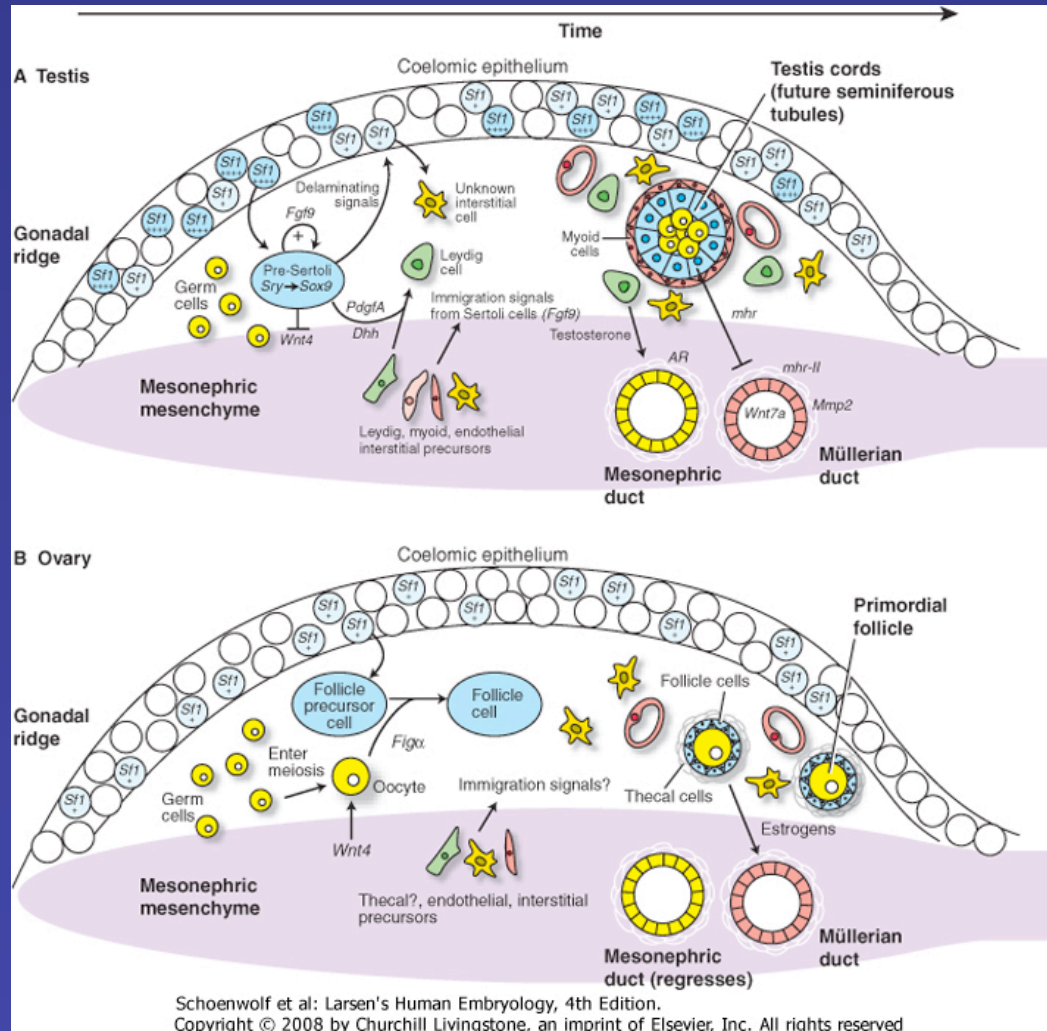
- Leydig cell development





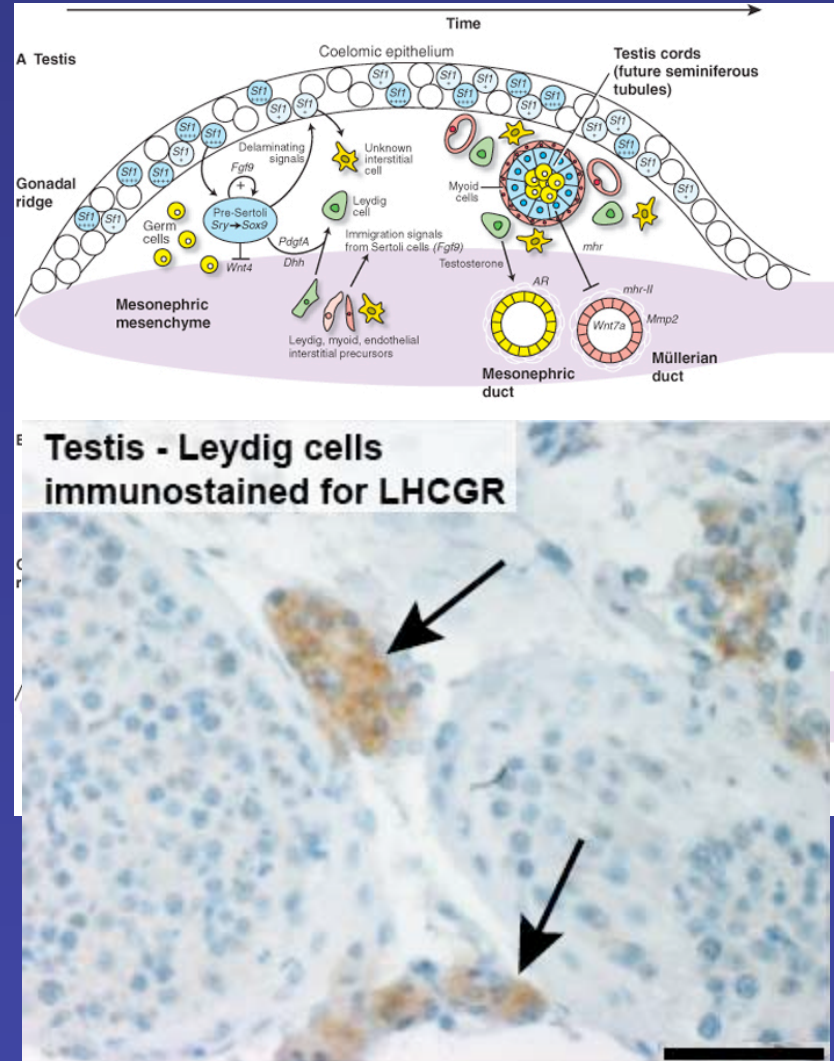
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Gonadal sex

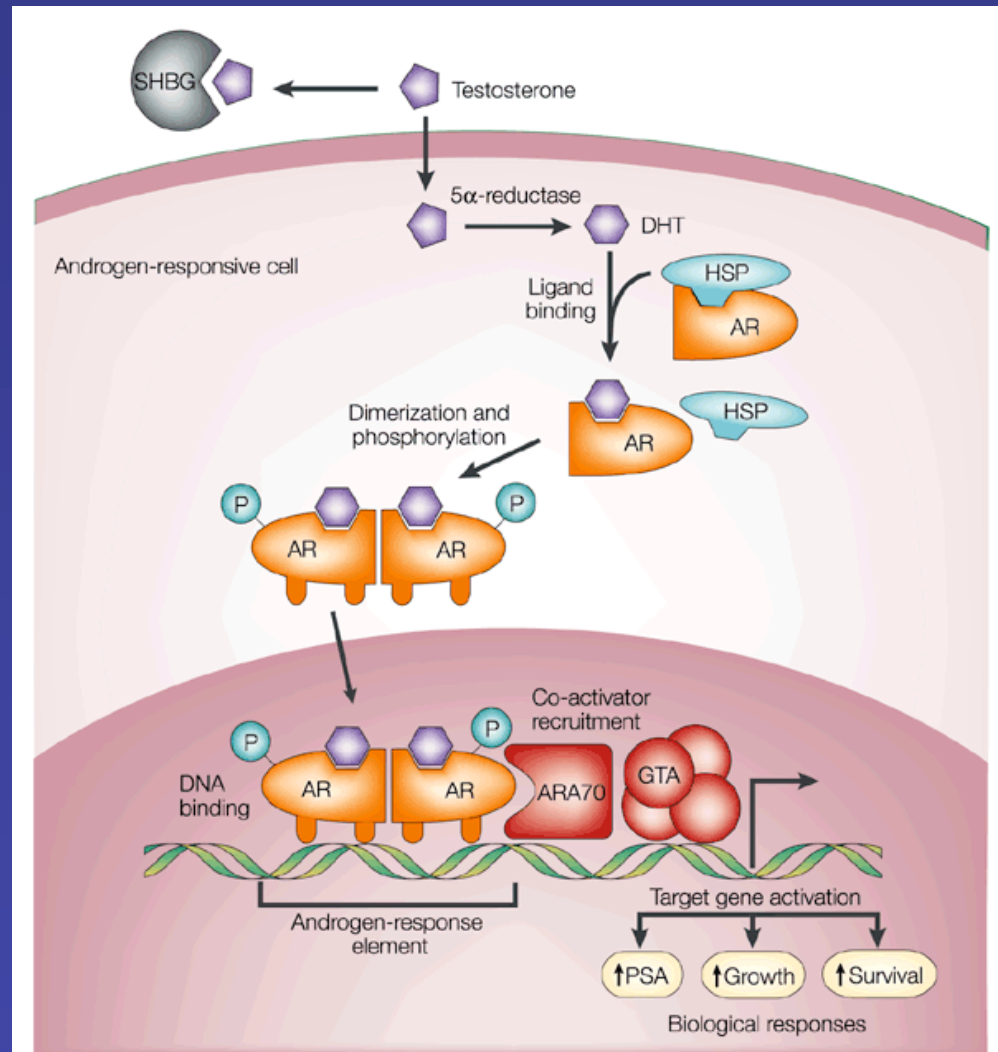
- Leydig cells
 - Secrete Testosterone
 - Week 9-10
 - Preserve mesonephric ducts
 - Regulated by chorionic gonadotropin
 - Placenta
 - Pituitary

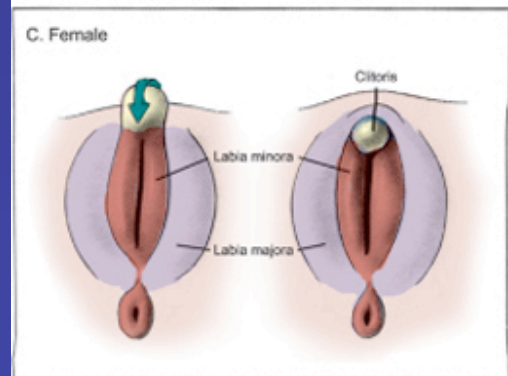
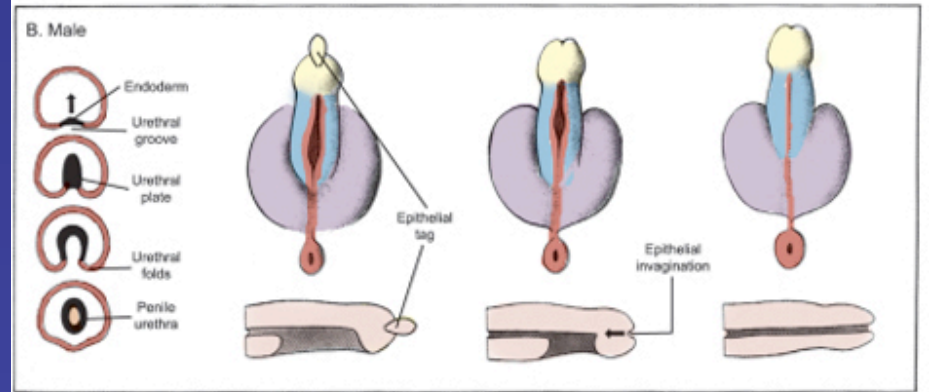
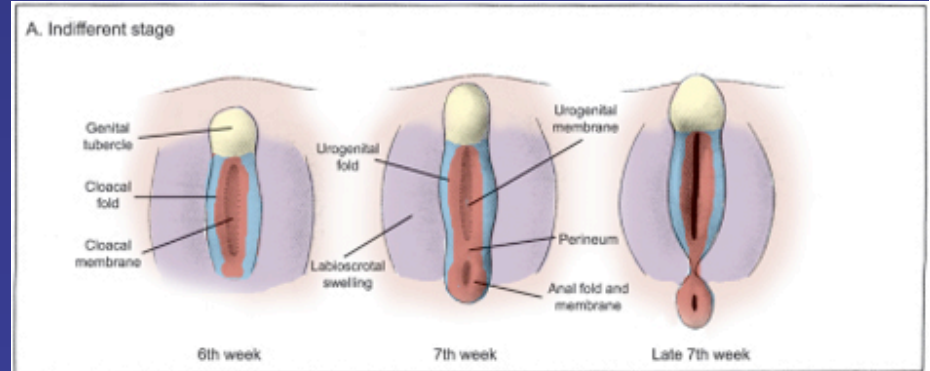
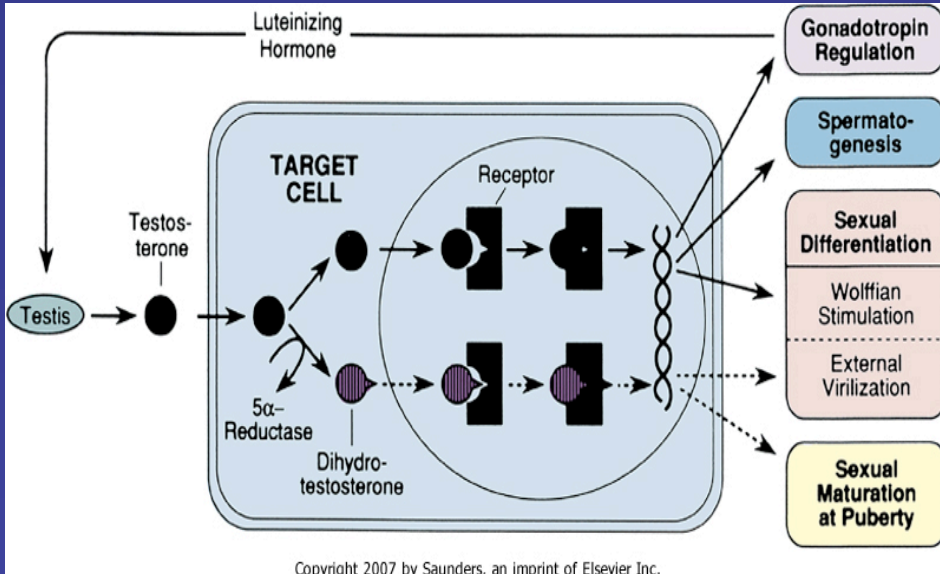


- Chromosomal sex
- Gonadal sex
- **Phenotypic sex**
 - Internal genitalia (T)
 - External genitalia (DHT)

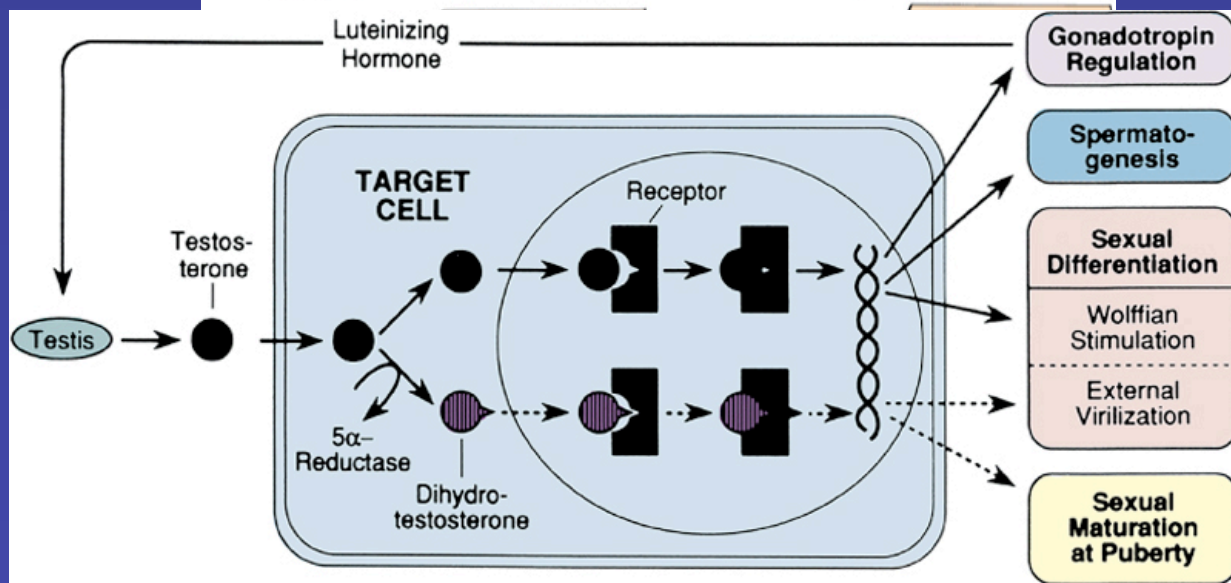
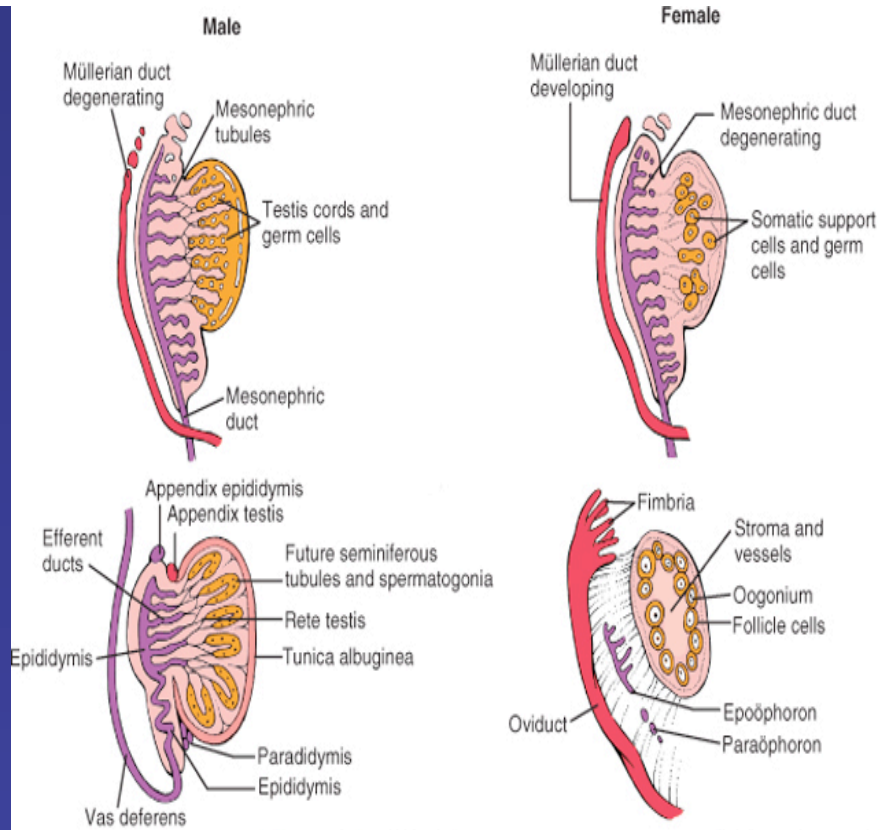
Phenotypic sex

- Androgens
 - Testosterone (T)
 - Dihydrotestosterone (DHT)
- Androgen receptors

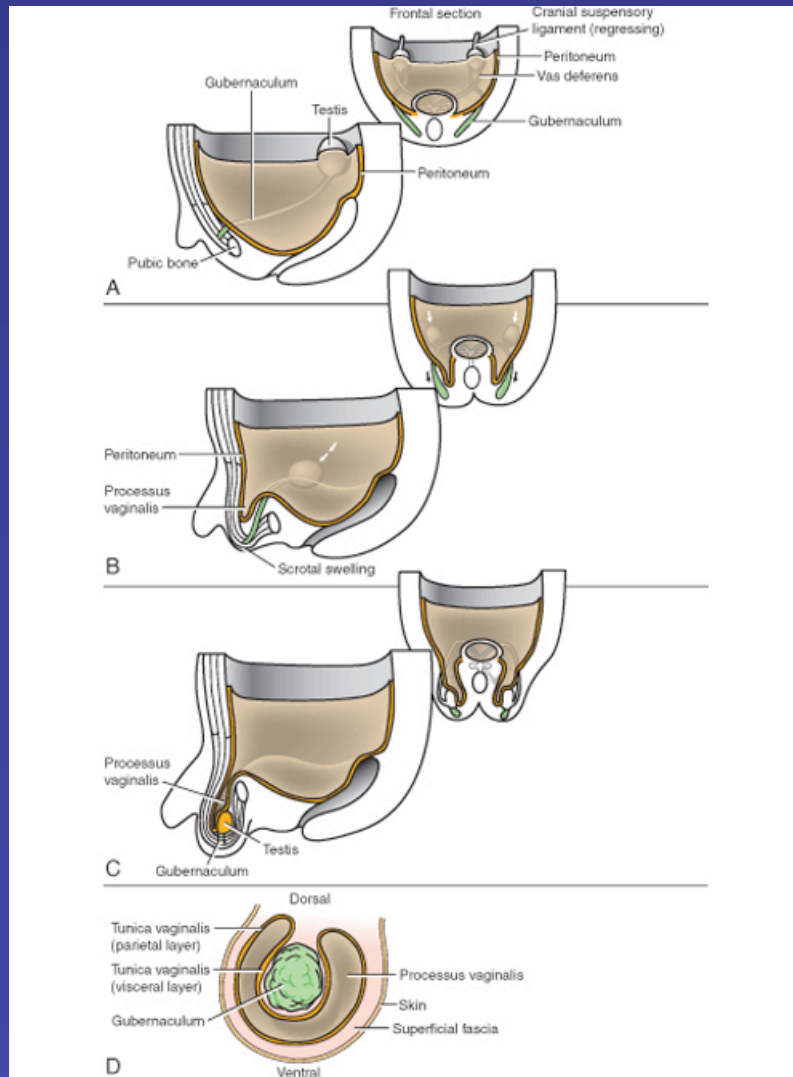




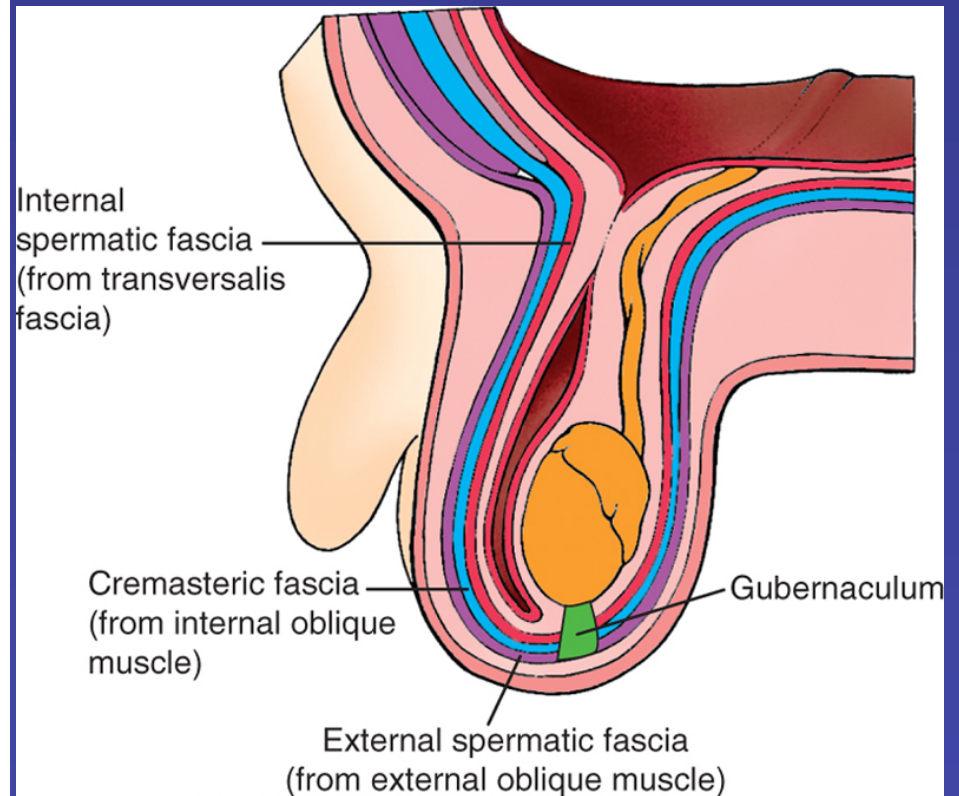
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Testicular descent

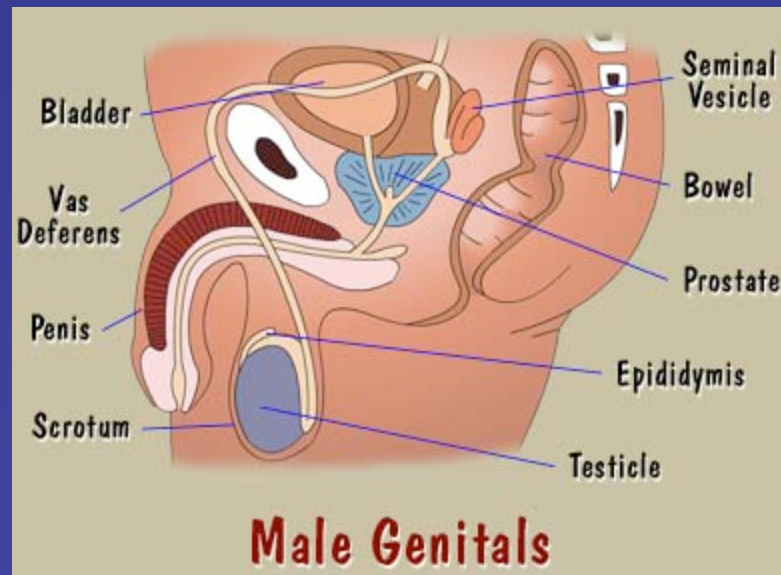


Schoenwolf et al: Larsen's Human Embryology, 4th Edition.
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Normal Male Genitalia



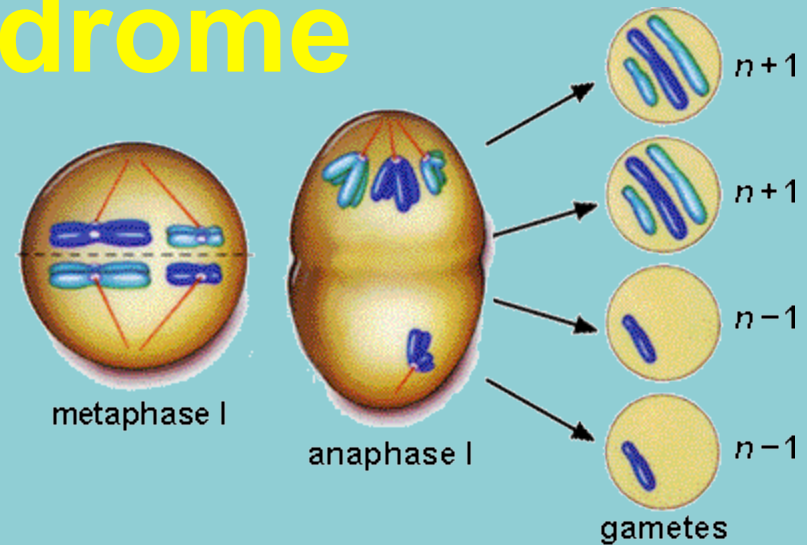
Disordered development

- Klinefelter's syndrome
- XX males
- Male pseudohermaphrodite
- Testicular feminization
- Persistent Mullerian duct syndrome
- Hypospadias
- Undescended testes

Klinefelter's syndrome

- **Chromosomal sex**

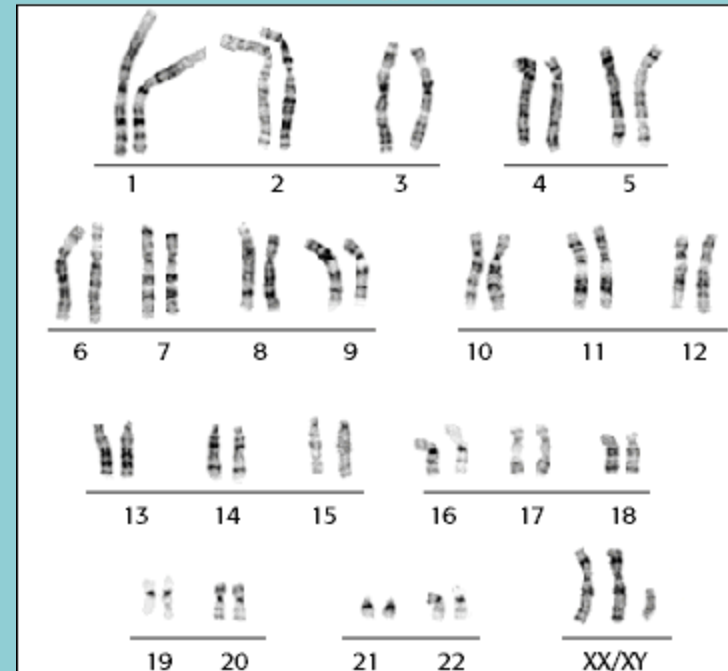
- Failure meiosis
- Disjunction
- XXY



- **Gonadal sex**

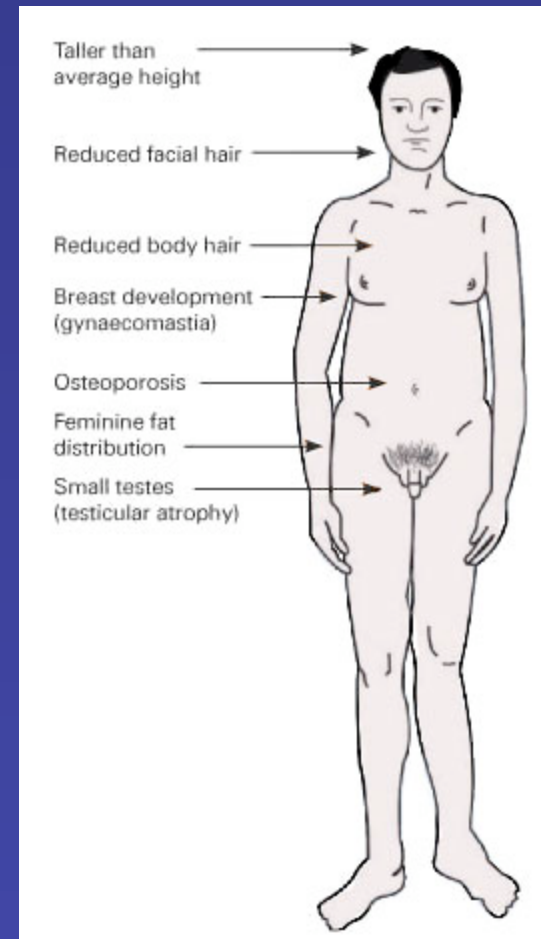
- **Phenotypic sex**

Human Karyotype (XXY, 47)



Klinefelter's syndrome XXY

- Small firm testes
- Gynecomastia
- Seminiferous tubular sclerosis
- High gonadotropins FSH
- 1 of 600 males

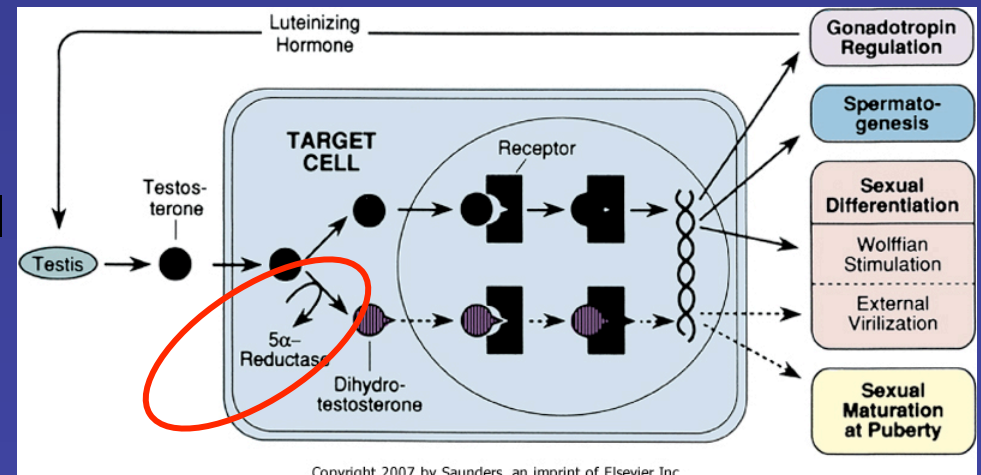


Hermaphrodite (Intersex)

- *“An individual having the reproductive organs and many of the secondary sex characteristics of both sexes”*
- *“a discrepancy between the external genitals and the internal genitals”*
- **Hermaphroditus**
 - the son of Hermes and Aphrodite
 - was fused with a nymph

Male pseudohermaphrodite

- Chromosomal sex
- Gonadal sex
- Phenotypic sex



Male pseudohermaphrodite

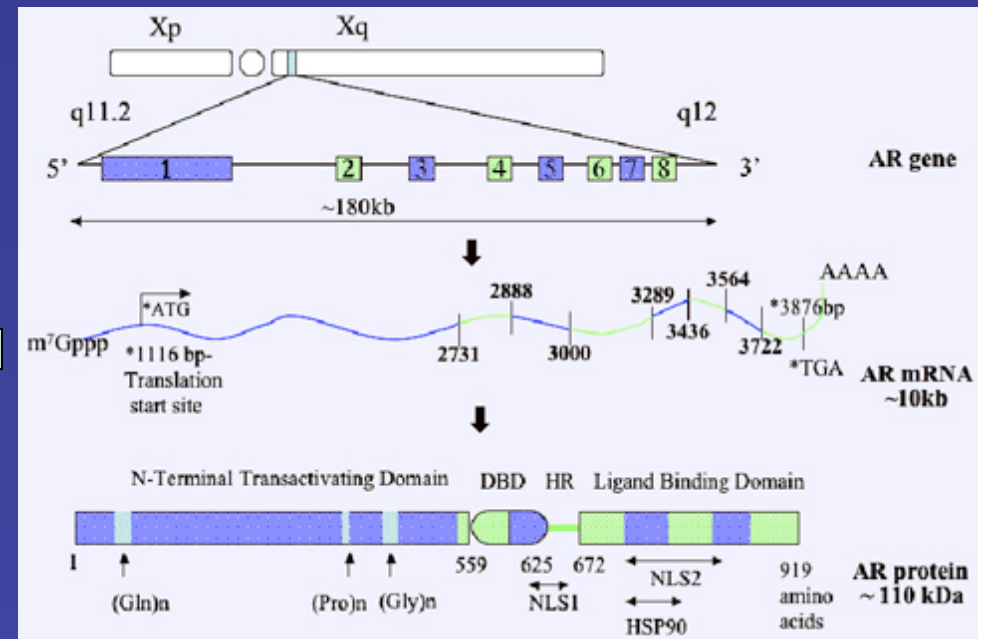
5 α -reductase
deficiency



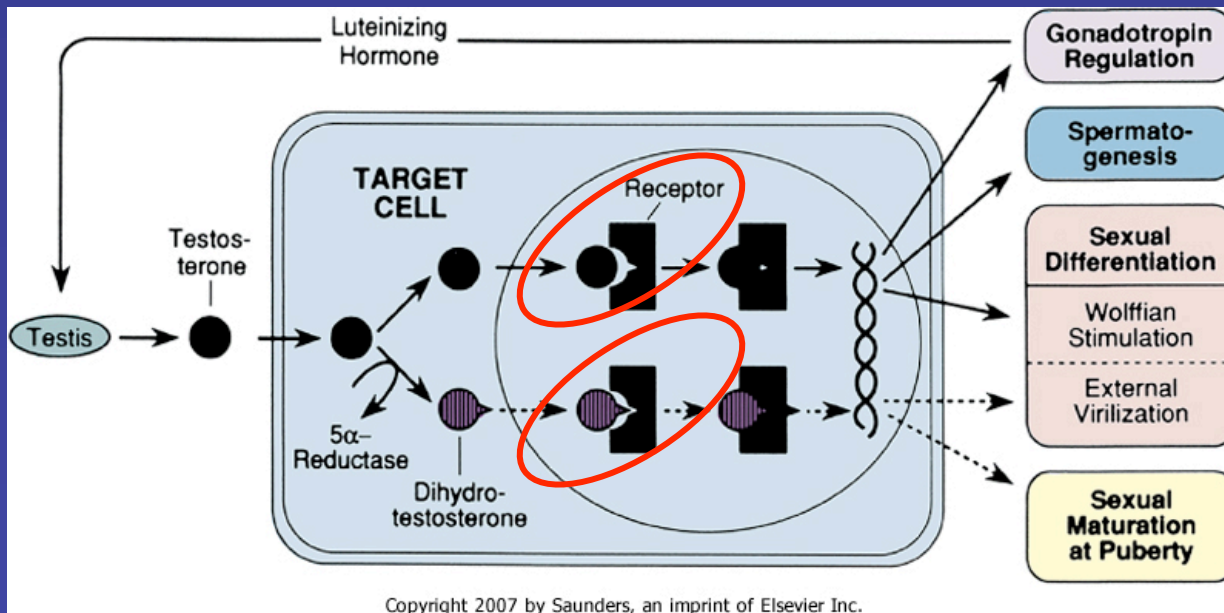
XY chromosomes!!

Testicular feminization (Androgen insensitivity)

- Chromosomal sex
- Gonadal sex
- Phenotypic sex



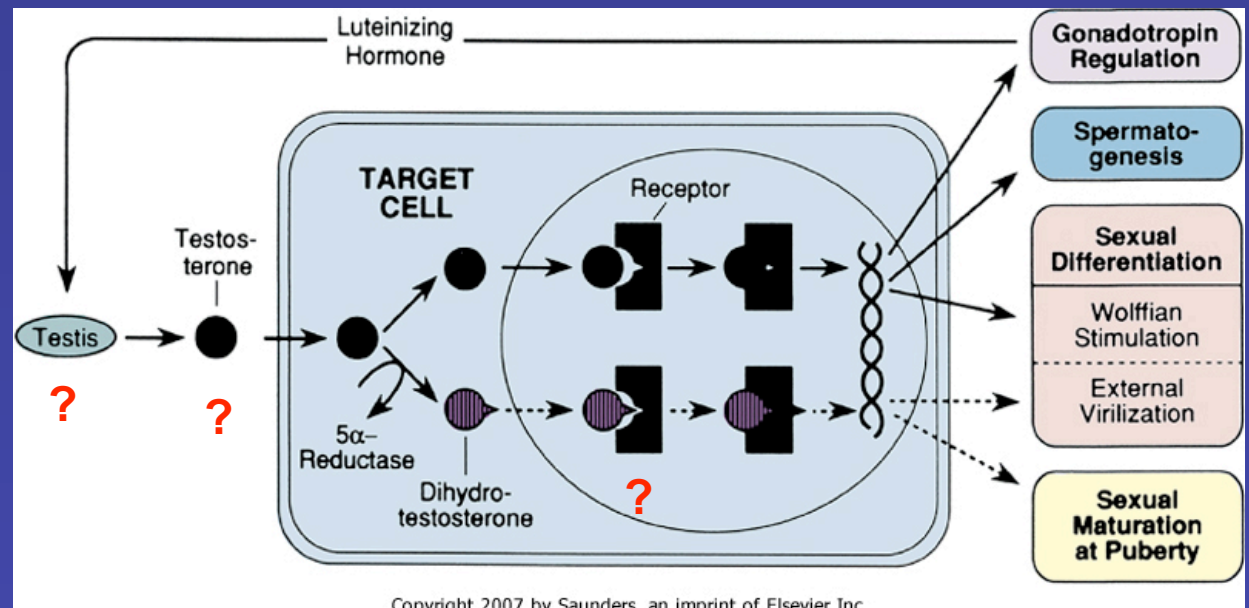
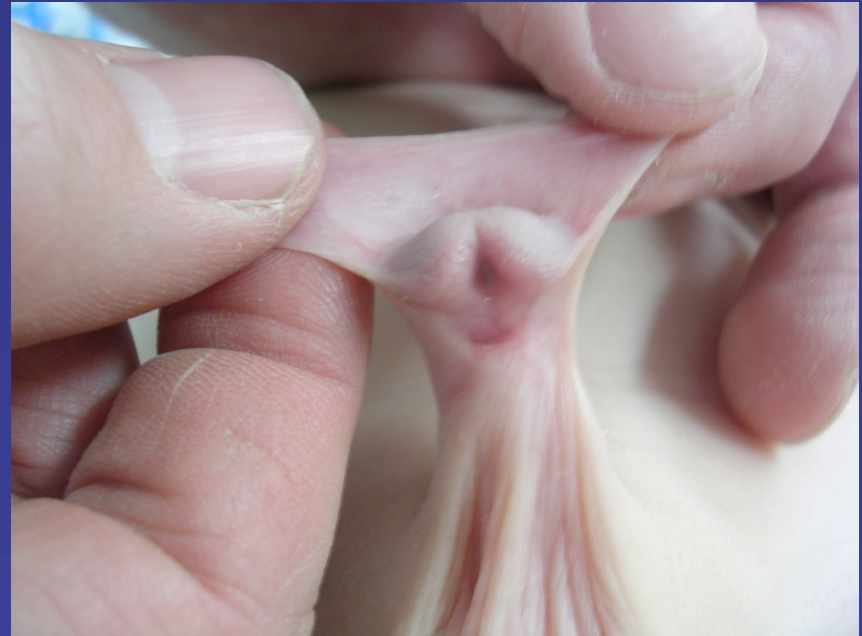
Testicular feminization (Androgen insensitivity)



XY chromosomes!!

Hypospadias

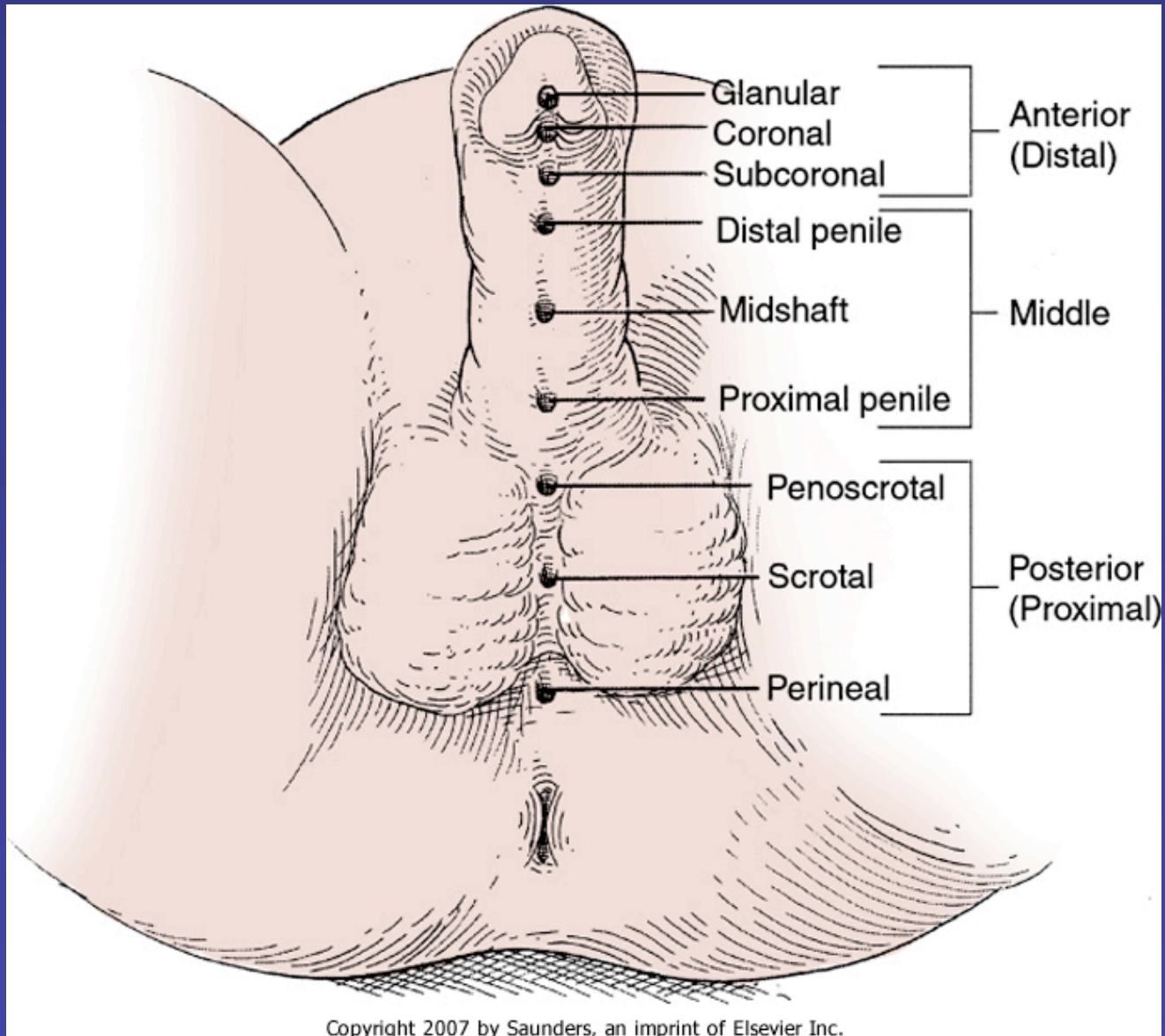
- Abnormal androgen production
- Abnormal androgen sensitivity
- Arrested development
- Estrogen exposure



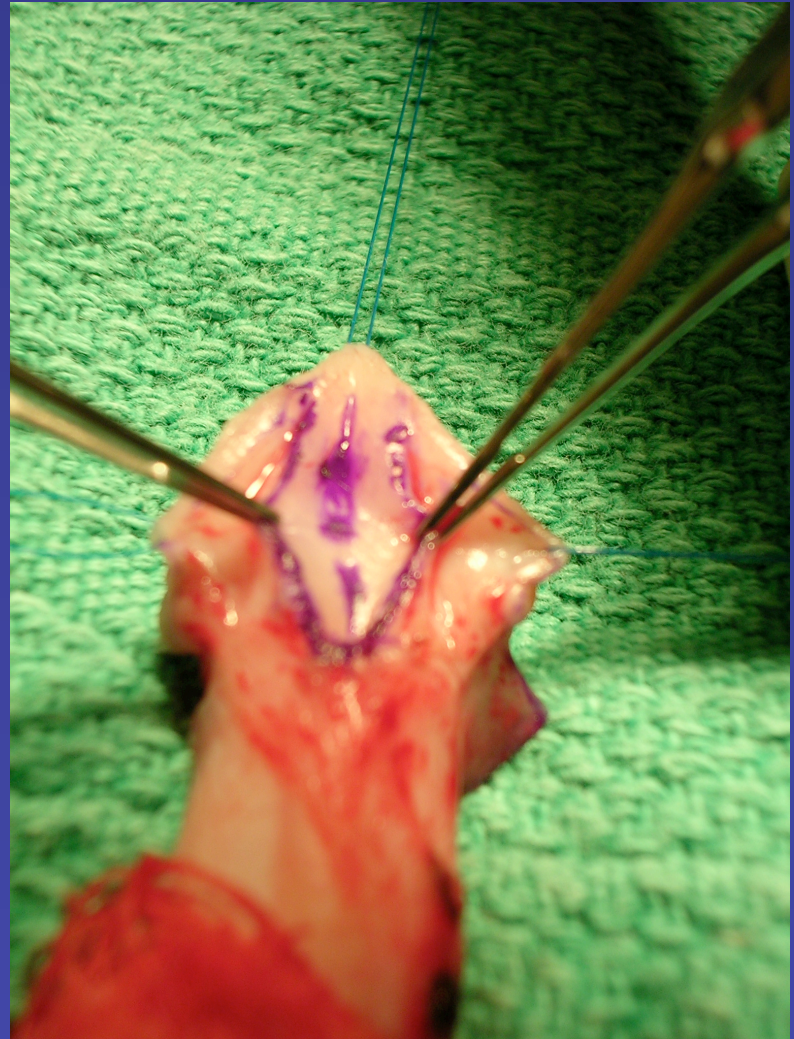
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Hypospadias

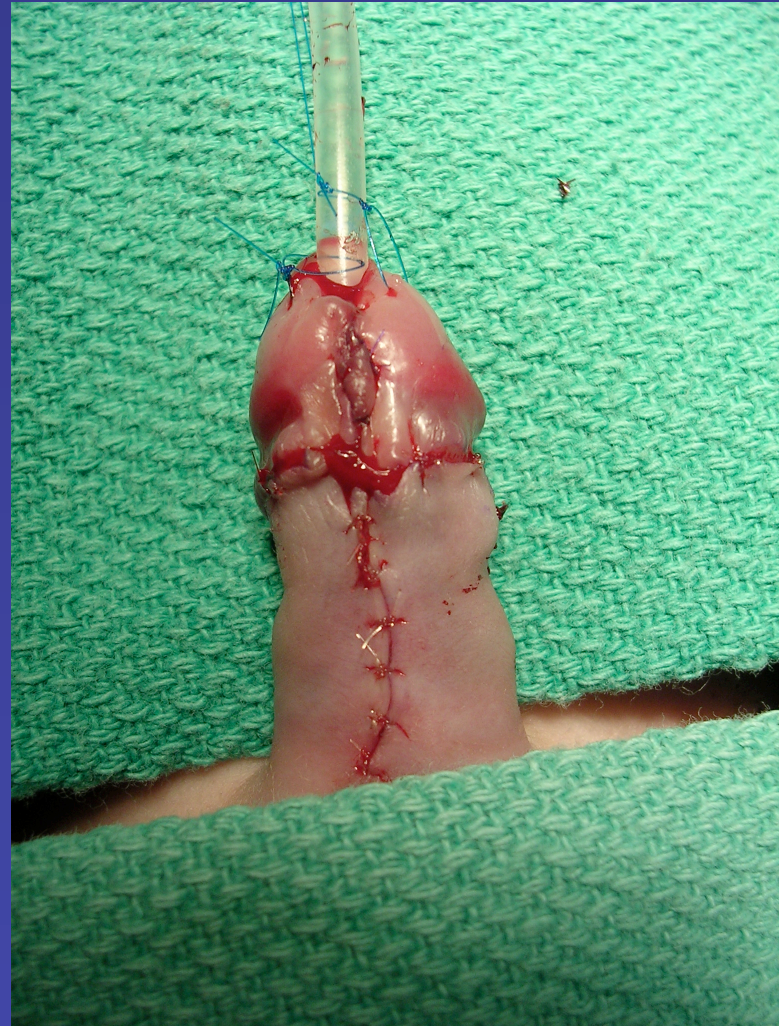




Hypospadias

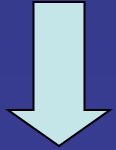


Hypospadias

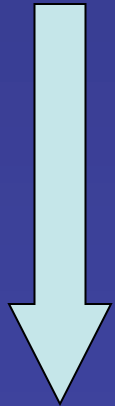


Undescended Testes

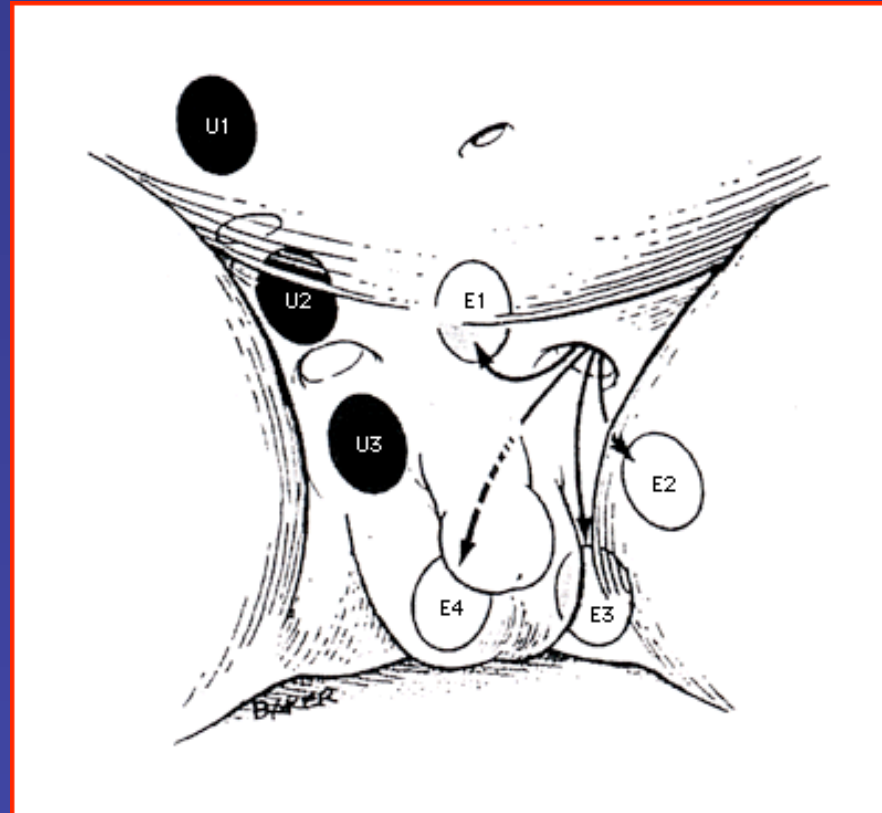
3 MONTHS



7 MONTHS



9 MONTHS



Ectopic testes Locations of undescended (U) and ectopic (E) testes. U1: intra-abdominal, U2: intracanalicular, U3: suprascrotal. E1: suprapubic, E2: femoral, E3: perineal, E4: contralateral. Reproduced with permission from: Pillai, SB, Besner, GE. Pediatric testicular problems. *Pediatr Clin North Am* 1998; 45:813. Copyright © 1998 Pediatric Clinics of North America.

-Gubernaculum

-Endocrine

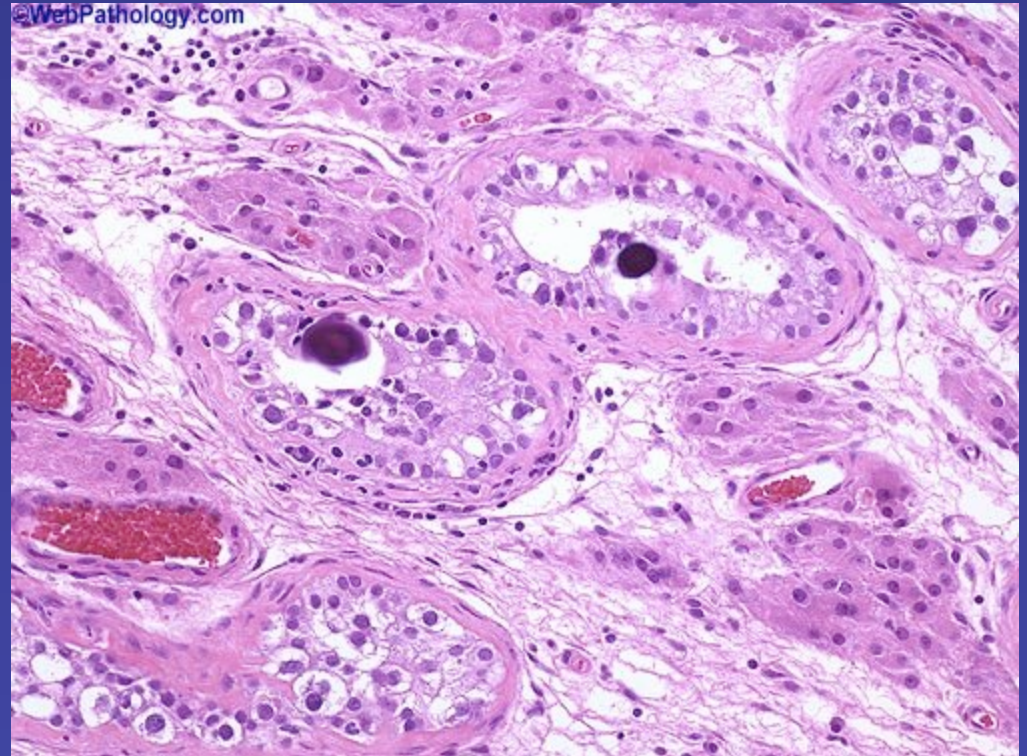
- Insulin like factor3

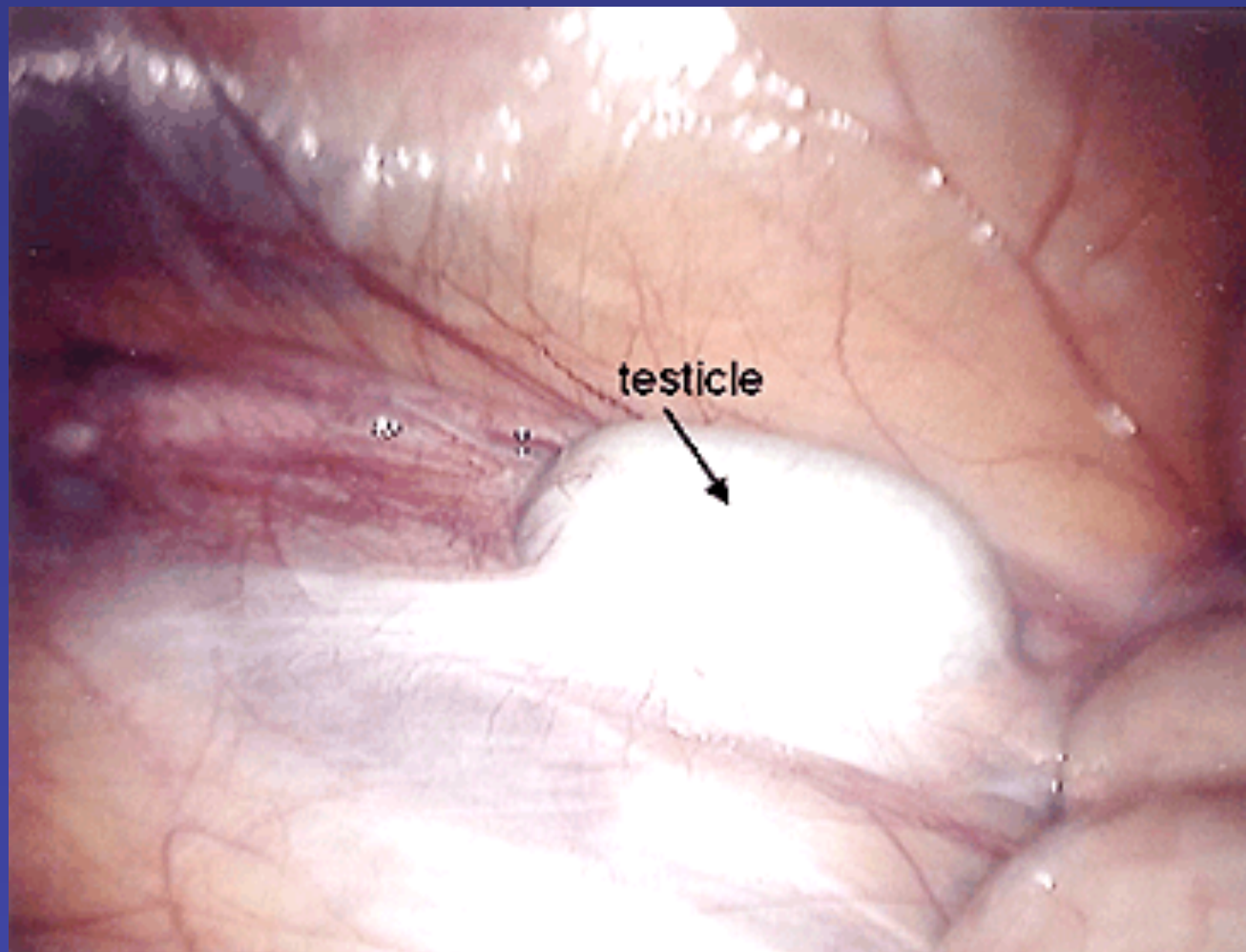
-Genitofem nerve

- CGRP (calcitonin gene Related Protein)

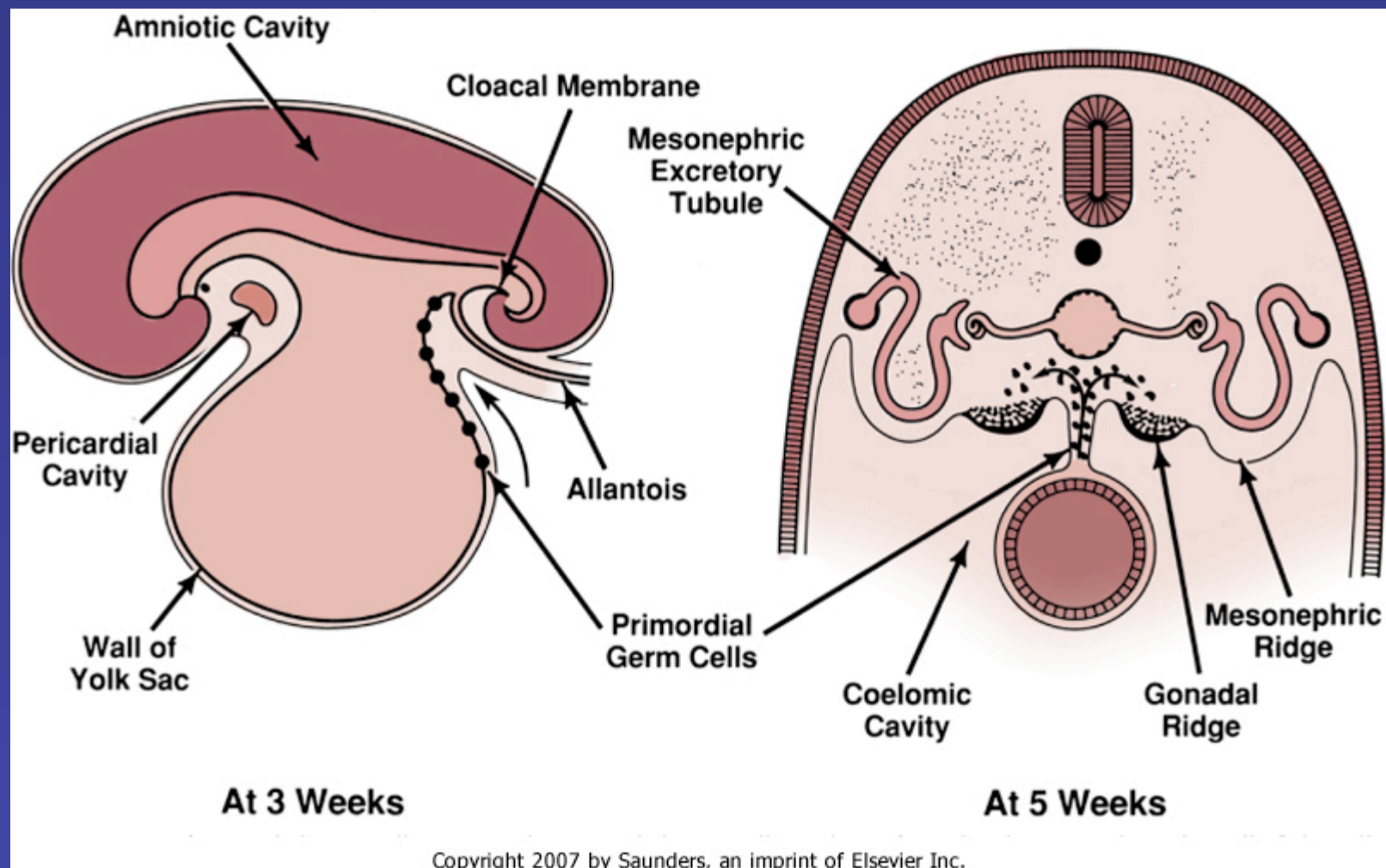
Undescended Testes

- Infertility
- Neoplasia
- Cosmesis
- Testis torsion

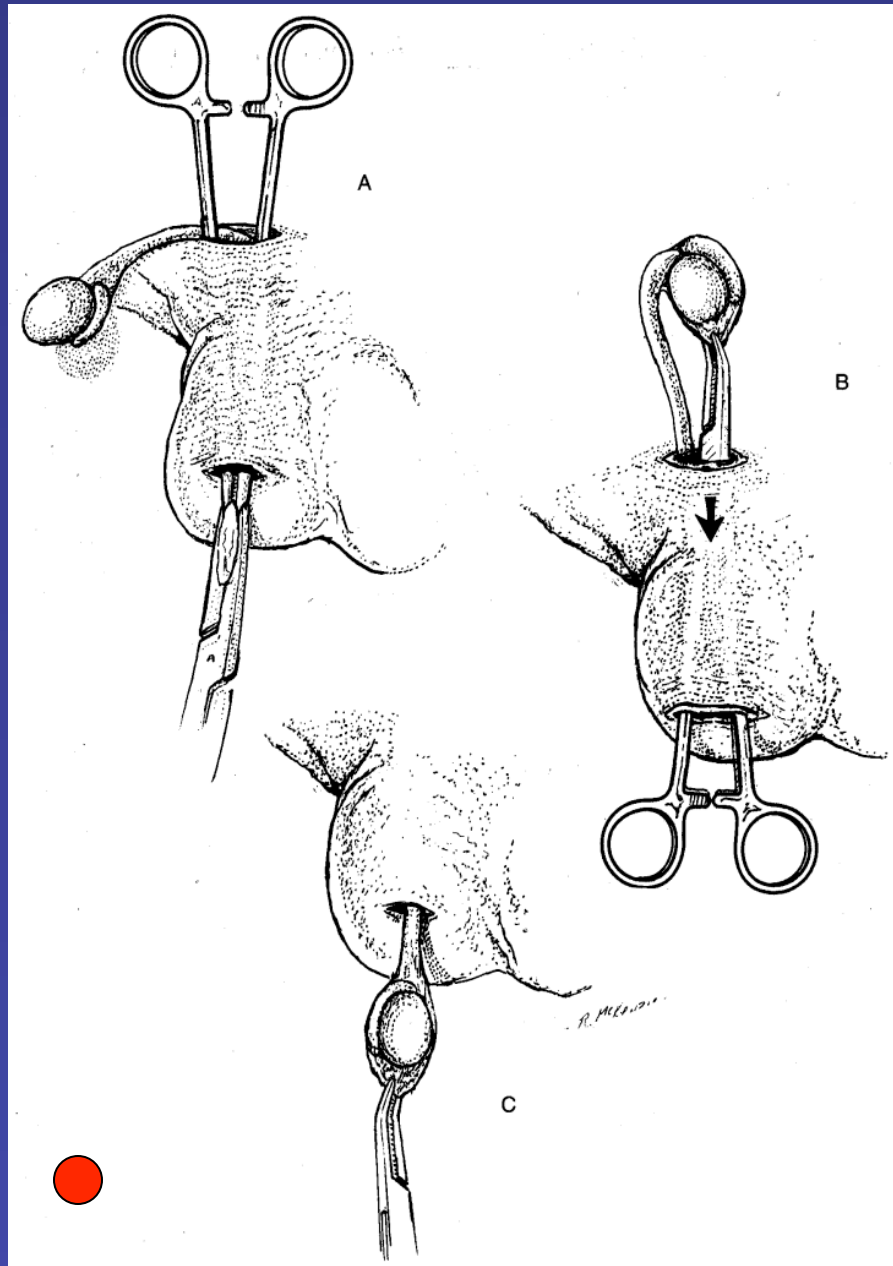




Undescended testicle Laparoscopic view of intra-abdominal right-sided undescended testicle. Courtesy of Christopher S Cooper, MD and Steven G Docimo, MD.

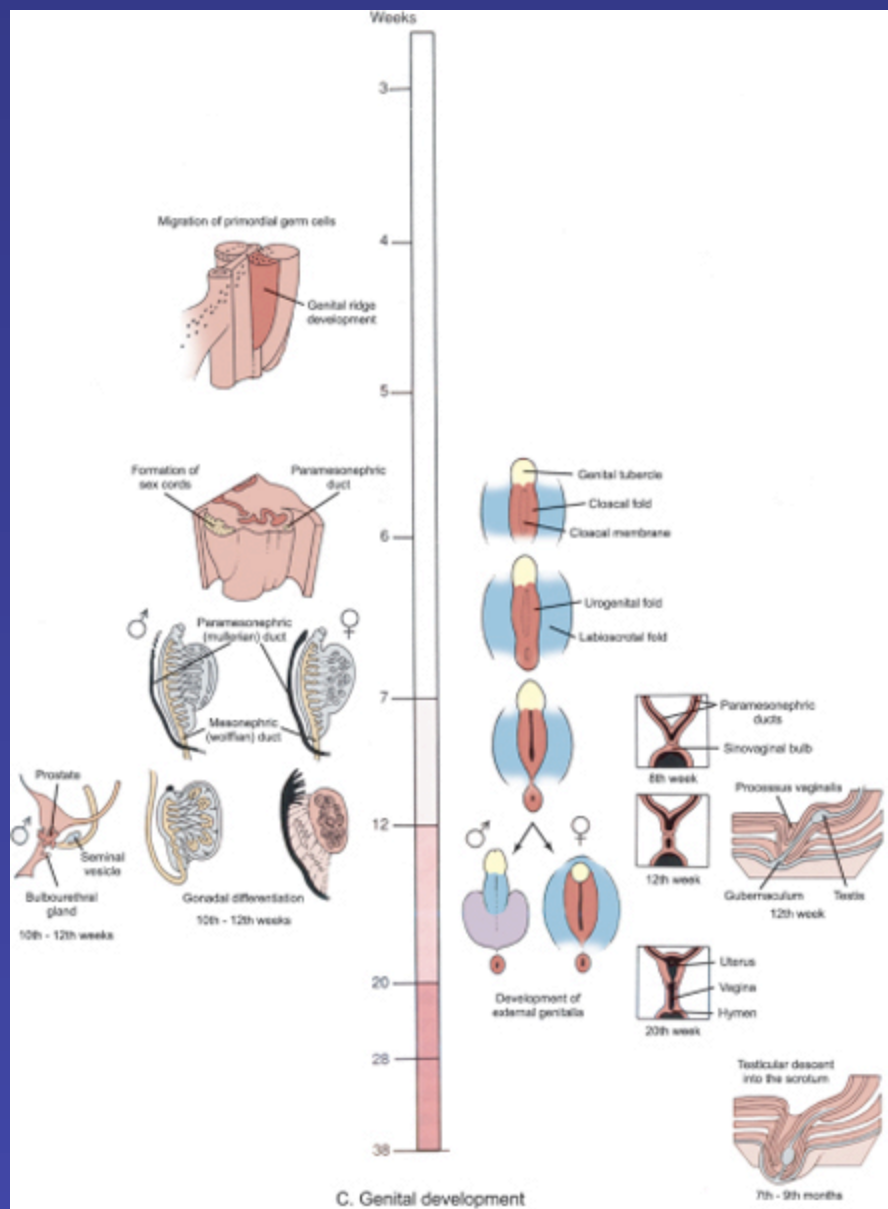








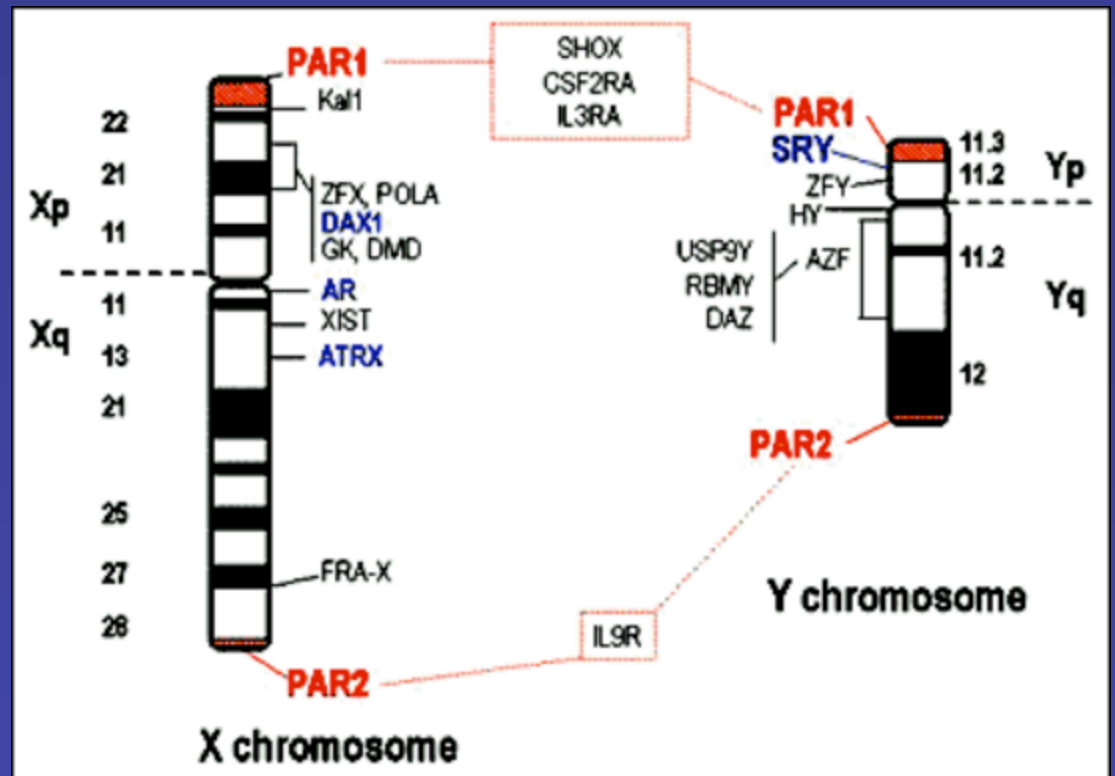
Men
and *Women*



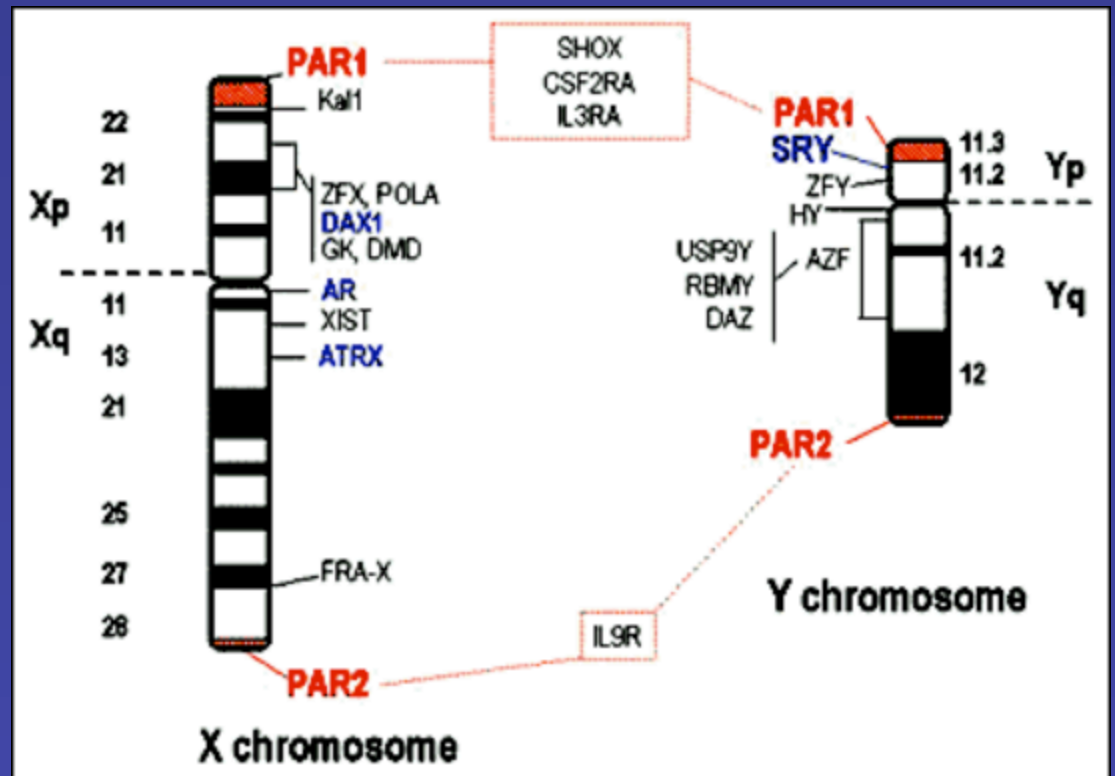
C. Genital development

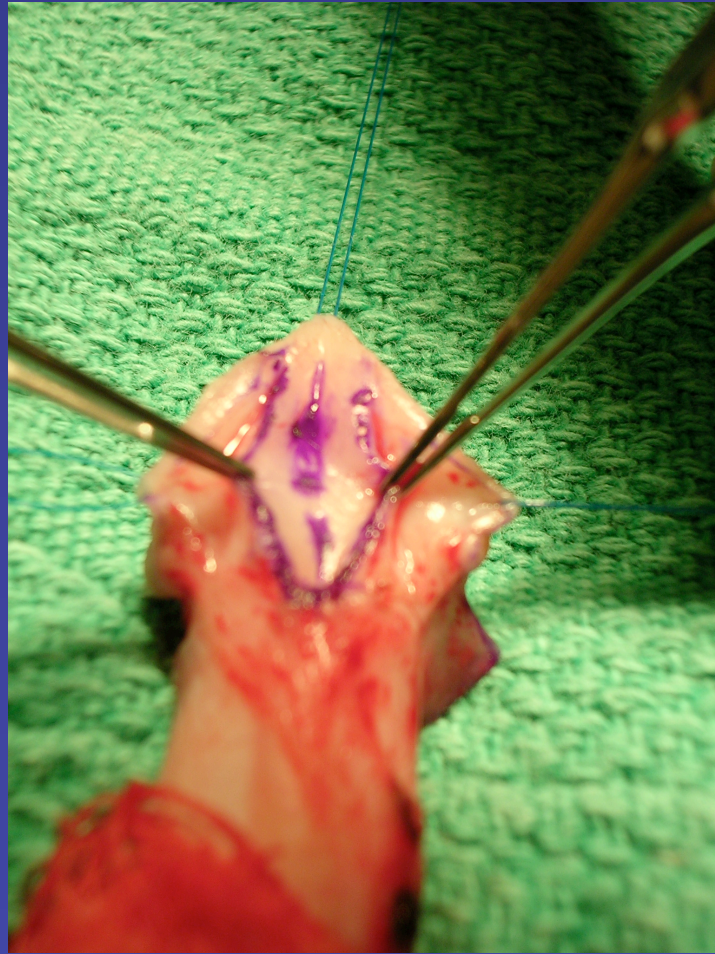
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- Chromosomal sex
- Gonadal sex
- Phenotypic sex

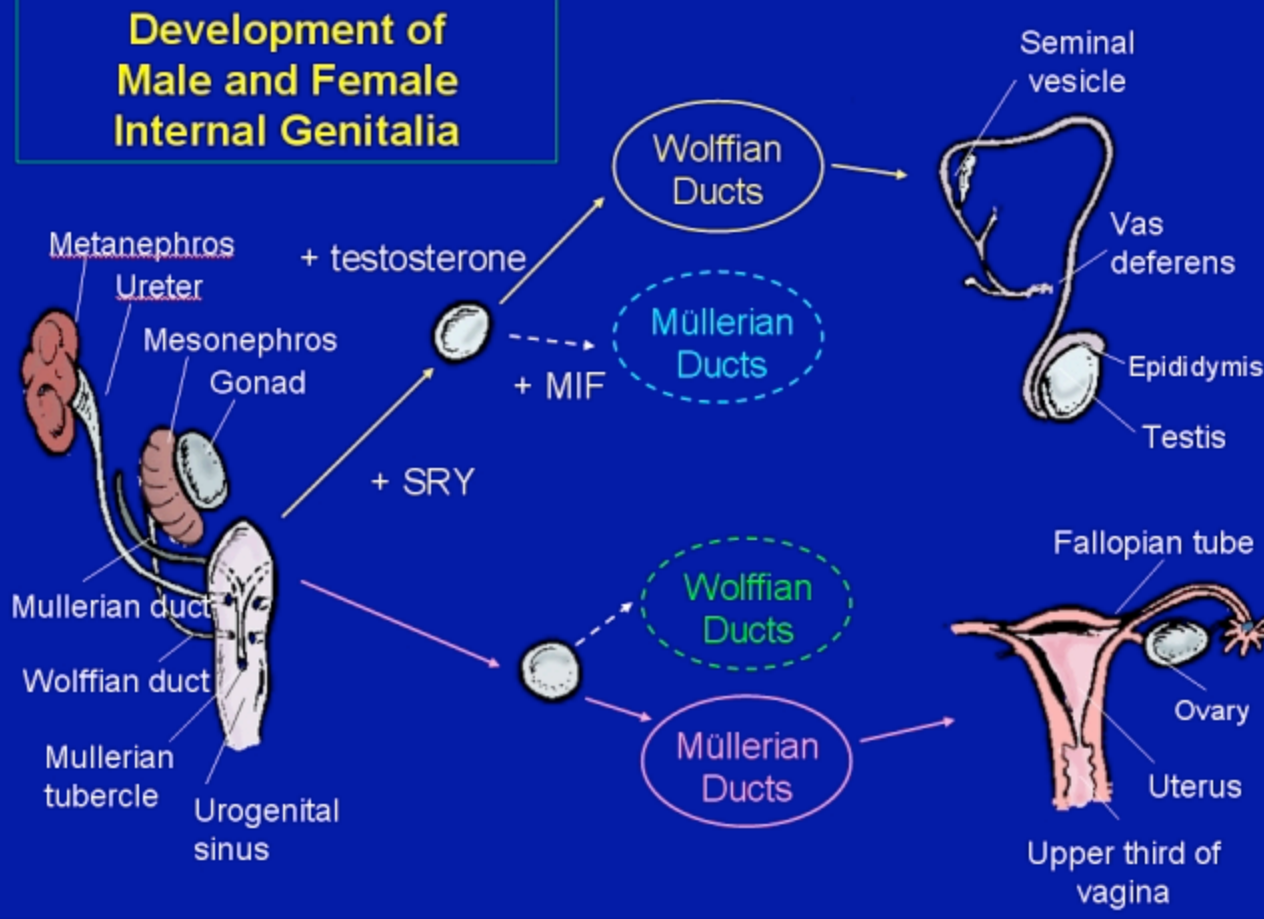


- Chromosomal sex
- Gonadal sex
- Phenotypic sex

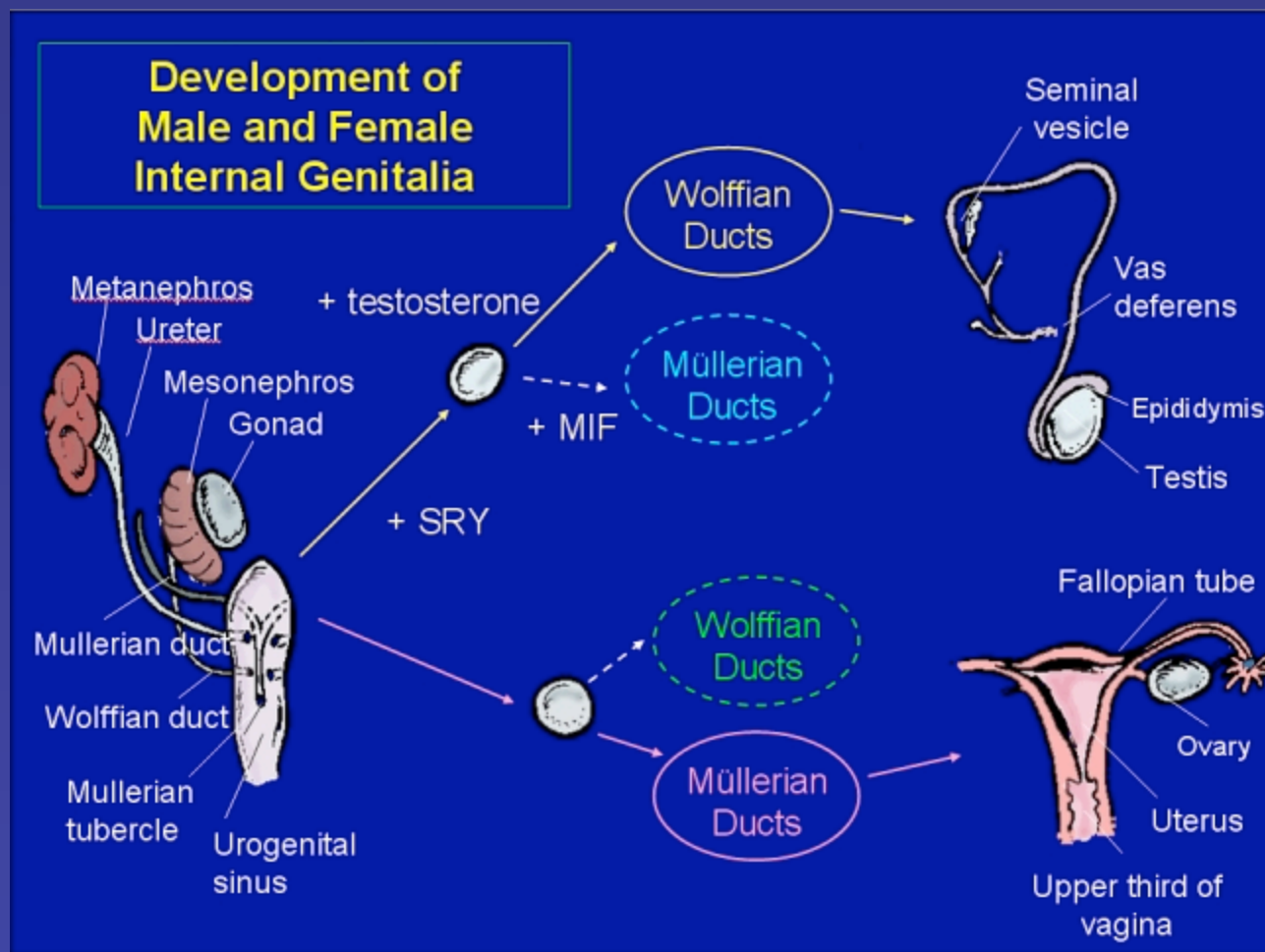


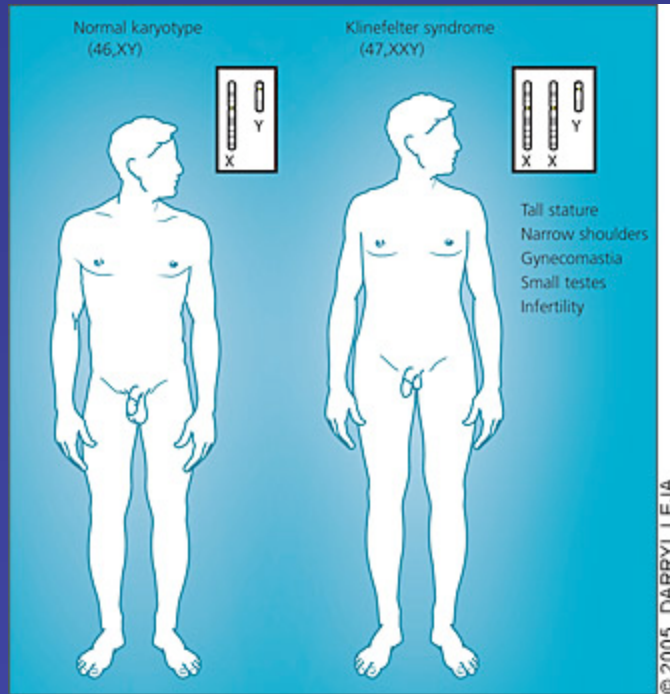


Development of Male and Female Internal Genitalia

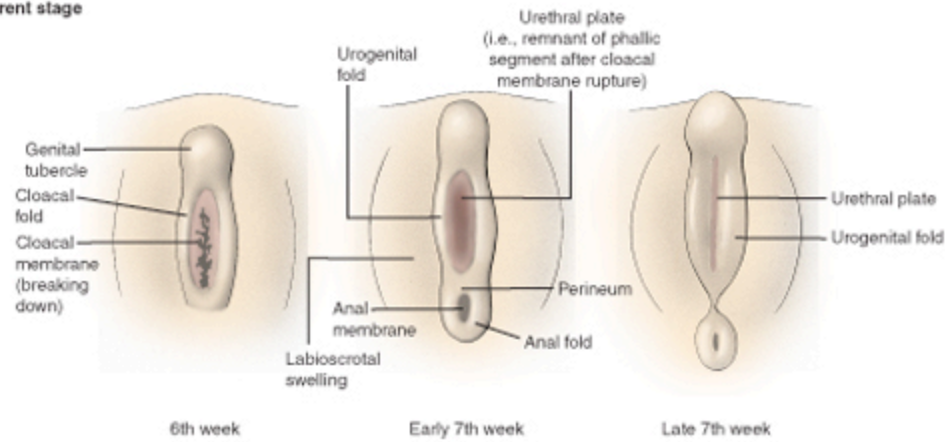


Development of Male and Female Internal Genitalia



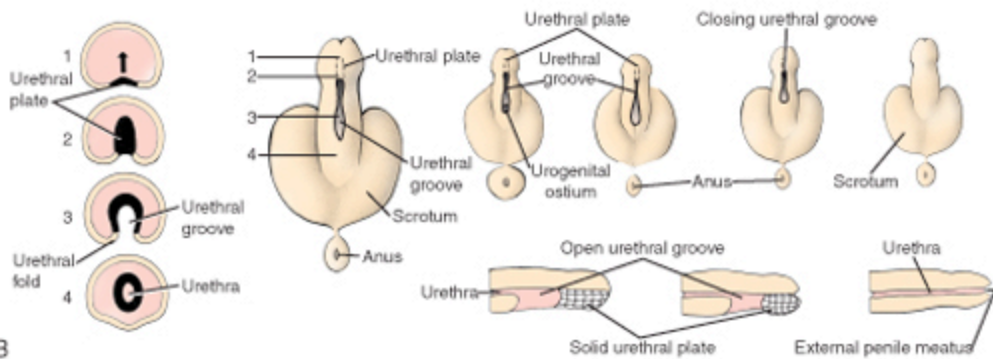


Indifferent stage



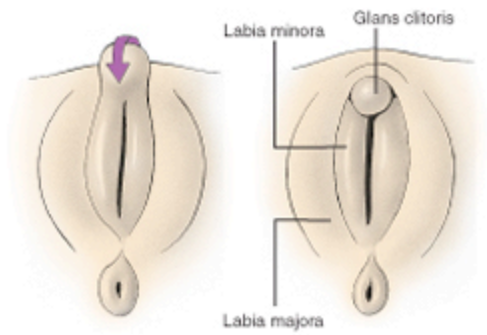
A 6th week Early 7th week Late 7th week

Male



B

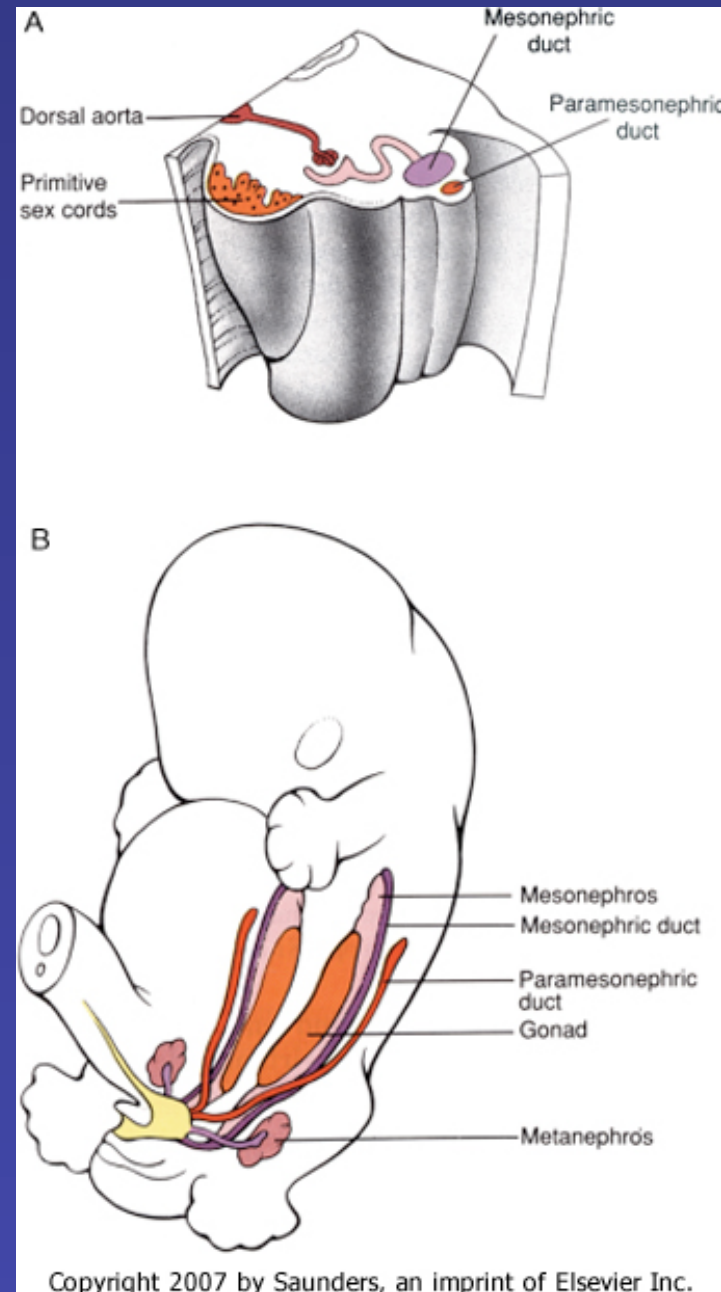
Female



C

- **Persistent mullerian duct**

Figure 106-20 Formation of genital ridges and paramesonephric ducts. A, During the 5th and 6th weeks, the genital ridges form in the posterior abdominal wall just medial to the developing mesonephros. The primordial germ cells induce the coelomic epithelial cells lining the peritoneal cavity and the cells of the mesonephros to proliferate and form the primitive sex cords. B, During the 6th week, the paramesonephric ducts develop lateral to the mesonephros. The caudal tips of the paramesonephric ducts fuse with each other as they connect with the urogenital sinus. (Modified from Larsen WJ: Human Embryology. New York, Churchill Livingstone, 1997.)



Disorder	Karyotype	Phenotype	Sexual Development	Intelligence	Behavioral Problem
Klinefelter syndrome	47,XXY	Tall male	Infertile; hypogonadism	Learning difficulties (some patients)	May have poor psychosocial adjustment
XYY syndrome	47,XYY	Tall male	Normal	Normal	Frequent
Trisomy X	47,XXX	Female, usually tall	Usually normal	Learning difficulties (some patients)	Occasional
Turner syndrome	45,X	Short female, distinctive features	Infertile; streak gonads	Normal (but see text)	Rare