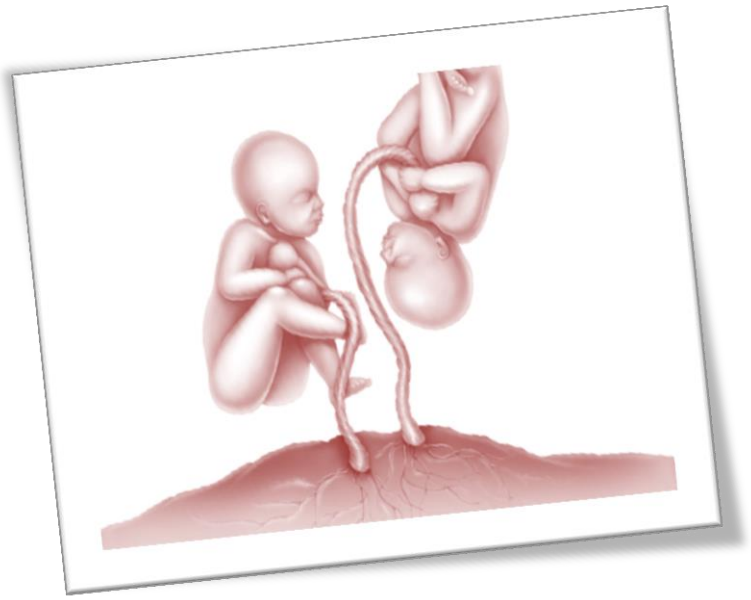
# Reproductive system



Anatomy Team 432

- Both - Black
- Male Notes - BLUE
- Female Notes - GREEN
- Explanation and additional notes - ORANGE
- Very Important note - Red

**LECTURE:** Development of male genital system

**DONE BY:** Deema Al-Turki – Shahad Al-Qreen

**REVIEWED BY:** Hossam Alawad

If there is any mistake or suggestions please feel free to contact us:

Anatomyteam32@gmail.com

## OBJECTIVES:

***At the end of the lecture, students should be able to:***

- List the causes of differentiation of genitalia into the male type.
- Describe the origin of each part of the male internal & external genitalia.
- List the causes & describe the events of descent of testis.
- List the common anomalies of male genital system & describe the causes of each of them.

# Mind map

## Male genital system

**Gonad:**

1. Testis.

**Genital Ducts:**

1. Epididymis.
2. Vas deferens.
3. Urethra.

**Genital Glands:**

1. Seminal vesicle.
2. Prostate.
3. Bulbourethral Glands.

## Development of gonads

**From *3 sources:***

1. Mesothelium
2. Underlying mesenchyme
3. Primordial germ cells

## 5ht week starts

INDIFFERENT GONADS
Male and female genital system is similar until 7th week

## Differentiation in 7th week

### DEVELOPMENT OF TESTIS

Due to expression of testes determining factor (TDS)

### DEVELOPMENT OF MALE GENITAL DUCTS

Leydig's cells → (8th week)
Testosterone → Masculine differentiation of:

- ♣ Mesonephric duct.
- ♣ seminal glands, and external genitalia

Sertoli cells → (7th week)
(Anti-Müllerian hormone)

### DEVELOPMENT OF MALE GENITAL GLANDS

**SEMINAL GLAND:**
Mesodermal (mesonephric duct)
**PROSTATE GLAND:**
Endodermal (prostatic urethra)
**BULBOURETHRAL GLAND:**
endodermal (spongy urethra)

### EXTERNAL GENITALIA
**9th week – 12 week**

**The phallus** → penis

**The urogenital folds** → spongy (penile) urethra

**The labioscrotal folds** → scrotum

# Mind map

## DESCENT OF TESTIS

### INTERNAL DESCENT OF TESTIS

- From posterior abdominal wall to deep inguinal ring.
- **Time**: During 12th week
- **Cause**: a relative movement (abdominal organs enlargement)

### EXTERNAL DESCENT OF TESTIS

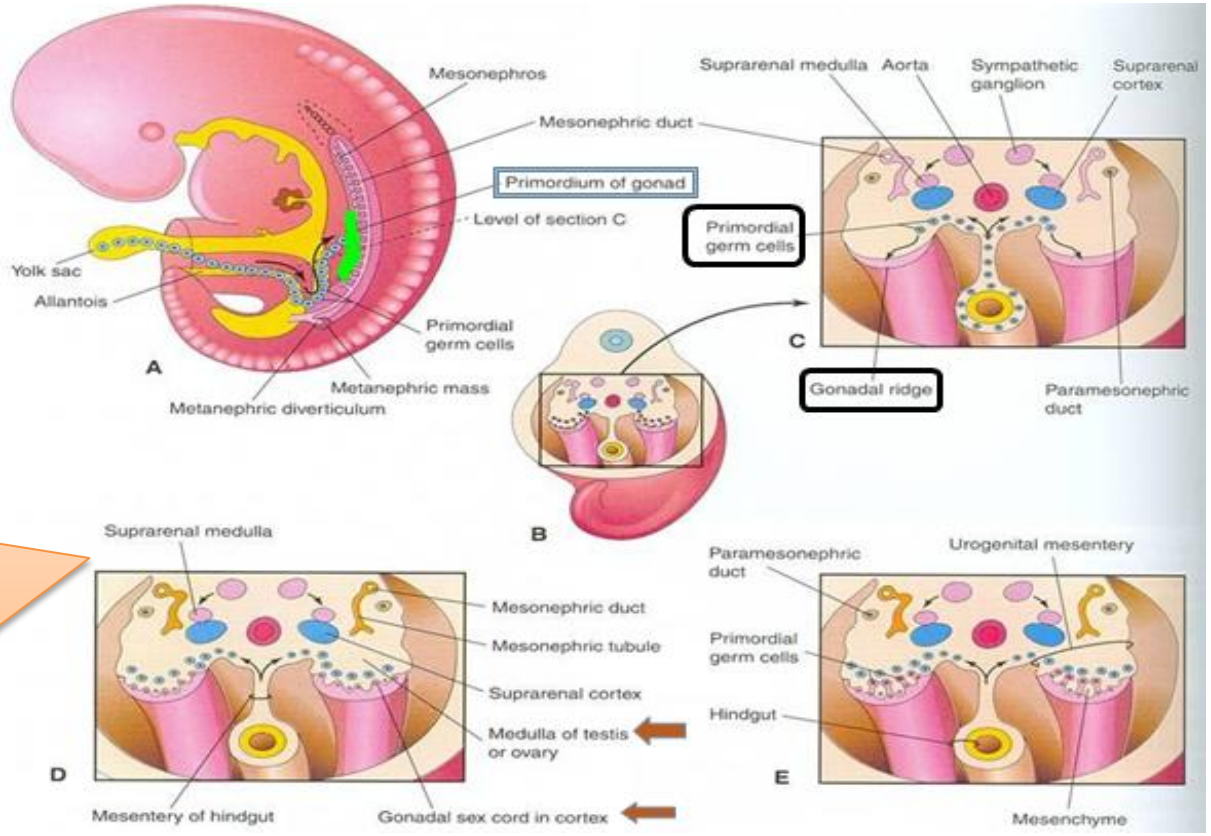
- from deep inguinal ring, through inguinal canal, to scrotum
- **Time**: Begins in 7th month and takes 2 to 3 days
- **Causes**: Controlled by androgens.

## CONGENITAL ANOMALIES

| CHRYPTORCHIDISM | CONGENITAL INGUINAL HERNIA | HYDROCELE OF SPERMATIC CORD | HYDROCELE OF TESTIS |
|---|---|---|---|
| UNDESCENDED TESTIS | Herniation of a loop of intestine through a non-obliterated processus vaginalis | Accumulation of fluid in spermatic cord | Accumulation of fluid in tunica vaginalis (in scrotum) |
| deficiency of androgens | The processus vaginalis does not obliterate | due to a non-obliterated portion of stalk of processus vaginalis | due to non-obliteration of the whole stalk of Processus vaginalis |

After this long mind map **let's start**
The beginning in a short story ☺

**Primitive germ cells are endodermal cells of the yolk sac migrate along dorsal mesentery of hindgut to gonadal ridges which will differentiate later to cortex and medulla. Cortex epithelium will proliferate forming sex cords that penetrate the medulla. Primitive germ cells become incorporated into gonadal cords.**



# MALE GENITAL SYSTEM

**Gonad:**

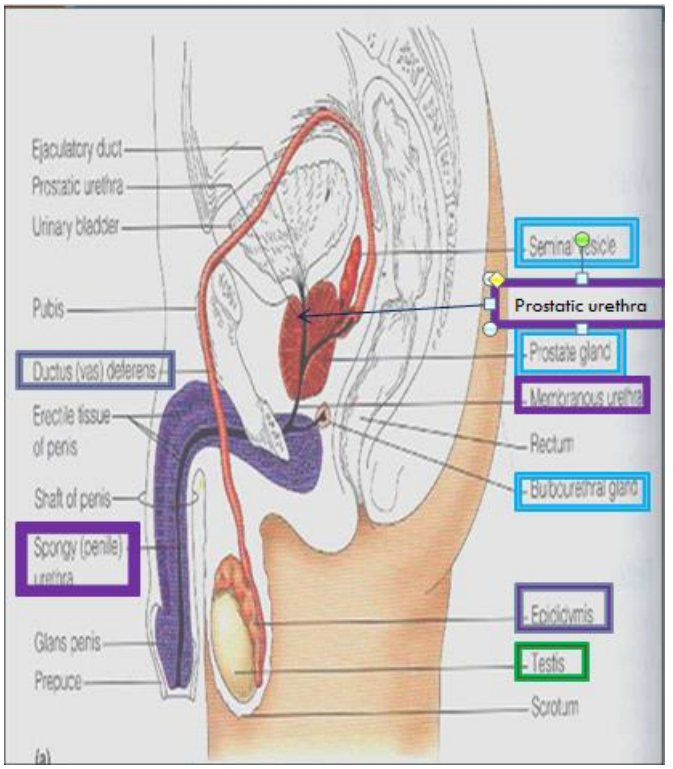
1. Testis.

**Genital Ducts:**

1. Epididymis.
2. Vas deferens.
3. Urethra.

**Genital Glands:**

1. Seminal vesicle.
2. Prostate.
3. Bulbourethral Glands.

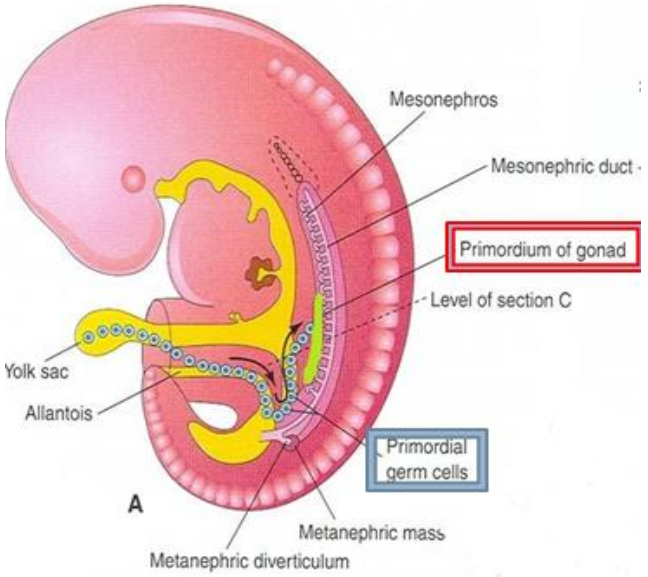



# DEVELOPMENT OF GONADS

- ♣ During 5th week: → gonadal development occurs.
- ♣ Until 7th week: → gonads are similar in both sexes. (haven't differentiated yet)

**Gonads are derived from *3 sources:***

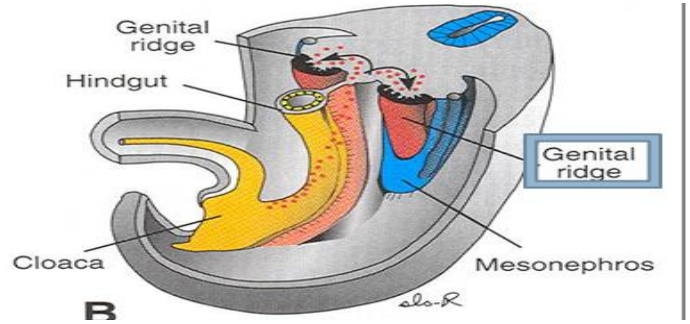
- Mesothelium (mesodermal epithelium lining the coelomic cavity)
- Underlying mesenchyme
- Primordial germ cells



## INDIFFERENT GONADS

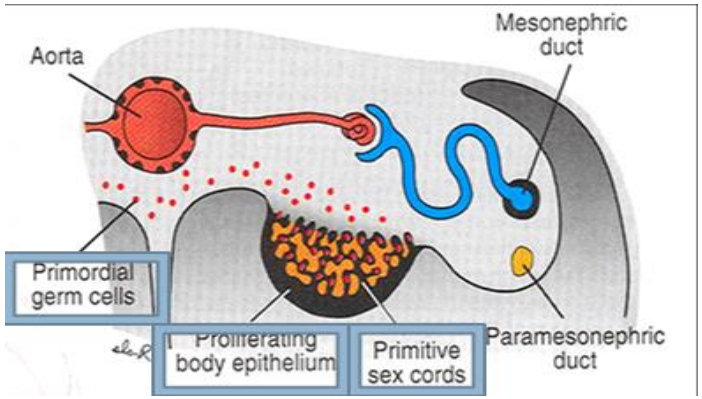
**Gonadal ridge:**

- a bulge on the medial side of mesonephros <u>produced by:</u>
- 1- Proliferation of mesothelium (cortex).
- 2- Proliferation of mesenchyme (medulla).




**Gonadal (primary sex) cords:**

- The proliferating **mesothelial cells** fuse and penetrate the underlying mesenchyme to **form gonadal cords**.



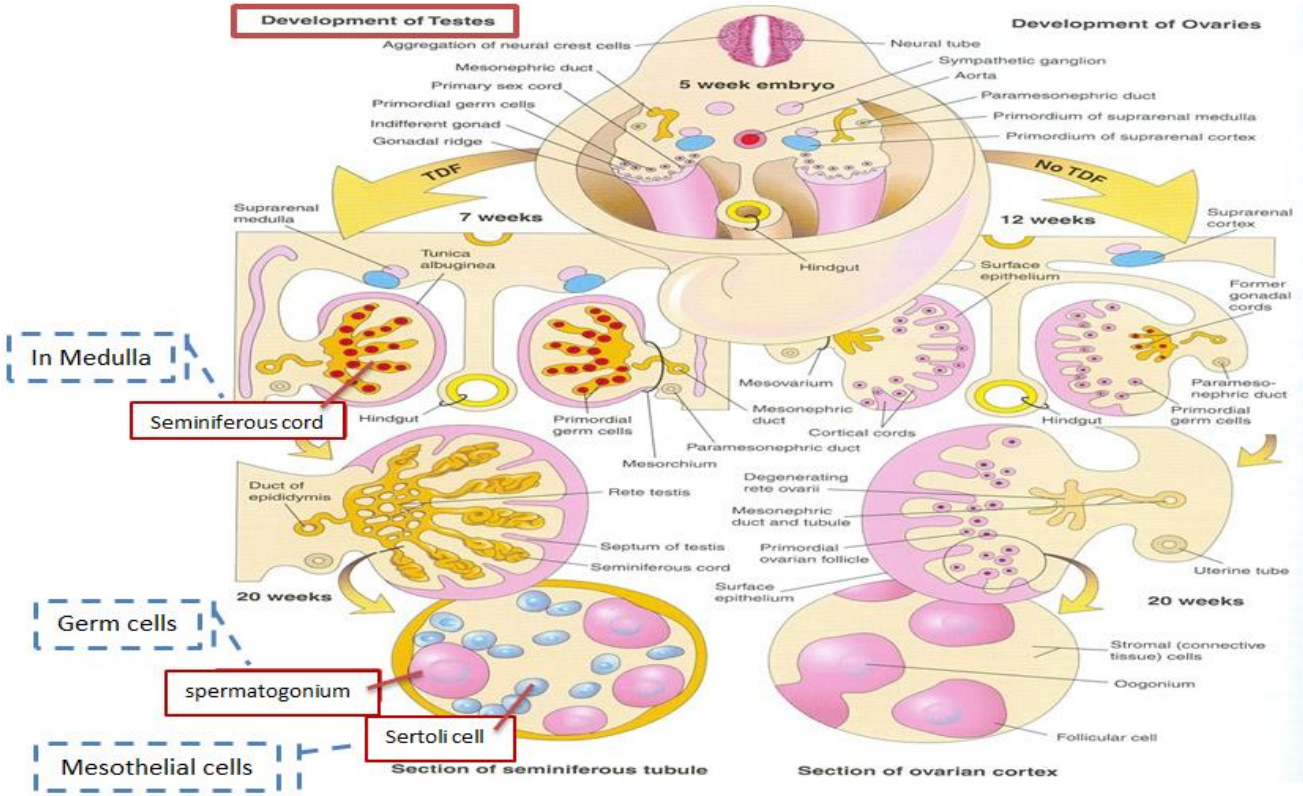

**Primordial germ cells:**

- **endodermal cells** of the yolk sac migrate along <u>dorsal mesentery of hindgut</u> to **gonadal ridges** & become incorporated into gonadal cords.

## DEVELOPMENT OF TESTIS

- <u>during 5th week Until 7th week</u> male and female genital systems are similar (development of primitive germ cells)
- <u>At 7th week :</u>
  Testes determining factor promote differentiation of gonads into testes

  (This factor is in the Y chromosome) → so nothing will happen in case of a female
- tunica albugenia is a characteristic feature of testicular tissue (first sign of differentiation)



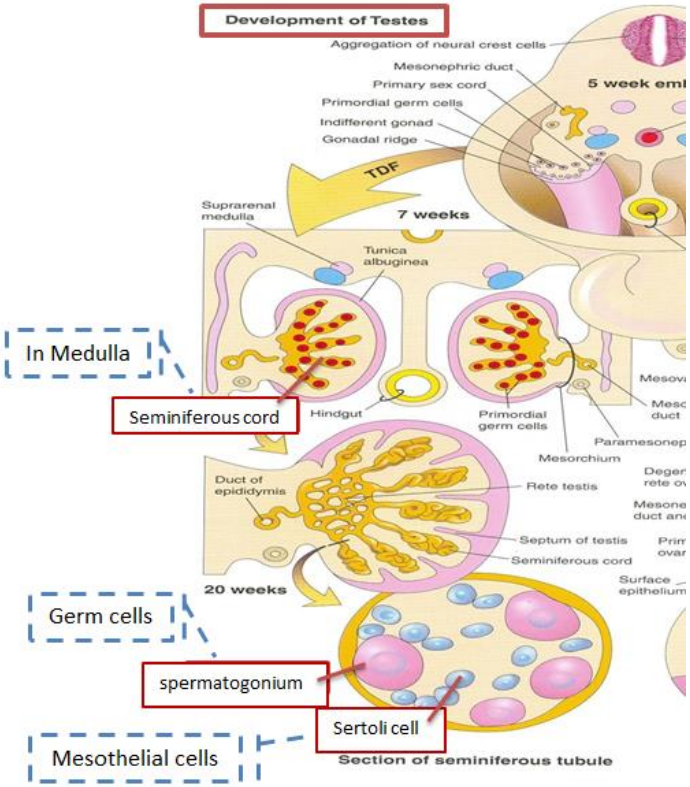
# DEVELOPMENT OF TESTIS

The Y chromosome has a testis-determining factor (TDS) that differentiates gonad into testis.

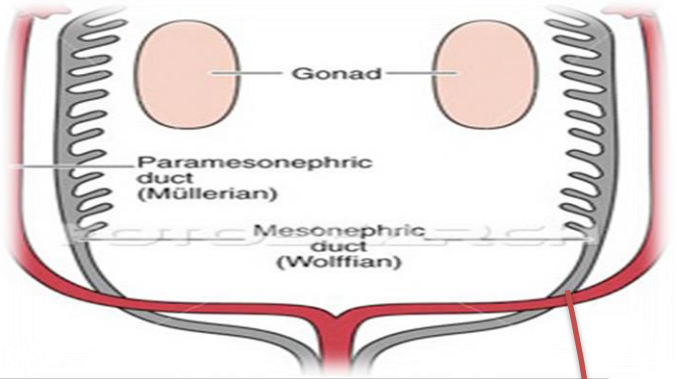
**At 7th week:**

1. Regression of cortex & differentiation of medulla into testis.
2. Gonadal cords condense & extend into medulla to form seminiferous cords.
3. The characteristic feature is the development of a thick fibrous capsule (tunica albuginea) that separates the enlarging testis from mesonephros.

- Seminiferous cords develop into seminiferous tubules.
- Seminiferous tubules remain solid **until puberty**. Its walls are composed of:
  1. Sertoli cells: derived from surface epithelium of testis (mesothelial cells).
  2. Spermatogonia: derived from primordial germ cells.
- **By eighth week**, mesenchyme surrounding seminiferous cords gives rise to interstitial cells (of Leydig) secreting testosterone.




# DEVELOPMENT OF MALE GENITAL DUCTS

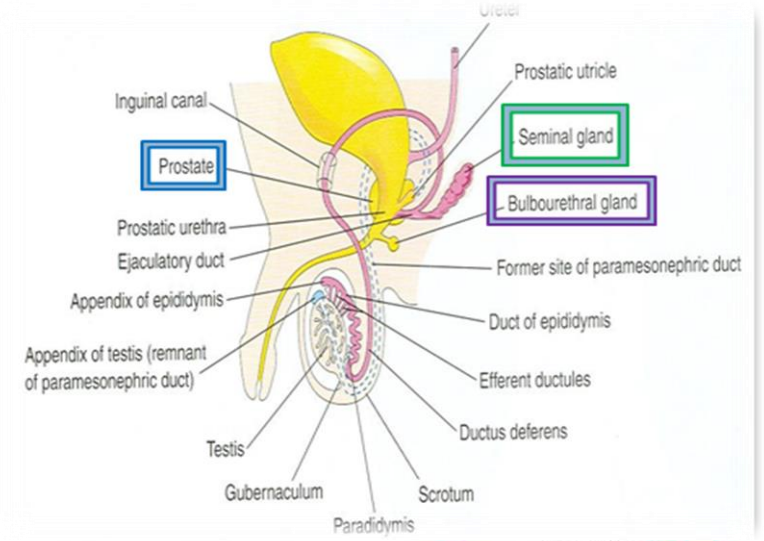



| | | |
|---|---|---|
| Leydig's cells | Testosterone (8th week) | Masculine differentiation of mesonephric duct:<br>1- epididymis,vas deferens, seminal glands, ejaculatory duct.<br>2- Masculine differentiation of external genitalia. |
| Sertoli cells | Müllerian inhibiting substance<br>(Anti- Müllerian hormone) (7th week) | Suppression of developmentof paramesonephric (Müllerian) duct **(Female duct)** |

# DEVELOPMENT OF MALE GENITAL GLANDS

1. SEMINAL GLAND: **mesodermal** outgrowth from mesonephric duct.
2. PROSTATE GLAND: **endodermal** outgrowth from prostatic urethra.
3. BULBOURETHRAL GLAND: **endodermal** outgrowth from spongy urethra.

**Stroma & Smooth muscles in 2 & 3 are derived from surrounding mesenchyme**



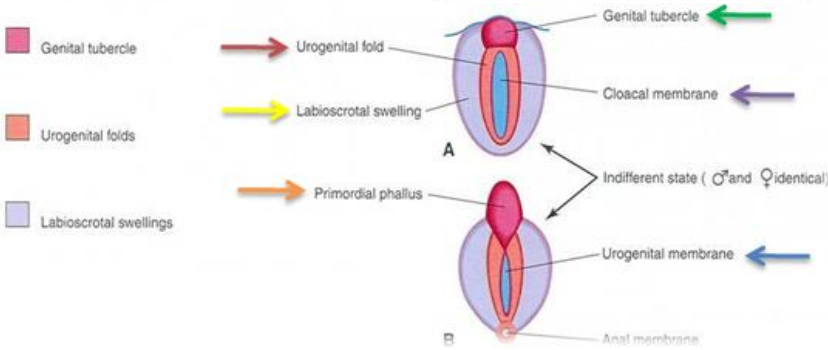

# DEVELOPMENT OF EXTERNAL GENITALIA

## INDIFFERENT STAGE OF EXTERNAL GENITALIA

***(From 4th to 7th week)***

The Male and female external genitalia are the same in this period.

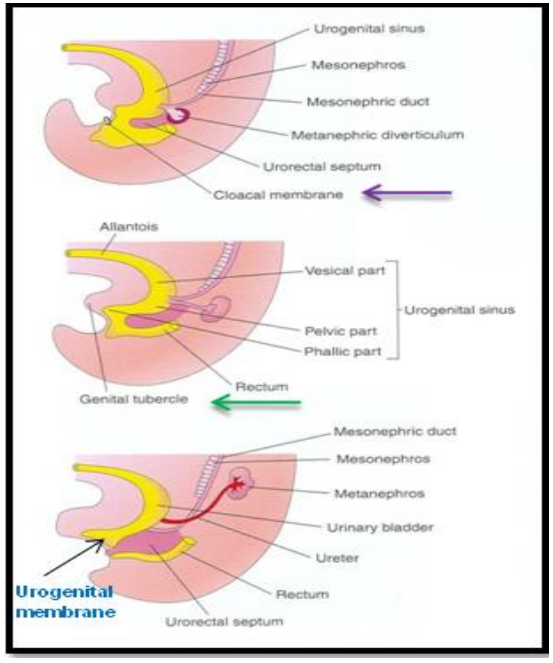
- **Genital tubercle:** produced from mesenchyme at the cranial end of cloacal membrane. It elongates to form **a primordial phallus.**
- **Urogenital folds:** develop on each side of cloacal membrane.
- **Labioscrotal swellings:** develop on each side of urogenital folds.

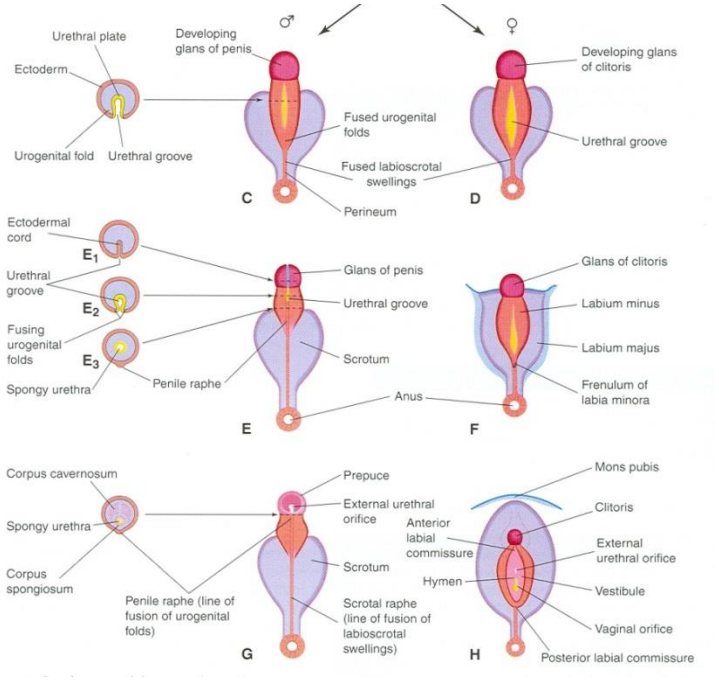



## DEVELOPMENT OF MALE EXTERNAL GENITALIA

***(stimulated by testosterone)***

- Begins at 9th week
- Complete differentiation at 12th week:
- The **phallus** enlarges to form the penis
- The **urogenital folds** fuse to form the spongy (penile) urethra
- The **labioscrotal folds** (swellings) fuse to form the scrotum

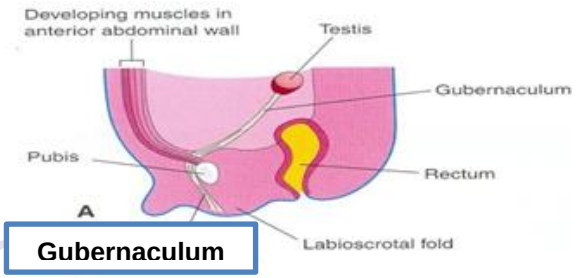


# DESCENT OF TESTIS

## Gubernaculum:

A mesenchymal band extending from inferior pole of gonad to labioscrotal fold.

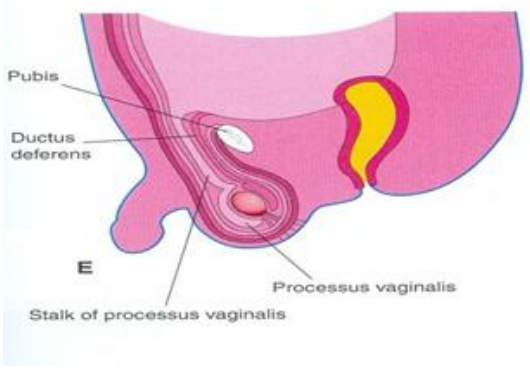


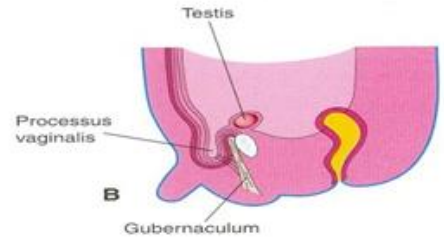

**Gubernaculum**

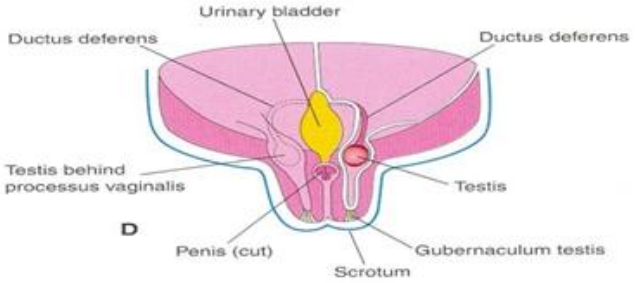
## Processus vaginalis:

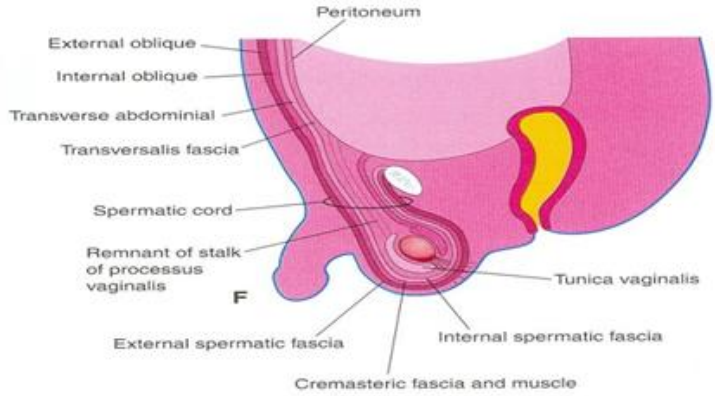
A peritoneal fold passing through inguinal canal before testis to facilitate its descent.


**Processus vaginalis**



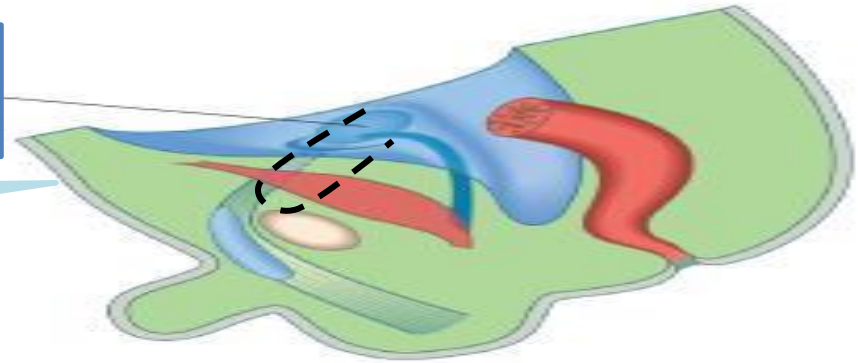




## Inguinal canal:

A pathway formed by gubernaculum through layers of anterior abdominal wall.

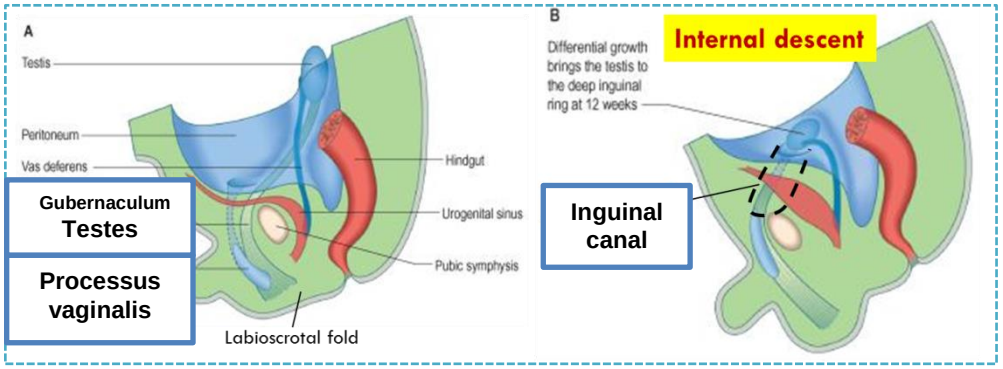
B

**Differential growth brings the testis to the deep inguinal ring at 12 weeks**



# DESCENT OF TESTIS

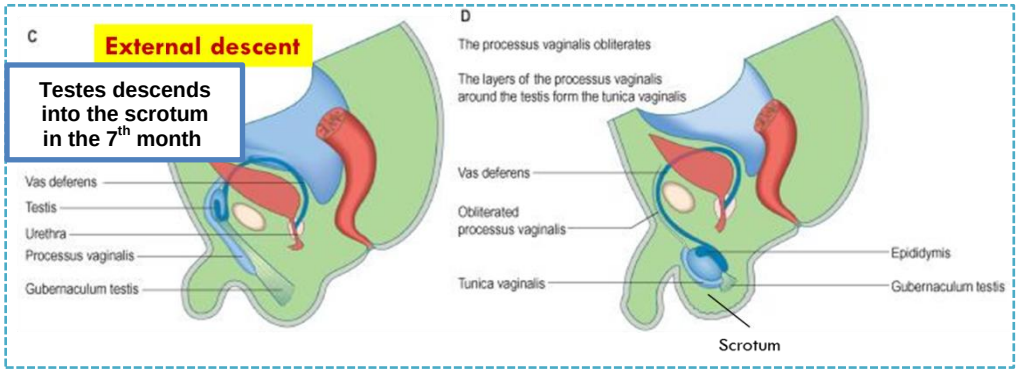
## INTERNAL DESCENT OF TESTIS




- ♣ **Definition**:
  Descent of testis from **posterior abdominal wall** to deep inguinal ring.
- ♣ **Time:**
  During 12th week.
- ♣ **Cause**:
  A relative movement resulting from elongation of cranial part of abdomen away from its caudal part (future pelvic cavity).

1. More than 97% of full-term new born males have both testes in scrotum.
2. During first 3 months after birth, most undescended testes descend into scrotum.
3. No spontaneous descent occurs after the age of 1 year.

## EXTERNAL DESCENT OF TESTIS




- ♣ **Definition**:
  Descent of testis from **deep inguinal ring**, through inguinal canal, to scrotum.
- ♣ **Time:**
  Begins in 7th month and takes 2 to 3 days.
- ♣ **Causes:**
  1. Controlled by androgens.
  2. Guided by gubernaculum.
  3. Facilitated by processus vaginalis.
  4. Helped by increased intra-abdominal pressure resulting from growth of abdominal viscera.

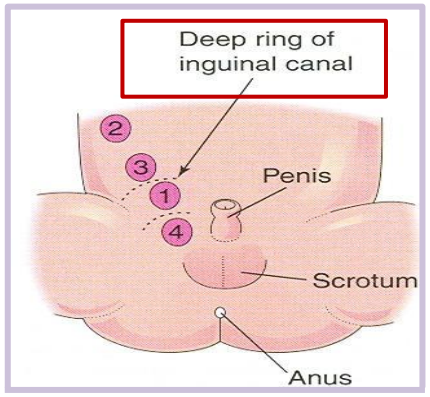
**Complete descent of testis is associated by:**

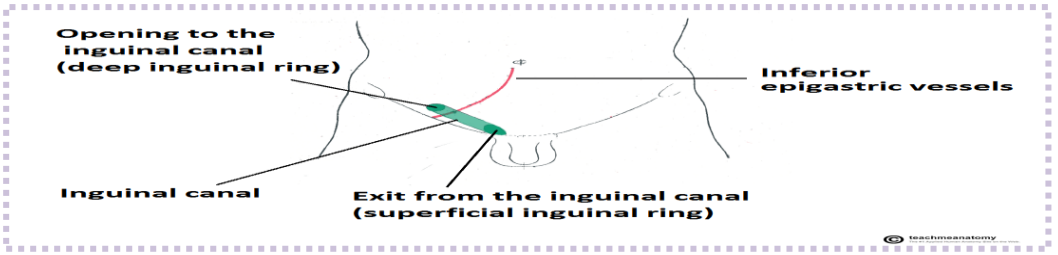
- Degeneration of gubernaculum.
- Obliteration of stalk of processus vaginalis.
- Persistence of part of processus vaginalis surrounding the testis in the scrotum to form "tunica vaginalis"

# Congenital anomalies

## CRYPTORCHIDISM (UNDESCENDED TESTIS)

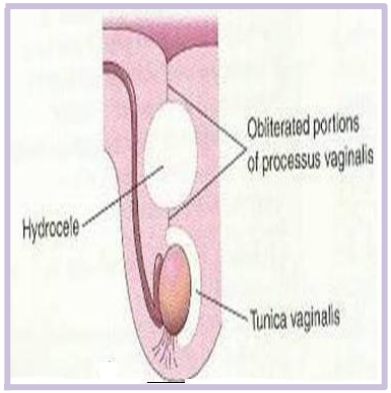
- **Incidence:**
  Is up to 30% of premature & 3-4% of full term males.
- **Cause:**
  Deficiency of androgens.
- **Common sites:**
  Look at the figure (Deep inguinal ring is the most common site)
- **Complications:**
  1. Sterility, if bilateral.
  2. Testicular cancer (20-44%).



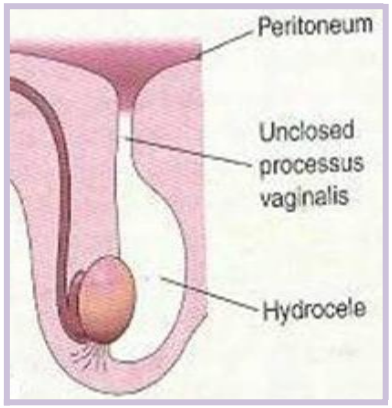

## HYDROCELE OF SPERMATIC CORD

Accumulation of fluid in spermatic cord due to a non-obliterated portion of stalk of processus vaginalis.

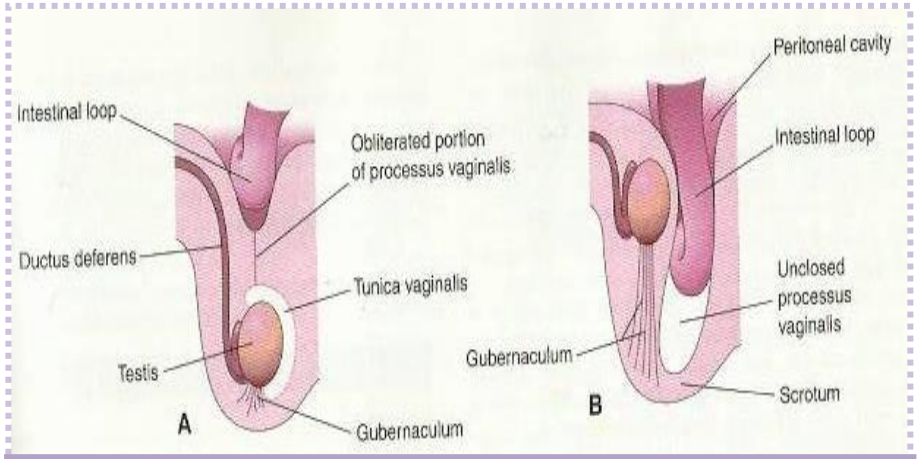



## HYDROCELE OF TESTIS

Accumulation of fluid in tunica vaginalis
(In scrotum) due to non-obliteration
Of the whole stalk of Processus vaginalis.




## CONGENITAL INGUINAL HERNIA



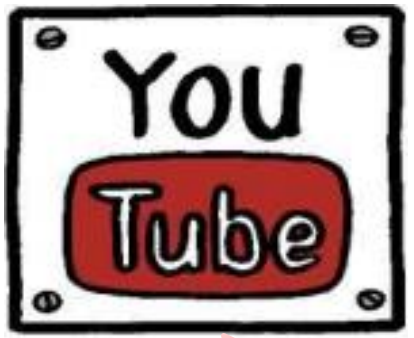

**Failure of closure of processus vaginalis**

- **Definition:** Herniation of a loop of intestine through a non-obliterated processus vaginalis.

  A: incomplete. B: complete (in scrotum).
- **Cause:** The processus vaginalis does not obliterate & remains in open communication with the peritoneal cavity.

# Summary

| | |
|---|---|
| 5th week | ♣ Gonadal development occurs |
| 7th week | ♣ Gonads are similar in both sexes<br>♣ Regression of cortex & differentiation of medulla into testis<br>♣ Gonadal cords condense & extend into medulla to form seminiferous cords<br>♣ Development of a thick fibrous capsule (tunica albuginea)<br>♣ müllerian inhibiting substance (anti- müllerian hormone) |
| 4th to 7th week | Indifferent stage of external genitalia |
| 8th week | Mesenchyme surrounding semineferous cords gives rise to Interstitial cells (of leydig) secreting testosterone. |
| 9th week | Development of male external genitalia (begins at it) |
| 12th week | ♣ Complete differentiation of male external genitalia<br>♣ Internal descent of testis |
| 7th month | External descent of testis (begins at it, takes 2 to 3 days) |
| 1 year. | No spontaneous descent of testis occurs after the age of 1 year |




A very helpful video

During 5th week: gonadal development occurs. Until 7th week: gonads are similar in both sexes.

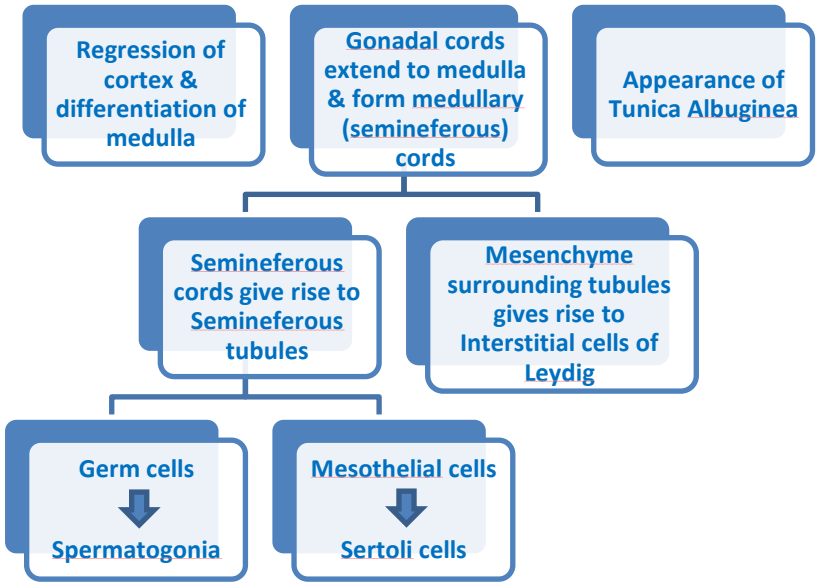
**Gonads are derived from 3 sources:**

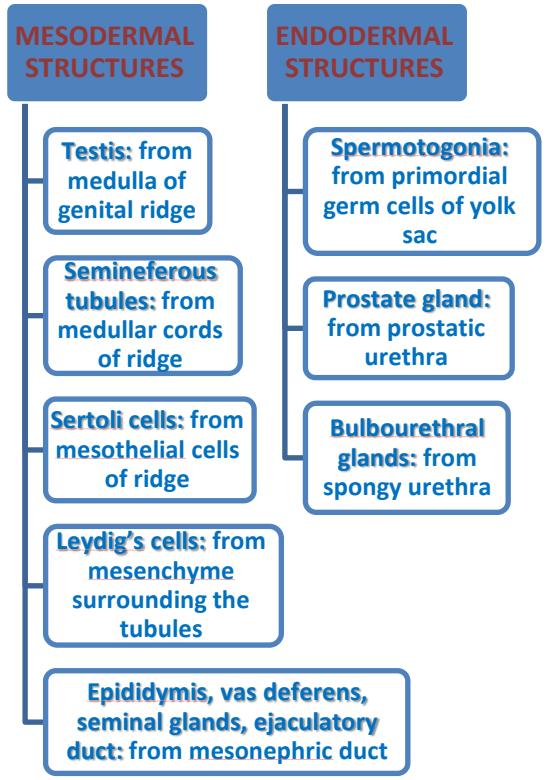
- ♣ Mesothelium (mesodermal epithelium lining the coelomic cavity).
- ♣ Underlying mesenchyme.
- ♣ Primordial germ cells.

**INDIFFERENT GONADS:**

- ♣ Gonadal ridge.
- ♣ Gonadal (primary sex) cords.
- ♣ Primordial germ cells.

# Summary


Regression of cortex & differentiation of medulla
Gonadal cords extend to medulla & form medullary (semineferous) cords
Appearance of Tunica Albuginea
Semineferous cords give rise to Semineferous tubules
Mesenchyme surrounding tubules gives rise to Interstitial cells of Leydig
Germ cells
Spermatogonia
Mesothelial cells
Sertoli cells


MESODERMAL STRUCTURES
Testis: from medulla of genital ridge
Semineferous tubules: from medullar cords of ridge
Sertoli cells: from mesothelial cells of ridge
Leydig's cells: from mesenchyme surrounding the tubules
Epididymis, vas deferens, seminal glands, ejaculatory duct: from mesonephric duct
ENDODERMAL STRUCTURES
Spermotogonia: from primordial germ cells of yolk sac
Prostate gland: from prostatic urethra
Bulbourethral glands: from spongy urethra

# Summary

## DEVELOPMENT OF TESTIS

- ♣ The Y chromosome has a testis-determining factor (TDS) that differentiates gonad into testis .
- ♣ At 7th week: Regression of cortex & differentiation of medulla into testis - Gonadal cords condense & extend into medulla to form seminiferous cords .
- ♣ Seminiferous cords develop into: seminiferous tubules which will remain solid until puberty, its walls are composed of 1- Sertoli cells. 2-Spermatogonia.
- ♣ At 8 weeks: mesenchyme surrounding seminiferous cords gives rise to interstitial cells of Leydig
  - ♠ Leydig's cells → Testosterone (8th week).
  - ♠ Sertoli cells → Müllerian inhibiting substance (7th week).

### DEVELOPMENT OF MALE GENITAL GLANDS

1. SEMINAL GLAND: **mesoderma**l outgrowth from mesonephric duct .
2. PROSTATE GLAND: **endodermal** outgrowth from prostatic urethra .
3. BULBOURETHRAL GLAND: **endodermal** outgrowth from spongy urethra .

- ♣ Genital tubercle: produced from mesenchyme at the cranial end of cloacal membrane. It elongates to form a **primordial phallus** .
- ♣ Urogenital folds: develop on each side of cloacal membrane .
- ♣ Labioscrotal swellings: develop on each side of urogenital folds .

### DEVELOPMENT OF MALE EXTERNAL GENITALIA

Stimulated by testosterone. Begins at 9th week and complete differentiation at 12th week

- ♣ The **phallus** the penis .
- ♣ The **urogenital folds** the spongy (penile) urethra.
- ♣ The **labioscrotal folds** the scrotum.

# Summary

- More than 97% of full-term new born males have both testes in scrotum .
- During first 3 months after birth, most undescended testes descend into scrotum.No spontaneous descent occurs after the age of 1 year .
- Complete descent of testis is associated by :
  1. Degeneration of gubernaculum.
  2. Obliteration of stalk of processus vaginalis.
  3. Persistence of part of processus vaginalis surrounding the testis in the scrotum to form "tunica vaginalis "

| | INTERNAL DESCENT OF TESTIS | EXTERNAL DESCENT OF TESTIS |
|---|---|---|
| **Definition** | Descent of testis from posterior abdominal wall to deep inguinal ring | Descent of testis from deep inguinal ring through inguinal canal to scrotum |
| **time** | During 12th week | Begins in 7th month and takes 2 to 3 days |
| **Cause** | A *relative movement* resulting from elongation of cranial part of abdomen away from its caudal part (future pelvic cavity). | 1. Controlled by androgens.<br>2. Guided by gubernaculum.<br>3. Facilitated by processus vaginalis.<br>4. Helped by increased intra-abdominal pressure resulting from growth of abdominal viscera. |

## congenital anomalies

### CHRYPTORCHIDISM (UNDESCENDED TESTIS)

**Cause:** deficiency of androgens
**Common sites:** deep ring of inguinal canal .
**Complications:** Sterility, if bilateral - Testicular cancer (20-44%) .

### CONGENITAL INGUINAL HERNIA

Herniation of a loop of intestine through a non-obliterated processus vaginalis .

**Cause:** The processus vaginalis does not obliterate & remains in open communication with the peritoneal cavity .

### HYDROCELE OF SPERMATIC CORD

Accumulation of fluid in spermatic cord due to a non-obliterated portion of stalk of processus vaginalis .

### HYDROCELE OF TESTIS

Accumulation of fluid in tunica vaginalis(in scrotum) due to non-obliteration of the whole stalk of Processus vaginalis .

# QS

**1- Which of the following is the characteristic feature of the testicular development?**

A. Rete testis .

B. Seminiferous cords .

C. Tunica albuginea .

D. Testis-determining factor (TDF).

**2- Which structure gives rise the seminal gland?**

A. Genital tubercle .

B. Mesonephric duct .

C. Paramesonephric duct .

D. Urogenital sinus .

**3- Which one of the following contributes in accumulation of fluid in scrotum?**

A. Cryptorchidism .

B. Congenital inguinal hernia .

C. Hydrocele of spermatic cord .

D. Hydrocele of testis.

**4- Which one of the following structure is a derivative of male urethra?**

A. Seminal gland.

B. Prostate gland.

C. Vas deferens.

D. Ejaculatory duct.

**5- Which one of the following cells is responsible for masculine differentiation of external genitalia?**

A. Sertoli cells.

B. Leyden's cells .

C. Mesothelium cells .

D. Primordial germ cells .

**6- The common site of the Cryptorchidism is?**

A. Superficial inguinal ring.

B. Deep inguinal ring.

C. Peritoneal cavity.

D. Pelvis.

**Answers:** 1- C 2- B 3- D 4- B 5- B 6-B

# QS

**7- Which one of the following derived from primordial germ cell ?**

A. Sertoli cells .

B. Spermatogonia .

C. Leydig's cells .

D. Seminiferous cords .

**8- Which one of the following derived from mesothelial cell ?**

A. Sertoli cells .

B. Spermatogonia .

C. Leydig's cells .

D. Seminiferous cords .

**9- Which structure when fuse form the spongy (penile) urethra ?**

A. The phallus .

B. Mesonephric duct .

C. labioscrotal folds .

D. Urogenital folds .

**10- Which structure when fuse form the scrotum ?**

A. The phallus .

B. Mesonephric duct .

C. labioscrotal folds .

D. Urogenital folds .

**11- Which one of the following causes of External descent of testis ?**

A. Controlled by androgens .

B. relative movement .

C. Degeneration of gubernaculum .

D. Obliteration of stalk of processus vaginalis .

**12- Which one of the following causes of Cryptorchidism ?**

A. increased of androgens .

B. increased intra-abdominal pressure .

C. deficiency of androgens .

D. processus vaginalis does not obliterate .

**Answers:** 7- B 8- A 9- D 10- C 11- A 12- C

# GOOD LUCK

*Anatomy Team Leaders:*

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