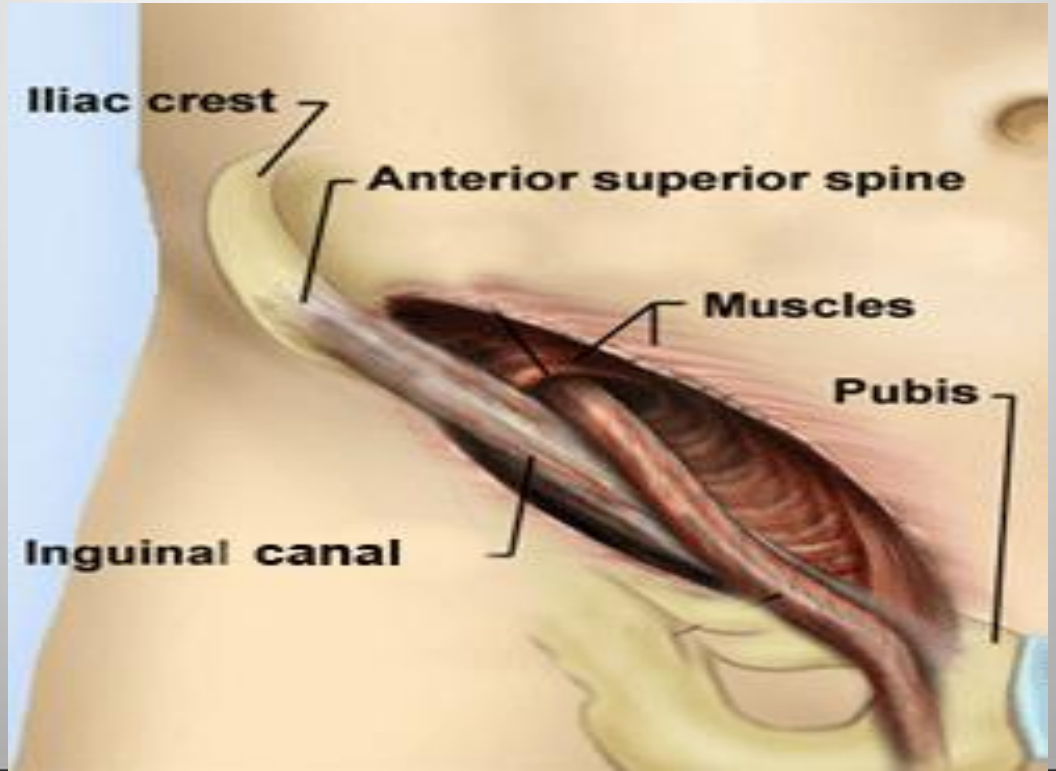
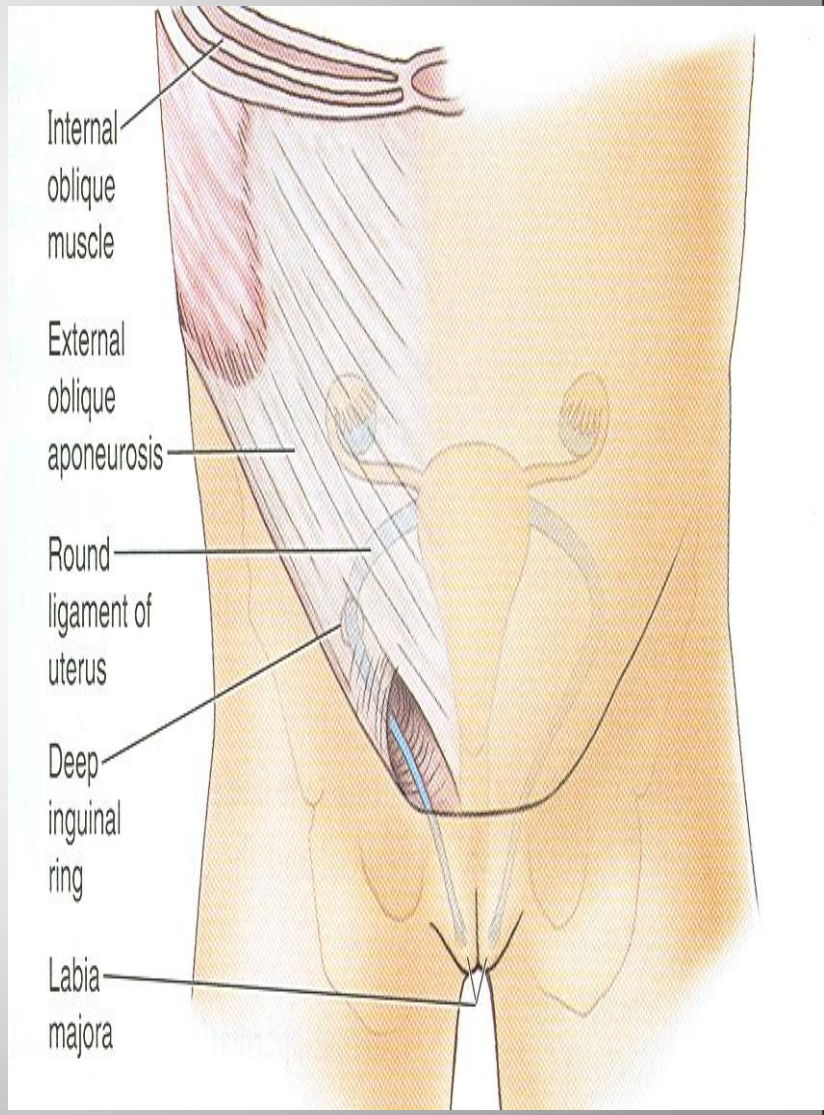
Inguinal canal



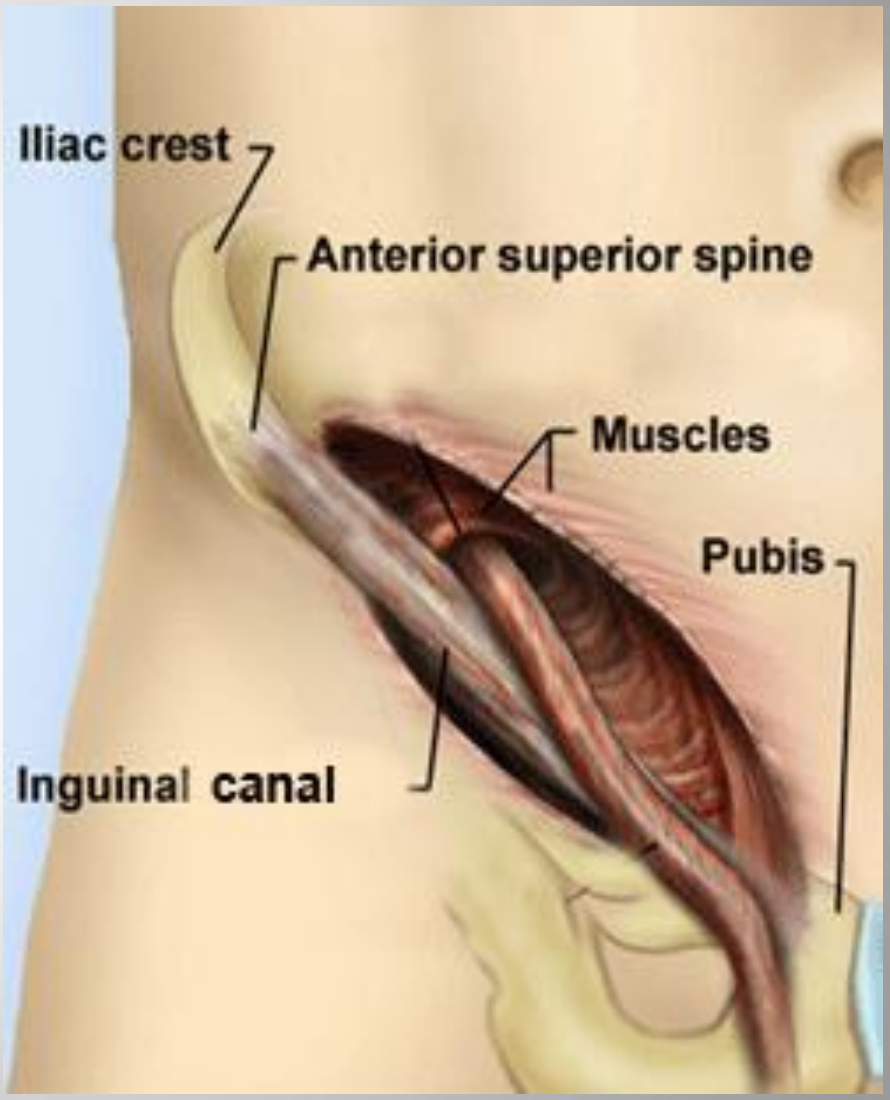
Inguinal Canal

- It is an oblique passage through the lower part of the anterior abdominal wall
- Present in both sexes
- It allows structures to pass to and from the testis to the abdomen in males
- In females it permits the passage of the round ligament of the uterus from the uterus to the labium majus
- Transmits ilioinguinal nerve in both sexes



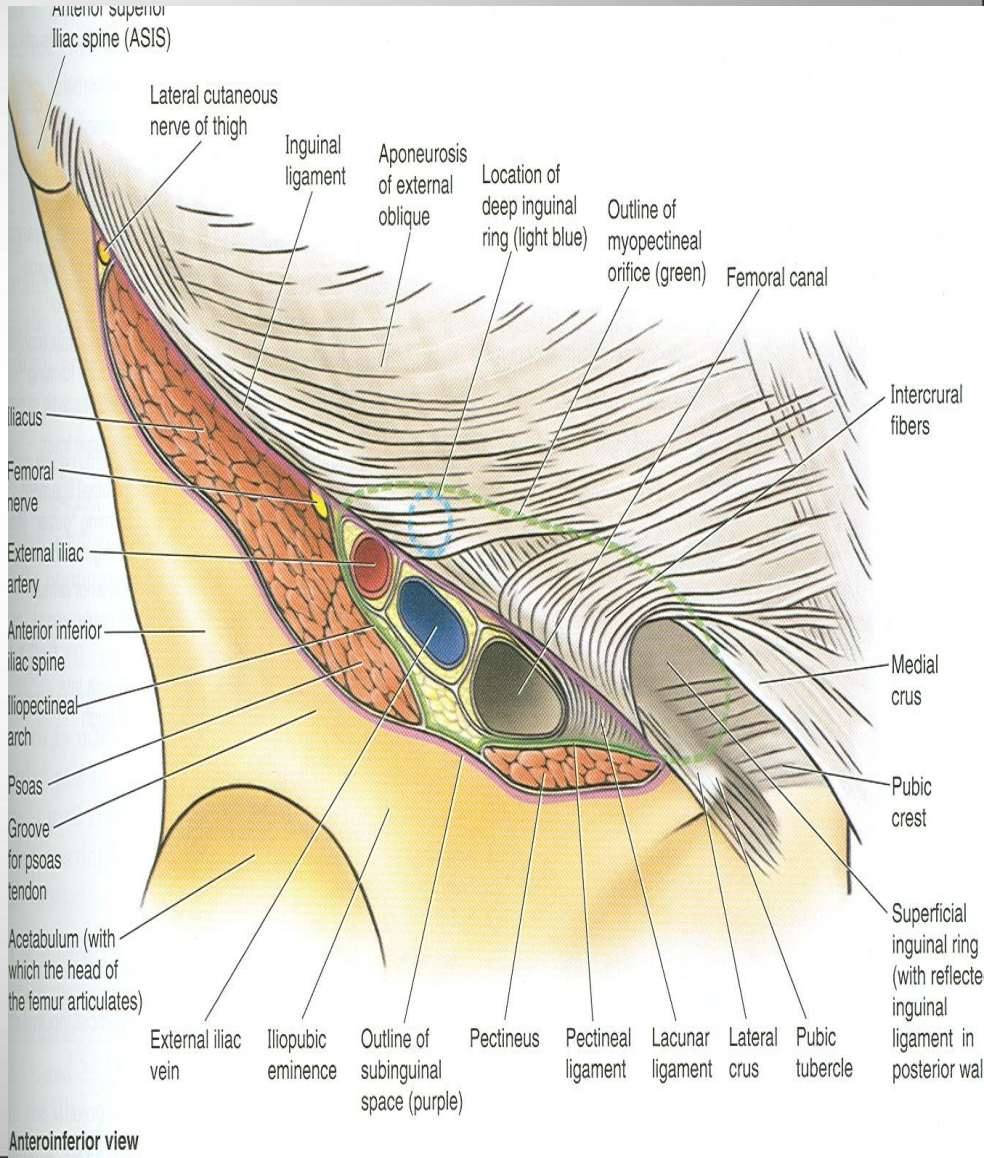
Inguinal Canal

- It is about 1 ½ inches or 4cm long in the adults
- Extends from the deep inguinal ring downward and medially to the superficial inguinal ring
- Lies parallel to and immediately above the inguinal ligament
- In the newborn child, the deep ring lies almost directly posterior to the superficial ring



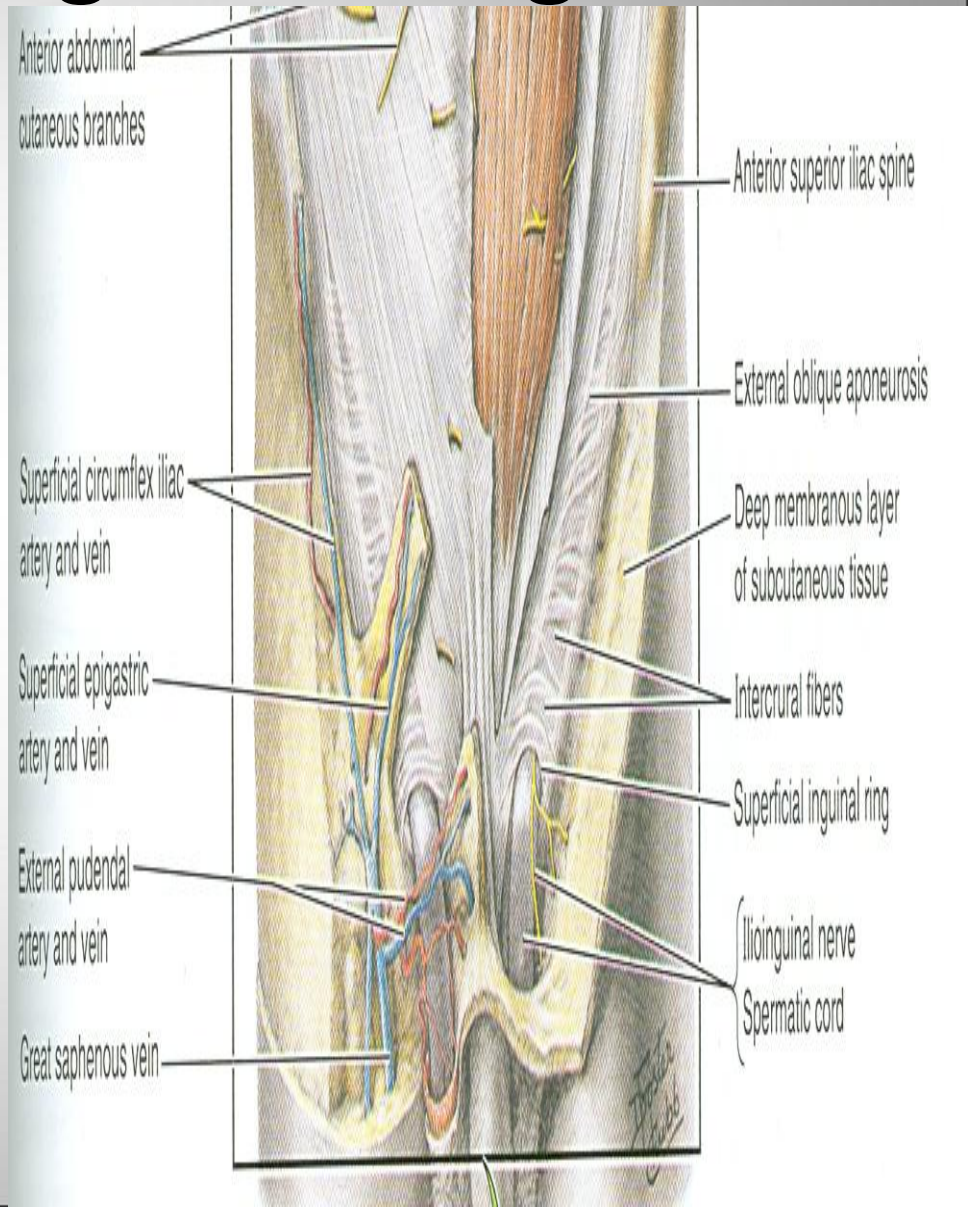
Deep Inguinal Ring

- Is an oval opening in the fascia transversalis
- Lies about ½ inch (1.3cm) above the inguinal ligament midway between the anterosuperior iliac spine and the symphysis pubis
- Margins of the ring give attachment to the internal spermatic fascia



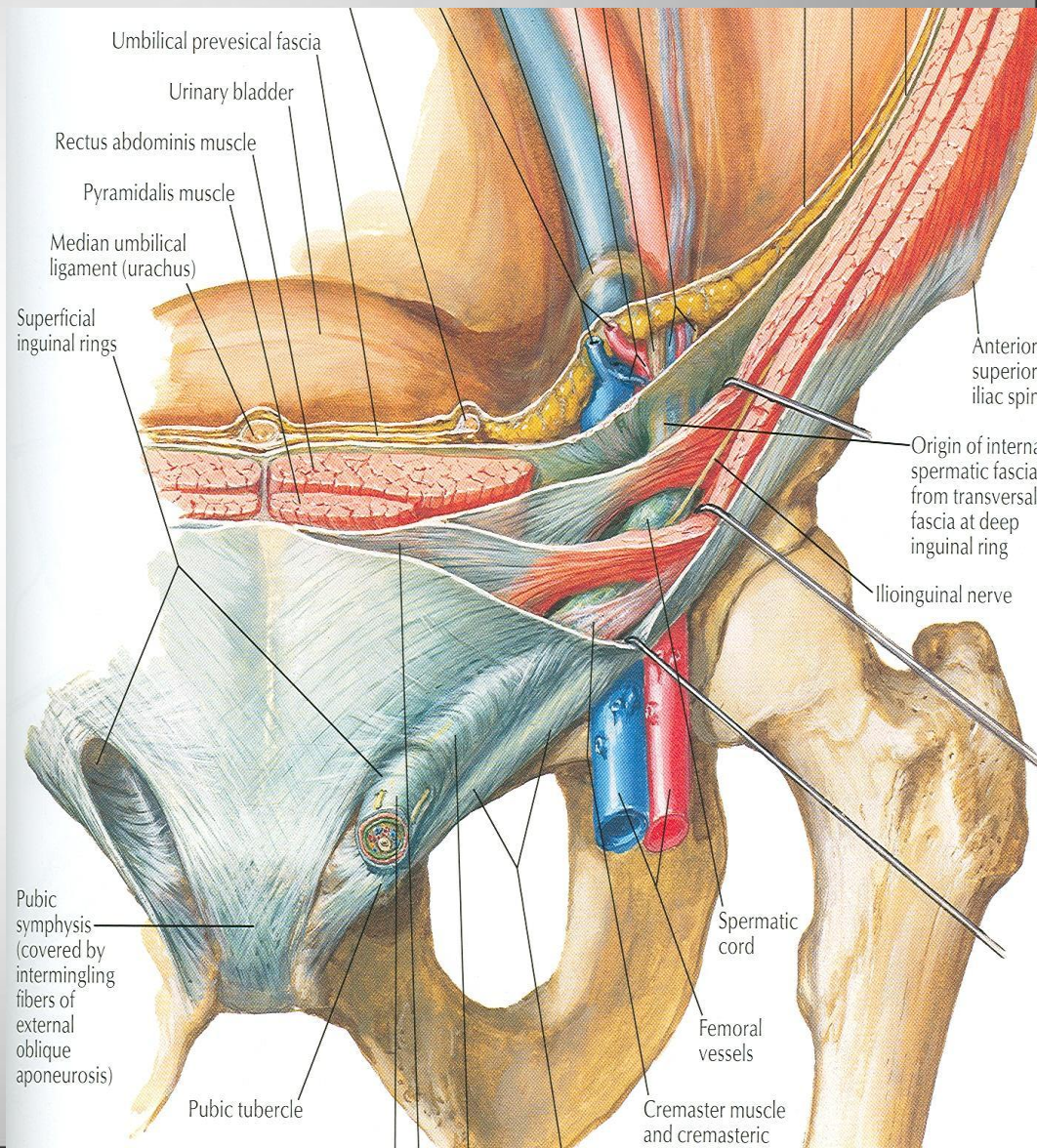
Superficial Inguinal Ring

- Triangular in shape
- Defect in the aponeurosis of the external oblique muscle
- Lies immediately above and medial to the pubic tubercle
- Its margins some times called crura(Med & lat crus), give attachment to the external spermatic fascia



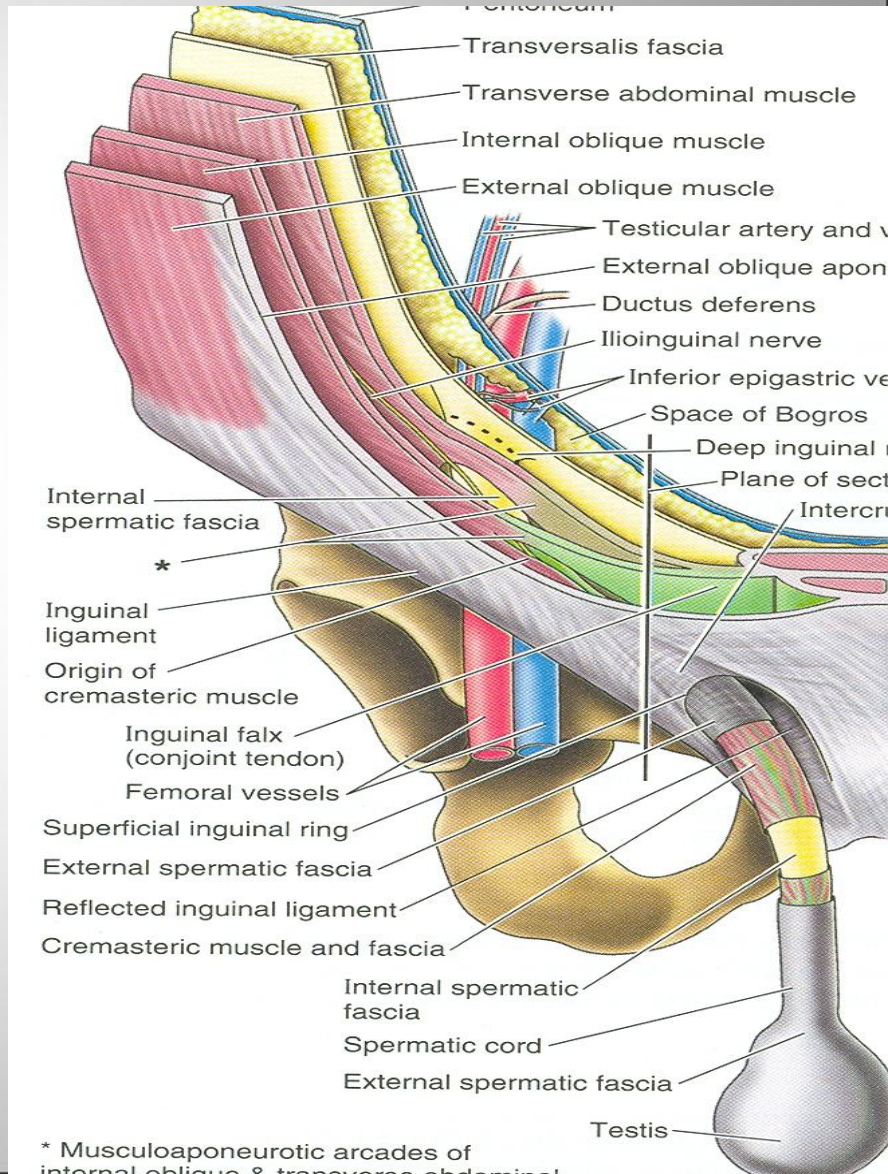
Anterior Wall of Inguinal Canal

- It is formed along its entire length by aponeurosis of the external oblique muscle
- It is reinforced in its lateral third by the origin of the internal oblique from the inguinal ligament
- This wall is strongest where it lies opposite the weakest part of posterior wall, that is deep inguinal ring



Posterior Wall of Inguinal Canal

- It is formed along its entire length by the fascia transversalis
- It is reinforced in its medial third by conjoint tendon, the common tendon of insertion of internal oblique and transversus, attached to the pubic crest and pectineal line
- This wall is strongest where it lies opposite the weakest part of the anterior wall, that is superficial inguinal ring



Inferior Wall of Inguinal Canal = floor

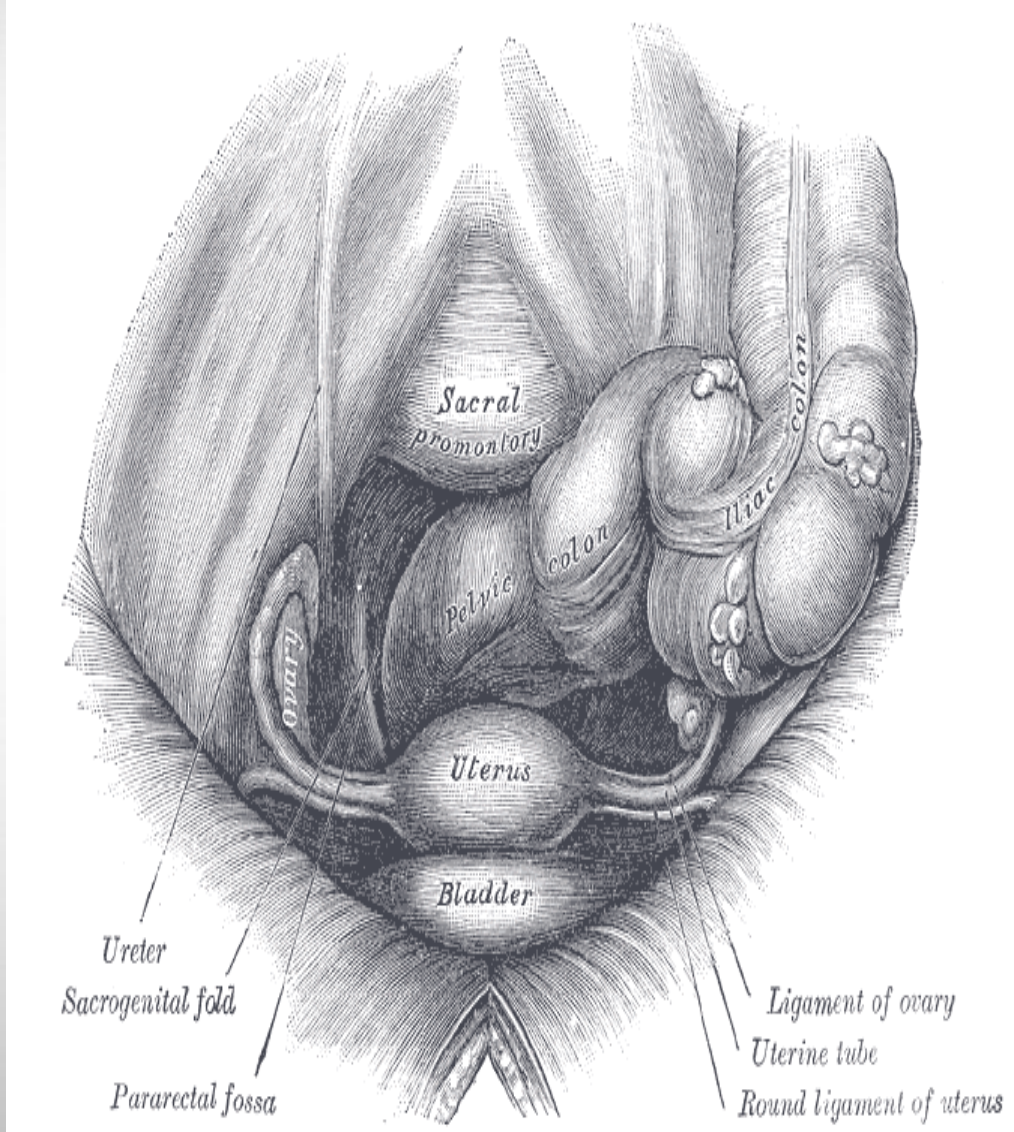
- It is formed by the rolled-under inferior edge of the aponeurosis of the external oblique muscle called inguinal ligament and at its medial end, the lacunar ligament
- Superior Wall of Inguinal Canal = Roof
- It is formed by the arching lowest fibers of the internal oblique and transversus abdominis muscles

Functions of Inguinal Canal

- It allows structures of spermatic cord to pass to and from the testis to the abdomen in male
- Permits the passage of round ligament of uterus from the uterus to the labium majus in female

Contents of inguinal canal

- Spermatic cord & its contents in male
- Round ligament in female
- Genital branch of genitofemoral nerve
- Ilioinguinal nerve: Enter the canal through the posterior wall

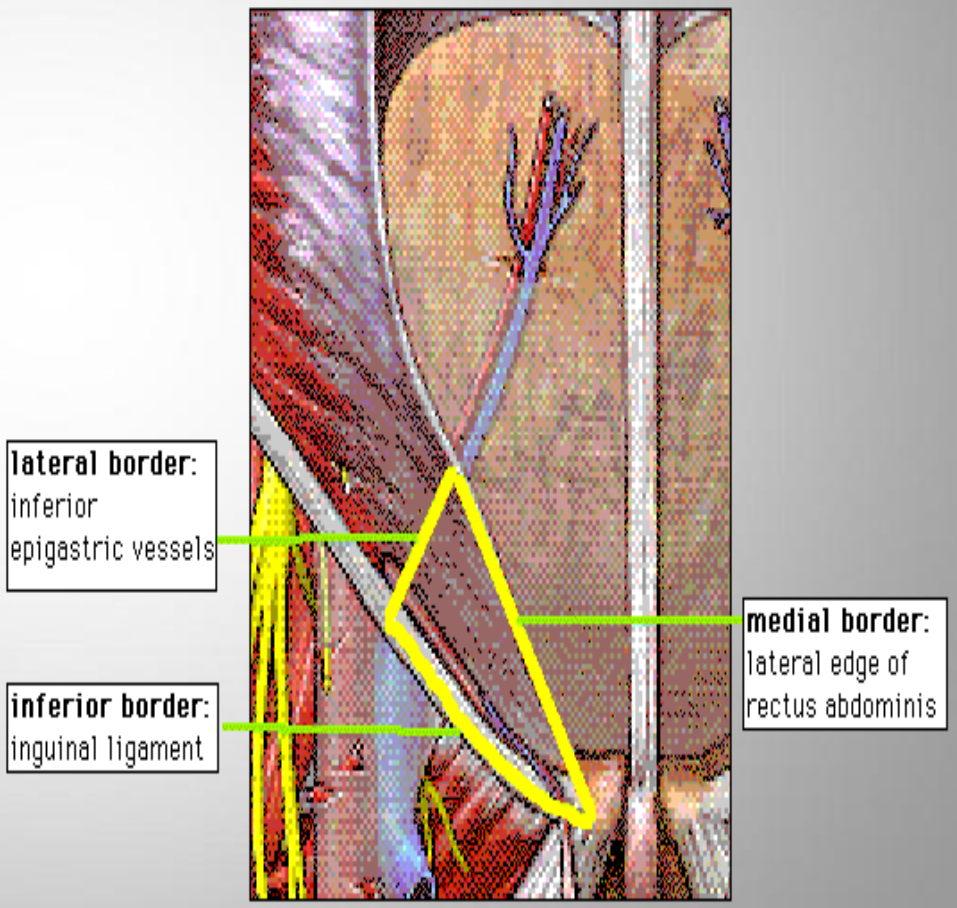


Inguinal triangle

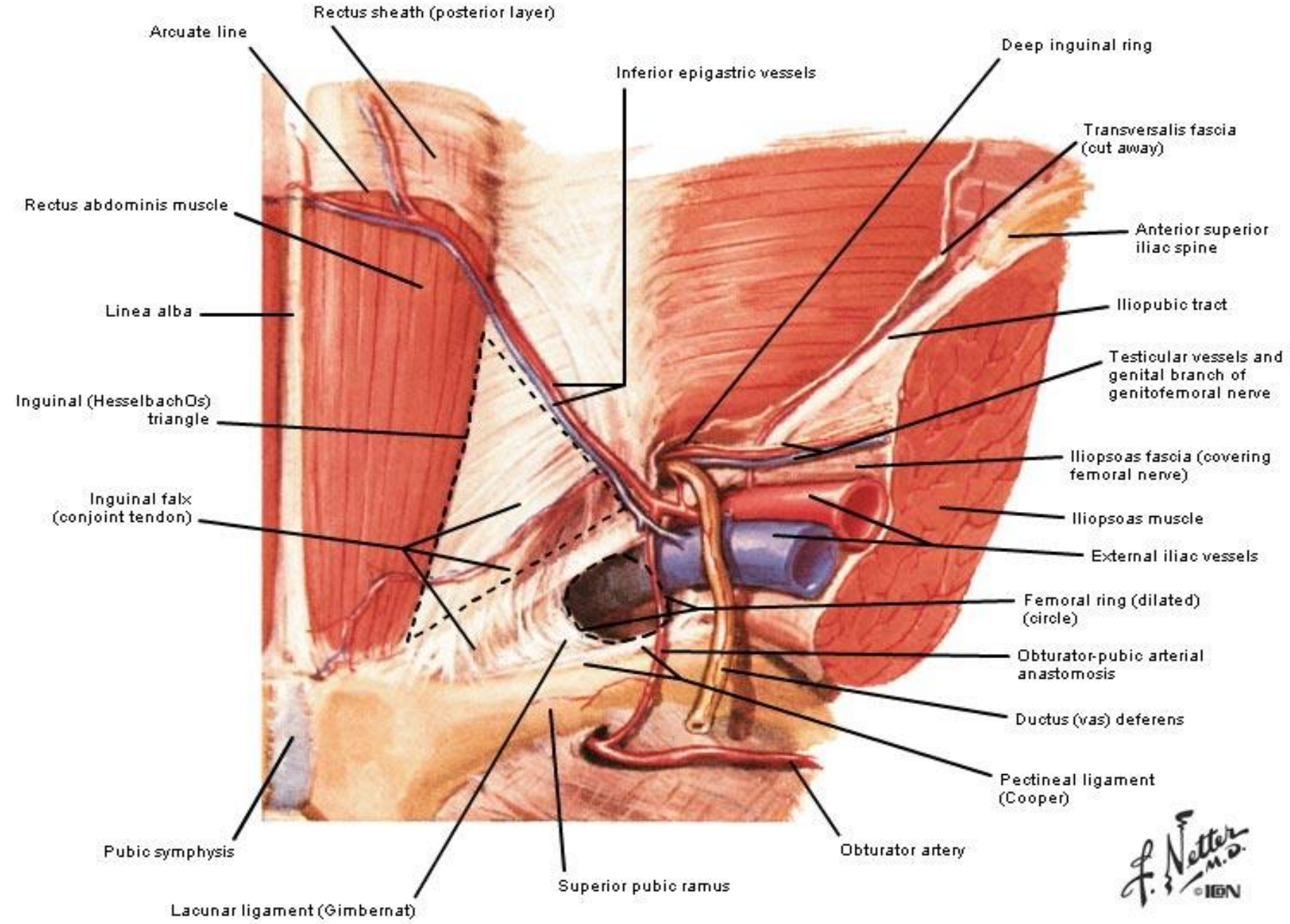
- Region of abdominal wall

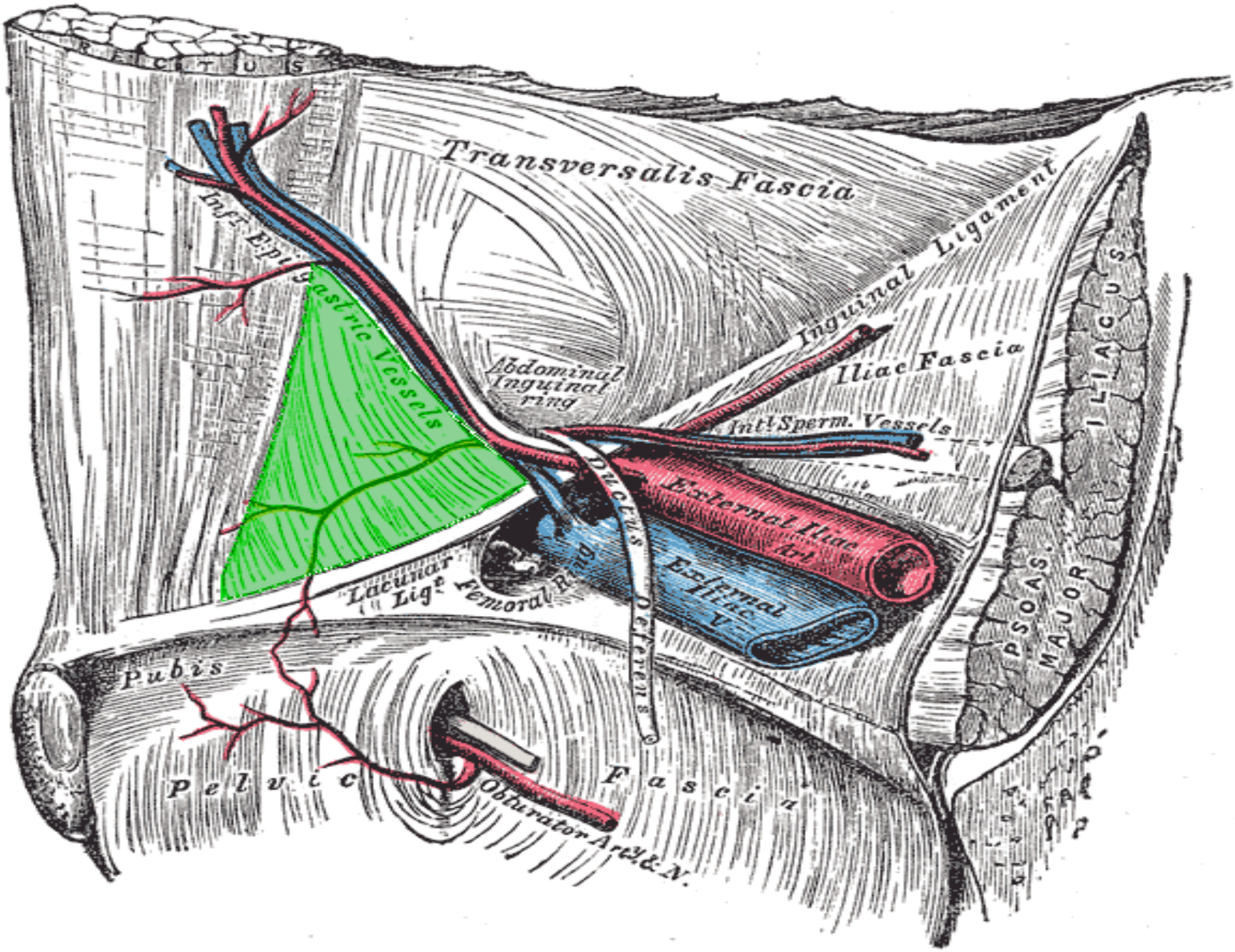
Borders

- Medial border: Lateral margin of the rectus sheath, also called linea semilunaris
- Superolateral border: Inferior epigastric vessels
- Inferior border: Inguinal ligament



Inguinal Region
Dissection - Posterior (Internal) View




RECTUS
Transversalis Fascia
Inguinal Ligament
Iliac Fascia
Inf. Epigastric Vessels
Abdominal Inguinal ring
Int. Sperm. Vessels
External Iliac Art.
External Iliac V.
Ductus Deferens
Lacunar Lig.
Femoral Ring
PSOAS MAJOR
ILIACUS
Pubis
Pelvic Fascia
Obturator Art. & V.

Spermatic Cord

- It is a collection of structures that pass through the inguinal canal to and from the testis
- It is covered with three concentric layers of fascia derived from the layers of anterior abdominal wall
- It begins at the deep inguinal ring lateral to the inferior epigastric artery and ends at the testis

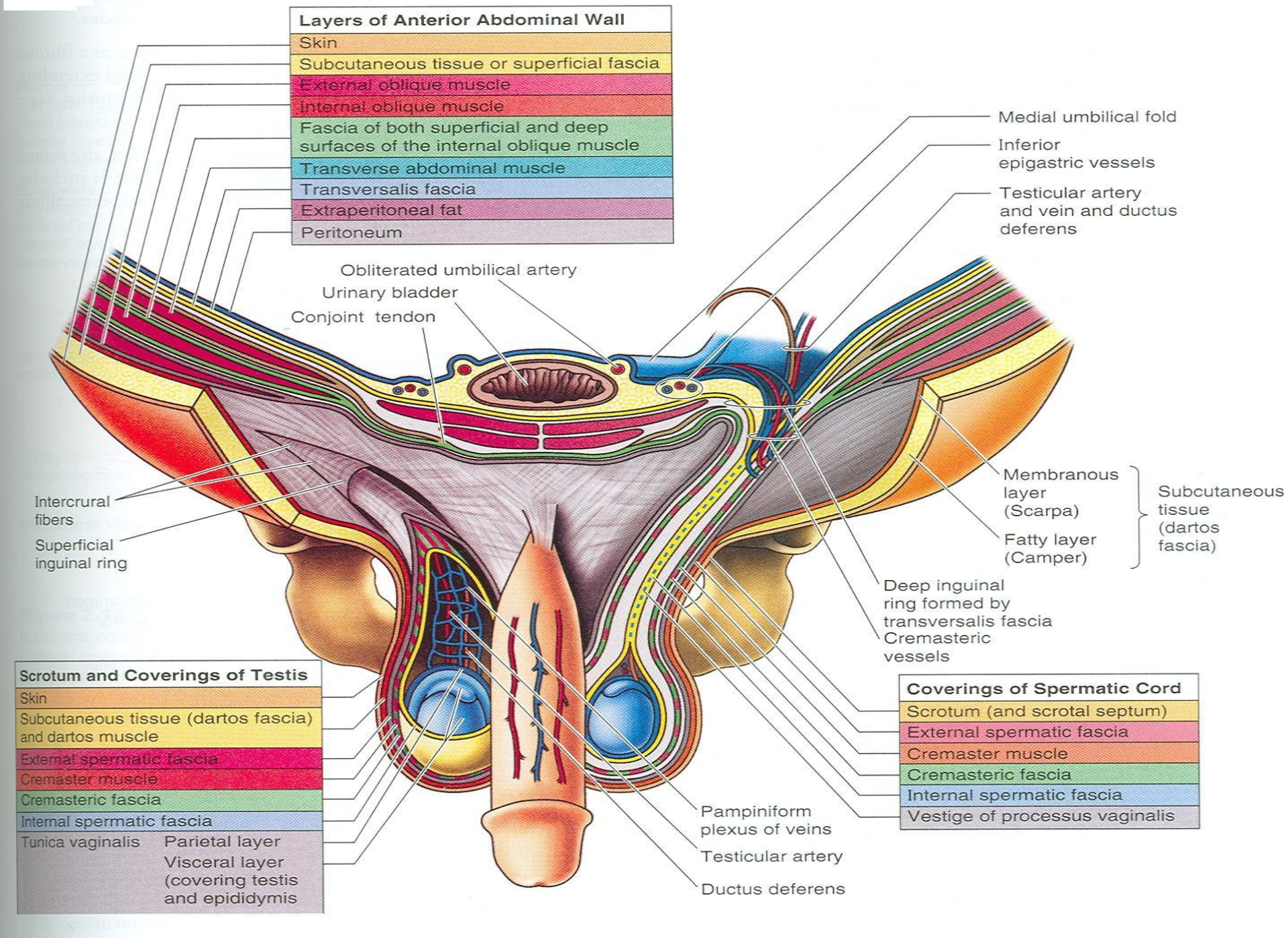
Structures of Spermatic Cord

- Vas deferens
- Testicular artery and vein
- Testicular lymph vessels
- Autonomic nerves
- Processus vaginalis
- Cremastric artery
- Artery of the vas deference
- Genital branch of genitofemoral nerve

Covering of the Spermatic Cord

- The covering of the spermatic cord are three concentric layers of fascia derived from the layers of the anterior abdominal wall
- Each covering is acquired as the processus vaginalis descends into the scrotum through the layers of the abdominal wall
- External Spermatic fascia: Is derived from the external oblique aponeurosis and attached to the margins of the superficial inguinal ring
- Cremasteric Fascia: Is derived from the internal oblique muscle
- Internal Spermatic Fascia: Is derived from the fascia transversalis and attached to the margins of deep inguinal ring

Corresponding Layers of the Anterior Abdominal Wall, Scrotum, and Spermatic Cord



Vas Deferens

- It is a cord like structure
- Can be palpated between finger and thumb in the upper part of the scrotum
- It is a thick walled muscular duct that transport spermatozoa from the epididymis to the prostatic urethra

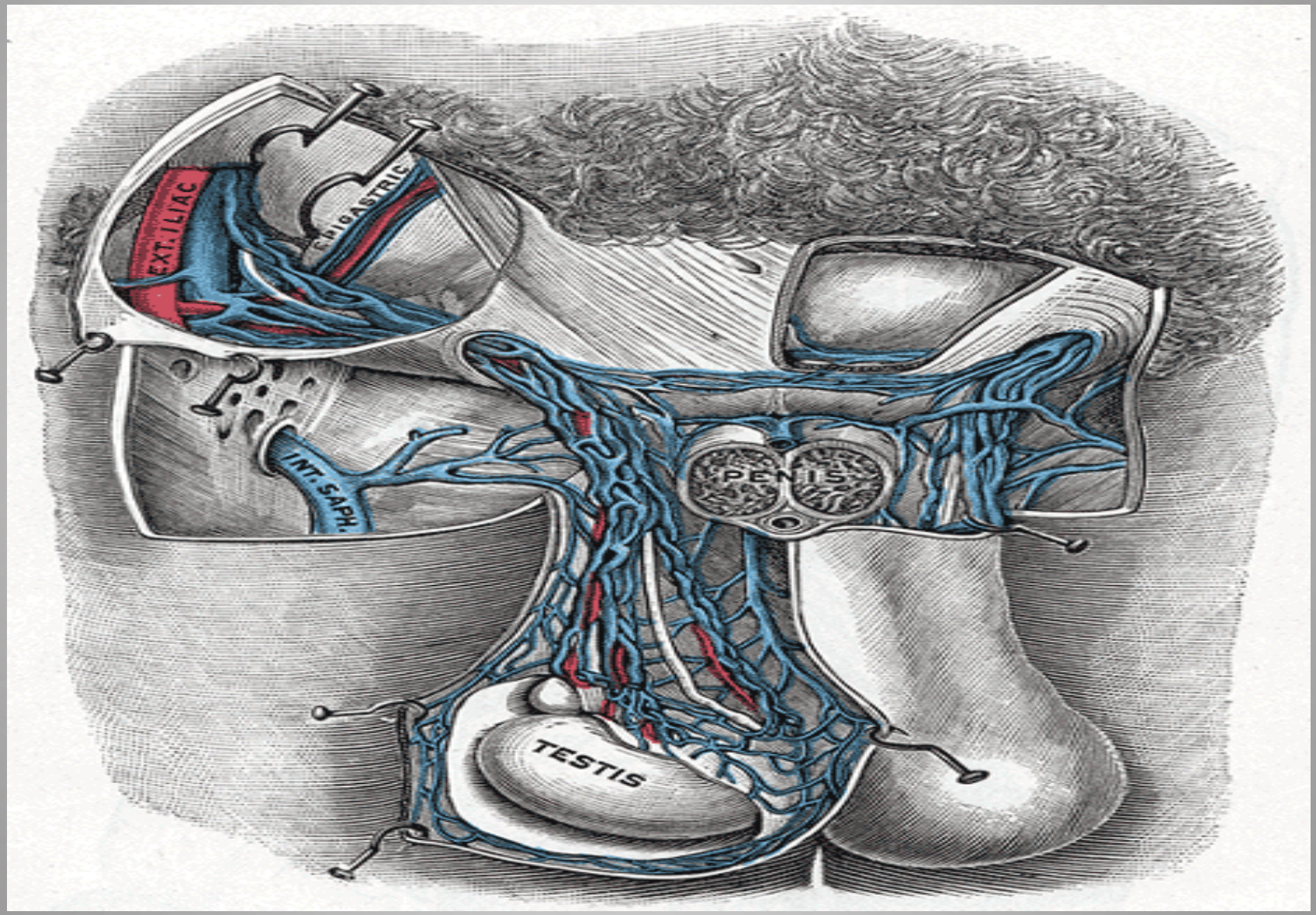
Testicular Artery

- It is a branch of abdominal aorta at level of L2
- It is long and slender
- Descends on the posterior abdominal wall
- It traverses the inguinal canal and supplies the testis and the epididymis

Testicular Veins

- These are the extensive venous plexus, the pampiniform plexus
- Leaves the posterior border of the testis
- As the plexus ascends, it becomes reduced in size so that at about the level of deep inguinal ring, a single testicular vein is formed
- Drains into left renal vein on left side and inferior vena cava on right side

Testicular artery & vein



Autonomic nerve & Genitofemoral nerve

Autonomic nerves

- Sympathetic fibers run with testicular artery from renal or aortic sympathetic plexuses
- Afferent sensory nerve

Genital branch of the genitofemoral nerve

- Its root L1& L2
- Supply the cremastric muscle

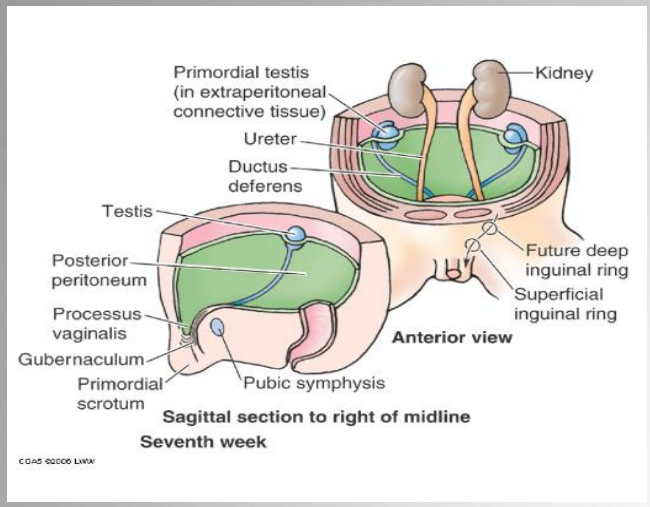
Testicular lymphatic vessels

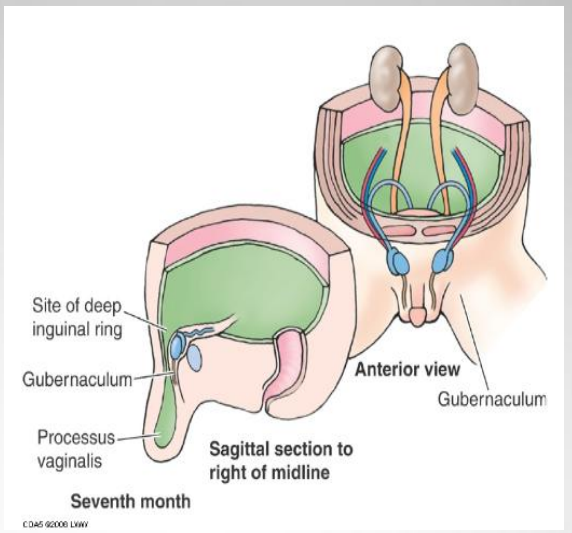
- Ascend through the inguinal canal
- Passes up over the post. Abdominal wall
- Reach the lumbar (Para-aortic) lymph nodes on each side of the aorta at level L1

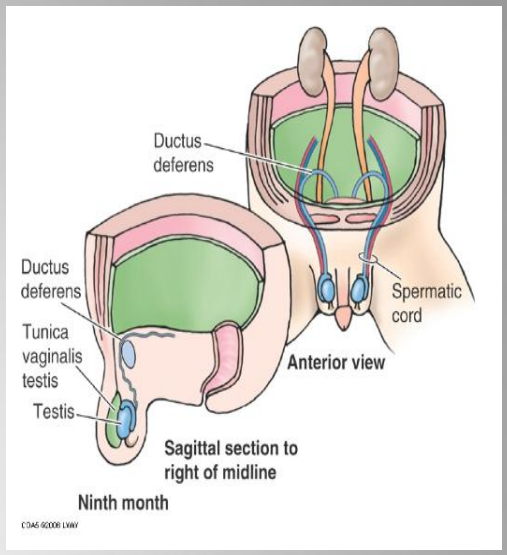
Processus vaginalis

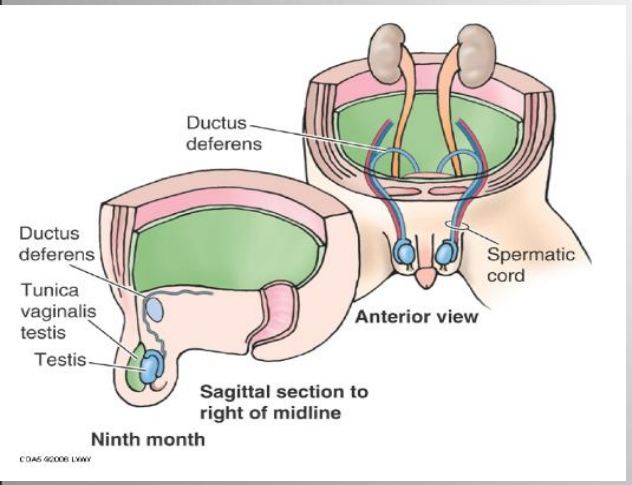
- An out pouching of peritoneum that in the fetus is responsible for the formation of the inguinal canal
- The remains of the processus vaginalis causes the indirect hernia

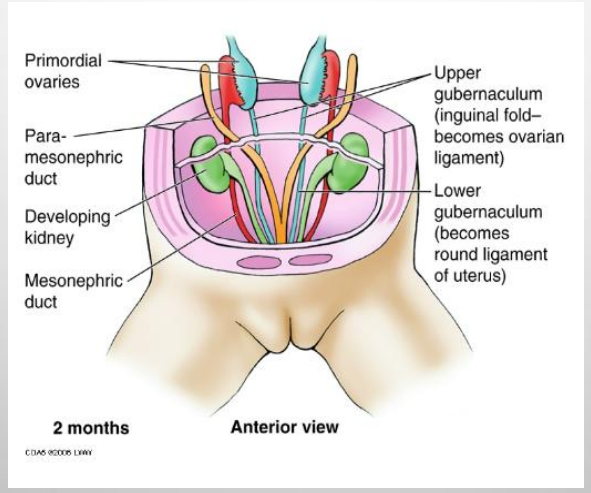
Developing of process vaginalis

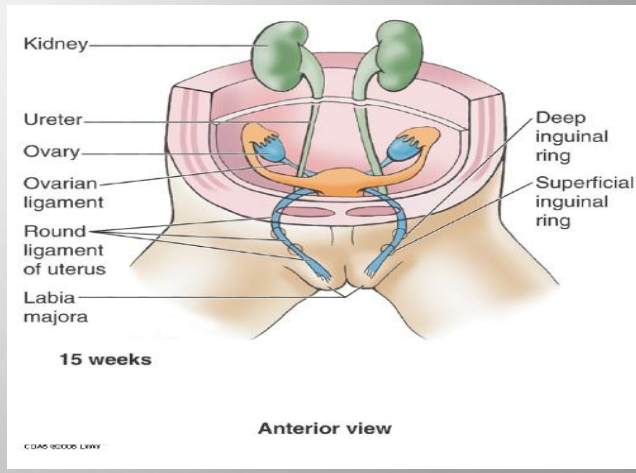




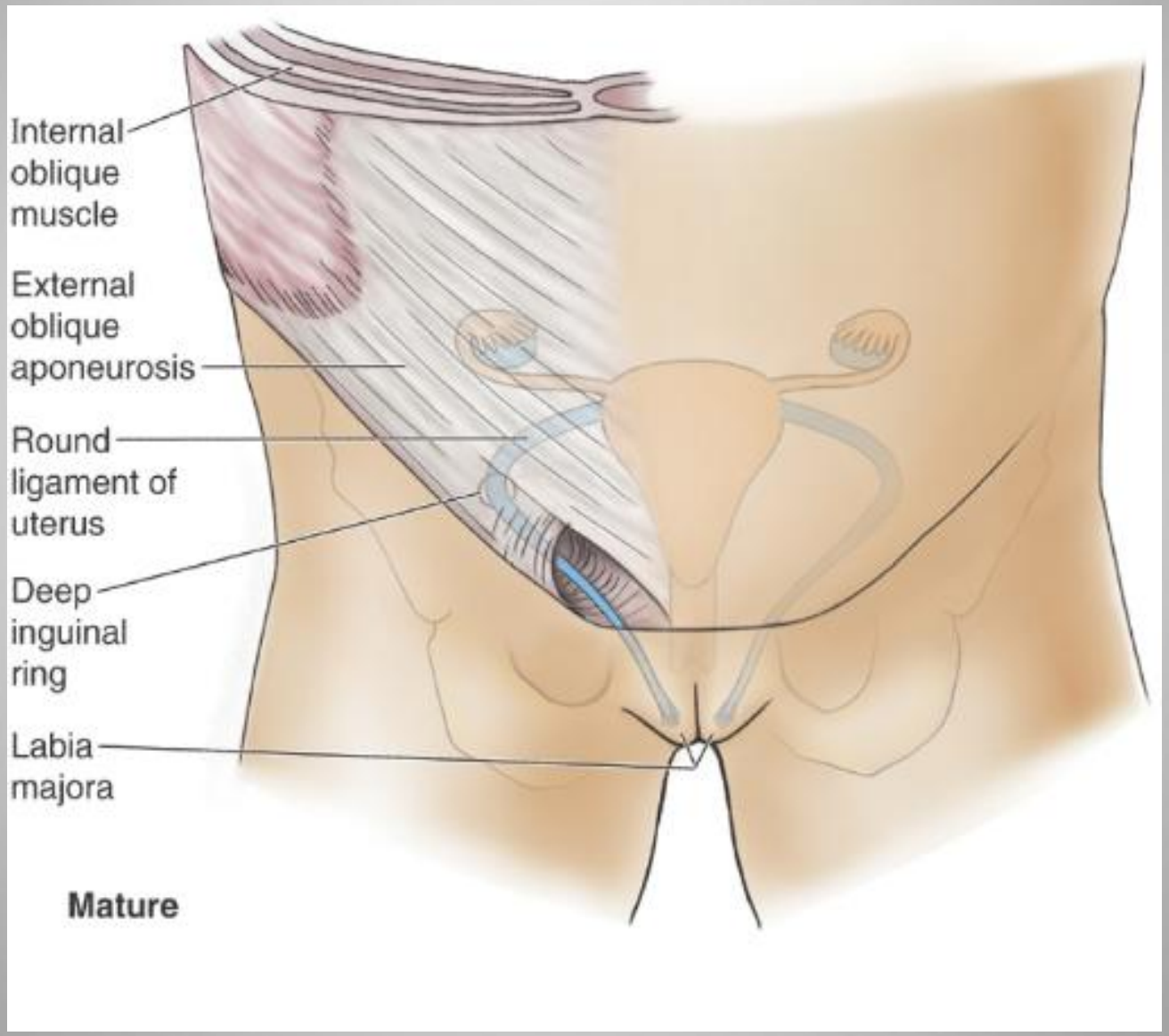






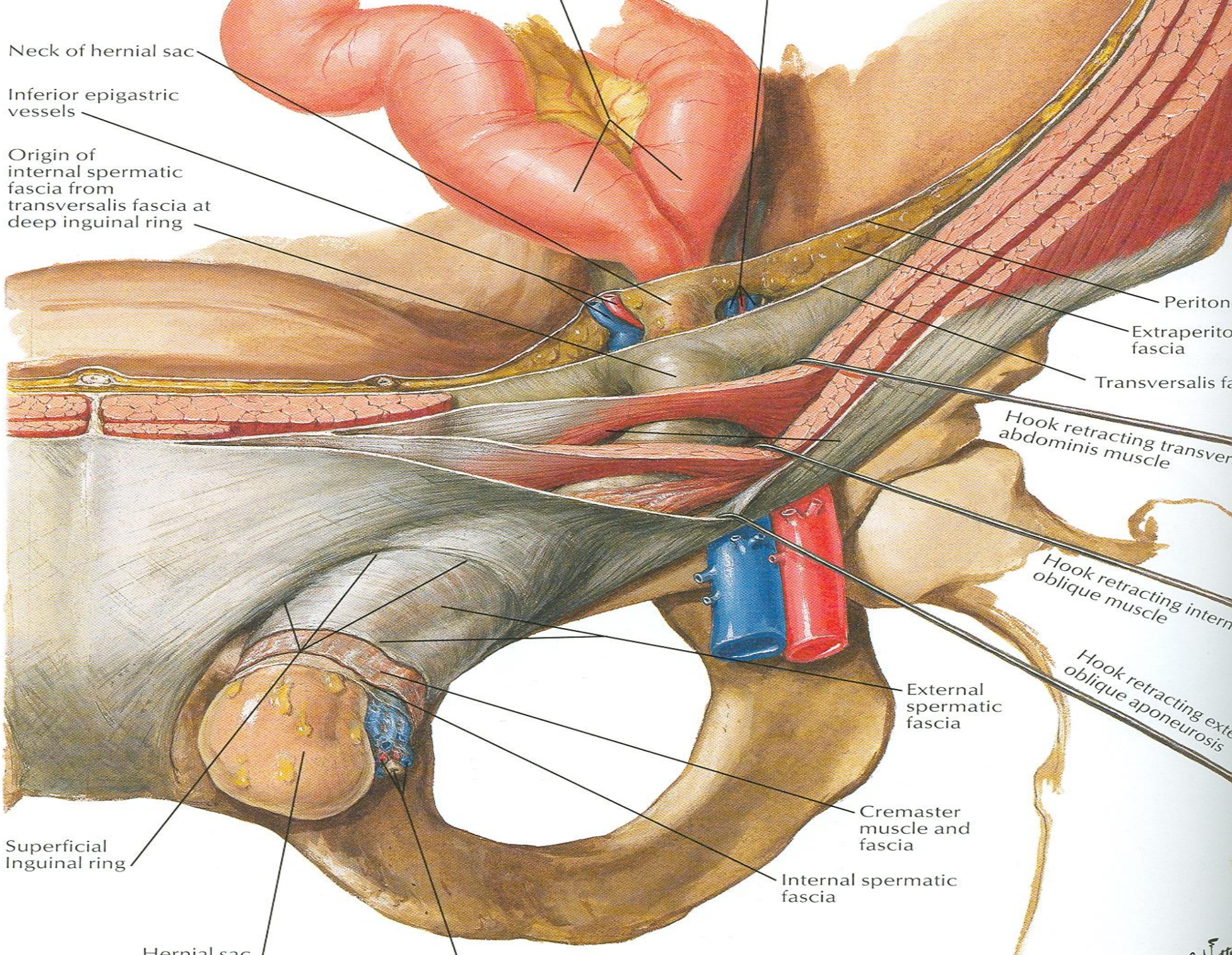


Developing of process vaginalis……..cont



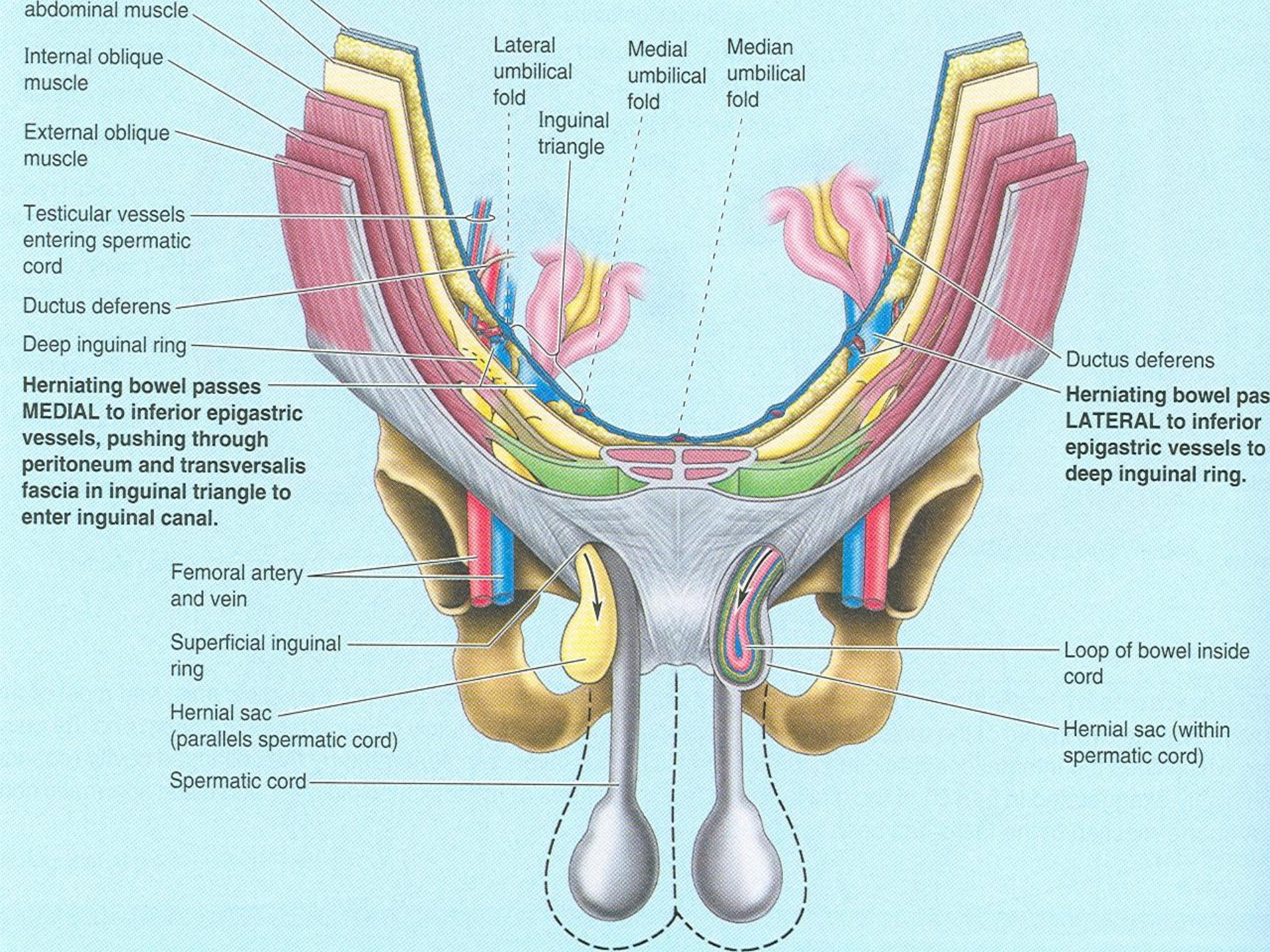
Inguinal Hernia

- A hernia is the protrusion of part of the abdominal contents beyond the normal confines of the abdominal wall
- Consists of three parts: the sac, contents of the sac, covering of the sac
- Hernial coverings are formed from the layers of the abdominal wall through which the hernial sac passes


Neck of hernial sac
Inferior epigastric vessels
Origin of internal spermatic fascia from transversalis fascia at deep inguinal ring
Periton
Extraperito fascia
Transversalis fa
Hook retracting transver abdominis muscle
Hook retracting intern oblique muscle
Hook retracting exte oblique aponeurosis
External spermatic fascia
Cremaster muscle and fascia
Internal spermatic fascia
Superficial Inguinal ring
Hernial sac

Indirect Inguinal Hernia

- It is the most common form of hernia
- Is believed to be congenital in origin
- The hernial sac is remains of processus vaginalis
- Enters the inguinal canal through the deep inguinal ring lateral to the inferior epigastric vessels
- It may extend part of the way along the canal or as far as the superficial inguinal ring


abdominal muscle
Internal oblique muscle
External oblique muscle
Testicular vessels entering spermatic cord
Ductus deferens
Deep inguinal ring
Herniating bowel passes MEDIAL to inferior epigastric vessels, pushing through peritoneum and transversalis fascia in inguinal triangle to enter inguinal canal.
Lateral umbilical fold
Inguinal triangle
Medial umbilical fold
Median umbilical fold
Femoral artery and vein
Superficial inguinal ring
Hernial sac (parallels spermatic cord)
Spermatic cord
Ductus deferens
Herniating bowel pas LATERAL to inferior epigastric vessels to deep inguinal ring.
Loop of bowel inside cord
Hernial sac (within spermatic cord)

Indirect Inguinal Hernia

- If the processus vaginalis has undergone no obliteration, the hernia is complete and extends through the superficial inguinal ring down into the scrotum or labium majus
- Under these circumstances the neck of the hernial sac lies at the deep inguinal ring
- It is 20 times more common in young males than females
- Is more common on the right side(the Rt. testis descends later than the Lt. testis)

Direct Inguinal Hernia

- It composes about 15% of all inguinal hernias
- Common in old men with weak abdominal muscles and rare in women
- Hernial sac bulges forward through the posterior wall of the inguinal canal medial to the inferior epigastric artery
- The neck of the hernial sac is wide

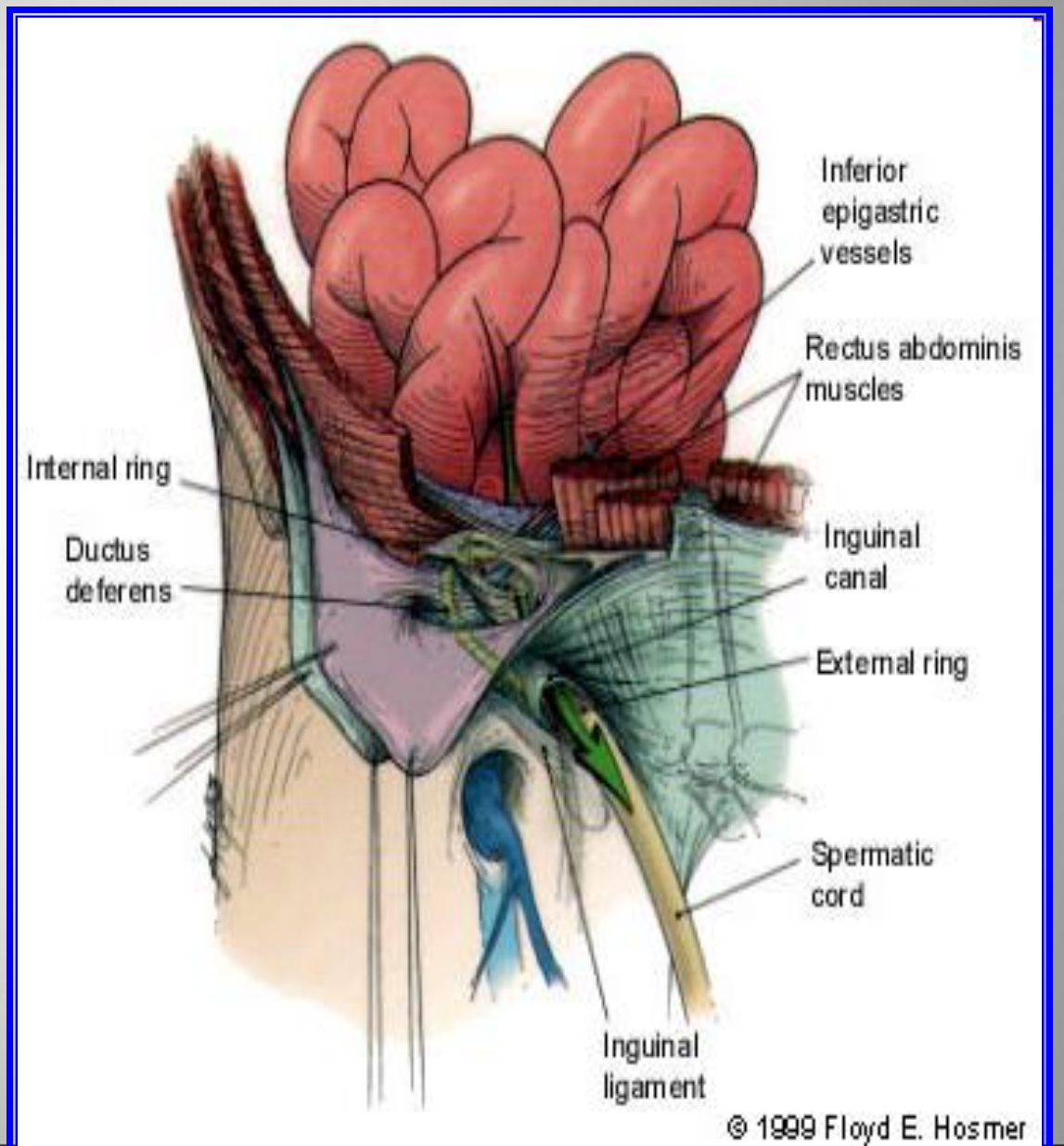
Inguinal Hernia

	Direct	Indirect
Age	Common on old	young
Bilaterally	Usually bilateral	unilateral
Shape	Hemispherical	Oval
Reaches scrotum	never	Can reach the scrotum
Direction of descent	Forwards	Downwards , forwards medially
Reduction	backward	Upward, backward laterally
Relation to inf. epigastric art.	Medially	Laterally
Superficial inguinal ring test	Feel impulse on the side finger	Feel an impulse on the tip of the finger
Deep ring test Reduction of hernia, put thumb over deep ring, ask patient to cough	Hernia appears	Hernia does not appear
Coverings	1- Lat. To lat. Umbilical lig Same as indirection 2- Med. To lat	Skin, superfacial fascia, Ex.sp.fascia, cremastric muscle & fascia, Int spermatic fascia

Direct Hernia Route

Note:

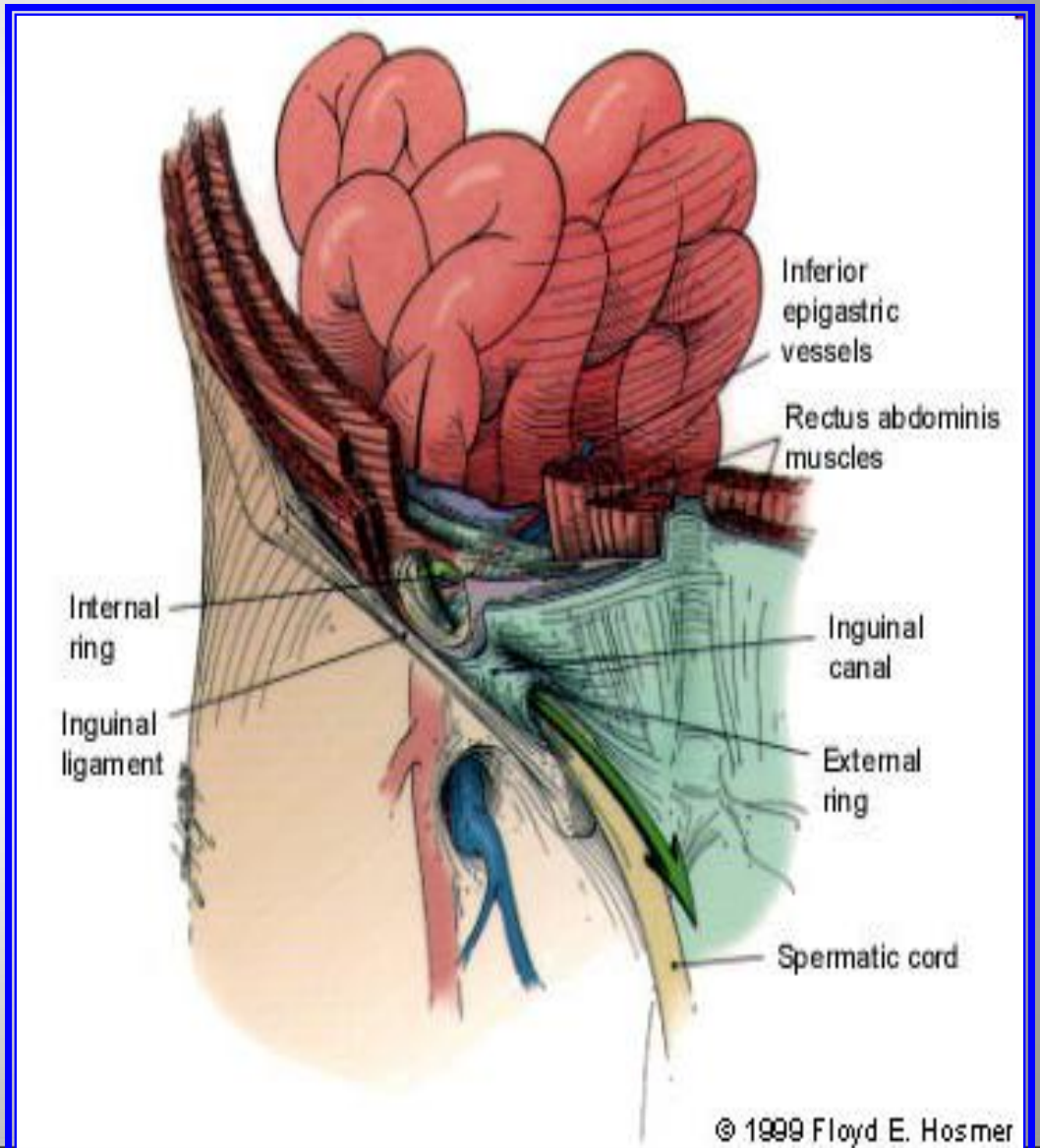
The hernia sac passes directly through inguinal triangle and may disrupt the floor of the inguinal canal.

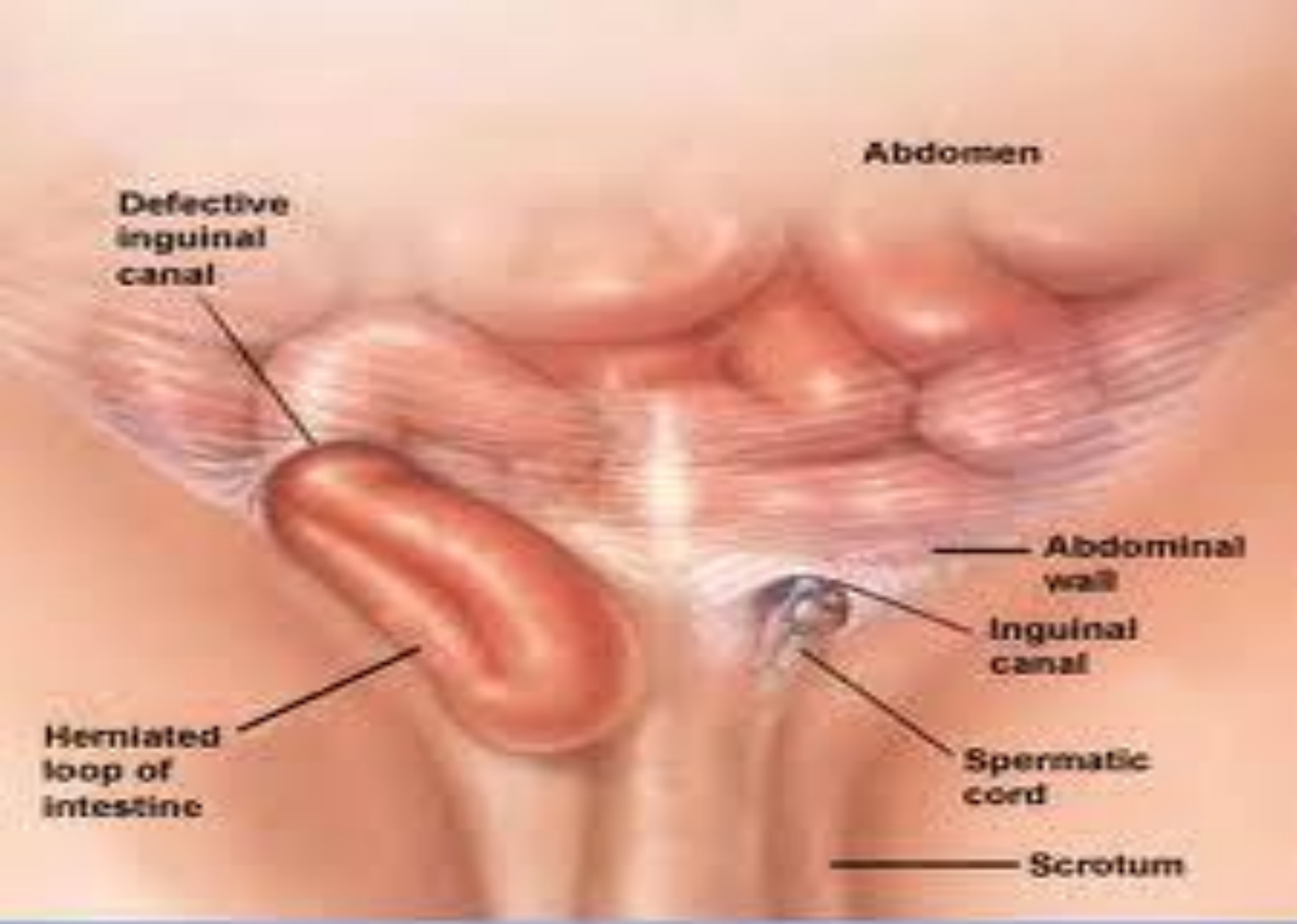


Indirect Hernia Route

Note:

The hernia sac passes outside the boundaries of Hesselbach's triangle(inguinal triangle) and follows the course of the spermatic cord.





Scrotum

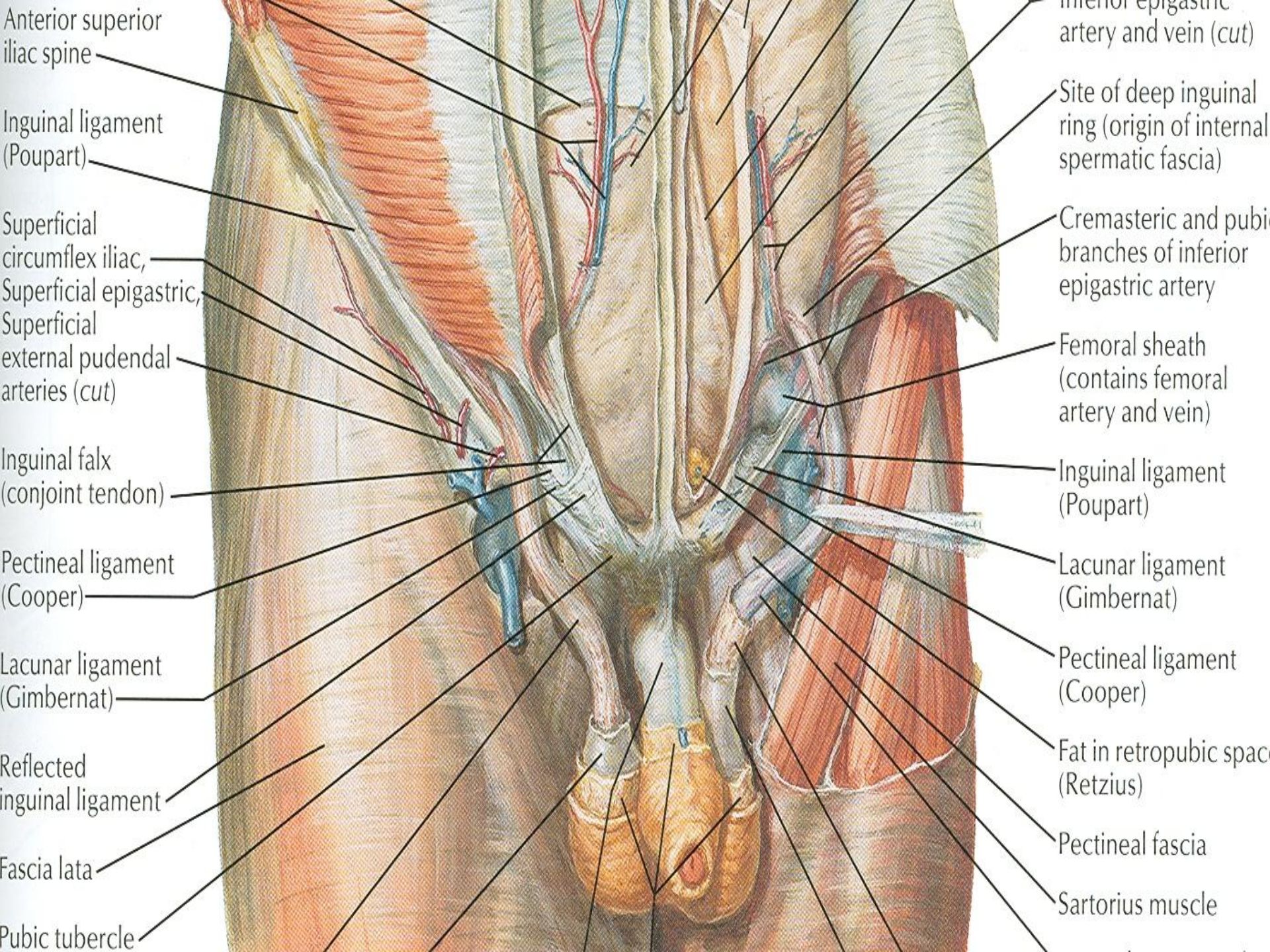
- It is an outpouching of the lower part of the anterior abdominal wall
- It contains testes, epididymis, and the lower ends of the spermatic cord
- Its wall has following layers: skin, superficial fascia, external spermatic fascia derived from external oblique, cremastric fascia derived from internal oblique internal spermatic fascia derived from transversalis, and tunica virginals(parietal & visceral layer)

Skin of the Scrotum

- Skin of the scrotum is thin, wrinkled, and pigmented and forms a single pouch
- A ridge in the midline indicates the line of fusion of the two lateral labioscrotal swellings
- Superficial fascia is continuous with the fatty and membranous layers of the anterior abdominal wall

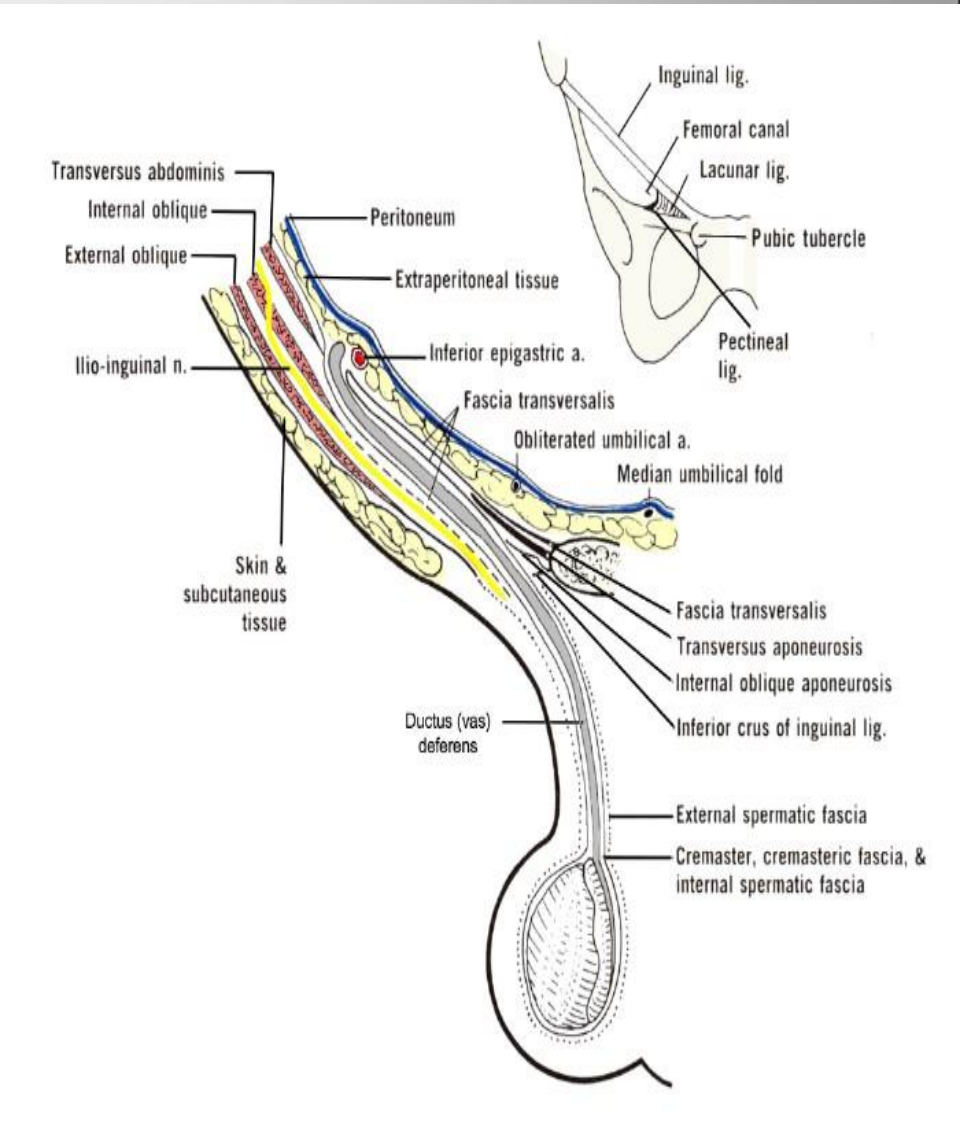
Superficial Fascia

- Superficial fascia is continuous with the fatty and membranous layers of the anterior abdominal wall
- The fat is replaced by smooth muscle called dartos muscle
- It is responsible for wrinkles of the skin
- Membranous layer referred to as Colle's fascia
- Innervated by sympathetic nerve fibers
- Both layers of sup. Fascia contribute to a median partition that crosses the scrotum and separates the testes from each other


Anterior superior iliac spine
Inguinal ligament (Poupart)
Superficial circumflex iliac, Superficial epigastric, Superficial external pudendal arteries (*cut*)
Inguinal falx (conjoint tendon)
Pectineal ligament (Cooper)
Lacunar ligament (Gimbernat)
Reflected inguinal ligament
Fascia lata
Pubic tubercle
Inferior epigastric artery and vein (*cut*)
Site of deep inguinal ring (origin of internal spermatic fascia)
Cremasteric and pubic branches of inferior epigastric artery
Femoral sheath (contains femoral artery and vein)
Inguinal ligament (Poupart)
Lacunar ligament (Gimbernat)
Pectineal ligament (Cooper)
Fat in retropubic space (Retzius)
Pectineal fascia
Sartorius muscle

Spermatic Fasciae

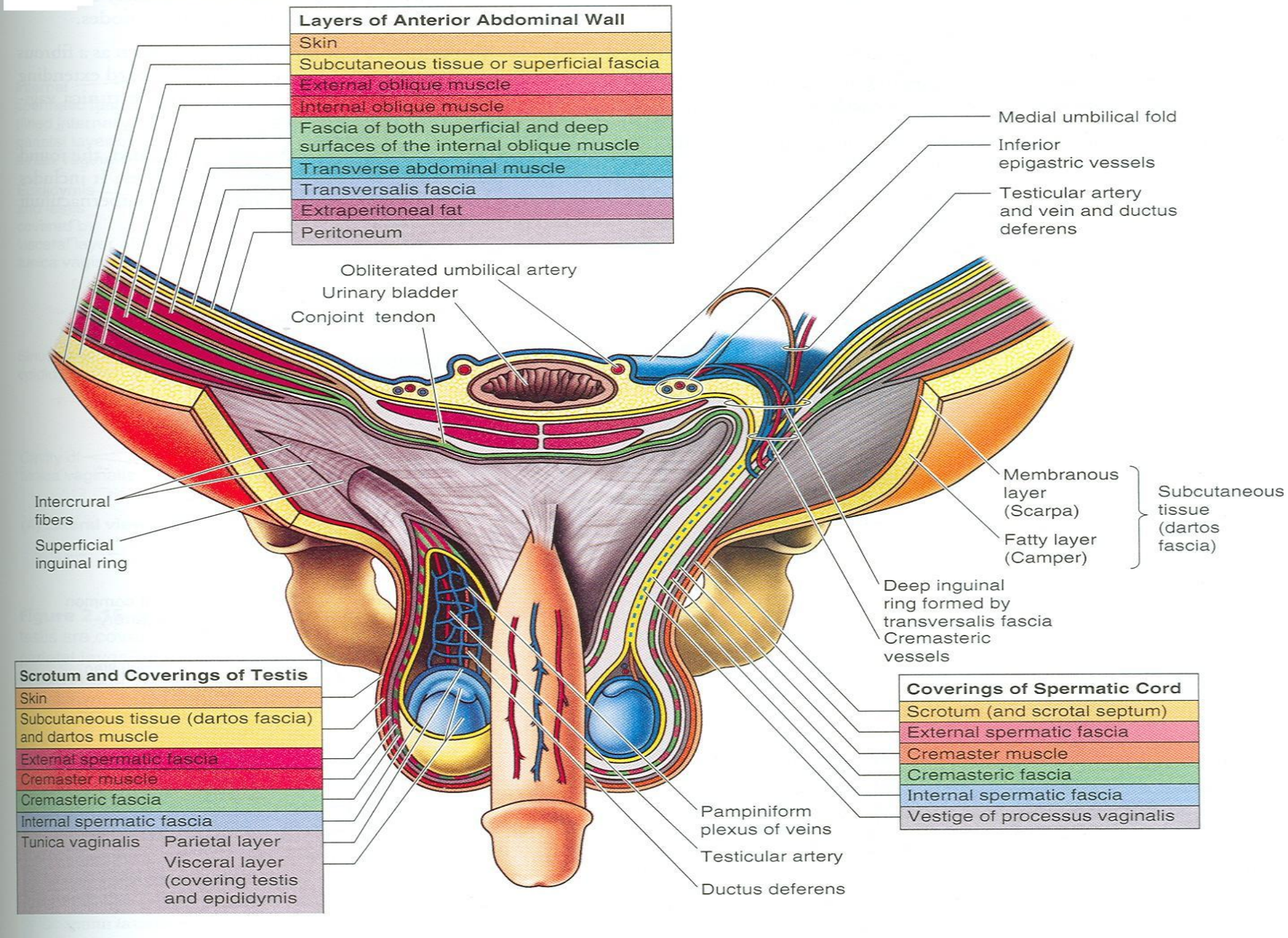
- Lies beneath the superficial fascia
- Derived from three layers of anterior abdominal wall on each side
- The external spermatic fascia is derived from external oblique
- The cremastric fascia is derived from internal oblique
- The internal spermatic fascia is derived from the fascia transversalis



Tunica Vaginalis

- Lies within the spermatic fasciae
- Covers the anterior, medial and lateral surfaces of each testis
- It is the lower expanded part of the processus vaginalis
- Normally shut off just before birth from the upper part of the processus and the peritoneal cavity

Corresponding Layers of the Anterior Abdominal Wall, Scrotum, and Spermatic Cord



Internal structures of the scrotum

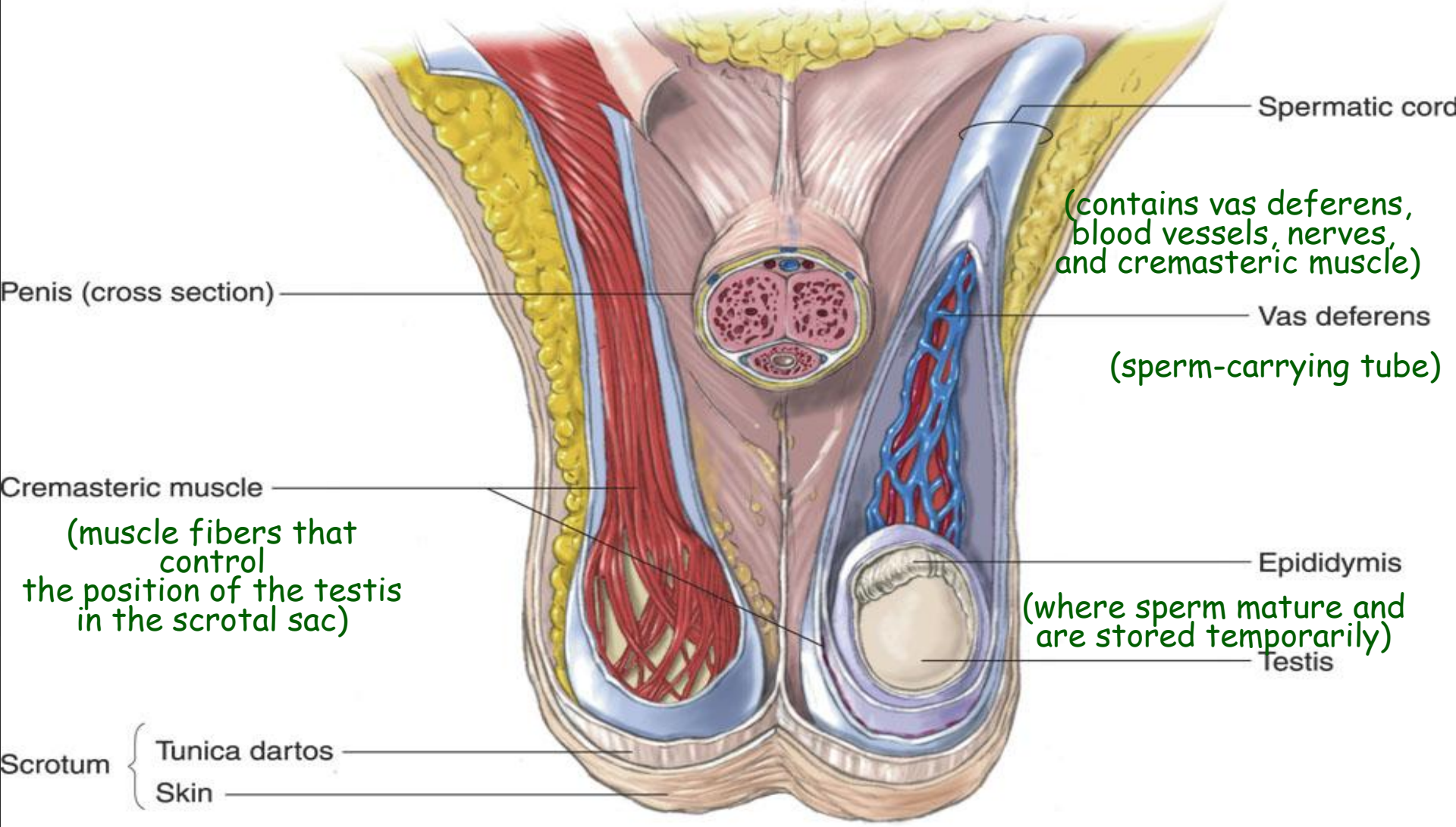


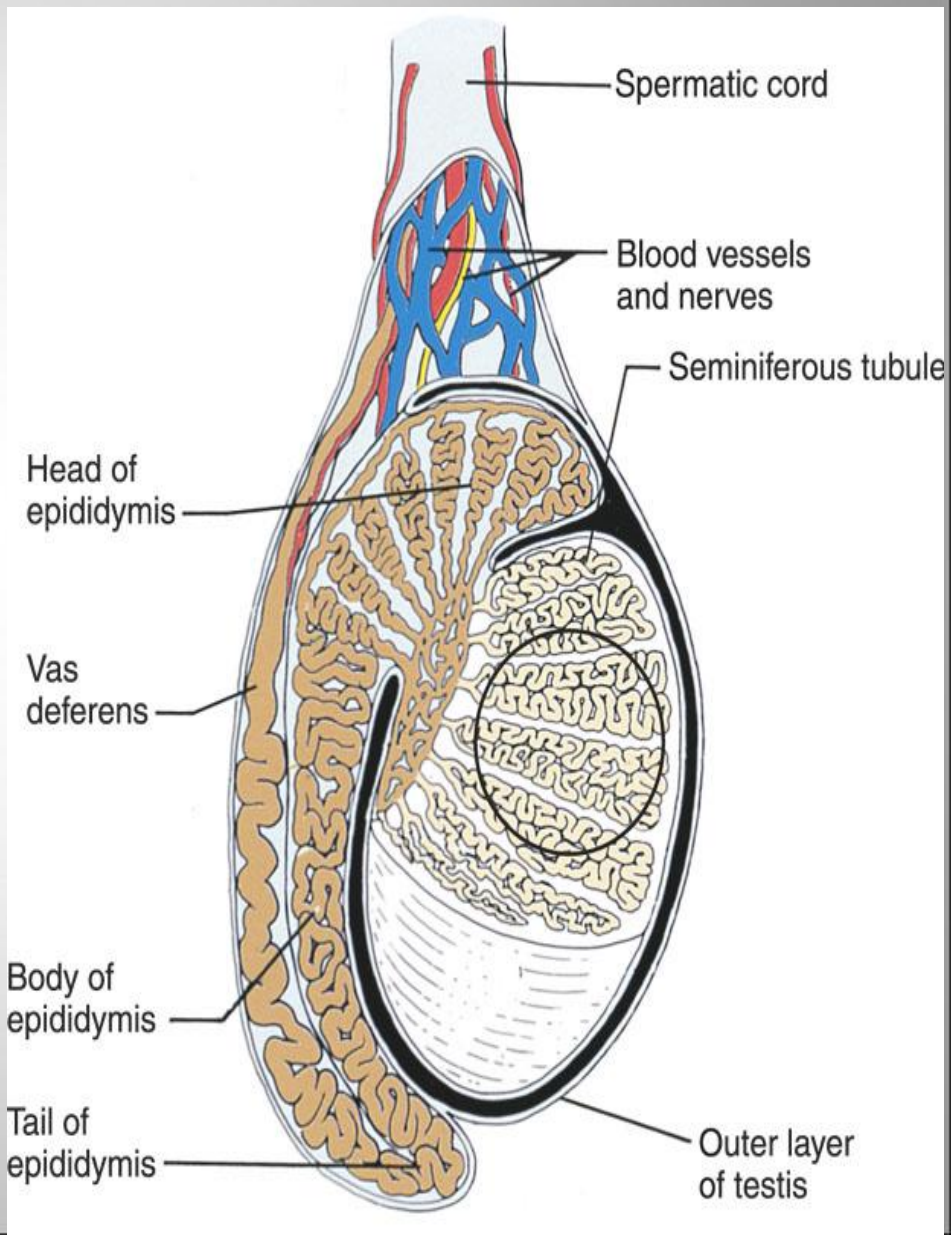
Fig : Internal structures of the scrotum. This illustration shows portions of the scrotum cut away to reveal the cremasteric muscle, spermatic cord, vas deferens, and a testis within the scrotal sac.

Testis

- They are a firm, mobile organ, within the scrotum
- Left testis usually lies at a lower level than the right
- Upper end of the gland is tilted forward
- Surrounded by a tough fibrous capsule, the tunica albuginea
- A series of fibrous septa divide the interior of the organ into lobules
- Lying in each lobule are one to three coiled seminiferous tubules
- The tubules open into the network of channels called the rete testis
- Small efferent ductules connect the rete testis to the upper end of the epididymis

Structures inside the testis

- **Seminiferous tubules**
  - Thin, highly coiled structures where sperm production occurs.
- **Interstitial cells**
  - Major source of androgens
  - Located between seminiferous tubules
- **Epididymis**
  - Site of sperm maturation
  - Runs along back of testis
- **Vas deferens**
  - Sperm-carrying tube
  - Begins at the testis and ends at the urethra.



Overview: male sexual anatomy

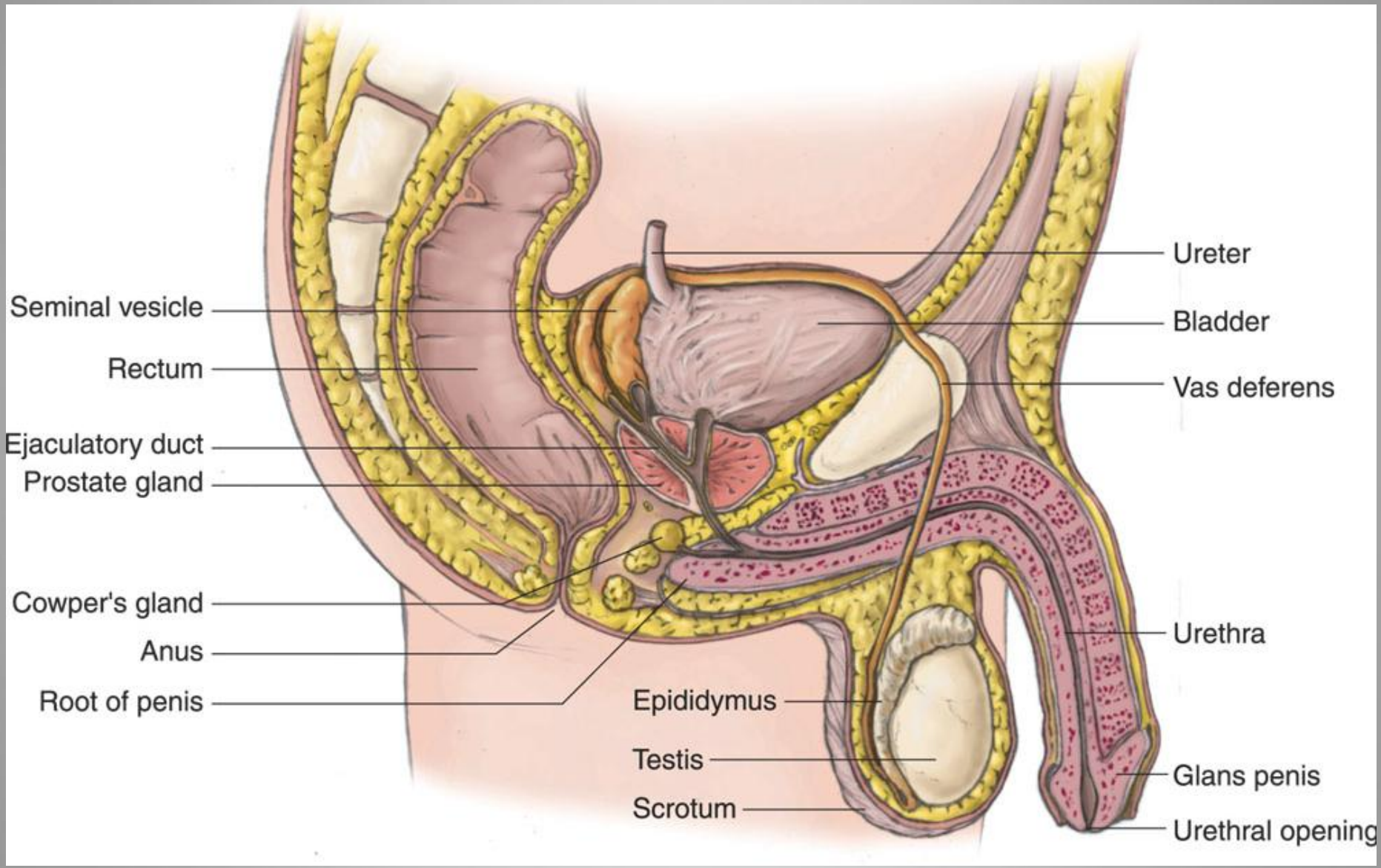
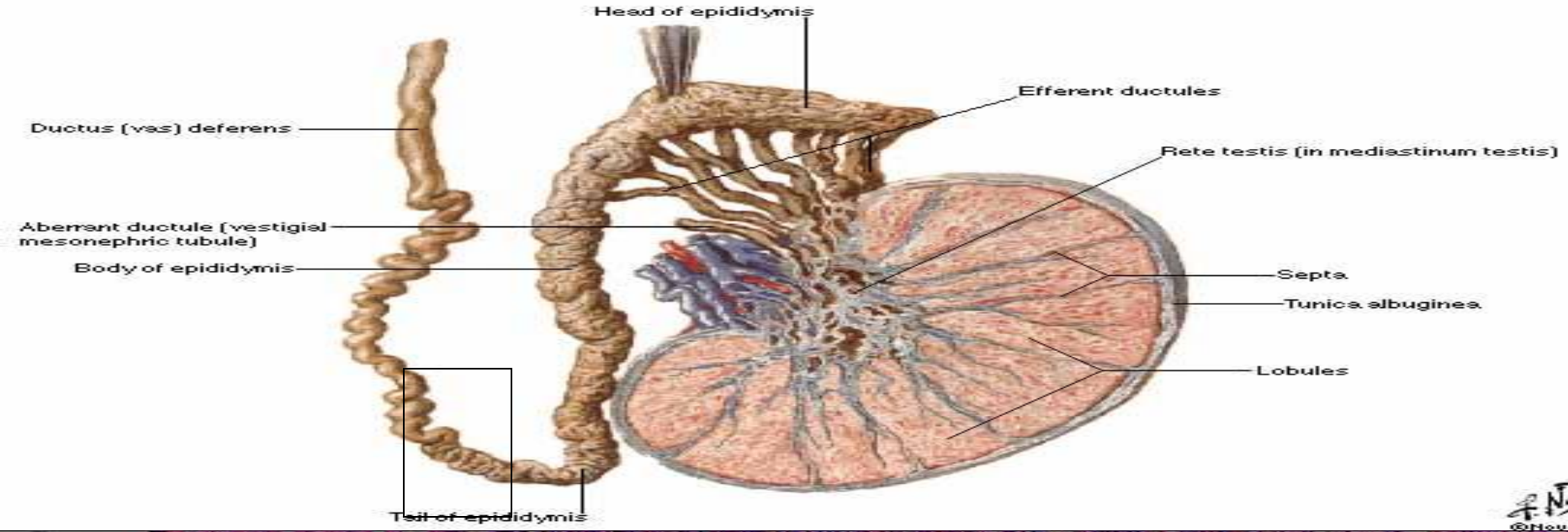
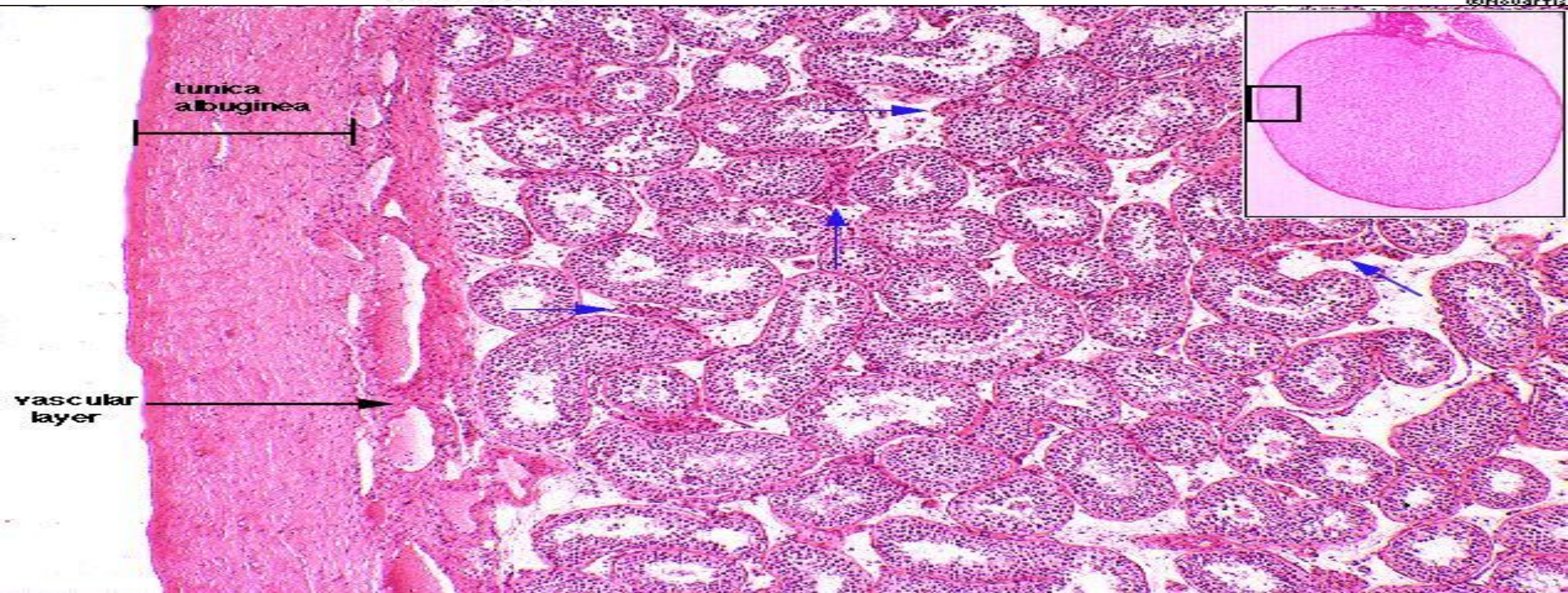


Fig : Male sexual anatomy: A cross-section side view of male reproductive organs.

Testis, Epididymis and Ductus Deferens

Frontal Section





Blood supply of testes

Artery

- Testicular arteries→ Abdominal aorta at level L2

Vein

- Pampiniform plexus → reduced to a single vein → ascend through inguinal canal → Rt. testicular vein drains into I.V.C & Lt. testicular vein drains into Lt.renal vein

Lymphatic drainage of testes

- Ascend in the spermatic cord
- End in the lymph nodes on the side of aorta(Lumber or Para- aortic) nodes at level L1
- Scrotum+ skin→ inguinal canal lymphatic nodes

Nerve supply to testes

Autonomic nerves

- Sympathetic fibers run with testicular artery from renal or aortic sympathetic plexuses
- Afferent sensory nerve

Genital branch of the genitofemoral nerve

- Supply the cremastric muscle

Scrotum → By the above nerves + ilioinguinal nerve

Clinical Notes

Clinical conditions involving the scrotum and testes

Varicocele:

-The veins of the pampiniform plexus elongated & dilated
- Lt side more common → venous pressure is higher
- Common in young & adult

- **Vasectomy** → Infertility

- **Processus vaginalis**

Upper part → obliterated just before birth
Lower part → Tunica vaginalis

Congenital anomalies of processus vaginalis
1- persist → indirect inguinal hernia
2- Narrowed → congenital hydrocele
3- Obliterated upper & lower part → encysted hydrocele of the cord

Abnormality in testis & scrotum……..cont

Hydrocele

- Accumulation of fluid within the tunica vaginalis of the testis
- **<u>Causes</u>**

1- Inflammatory

2- idiopathic

- Tapping ahydrocele → structures (all layers covering the testis, skin→ tunica vaginalis)traversed by the cannula

Congenital anomalies of the testes

Cryptorchidism

- Incomplete descent of testis although traveling down normal pathway
- It may be found in

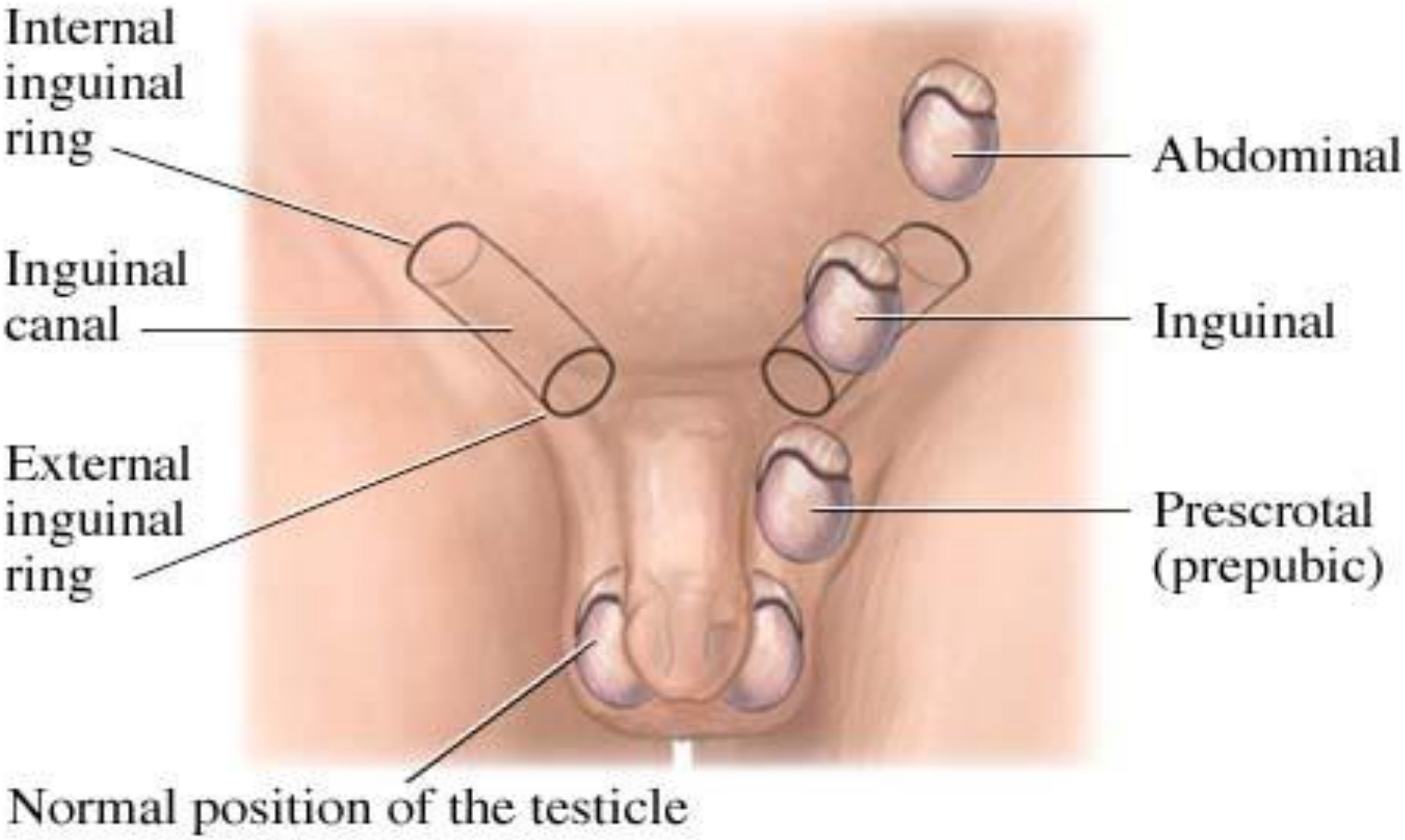
1- Abdominal cavity
2- In inguinal canal
3- At superficial inguinal ring
4- In upper part of scrotum

Maldescent

- Testes travel down an abnormal pathway

1- Superfacial fascia
2- Root of penis
3- Perineum
4- In the thigh

Cryptorchidism



Thank you