OBJECTIVES

- Identify the muscles of the anterior abdominal wall and describe their action and innervation.
- Name the blood and nerve supply of the anterior abdominal wall.
- Describe the layers of the abdominal wall involved in construction of the inguinal canal.
- Describe the deep and superficial inguinal rings and their contents.
- List and identify the contents of the spermatic cord.
- Explain the similarities and differences between direct and indirect inguinal hernias.

Abdominal Planes & Regions
**Layers of the Abdomen**

- **Superficial Fascia**
  - Fatty layer: Camper's fascia

- **Superficial Fascia (Subcutaneous Layer: Scarpa's Fascia)**

- **Anterior Abdominal wall muscles**
  - External oblique
  - Internal oblique
  - Transversus abdominis

**Extraperitoneal Fat (fascia)**

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**Superficial Fascia**

**Peritoneum**

**Muscles of the Anterior Abdominal Wall**

**Anterolateral Group:**
- External oblique
- Internal oblique
- Transversus abdominis

**Midline Group:**
- Rectus Abdominis
  - Pyramidalis

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**Muscles of the Anterior Abdominal Wall**

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Proximal Attachment (Origin)</th>
<th>Distal Attachment (Insertion)</th>
<th>Innervation</th>
<th>Main Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>External oblique</td>
<td>External surface of ribs 1–12</td>
<td>Internal oblique; anterior iliac spine; anterior superior iliac spine</td>
<td>Lumbar, genitofemoral, iliohypogastric, ilioinguinal</td>
<td>Compresses and supports abdominal viscera, flexes, and rotates trunk</td>
</tr>
<tr>
<td>Internal oblique</td>
<td>Transversus abdominis, 2/3 of iliocostalis, lateral half of external oblique</td>
<td>Internal oblique of 10–12, iliopsoas; anterior superior iliac spine</td>
<td>Lumbar, genitofemoral, iliohypogastric, ilioinguinal</td>
<td>Compresses and supports abdominal viscera, flexes, and rotates trunk</td>
</tr>
<tr>
<td>Pyramidalis</td>
<td>Pubis, anterior superior iliac spine</td>
<td>Lumbar, genitofemoral, iliohypogastric, ilioinguinal</td>
<td>Lumbar, genitofemoral, iliohypogastric, ilioinguinal</td>
<td>Tenses linea alba, compresses abdominal viscera</td>
</tr>
<tr>
<td>Rectus Abdominis</td>
<td>Pubis, anterior superior iliac spine</td>
<td>Rectus sheath, linea alba</td>
<td>Lumbar, genitofemoral, iliohypogastric, ilioinguinal</td>
<td>Anterior shear, compresses abdominal viscera</td>
</tr>
<tr>
<td>Transversus abdominis</td>
<td>Interspinal septum 2/3, transversus abdominis; sphenopalatine ganglion</td>
<td>Interspinal septum 2/3, transversus abdominis; sphenopalatine ganglion</td>
<td>Lumbar, genitofemoral, iliohypogastric, ilioinguinal</td>
<td>Compresses and supports abdominal viscera</td>
</tr>
</tbody>
</table>

*The linea alba is a fibrous structure that runs down the midline of the abdomen from the xiphoid process to the pubic symphysis.*
Anterolateral Muscles

Transversus abdominis
Internal oblique
External oblique

"Hands in someone else's pockets" or "Hands praying"
"Hands in your pockets"

Anterolateral Muscles

Above the Arcuate line.

The rectus sheath is formed by the aponeuroses of the transverse abdominal and the external & internal oblique muscles and the transversalis fascia. It contains the rectus abdominis muscle. It can be divided into anterior and posterior laminae by the arcuate line. It also contains the superior & inferior epigastric arteries.

Below the Arcuate line.

Rectus Sheath

Internal View

External View

Rectus abdominis muscle removed
Blood and Nerve Supply

2 Major Vessels:
• Superior epigastric: Internal thoracic artery divides into the Musculophrenic and Superior epigastric arteries near the xiphoid process.
• Inferior epigastric: External iliac gives off the Inferior epigastric just before passing under the inguinal ligament and becoming the Femoral artery.
  > Subcostal arteries supply the anterolateral muscles.

Cutaneous sensation over the abdomen is via the lower 6 intercostal nerves; Iliohypogastric & Ilioinguinal nerves (L1) are found medially near the pubis.

Internal Abdominal Wall Structures

Median umbilical fold: obliterated Urachus
Medial umbilical fold: obliterated umbilical a.
Lateral umbilical folds: Inferior epigastric a. & v.

Inguinal triangle (Hesselbach's triangle)
• Medially: linea semilunaris
• Laterally: inferior epigastric vessels
• Inferiorly: inguinal ligament

The inguinal triangle contains a depression referred to as the medial inguinal fossa, through which direct inguinal hernias protrude through the abdominal wall.

Descent of Testes

The inguinal canal is formed by the relocation of the gonads during fetal development.

Gubernaculum: a fibrous band extending from the caudal part of testis. It plays a role in the decent of the testis.

Processus vaginalis: is a diverticulum or outpouching of the peritoneum that is "dragged along" with the testis as it descends.
Descent of Testes

Abdominal Layers

Scrotal Layers

Descent of Testes

Abdominal Layers

Scrotal Layers

Descent of Testes
### The Scrotum

<table>
<thead>
<tr>
<th>Scrotum Layers</th>
<th>Abdominal Wall Derivative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>Skin</td>
</tr>
<tr>
<td>Darts fascia &amp; dartos muscle</td>
<td>Subcutaneous tissue</td>
</tr>
<tr>
<td>External spermatic fascia</td>
<td>External oblique muscle</td>
</tr>
<tr>
<td>Cremaster muscle</td>
<td>Fascia of internal oblique muscle</td>
</tr>
<tr>
<td>X X X X X</td>
<td>Transverse abdominal muscle</td>
</tr>
<tr>
<td>Internal spermatic fascia</td>
<td>Transversalis fascia</td>
</tr>
<tr>
<td>Tunica vaginalis</td>
<td>Extraperitoneal fat</td>
</tr>
<tr>
<td>+ Parietal layer</td>
<td>Peritoneum</td>
</tr>
<tr>
<td>+ Visceral layer</td>
<td></td>
</tr>
</tbody>
</table>

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### Fascia of the Scrotum

There are 2 major components to the superficial fascia of the abdomen:
- Camper's Fascia ("fatty Camper's"), continuous with fascia of the thigh
- Scarpa's Fascia ("skinny Scarpa's") becomes Darto's fascia / Colles' Fascia (perineum)

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### The Testes

- Vas (ductus) deferens
- Vaterian pleurae (testicular versus pleurae)
- Head of epididymis
- Tail duct (away from testis)
- Tail of epididymis
- Nutons deferens (fat in testis)
- Body of epididymis
- Head of epididymis
- Tail of epididymis
- Tunica albuginea

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**Gray's anatomy for students / Richard L. Drake, A. Wayne Vogl, & Adam W. M. Mitchell—2nd Ed.**
Inguinal Ligament

The **inguinal (crural) ligament** runs from the **anterior superior iliac crest** of the ilium to the **pubic tubercle** of the pubic bone. It is formed by the external abdominal oblique aponeurosis and is continuous with the **fascia lata** of the thigh.

The ligament serves to contain soft tissues as they course anteriorly from the trunk to the lower extremity. This structure demarcates the superior border of the femoral triangle in the thigh, and the inferior border of the inguinal triangle.

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**Inguinal Rings**

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**Inguinal Canal**

The inguinal canal is a 4 cm. long canal which begins at the **deep inguinal ring** (an outpouching of the transversalis fascia lateral to the epigastric vessels) and ends at the **superficial ring** (a triangular opening in the aponeurosis of the external oblique muscle).

In females, the only structure it carries is the remnant of the **round ligament** of the uterus.

In males, it carries the **spermatic cord** from the scrotum to the abdominal cavity.
Nerves of the Inguinal Canal

The ilioinguinal nerve pierces the internal oblique muscle, distributing filaments to it, and then accompanies the spermatic cord (in males) or the round ligament of uterus (in females) through the superficial inguinal ring. It innervates the skin of the upper and medial part of the thigh, and:

- In the male (anterior scrotal nerve) the skin over the root of the penis and upper part of the scrotum (medial).
- In the female (anterior labial nerve) to the skin covering the mons pubis and labia majora.

The ilioinguinal nerve does not pass through the deep inguinal ring, and thus only travels through part of the inguinal canal.

The genitofemoral nerve divides into two branches:

- The genital branch of the genitofemoral nerve passes through the deep inguinal ring and supplies:
  - In males, the genital branch supplies the cremaster and lateral scrotal skin.
  - In females, the genital branch accompanies the round ligament of uterus, terminating in and innervating the skin of the mons pubis and labia majora.
- The femoral branch (both sexes) passes underneath the inguinal ligament, where it innervates skin of the upper leg immediately above the femoral triangle.

Boundaries of the Inguinal Canal

- **Anterior wall**
  - External oblique aponeurosis
  - Internal oblique fibers (lateral 2/3)
  - Medial & lateral crus
- **Posterior wall**
  - Transversalis fascia
  - Conjoint tendon (medial 1/3)
- **Roof**
  - Arch of internal oblique (low arched) & transversus abdominis (high arched)
- **Floor**
  - Inguinal ligament

Spermatic Cord

- **3 coverings**
  - External spermatic fascia
  - Cremasteric fascia
  - Internal spermatic fascia
- **3 Arteries**
  - Testicular a.
  - Cremastatic a.
  - Artery of Vas deferens
- **3 V's**
  - Vas deferens
  - Venous (pampiniform) plexus
  - Vestige of Processus Vaginalis
- **3 Nerves**
  - Genital branch of genitofemoral a.
  - Sympathetic plexus around testicular a.
  - Sympathetic plexus around artery of Vas
Types of inguinal hernias:
- **Indirect:** traverses inguinal canal within the spermatic cord (lateral to inferior epigastric vessels) by entering deep inguinal ring.
- **Direct:** pushes through *Hesselbach’s triangle* medial to inferior epigastric vessels.

Protrusion of abdominal contents (usually intestine) within a sac of peritoneum into the inguinal region.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Direct/Areolar</th>
<th>Indirect/Compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing factors</td>
<td>Weakness of anterolateral abdominal wall in inguinal hiatal opening or defects in the abdominal fascia; trauma or surgery</td>
<td>Patency of peritoneal inguinal canal or at least the superior part of the inguinal canal in newborns or young children</td>
</tr>
<tr>
<td>Frequency</td>
<td>Less common (one third to one quarter of inguinal hernias)</td>
<td>More common (two thirds to three quarters of inguinal hernias)</td>
</tr>
<tr>
<td>Exit from abdominal cavity</td>
<td>Femoral ring (Fig. 51A &amp; B)</td>
<td>Peritoneal hernia, usually occurs through one or two fascial coverings of the cord</td>
</tr>
<tr>
<td>Course (Fig. 53 SC)</td>
<td>Passes through or around inguinal canal, usually lateral to and separated from the cord</td>
<td>Traverses inguinal canal (infant canal if it is not sufficient)</td>
</tr>
<tr>
<td>Exit from anterior abdominal wall</td>
<td>Via superficial ring, lateral to cord; rarely enters scrotum</td>
<td>Via superficial ring inside cord, commonly passing into external iliac fossa</td>
</tr>
</tbody>
</table>

- More than 2/3rd of hernias are indirect.
- Indirect hernia is **20 times more common in males than females**.