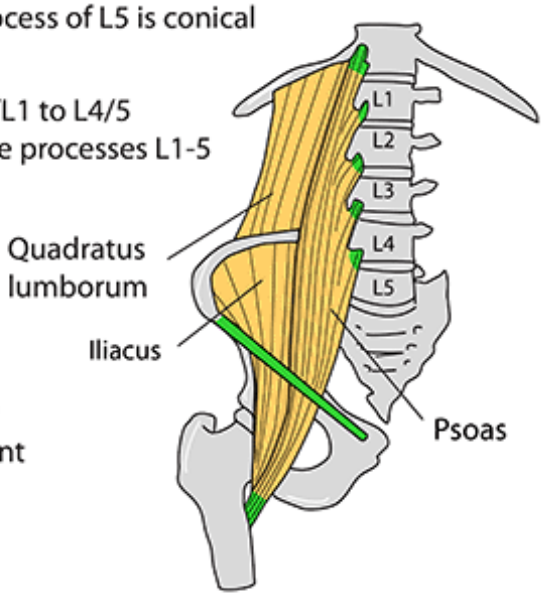
**POSTERIOR ABDOMINAL WALL:**

## POSTERIOR ABDOMINAL WALL

- 5 vertebrae
- Transverse process of L3 is largest
- Transverse process of L5 is conical




**PSOAS MAJOR**
Origin: Intervertebral discs T12/L1 to L4/5
Bodies of L1-5, transverse processes L1-5
Inserts: Lesser trochanter
Nerve: L1,2,3
Action: Flexes hip

**PSOAS MINOR (not shown)**
Origin: Bodies T12,L1
Inserts: Fascia over psoas major behind inguinal ligament
Nerve: L1
Action: Weak spine flexor

**QUADRATUS LUMBORUM**
Origin: Transverse process L5
Iliolumbar ligament &
posterior 1/3 iliac crest
Inserts: Medial 1/2 12th rib 8
transverse process L1-4
Nerve: T12-L4
Action: Holds down 12th rib

**ILIACUS**
Origin: Hollow of iliac fossa
Inserts: Psoas tendon &
below lesser trochanter
Action: Flexes hip
Nerve: Femoral (L2,3,4)

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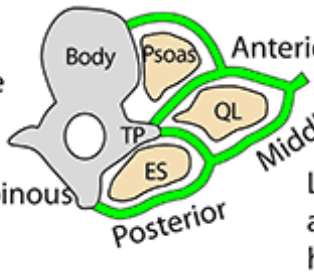
LAYERS OF THORACOLUMBAR FASCIA

TP= Transverse process
ES= Erector spinae
QL= Quadratus lumborum
Spine/supraspinous ligaments




Attachment of transversus & internal oblique

Lumbar region all 3 layers are present, thoracic region has posterior layer only

**ANTERIOR ABDOMINAL WALL:**

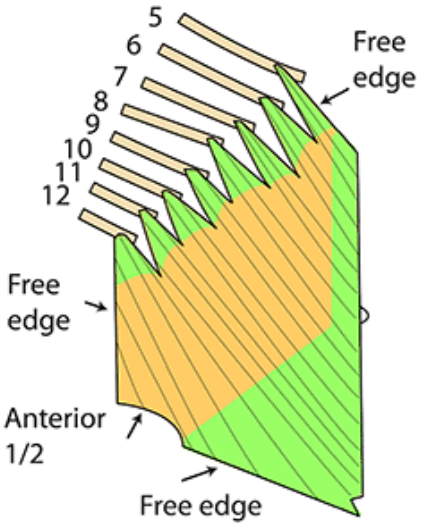
- The abdomen is divided into regions that are defined by lines on the surface of the anterior abdominal wall
  - Usually NINE REGIONS are delineated by two vertical and two horizontal lines
  - VERTICAL LINE:

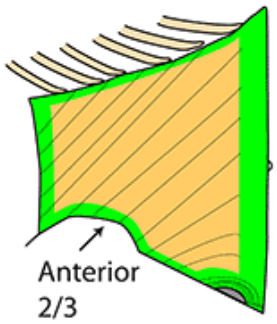
        - Corresponds to the MIDCLAVICULAR LINE on each side when extended down to the MIDINGUINAL POINT (midway between the pubic symphysis and the ASIS
    - HORIZONTAL LINES:
        - Lower transverse line:
            - Drawn between the tubercles of the iliac crests (INTERTUBERCULAR LINES)
        - Upper transverse lines:
            - In the TRANSPYLORIC PLANE, midway between the jugular notch and the tope of the pubic symphysis
- Using these four lines, three CENTRAL REGIONS are defined, from above downwards:
    - EPIGASTRIC
    - UMBILICAL
    - HYPOGASTRIC
- Similarly there are THREE LATERAL REGIONS on each side:
    - HYPOCHONDRAL
    - LUMBAR
    - ILIAC

**ANTEROLATERAL ABDOMINAL MUSCLES:**

- The three muscle layers of the body wall are SEPARATE IN THE FLANKS
    - The layers have fused ventrally to form the RECTUS ABDOMINUS MUSCLE

# ABDOMINAL WALL MUSCLES
# EXTERNAL & INTERNAL OBLIQUE



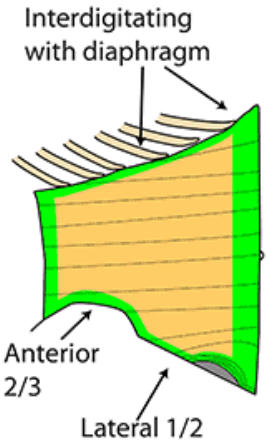

## EXTERNAL OBLIQUE

**From:** ant angles last 8 ribs.
**To:** xiphisternum, linea alba, pubic symphysis & crest, inguinal lig, ant 1/2 iliac crest.
**Fibres:** down/medial
**N:** T7-12

## INTERNAL OBLIQUE

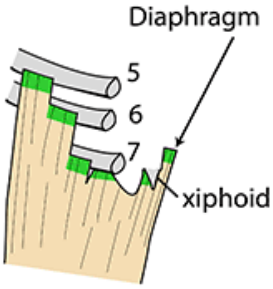
**From:** ant. 2/3 iliac crest, lat 2/3 inguinal lig, lumbar fascia
**To:** costal margin, rectus sheath. Conjoint tendon (CT) on pubic crest & pectineal line.
**Fibres:** Upward/medial
**N:** T7-12, ilioinguinal to CT

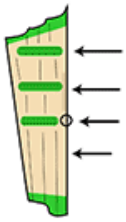
## ABDOMINAL WALL MUSCLES
## TRANSVERSUS, RECTUS ABDOMINIS, PYRAMIDALIS




**TRANSVERSUS ABDOMINIS**
**From:** costal margin, lumbar fascia, ant 2/3 iliac crest. lat 1/2 inguinal lig
**To:** rectus sheath, linea alba, CT to pubic crest & pectineal line
**Fibres:** transverse
**N:** T7-12, ilioinguinal to CT

**RECTUS ABDOMINIS**
From: pubic crest, tubercle & symphysis
To: costal cartilages 5,6,7, costal margin of 7, sternum & diaphragm
N: T7-12
(note: 3 morphological layers)



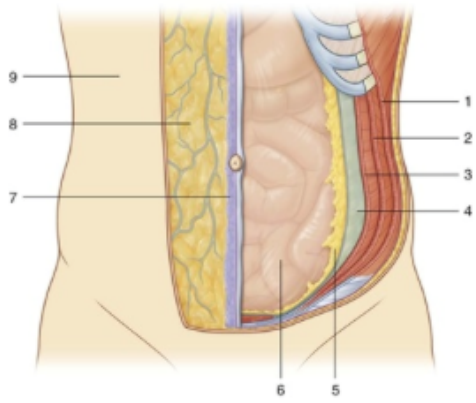



3 Tendinous intersections (rarely 4)
Fusion to anterior sheath

PYRAMIDALIS
From: front of body of pubis
To: linea alba
N: T12 (subcostal)

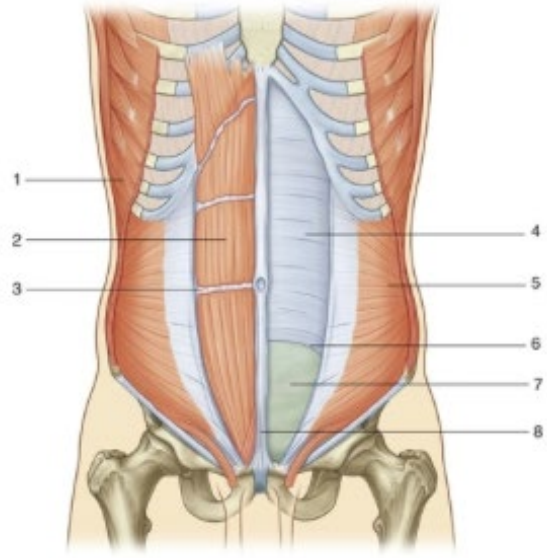
- **EXTERNAL OBLIQUE:**
  - Muscle arises by eight digitations, one from each of the lower eight ribs just lateral to their anterior extremities
  - From its fleshy origin, it fans out to a very wide insertion, much of which is aponeurotic
  - FREE POSTERIOR BORDER
    - Extends from the 12$^{th}$ rib to its insertion into the anterior half of the outer lip of ILIAC CREST
  - Muscle fibres are replaced by an aponeurosis below a line joining the ASIS to umbilicus
    - The aponeurotic fibres interdigitate with each other across the front of rectus abdominus along the whole length of the linea alba
  - Posterior border of the muscle is free, and forms the anterior boundary of the LUMBAR TRIANGLE
    - Bounded behind by anterior border of lat dorsi and below by iliac crest

- **The lower border, lying between the ASIS and the pubic tubercle, forms the INGUINAL LIGAMENT**
    - Its edge is rolled inwards to form a gutter
        - Lateral part of this gutter gives origin to part of the internal oblique and transversus abdominis muscles
    - **Fascia lata is attached to the inguinal ligament**
    - Just above and lateral to the pubic tubercle is an oblique, triangular gap, the SUPERFICIAL INGUINAL RING
        - Base of the gap is the pubic crest
        - Margins are the crura of the ring
- From the medial end of the inguinal ligament the triangular LACUNAR LIGAMENT extens backwards to the pectineal line and forms the medial margin of the pectineal line




1. External oblique muscle
2. Internal oblique muscle
3. Transversus abdominis muscle
4. Transversalis fascia
5. Extraperitoneal fascia
6. Parietal peritoneum
7. Superficial fascia—membranous layer (Scarpa's fascia)
8. Superficial fascia—fatty layer (Camper's fascia)
9. Skin

Figure from *Gray's Anatomy for Students*, 3rd edition, p. 280.




1. External oblique muscle
2. Rectus abdominis muscle
3. Tendinous intersection
4. Posterior wall of rectus sheath
5. Internal oblique muscle
6. Arcuate line
7. Transversalis fascia
8. Linea alba

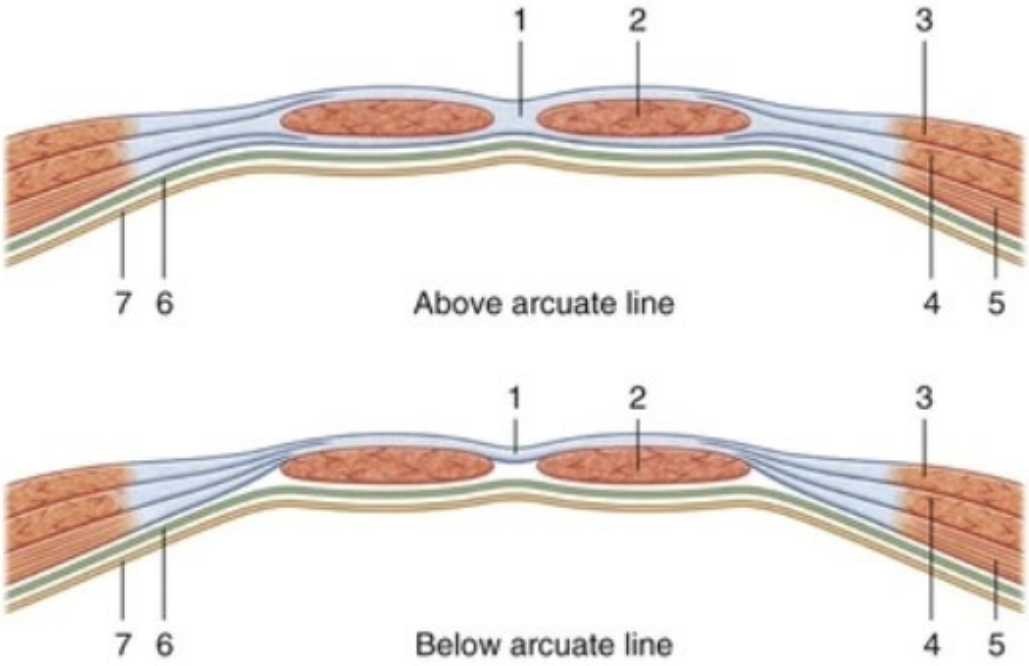
- **INTERNAL OBLIQUE:**
    - Fleshy fibres of the muscle arise from the whole length of the lumbar fascia, from the intermediate area of the anterior tow-thirds of the iliac crest and from the lateral two-thirds of the inguinal ligament
    - Fibres then run up along the costal margin (to which they are attached), becoming aponeurotic at the tip of the ninth costal cartilage

    - Halfway between the umbilicus and the pubic symphysis, the posterior layer ends in a curved free margin, the ARCUATE LINE
        - Below this point, the aponeurosis passes wholly in front of the rectus, to the linea alba
    - The fibres that arise from the inguinal ligament are continued into an aponeurosis that is attached to the crest of the pubic bone and, more laterally, to the pectineal line
        - This aponeurosis is fused with a similar arrangement of the transversus aponeurosis to form the CONJOINT TENDON

- **TRANSVERSUS ABDOMINIS:**
    - Arises in continuity from the lateral third of the inguinal ligament, the anterior two-thirds of the inner lip of the iliac crest, the lumbar fascia, $12^{th}$ rib and from inner aspects of the lower six costal cartilages, where it interdigitates with the diaphragm
    - Fuse with internal oblique aponeurosis behind the rectus in the linea alba
    - Below the arcuate line the aponeurosis passes wholly in front of the rectus muscle
    - Lower fibres curve downwards and medially with those of internal oblique as the CONJOINT TENDON, to insert on the pubic crest and pectineal line

**RECTUS ABDOMINIS AND PYRAMIDALIS:**

- Arises by TWO HEADS:
    - Medial from in front of the pubic symphysis
    - Lateral from the upper border of the pubic crest
    - Two muscles lie together in the lower parts but broaden out above to be separated by the LINEA ALBA
- Inerted on to the front of the $5^{th}$-$7^{th}$ costal cartilages
- Typically three TENDINOUS INTERSECTIONS are found in the muscle
    - One at the umbilicus
    - One at the xiphisternum
    - One between the two
        - These blend inseparably with the anterior layer of the rectus sheath
- Small triangular PYRAMIDALIS arises from the pubic and the symphysis between rectus and its sheath
    - Converges with its fellow into the linea alba 4cm above its origin
- Between the two recti all the aponeuroses that form the LINEA ALBA, a strong midline fibrous structure which is firmly attached to the xiphoid process above and the pubic symphysis below



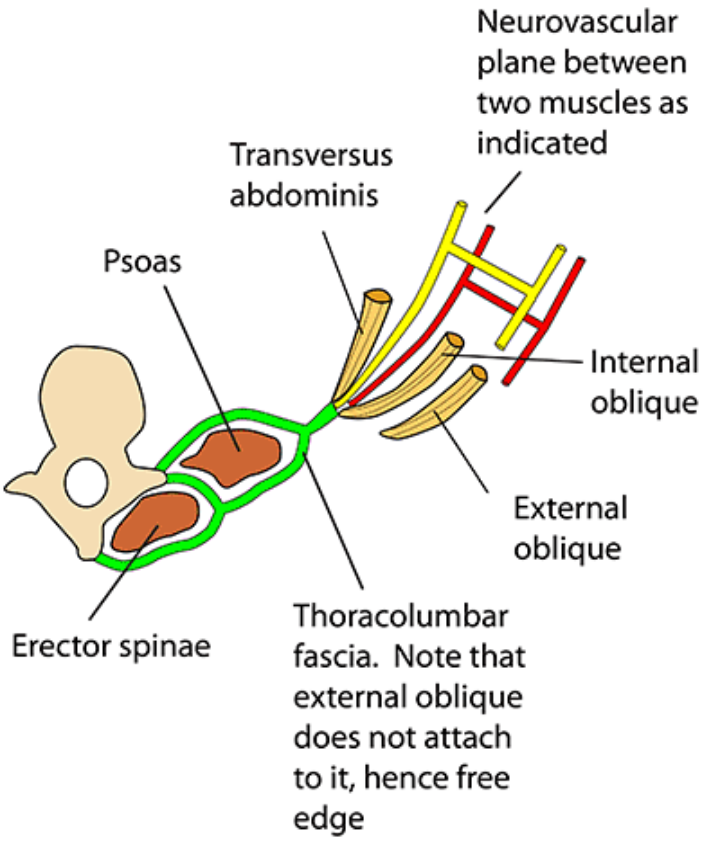

1. Linea alba
2. Rectus abdominis muscle
3. External oblique muscle
4. Internal oblique muscle
5. Transversus abdominis muscle
6. Transversalis fascia
7. Parietal peritoneum

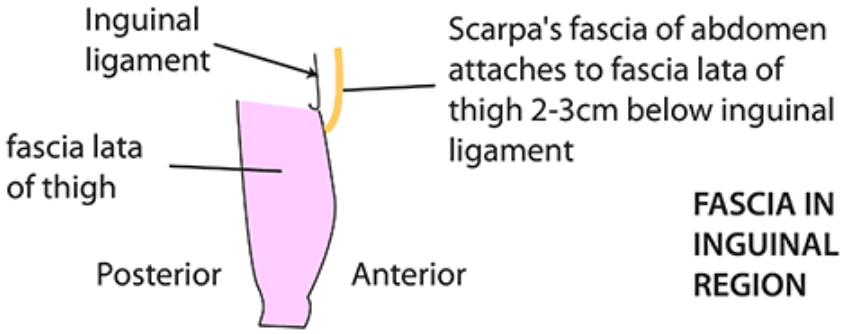
**RECTUS SHEATH:**

- The aponeurosis of the internal oblique splits into anterior and posterior layers to enclose the rectus muscle
    - External oblique aponeurosis fuses with the anterior layer and transversus aponeurosis fuses with the posterior layer
    - From halfway between the umbilicus and the pubic symphysis all three aponeuroses pass in front of the muscle
        - The posterior border thus has a free margin = ARCUATE LINE
- Posterior layer of the sheath is attached to the costal margin
- The splitting of the internal oblique aponeurosis along the lateral border of the rectus muscle forms a relatively shallow groove = SEMILUNAR LINE
- Layers of the three aponeuroses decussate across the midline
- CONTENTS:
    - Apart from the rectus and pyramidalis, the sheat contains the ends fo the lower six thoracic nerves and their accompanying posterior intercostal vessels and the superior and inferior epigastric arteries
    - INTERCOSTAL NERVES:

        - Pass from their intercostal spaces into the abdominal wall between the internal oblique and transversus muscles and enter the sheath by piercing the posterior layer of the internal oblique aponeurosis
        - They then proceed behind the rectus, supply it and pass through the anterior layer to become anterior cutaneous nerves
    - SUPERIOR EPIGASTRIC ARTERY:
        - A terminal branch of internal thoracic
        - Enters the sheath by passing between the sternal and highest costal fibres of the diaphragm
        - Supplies the rectus muscle and anastomoses within it with the INFERIOR EPIGASTRIC ARTERY
            - This vessel leaves the external iliac at the inguinal ligament, passing upwards
        - Veins accompany these arteries, draining to internal thoracic and exgternal iliac veins respectively

## ABDOMINAL WALL - THORACOLUMBAR FASCIA, NEUROVASCULAR PLANE & FASCIA OVER INGUINAL REGION




FASCIA IN INGUINAL REGION

**BLOOD SUPPLIES:**

- Apart from the intercostal and epigastric vessels mentioned above, the anterolateral abdominal muscles also receive a blood supply from the lumbar and deep circumflex iliac arteries
- Lumbar arteries end among the anterolateral muscles and DO NOT ENTER THE SHEATH
- DEEP CIRCUMFLEX ILIAC ARTERY:

    - Arises from the external iliac behind the inguinal ligament and runs laterally towards the ASIS in a sheath formed by the transversalis and iliac fasciae wehre they meet
    - Anastomoses with iliolumbar and superior gluteal arteries

**LYMPH DRAINAGE:**

- Superficial tissue of anterolateral abdominal wall drain in quadrants
    - To pectoral groups of axillary nodes above the umbilicus on each side
    - To superficial inguinal nodes below that level
- Deeper parts of the wall drain into vessels in the extraperitoneal tissues

**NERVE SUPPLIES:**

- **Rectus, EO, IO, TA – all supplied by:**
    - **Lower intercostal nerves**
    - **Subcostal nerves (T7-12)**
- **IO + TA also supplied by:**
    - **Iliohypogastric nerve**
    - **Ilioinguinal nerve**
- Lowest fibres of internal oblique and transversus that continue medially as the conjoint tendon receive L1 innervation
- Pyramidalis is supplied by T12 nerve

**ACTIONS OF ABDOMINAL MUSCLES:**

- Muscles of the anterior abdominal wall have FOUR MAIN ROLES
- MOVING THE TRUNK:
    - Through its attachment to both the bony pelvis and the thoracic cage, their action is to approximate the two
    - They are thus FLEXORS OF THE VERTEBRAL COLUMN in its lumbar and lower thoracic regions, rectus being the most powerful flexor
    - Oblique muscles are also lateral flexors and rotators of the trunk
- DEPRESSING THE RIBS:
    - Recti and obliques approximate the ribs to the pelvic girdle
    - If erector spinae prevents thoracolumbar flexion, this provides a powerful expiratory force
    - Added to this is the abdominal compression (aided by transversus) that elevates the diaphragm to increase expiratory effort
- COMPRESSING THE ABDOMEN:
    - Oblique muscles (strongly aided by transversus) compress the abdominal cavity
    - Aids in evacuation of effluents if diaphragm held steady by closed glottis
- SUPPORTING AND PROTECTING VISCERA:
    - If the anterior abdominal wall is incised, ONLY THE INTESTINES SPILL OUT as the other upper abdominal viscera do no require the support of the wall
    - Reflex contraction in response to a blow helps to protect all viscera