



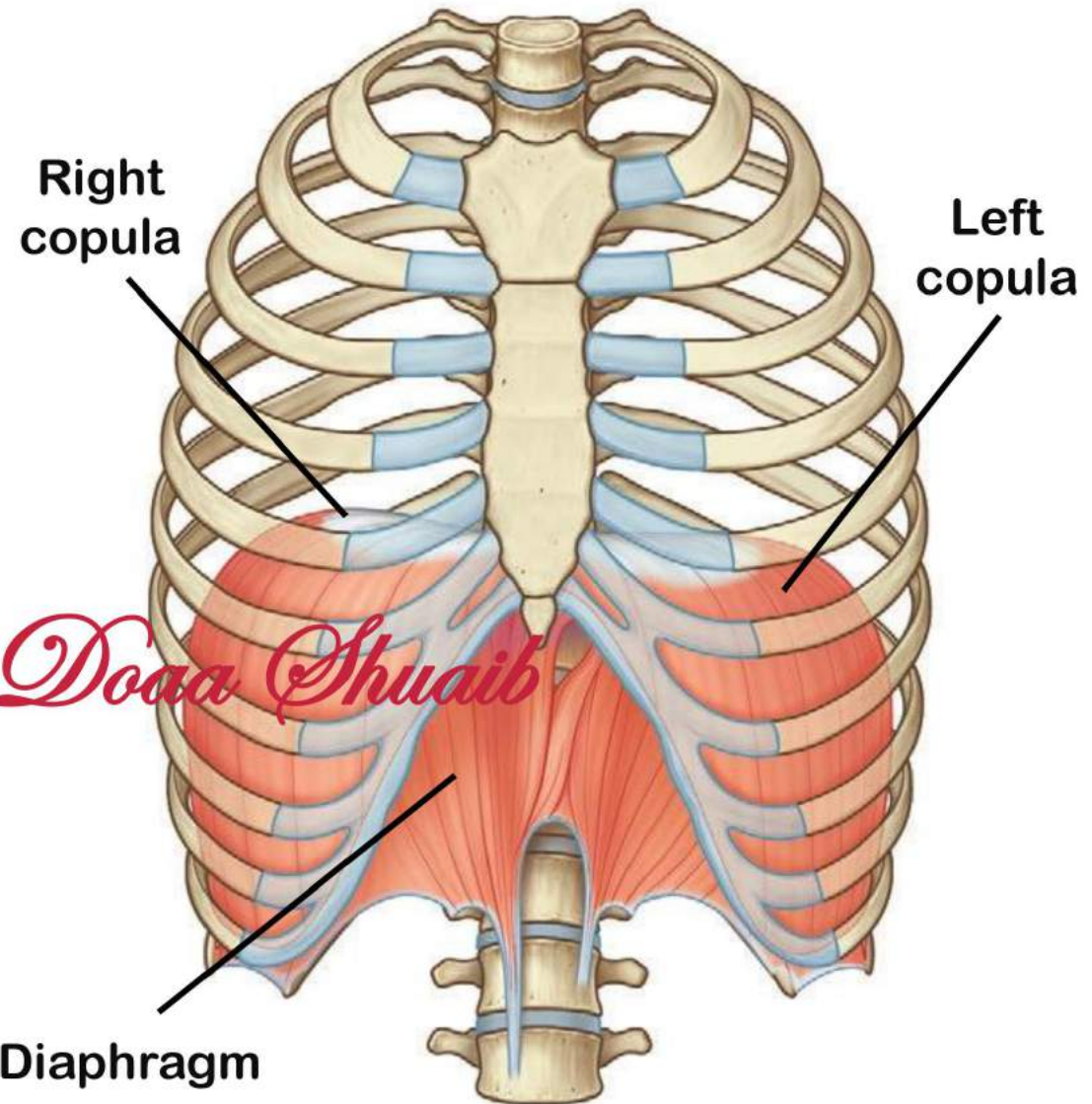
Dr. Doaa Shuaib

Anatomy of the diaphragm

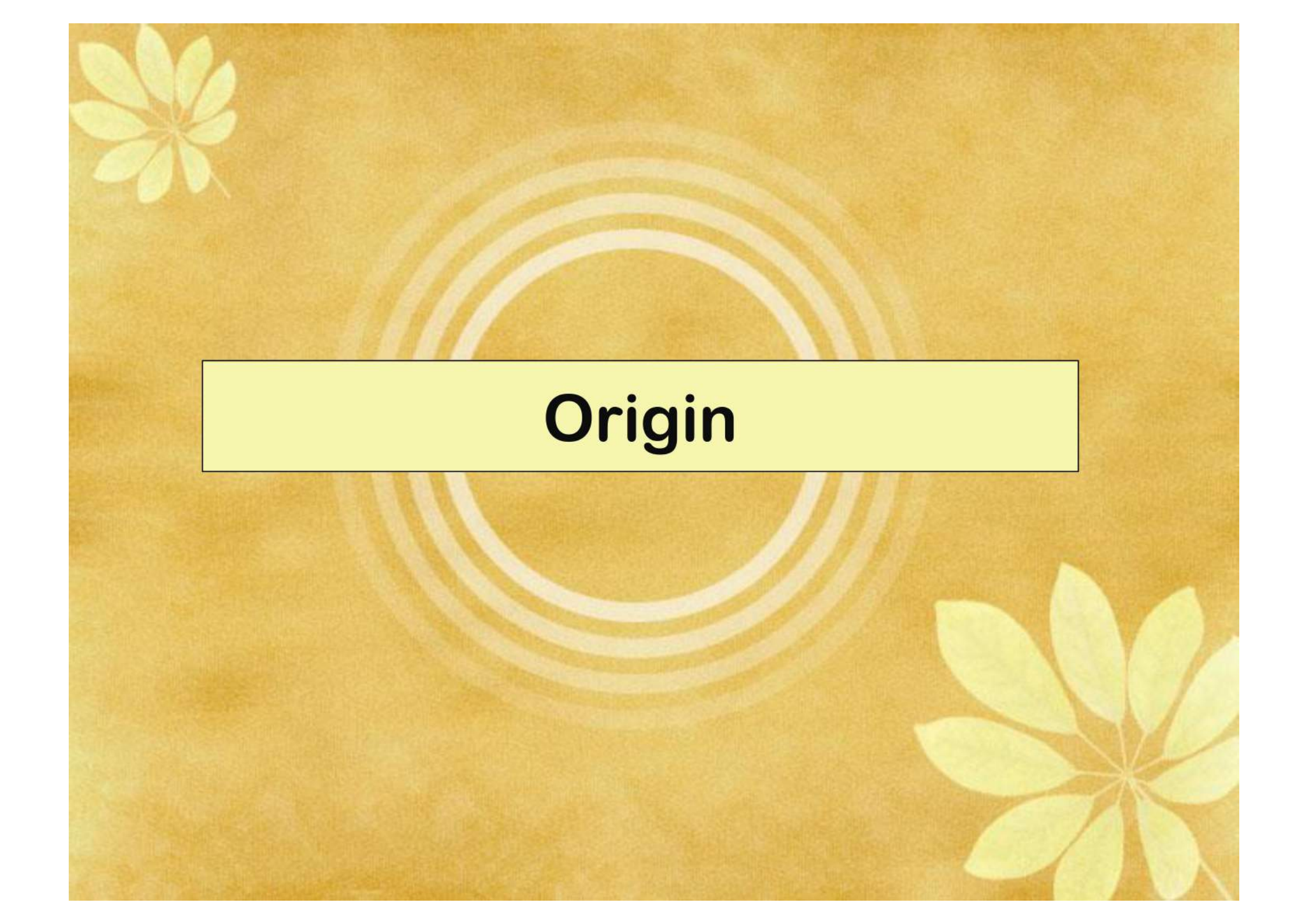
**Assistant Professor of Anatomy & Embryology
Faculty of Medicine – Cairo University
Email: doaa.shuaib@kasralainy.edu.eg**

Shape

- It is a large dome-shaped fibromuscular partition, which separates the thoracic cavity from the abdominal cavity.
- It is convex upwards.
- Its right side (called right cupola) is higher than its left side (called left cupola) due to the underlying large right lobe of liver.

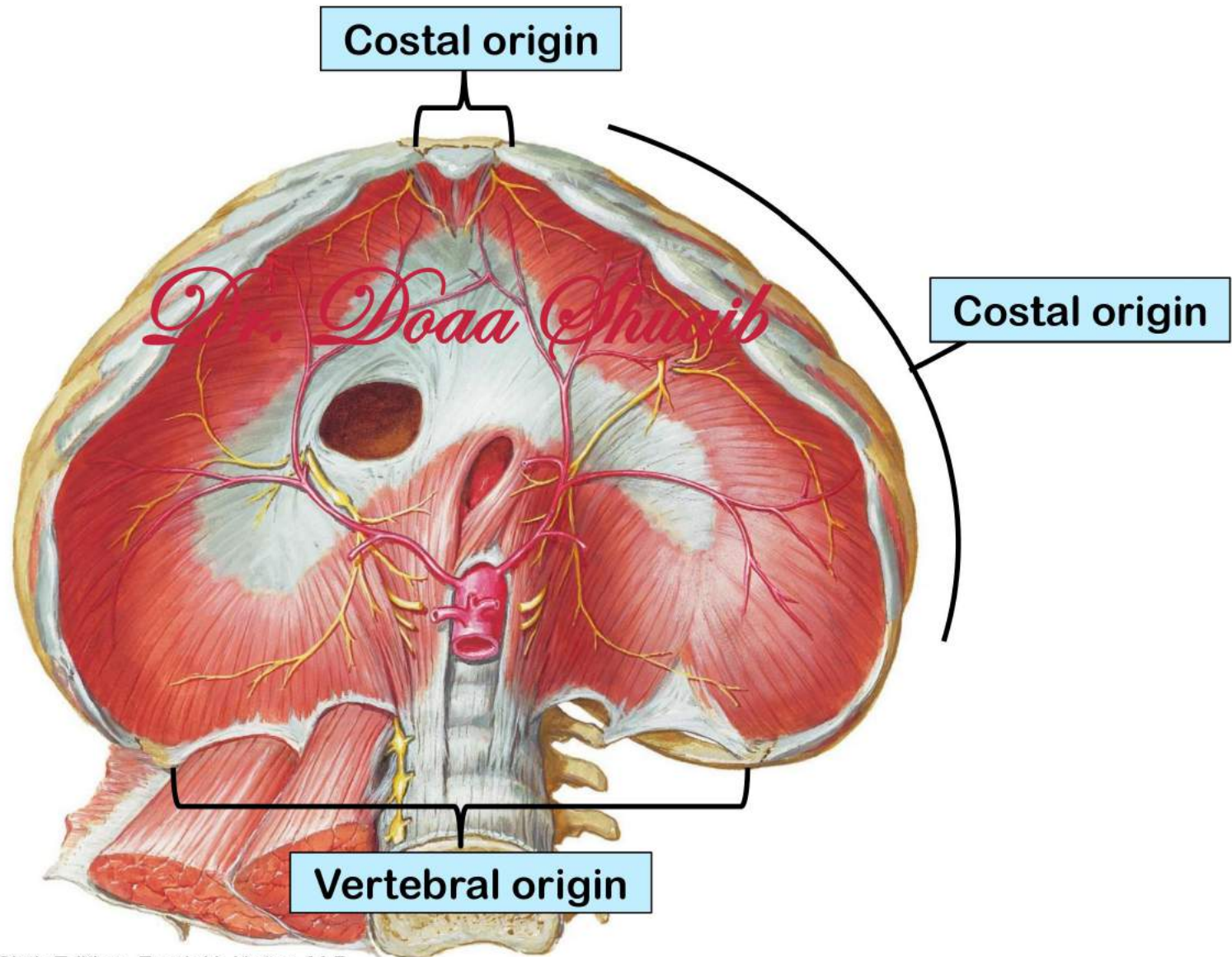


Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl, Adam W.M. Mitchell

The background is a textured, golden-yellow surface. In the center, there are several concentric circles in a lighter shade of yellow. In the top-left and bottom-right corners, there are stylized floral motifs with multiple pointed petals.

Origin

Origin



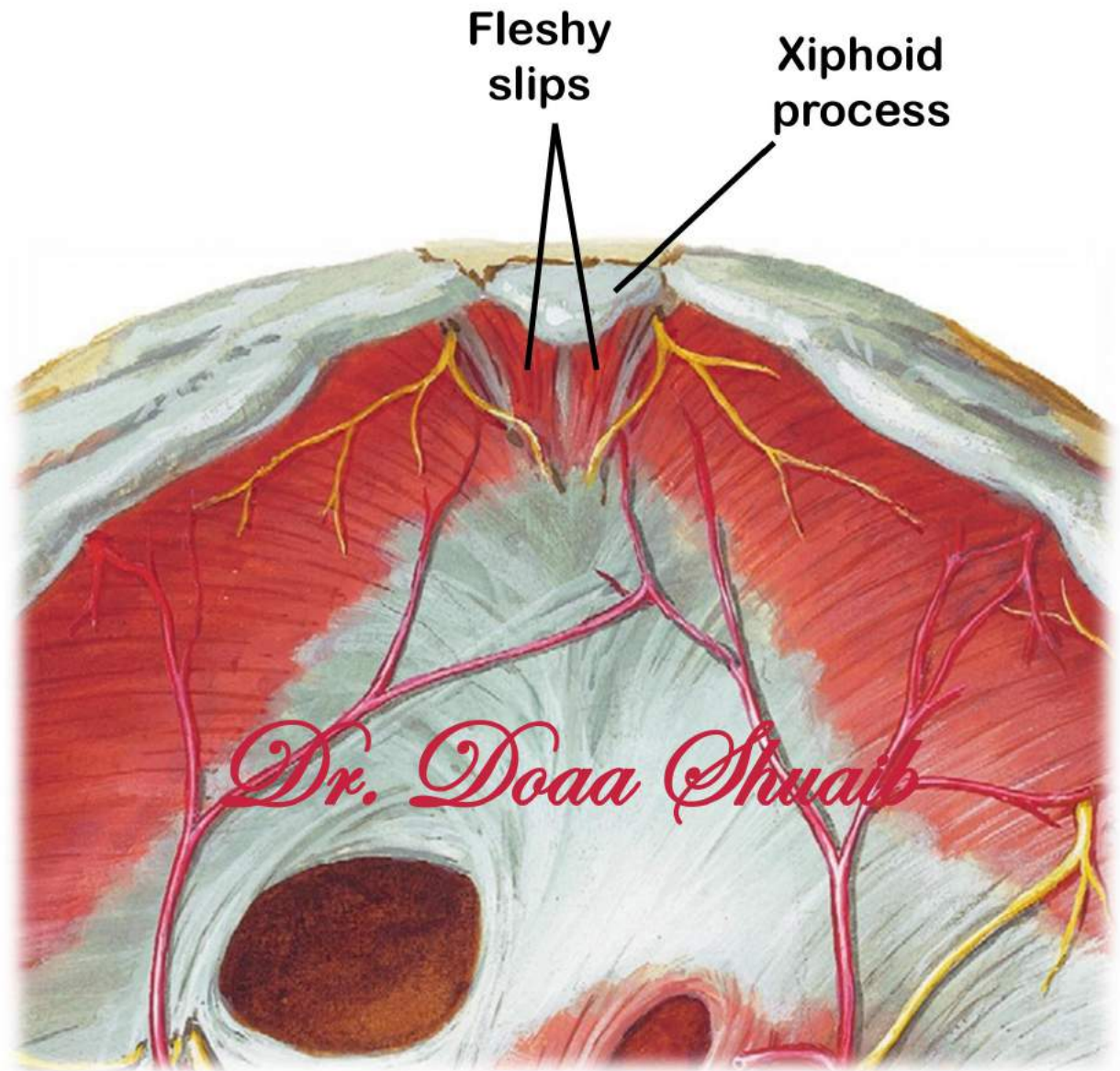
Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

- It has a wide origin from the whole circumference of the inner aspect of the thoracic outlet and the vertebral column.
- It takes origin from three areas:
 1. Sternal origin
 2. Costal origin
 3. Vertebral origin

Origin

1. Sternal origin

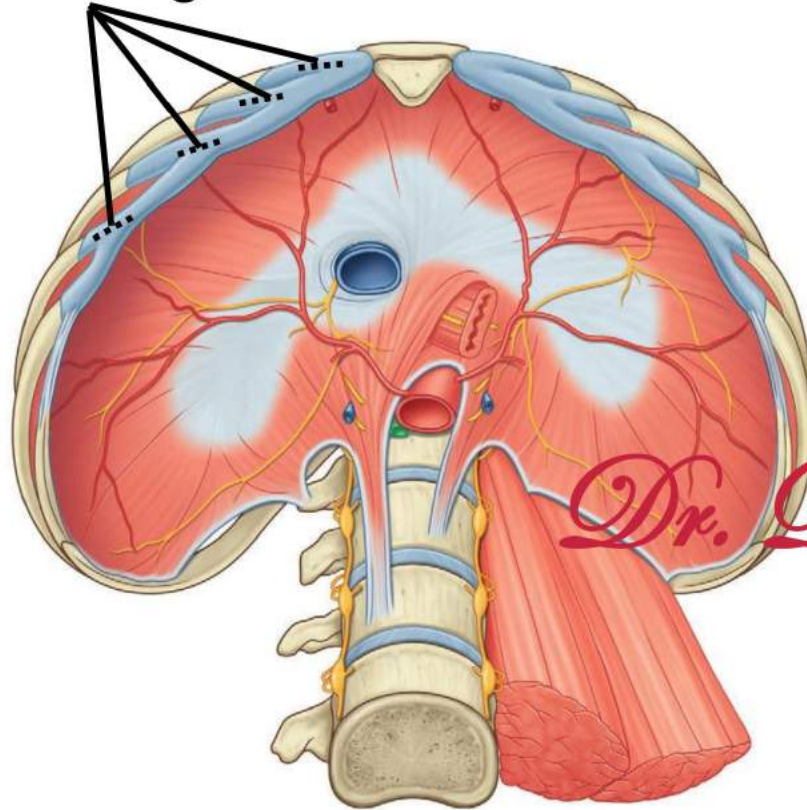
- From the back of xiphoid process
- By two fleshy slips



Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

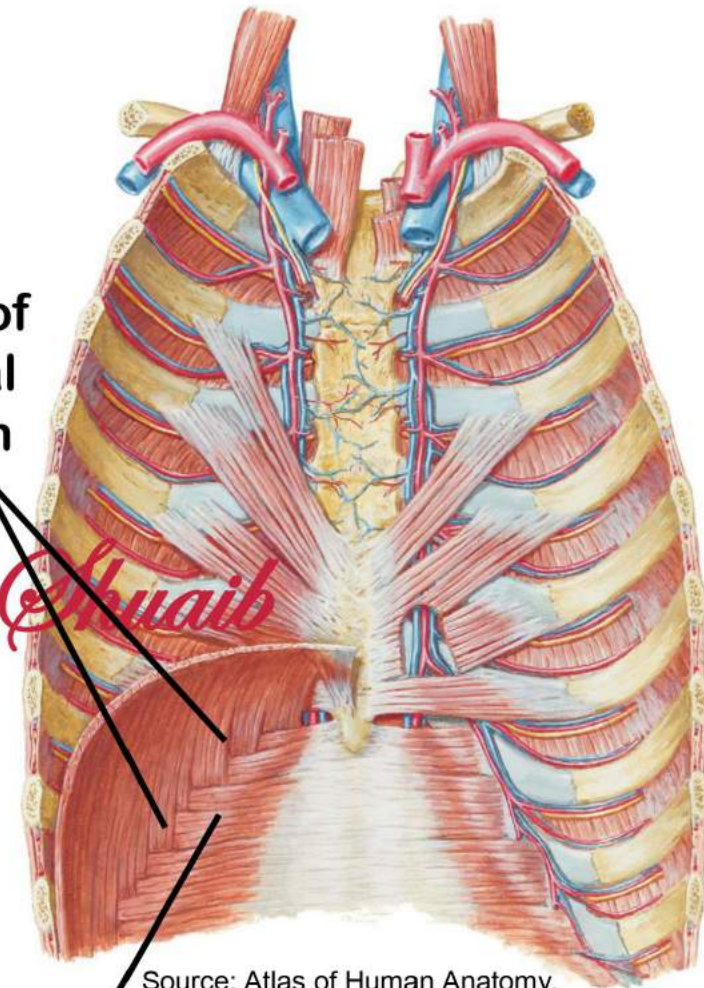
Origin

Costal origin



Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl, Adam W.M. Mitchell

Slips of costal origin



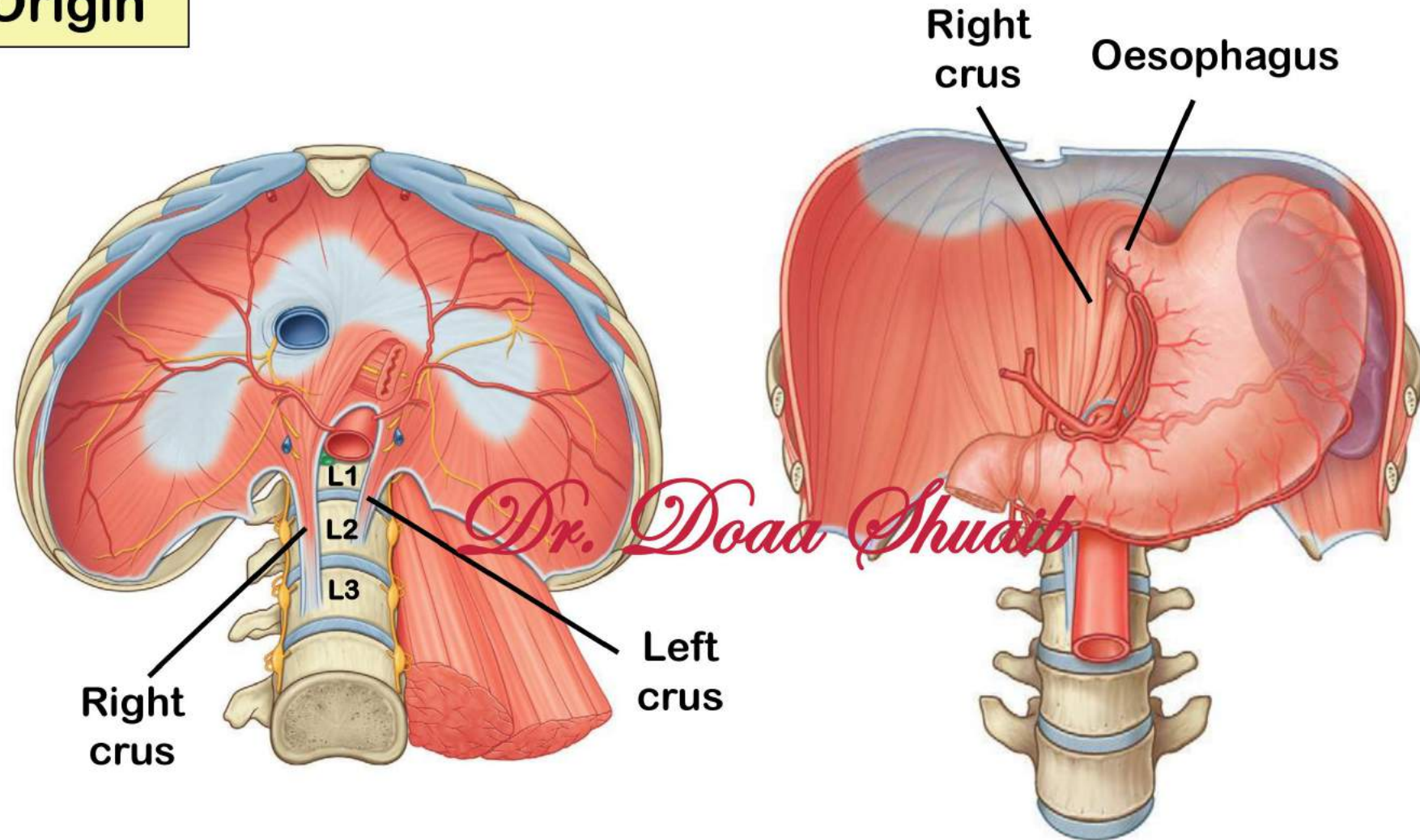
Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

Transversus abdominis

2. Costal origin

- From the deep surface of the lower six costal cartilages by fleshy slips interdigitating with the origin of the transversus abdominis muscle

Origin



Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl, Adam W.M. Mitchell

3. Vertebral origin

1. Crura of the diaphragm:

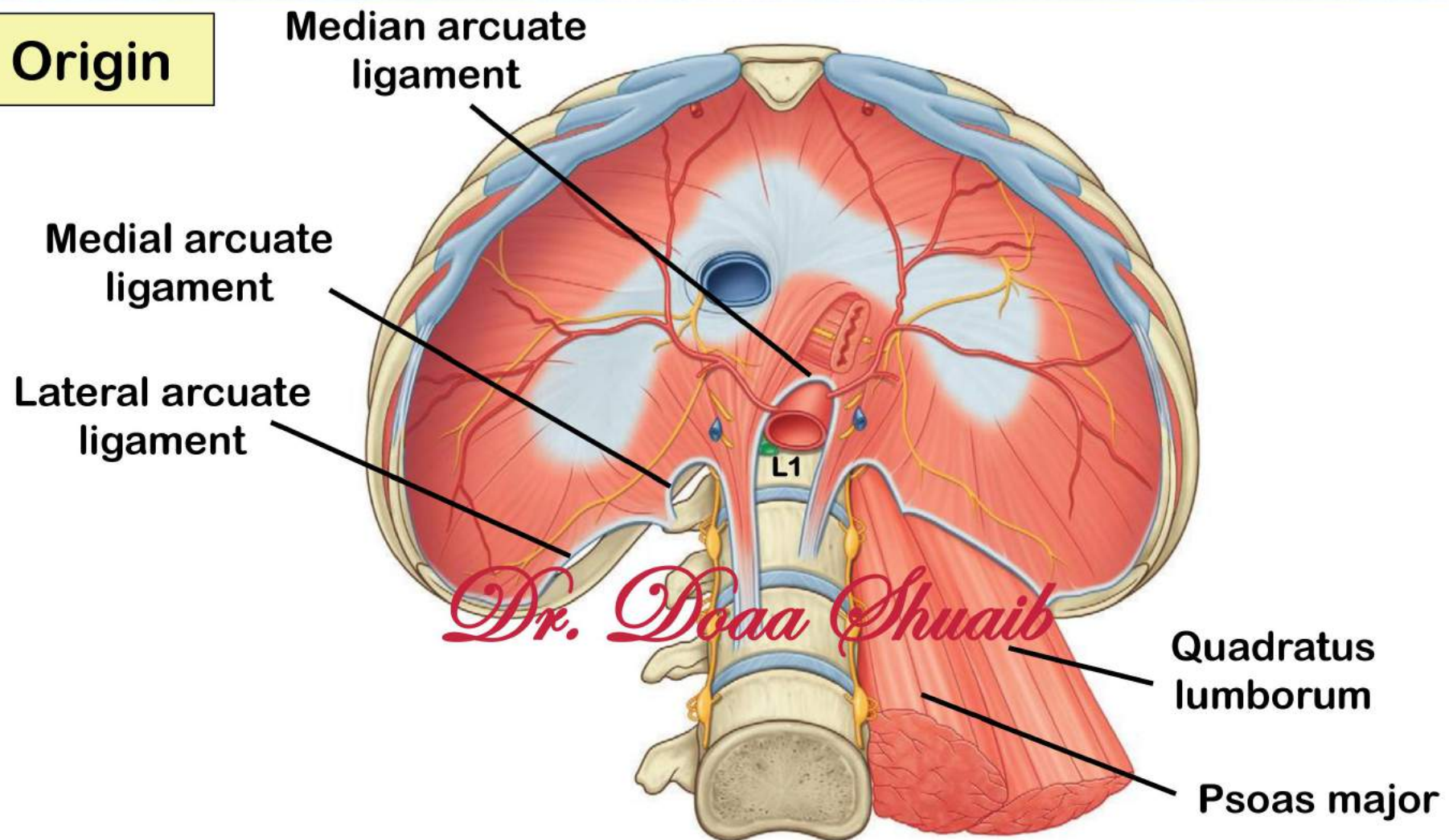
- **The right crus:**

- It arises from the bodies of the upper three lumbar vertebrae.
- Its fibers extend up to surround the lower end of the oesophagus forming a physiological sphincter around the cardiac end of the stomach.

- **The left crus:**

It is smaller and arises from the bodies of the upper two lumbar vertebrae.

Origin

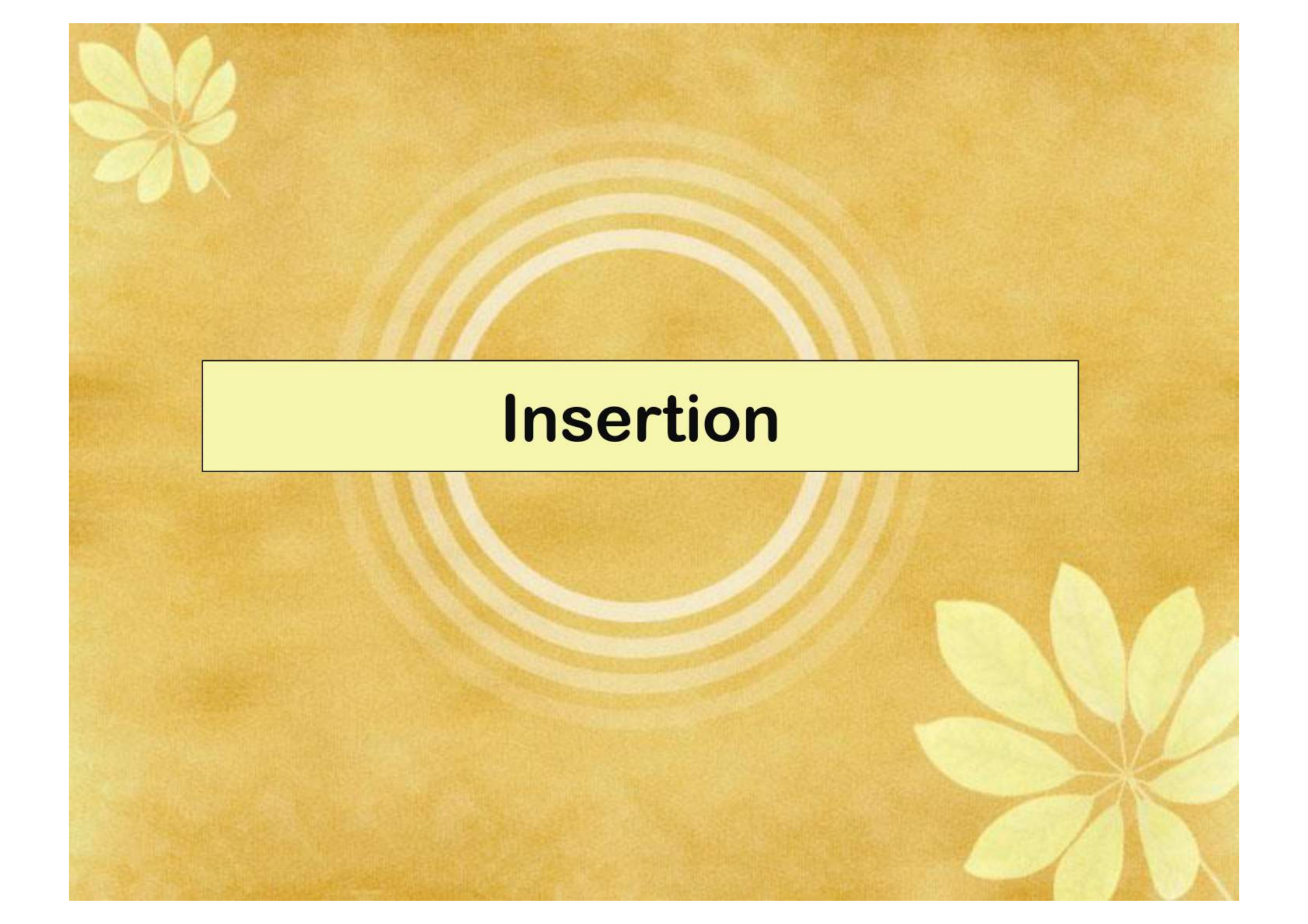


Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl, Adam W.M. Mitchell

3. Vertebral origin

2. Arcuate ligaments:

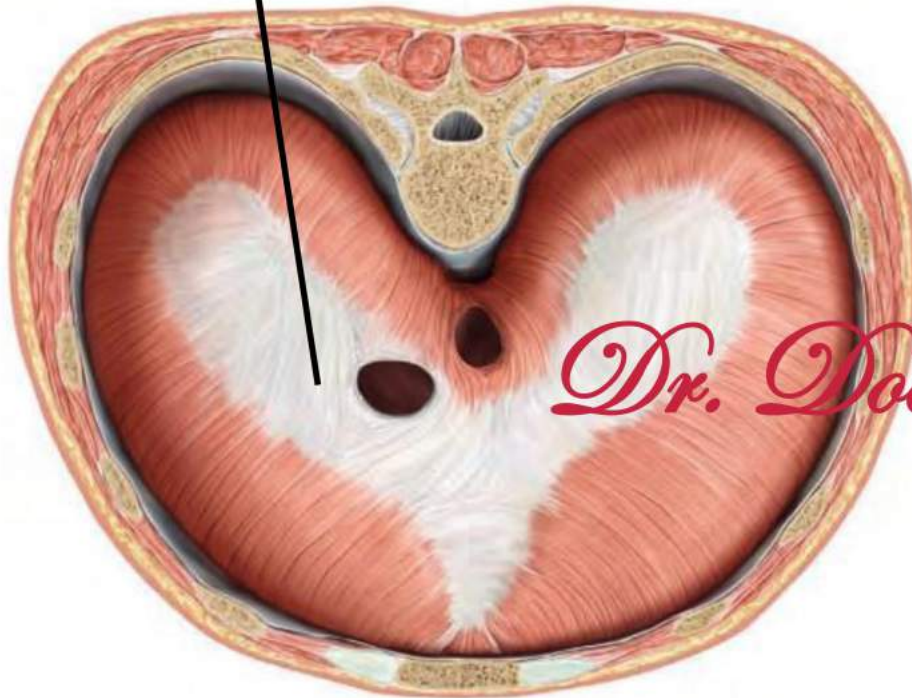
- **Median arcuate ligament:** One only, lies in the median plane. It extends between the right and left crura. It arches over the aorta.
- **Two medial arcuate ligaments:** One on each side. It extends from the crus of the diaphragm to the tip of transverse process of L1. It arches over the psoas major
- **Two lateral arcuate ligaments:** One on each side. It extends from the tip of transverse process of L1 to the last rib. It arches over the upper part of quadratus lumborum muscle.

The background is a textured, golden-yellow surface. In the center, there are several concentric circles in a lighter shade of yellow. In the top-left and bottom-right corners, there are stylized floral motifs with multiple pointed petals.

Insertion

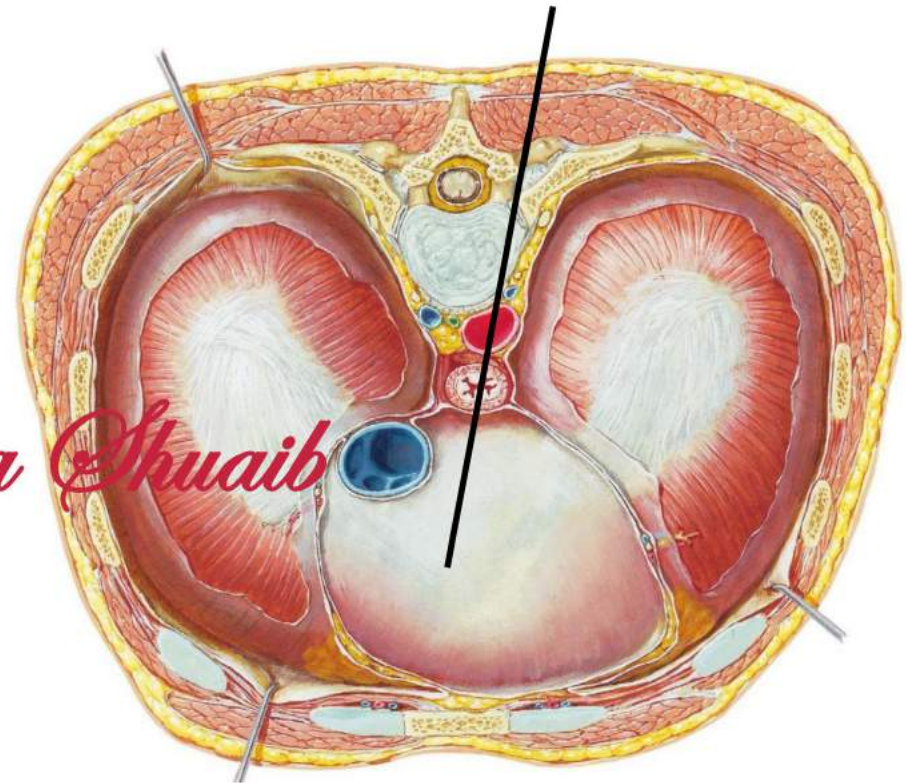
Insertion

Central tendon
of the diaphragm



Source: Atlas of Anatomy, Anne M. Gilroy, Brian R. MacPherson, Lawrence M. Ross (2nd edition)

Pericardium
(cut edge)



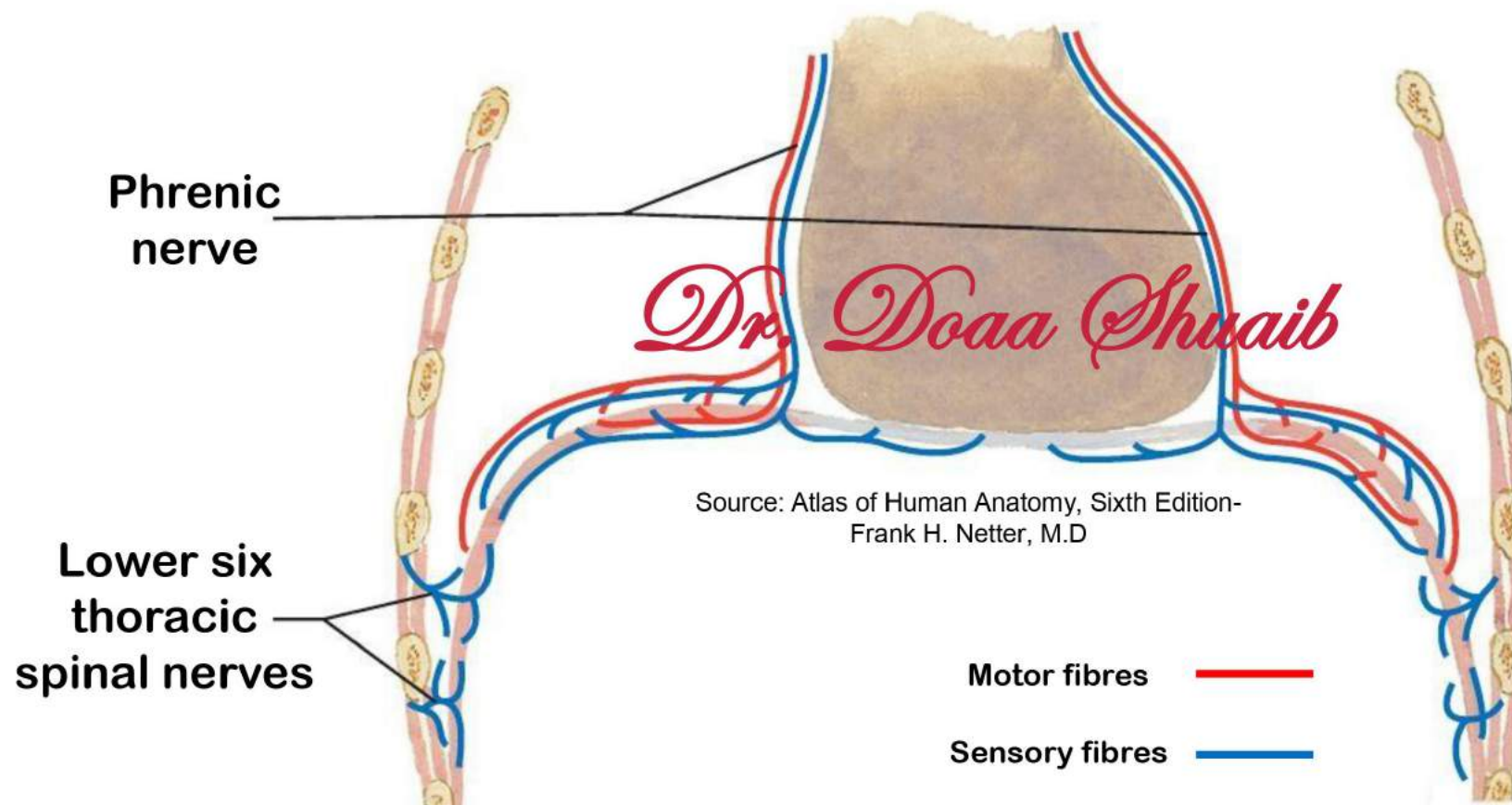
Source: Atlas of Human Anatomy, Sixth Edition-
Frank H. Netter, M.D

- The diaphragm has no bony insertion
- All the fibers converge to be inserted into the central tendon of the diaphragm.
- This tendon is a strong aponeurosis, semilunar in shape, formed of one median and two lateral folia (i.e. trifoliate).
- The median lobe is related to the pericardium and heart.

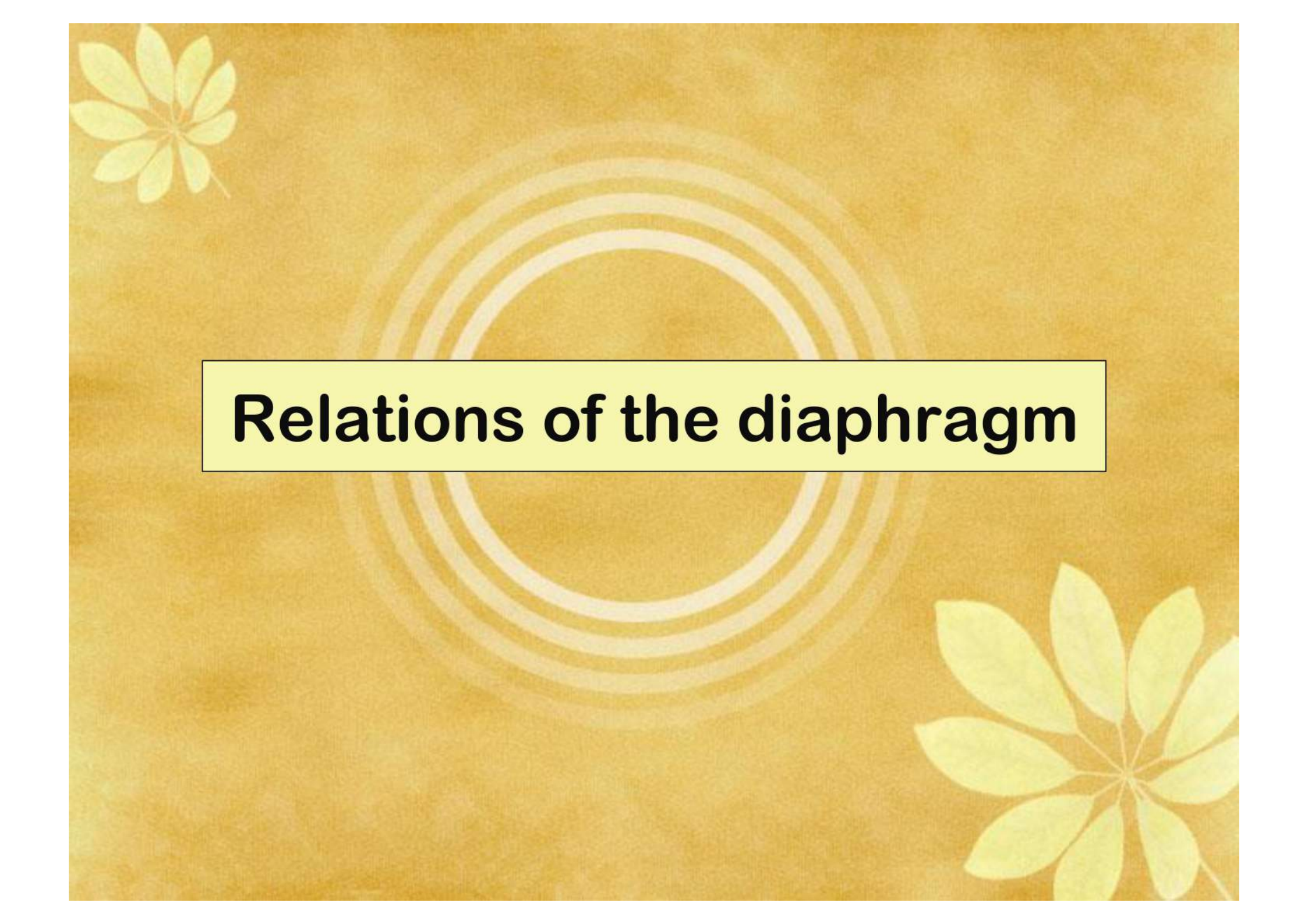
The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

Nerve supply

Nerve supply



- **Motor:** right and left phrenic nerves (C3, 4 & 5)
- **Sensory:** mainly to the peritoneum and the pleura related to the diaphragm.
- **Sensory supply includes:**
 1. **Lower six thoracic spinal nerves**, are sensory to the peripheral parts.
 2. **The phrenic nerves** are sensory to the central part of the diaphragm.

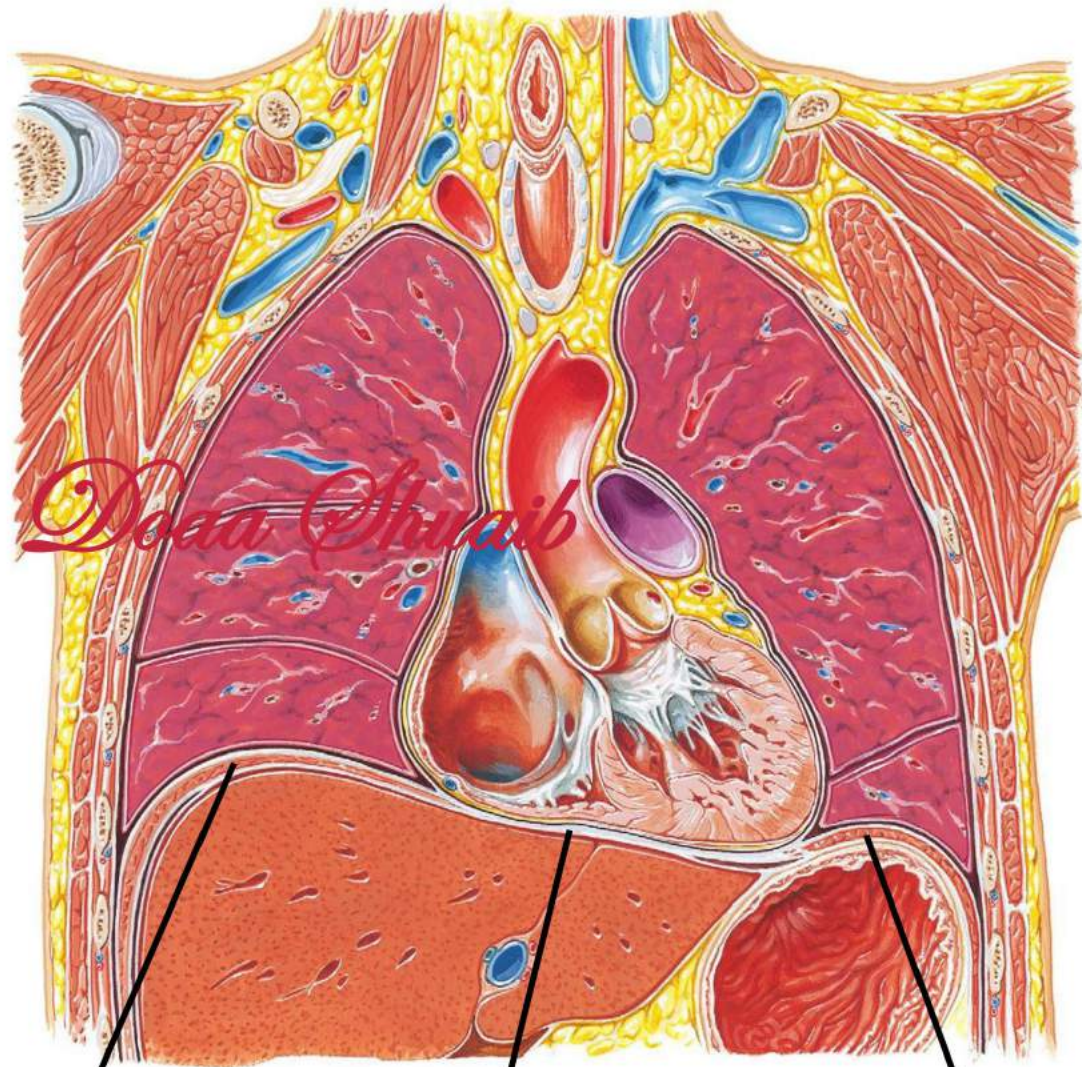
The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

Relations of the diaphragm

Relations

Superior surface

1. The right cupola is related to the right pleura and lung.
2. The left cupola is related to the left pleura and lung.
3. The central tendon is related to the heart and pericardium.



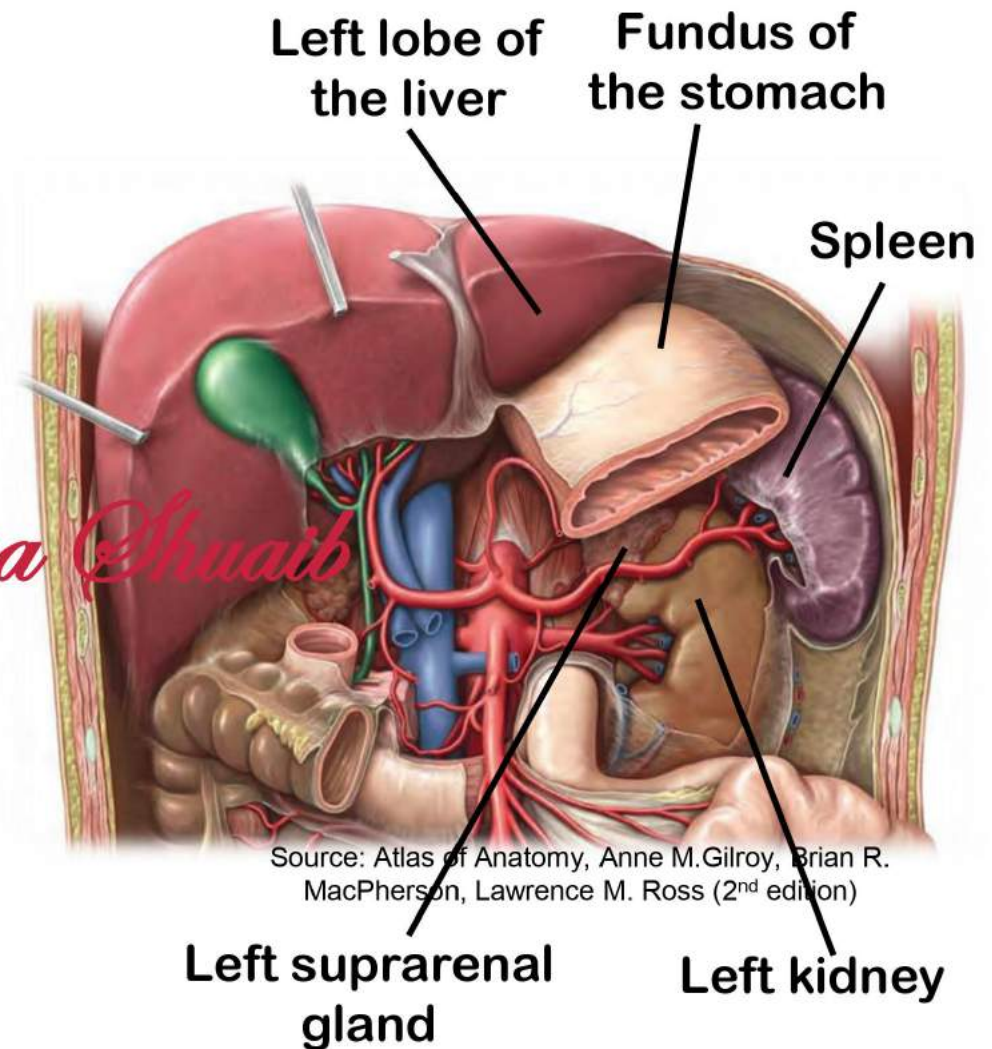
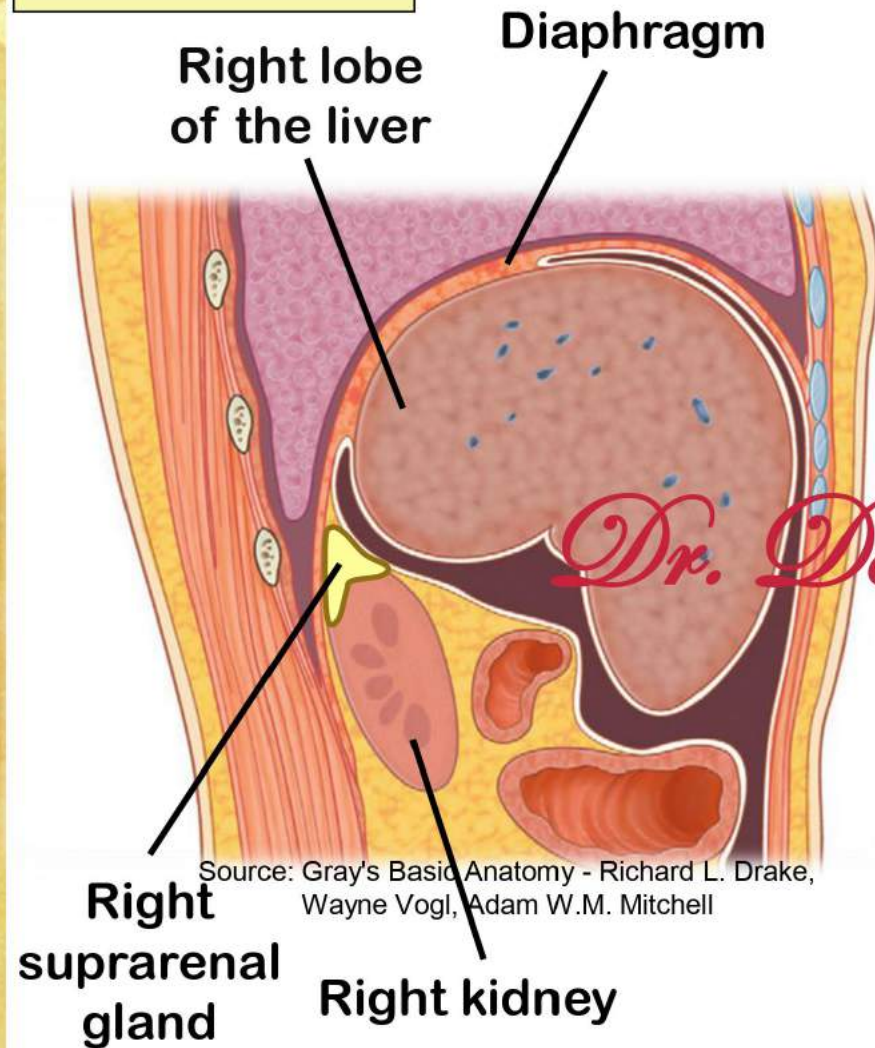
Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D.

Right
cupola

Central tendon
of the diaphragm

Left
cupola

Relations

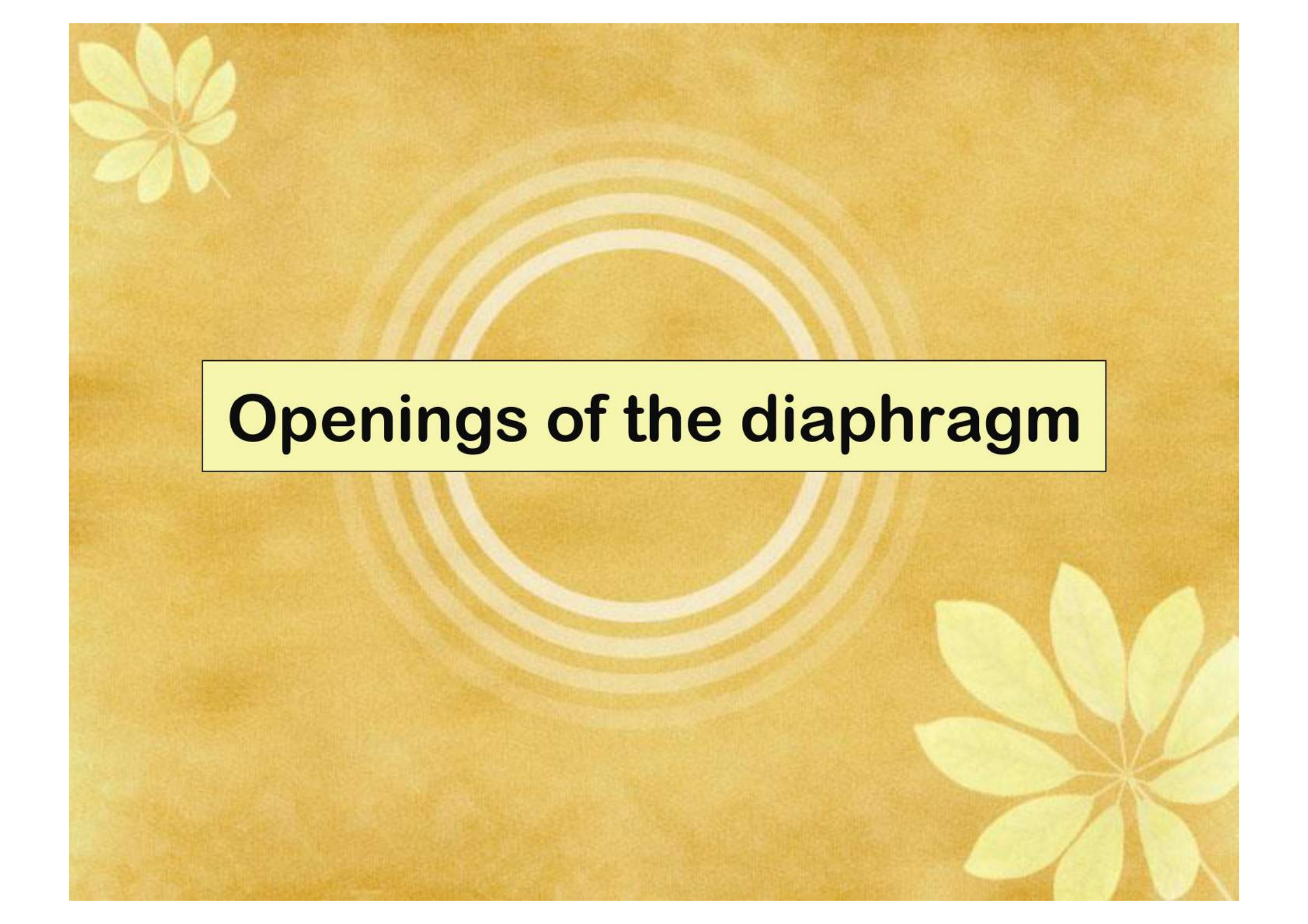


Inferior surface (on the right)

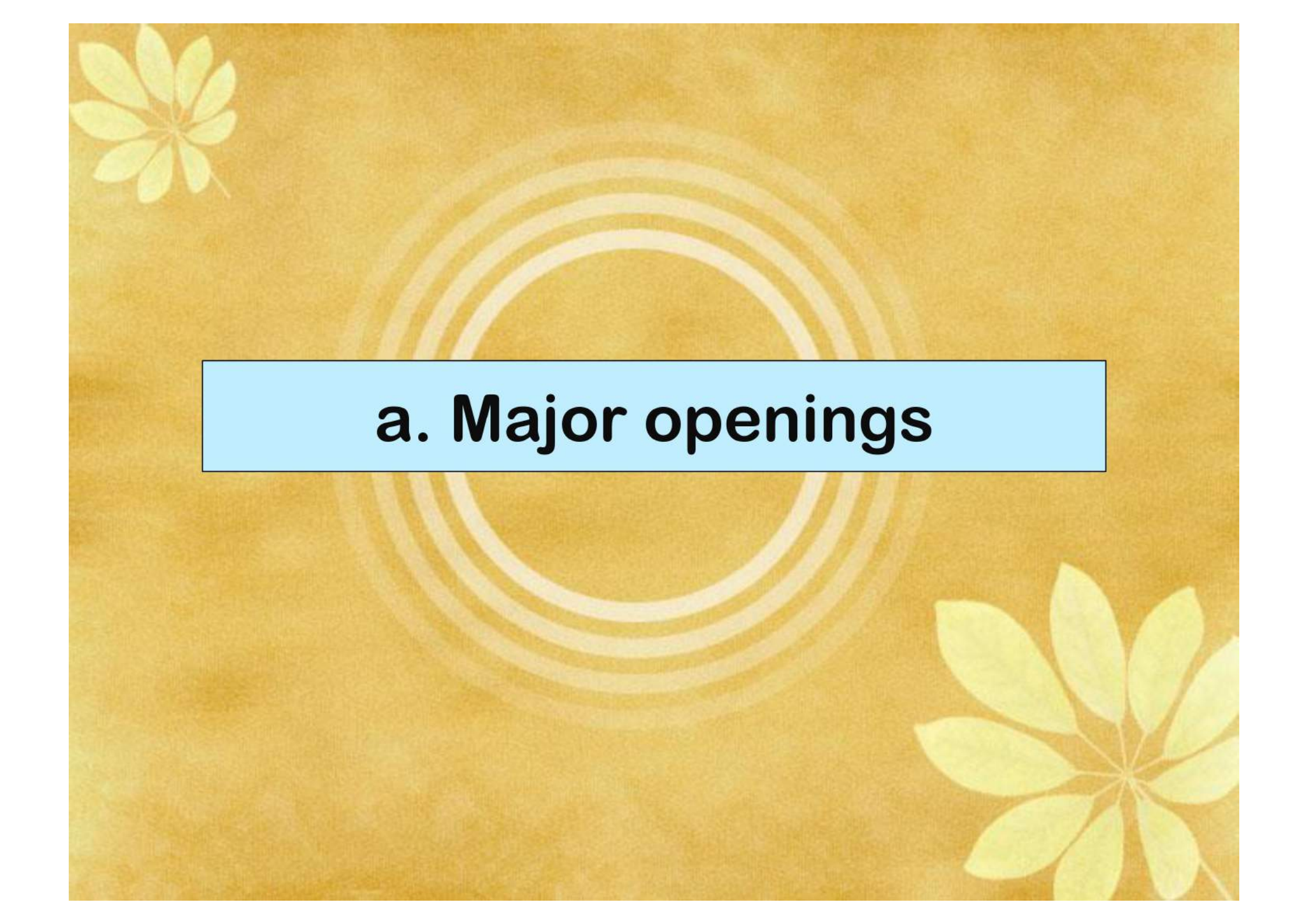
- Right lobe of the liver.
- Right kidney and right suprarenal gland.

Inferior surface (on the left)

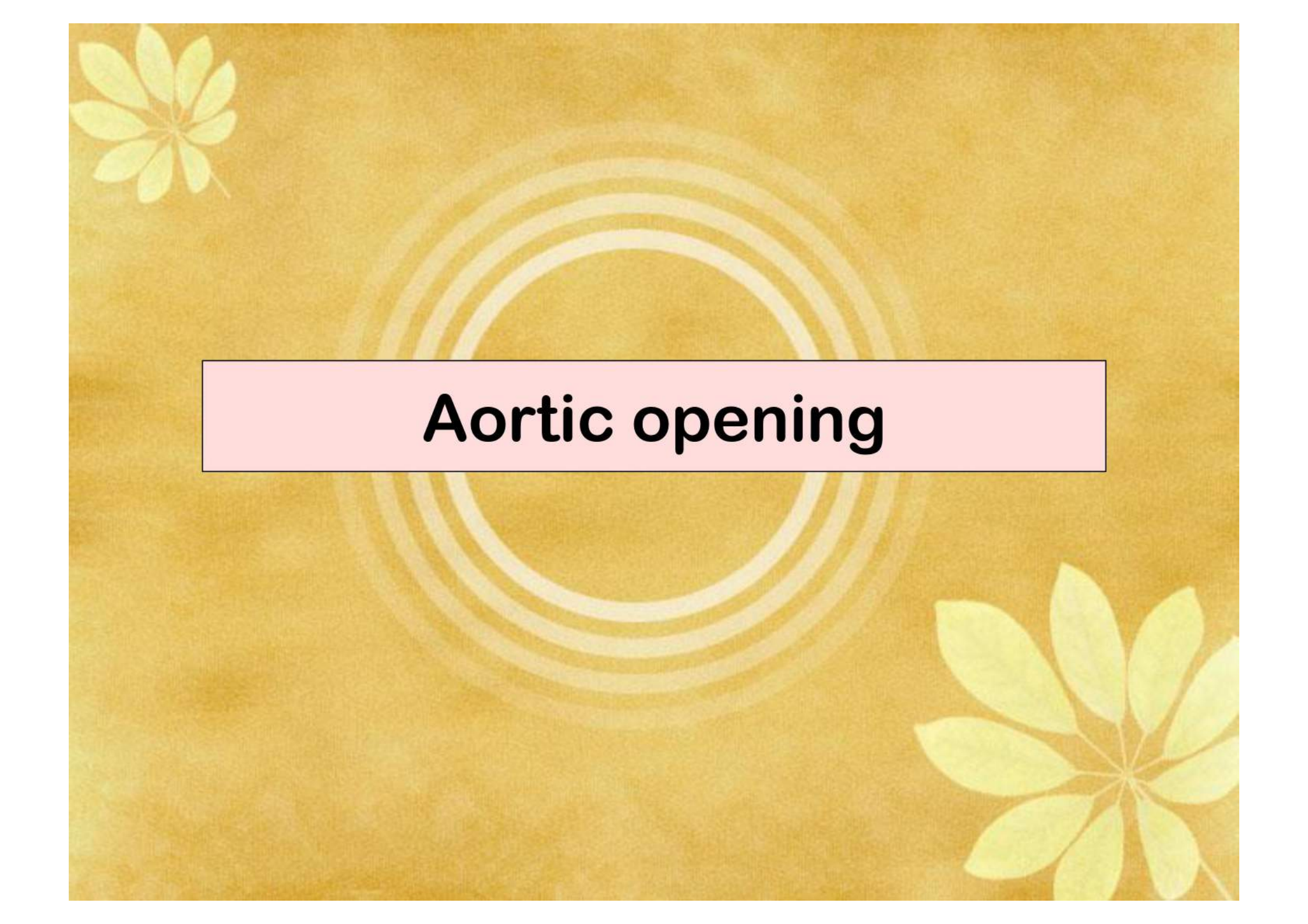
- Left lobe of the liver.
- Fundus of the stomach and spleen.
- Left kidney and left suprarenal gland.

The background is a textured, golden-yellow color. In the center, there are several concentric circles of varying shades of yellow and white, creating a subtle, circular pattern. In the top-left and bottom-right corners, there are stylized floral motifs with multiple pointed petals, rendered in a light yellow color.

Openings of the diaphragm

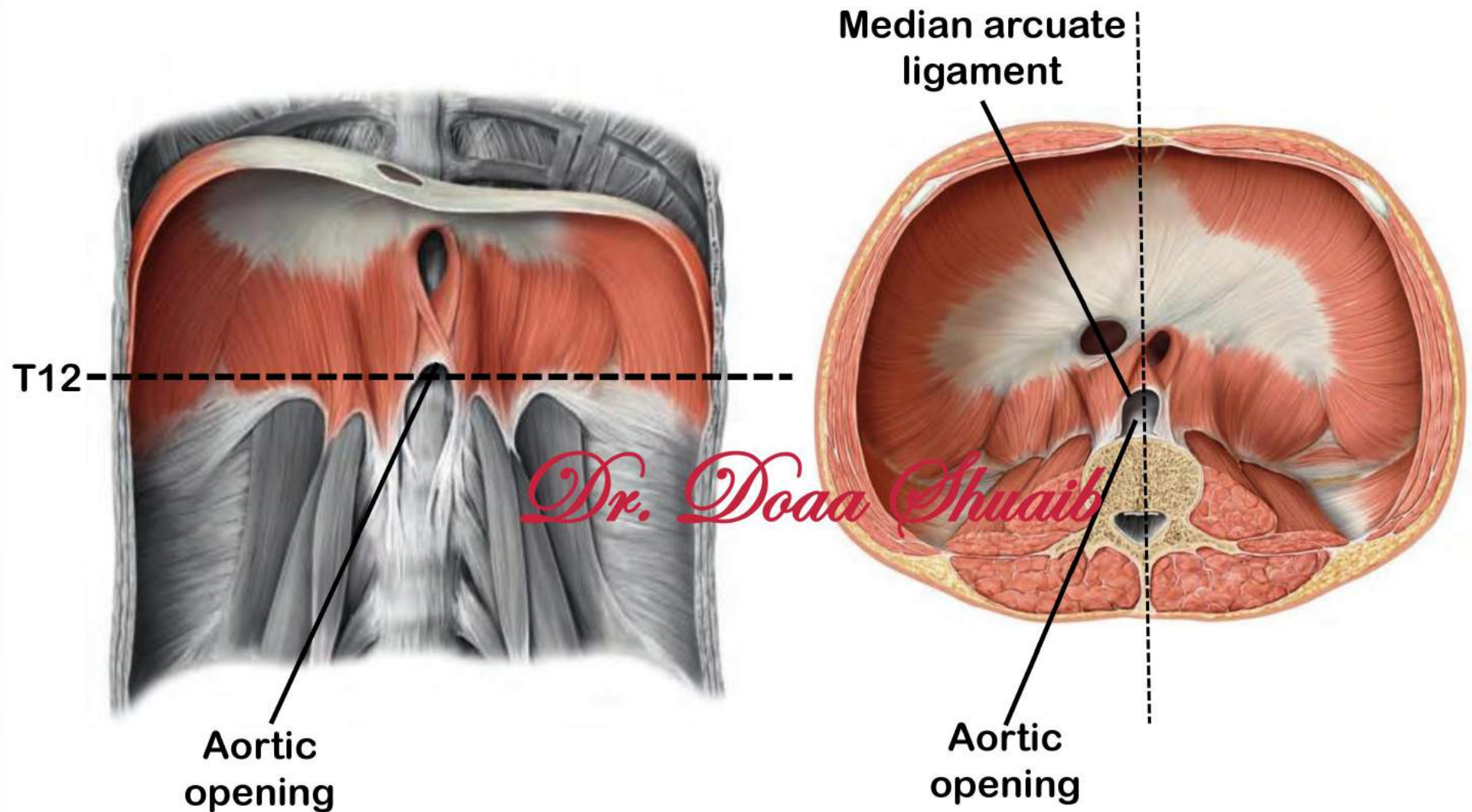
The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

a. Major openings

The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

Aortic opening

Aortic opening



Source: Atlas of Anatomy, Anne M. Gilroy, Brian R. MacPherson, Lawrence M. Ross (2nd edition)

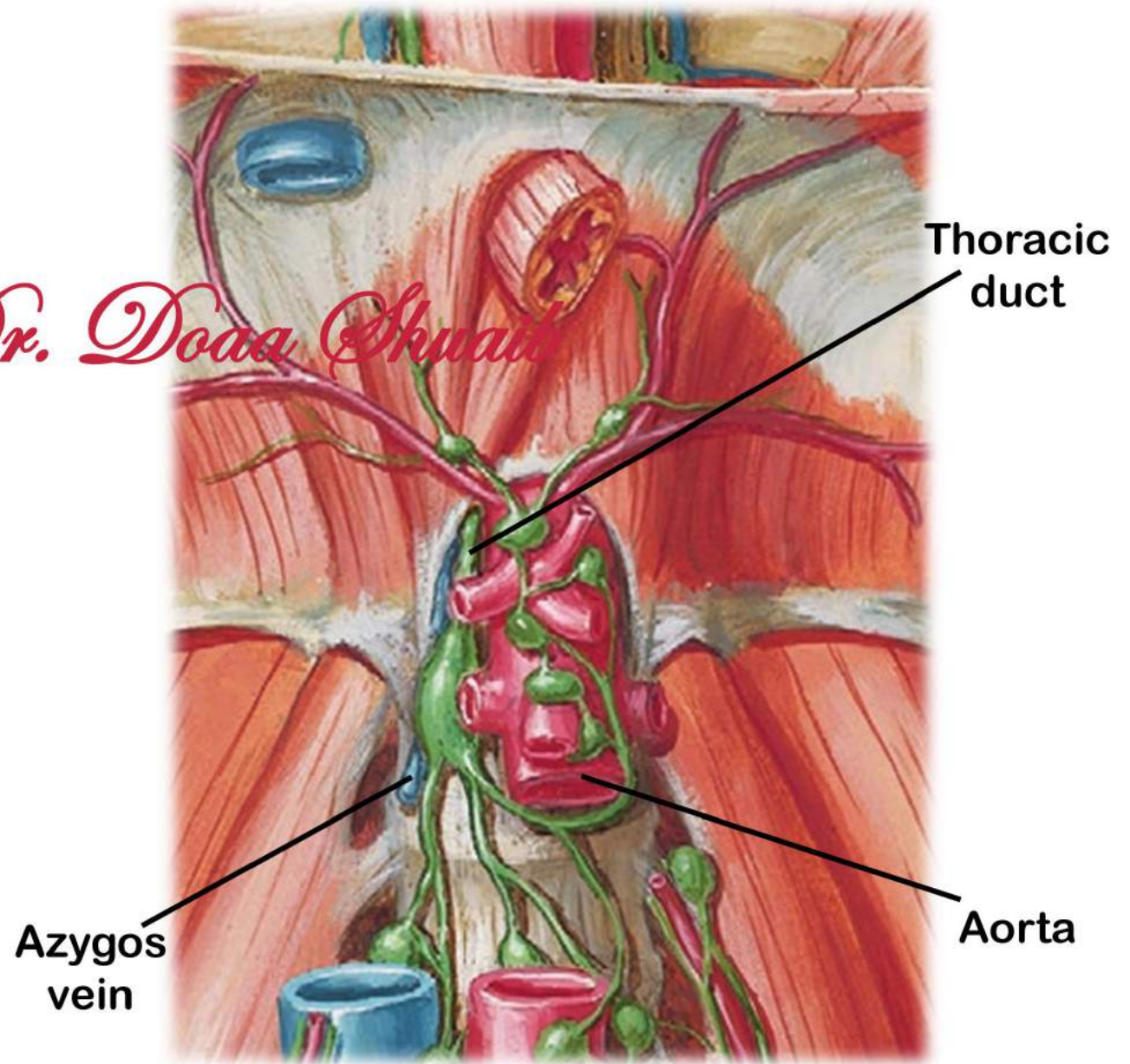
Site

- T12 vertebra
- In the middle line
- Behind median arcuate ligament

Aortic opening

**Structures
passing through**

- Aorta to the left
- Azygos vein to the right
- Thoracic duct in between

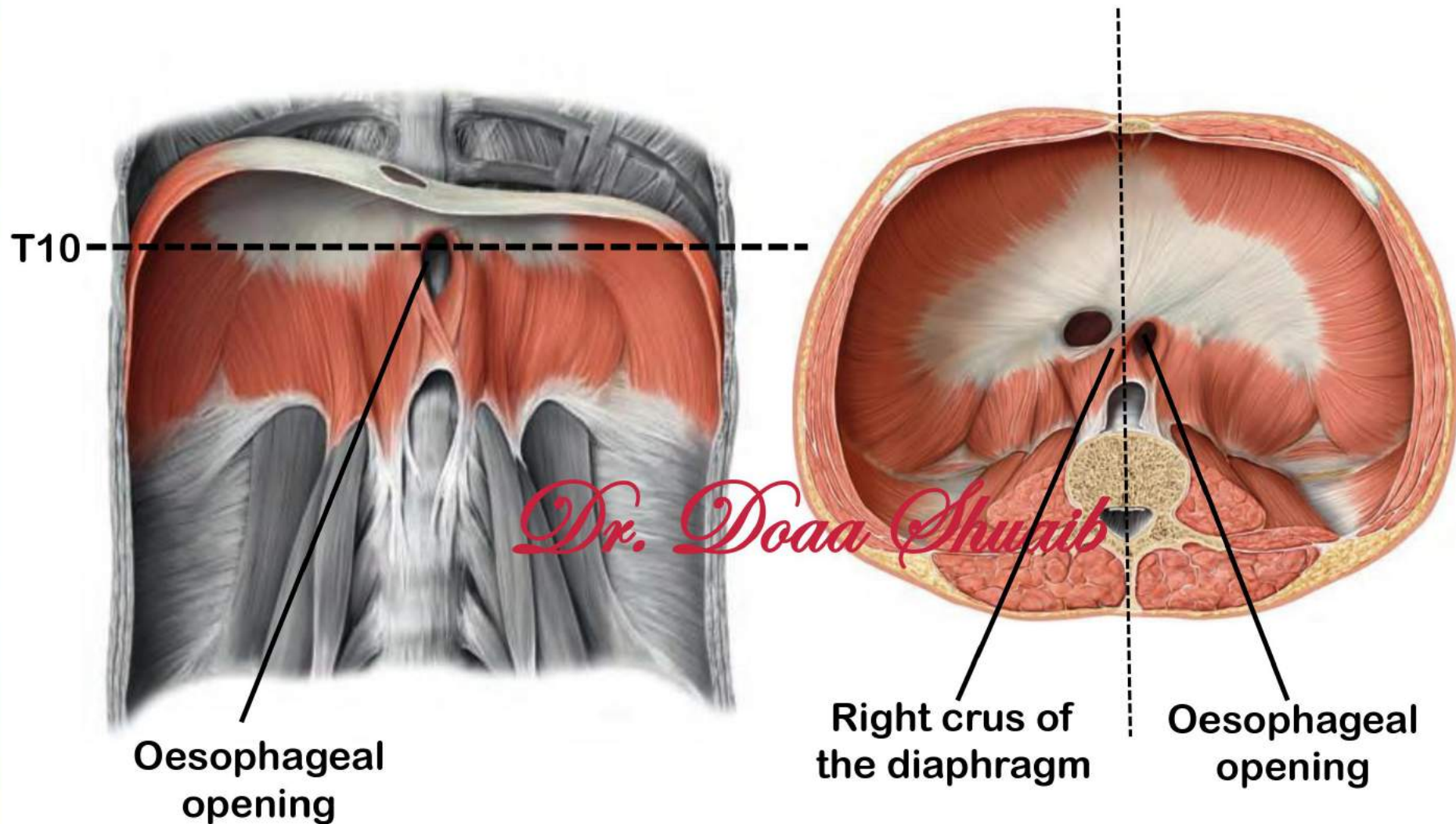


Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

Oesophageal opening

Oesophageal opening

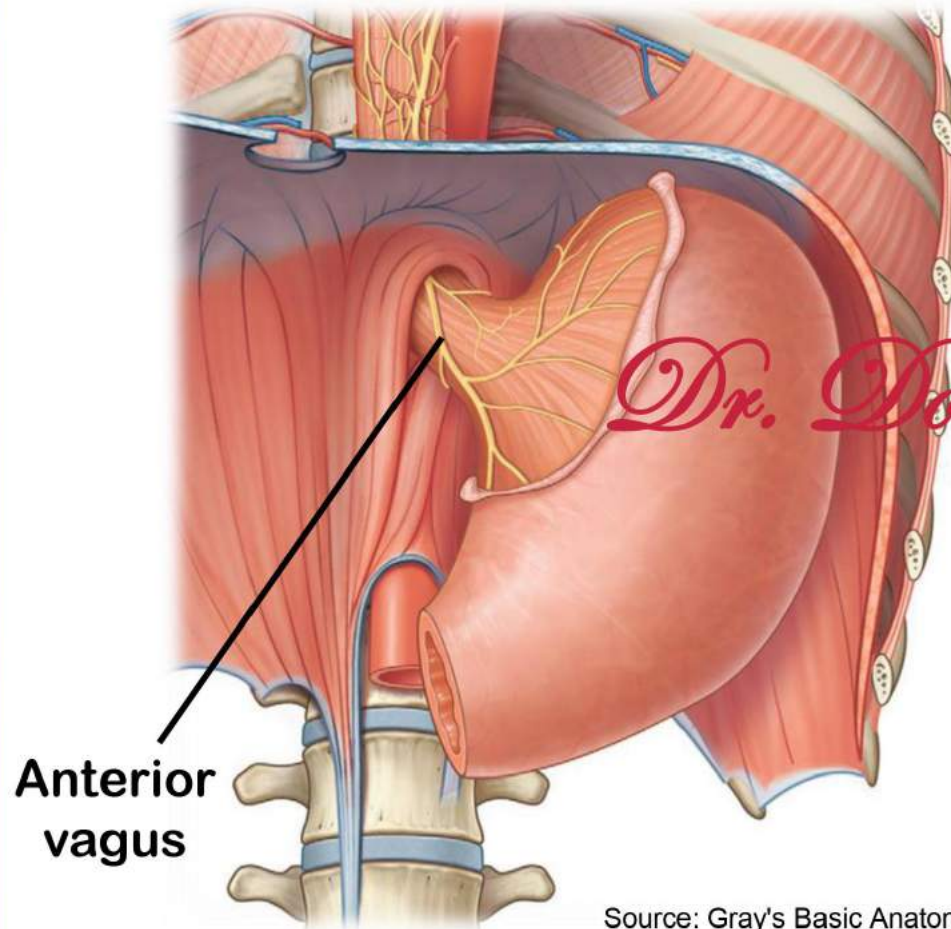


Source: Atlas of Anatomy, Anne M. Gilroy, Brian R. MacPherson, Lawrence M. Ross (2nd edition)

Site

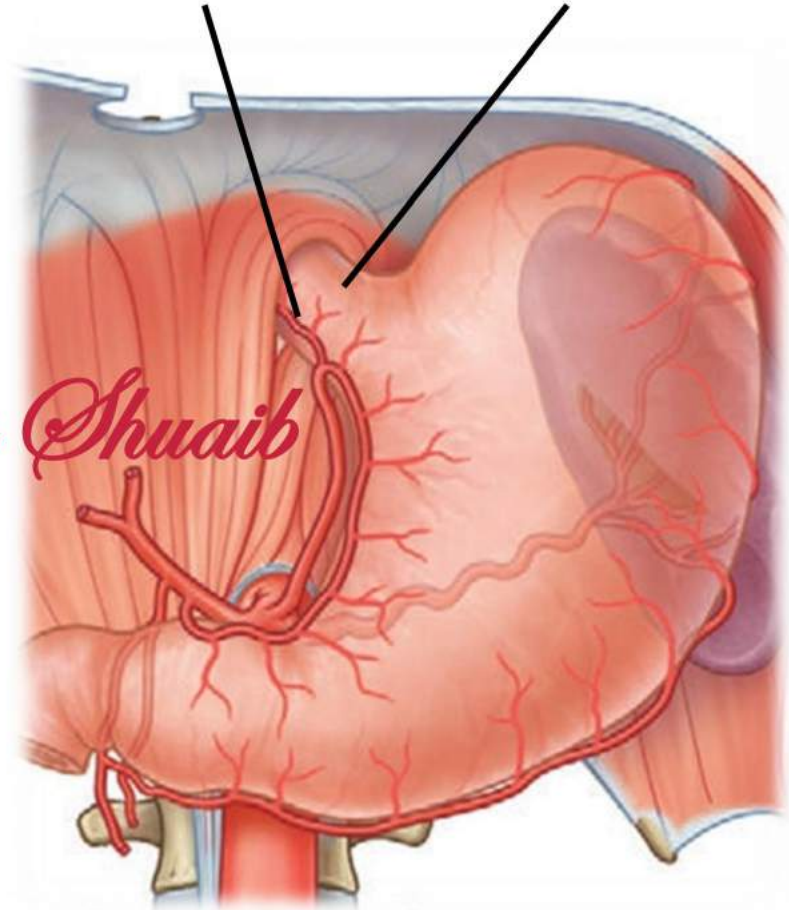
- T10 vertebra
- One inch to the left from middle line
- In the right crus

Oesophageal opening



Oesophageal branches of left gastric artery

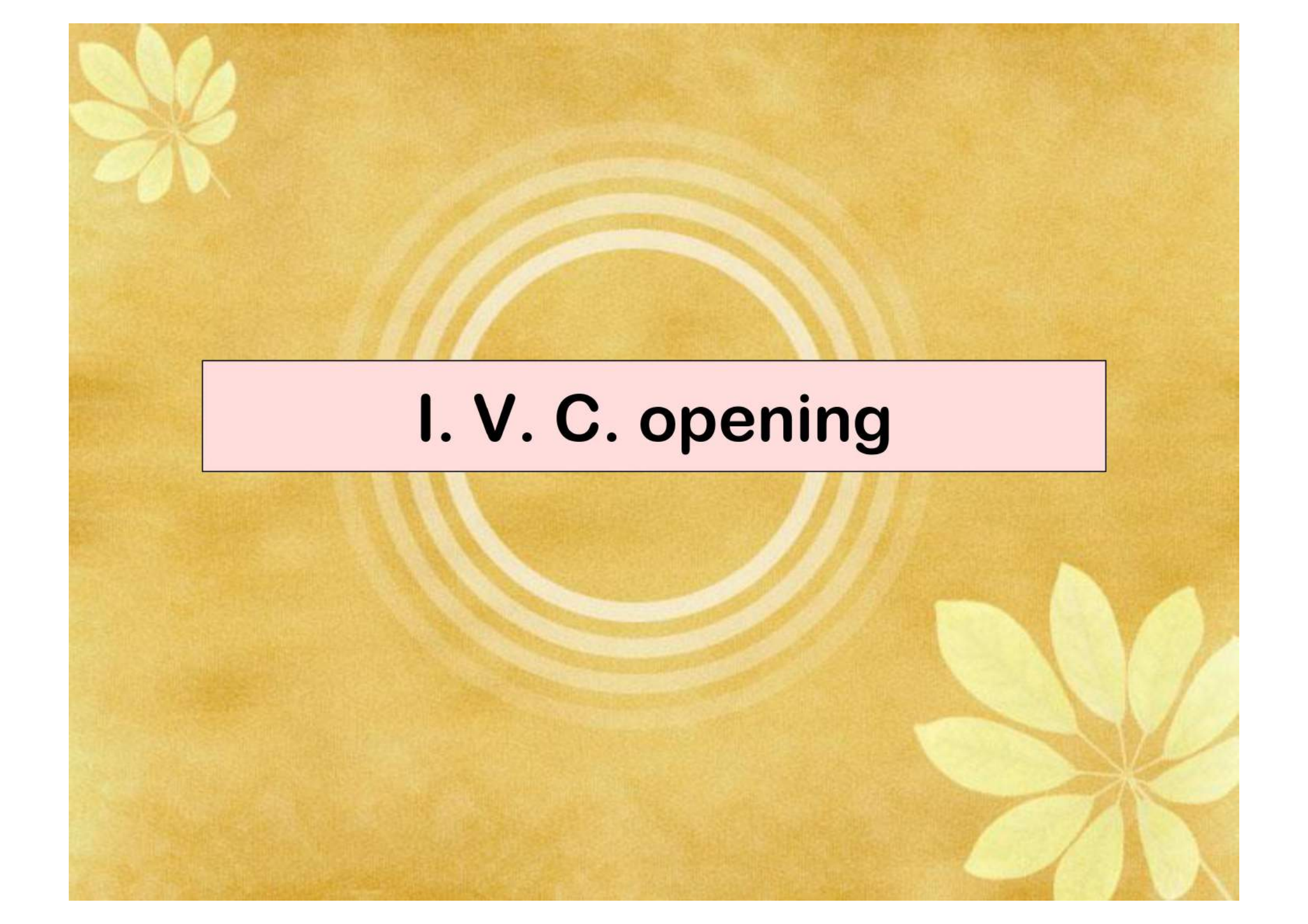
Oesophagus



Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl, Adam W.M. Mitchell

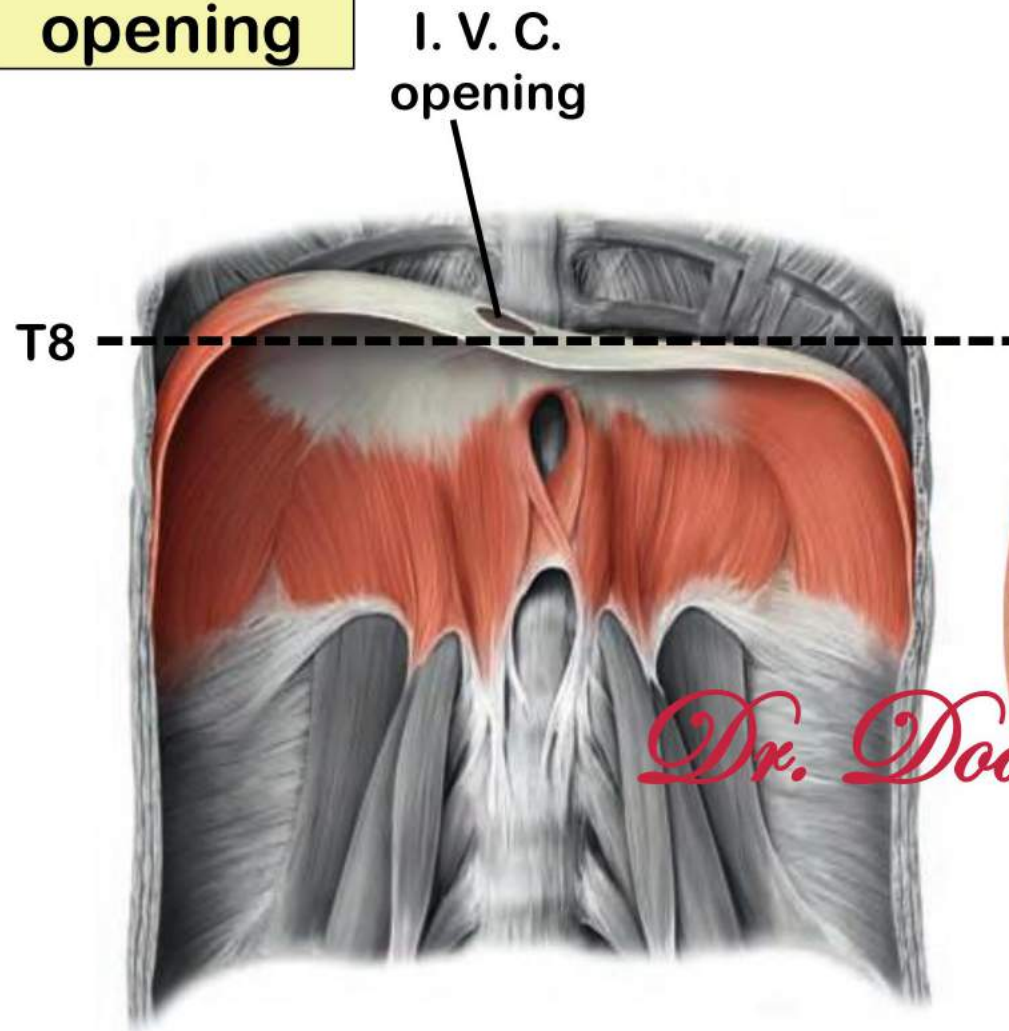
Structures passing through

- Oesophagus
- Two vagi
- Oesophageal branches of left gastric vessels

The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

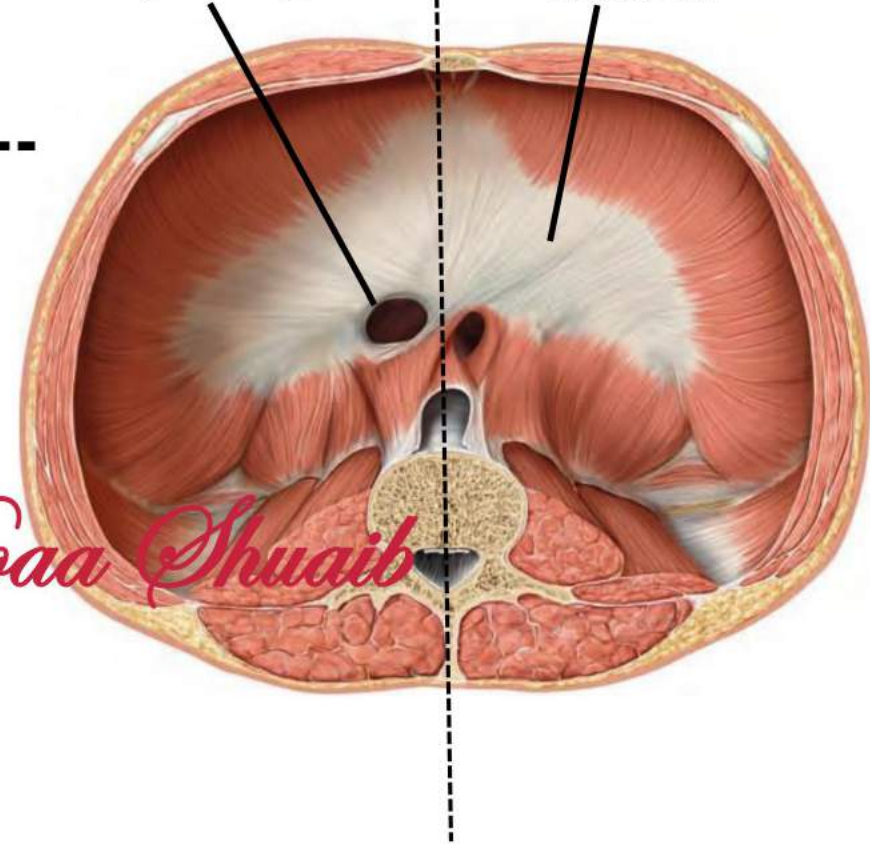
I. V. C. opening

I. V. C. opening



I. V. C.
opening

Central
tendon



Dr. Doaa Shuaib

Source: Atlas of Anatomy, Anne M. Gilroy, Brian R. MacPherson, Lawrence M. Ross (2nd edition)

Site

- T8 vertebra
- One inch to right of middle line
- In the central tendon

IVC opening

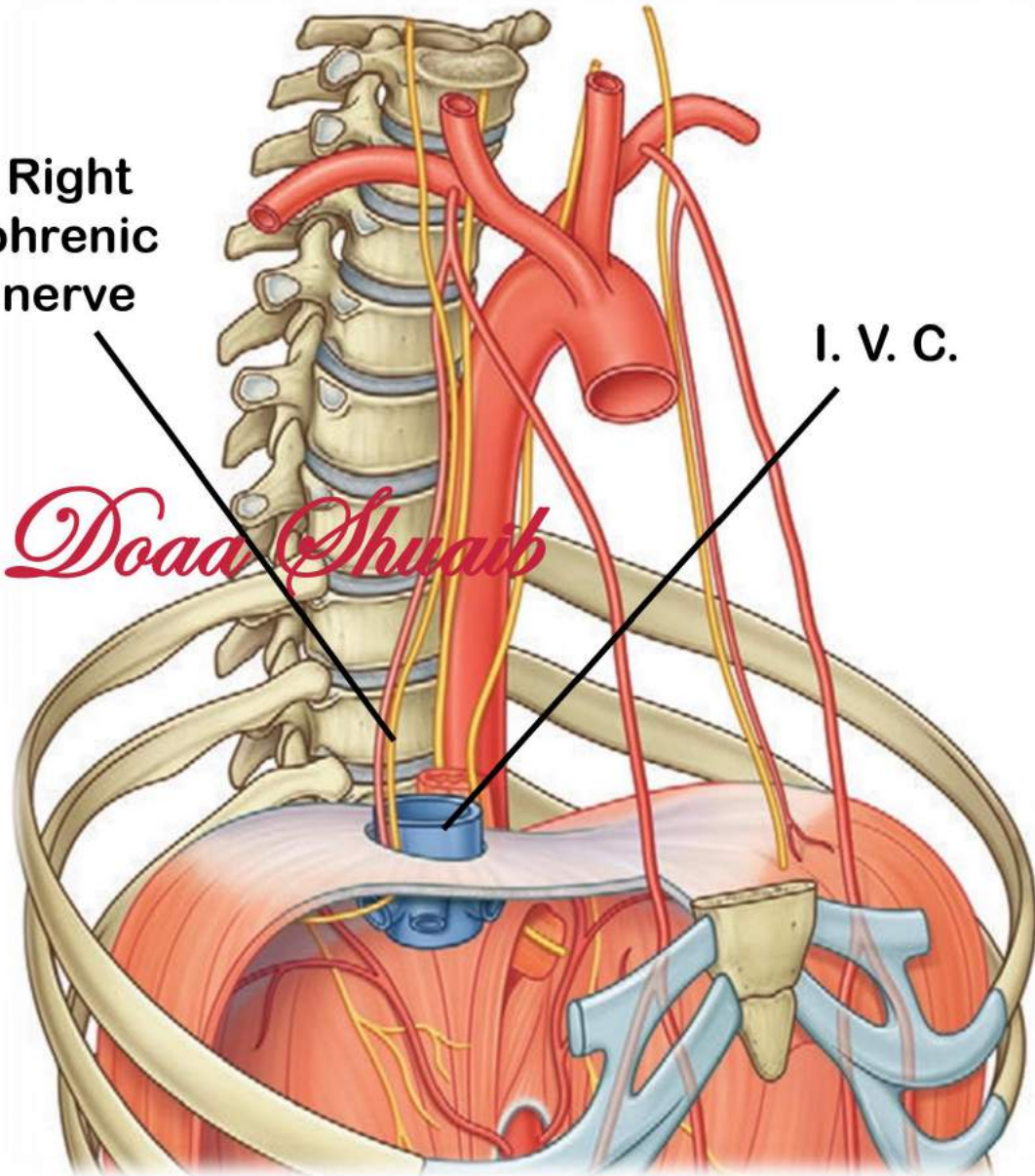
Structures passing through

- I.V.C.
- Right phrenic nerve
- Lymphatics

Right
phrenic
nerve

I. V. C.

Dr. Doaa Shuaib



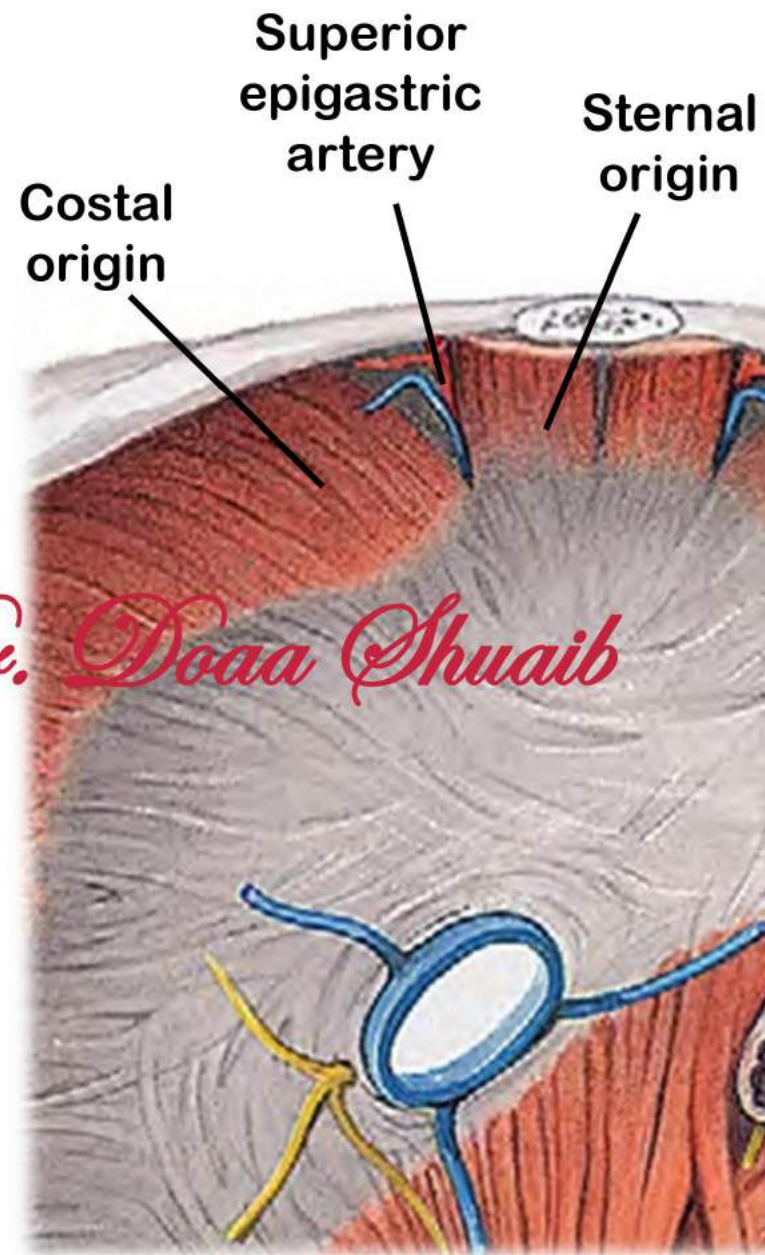
Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl,
Adam W.M. Mitchell

The background is a textured, golden-yellow surface. In the center, there are several concentric, light-colored circles that create a ripple effect. In the top-left and bottom-right corners, there are stylized, light-green floral motifs with multiple pointed petals.

a. Minor openings

Minor openings

1. **Superior epigastric artery:**
It passes between sternal and costal origins



Source: Sobotta Atlas of Anatomy

Minor openings

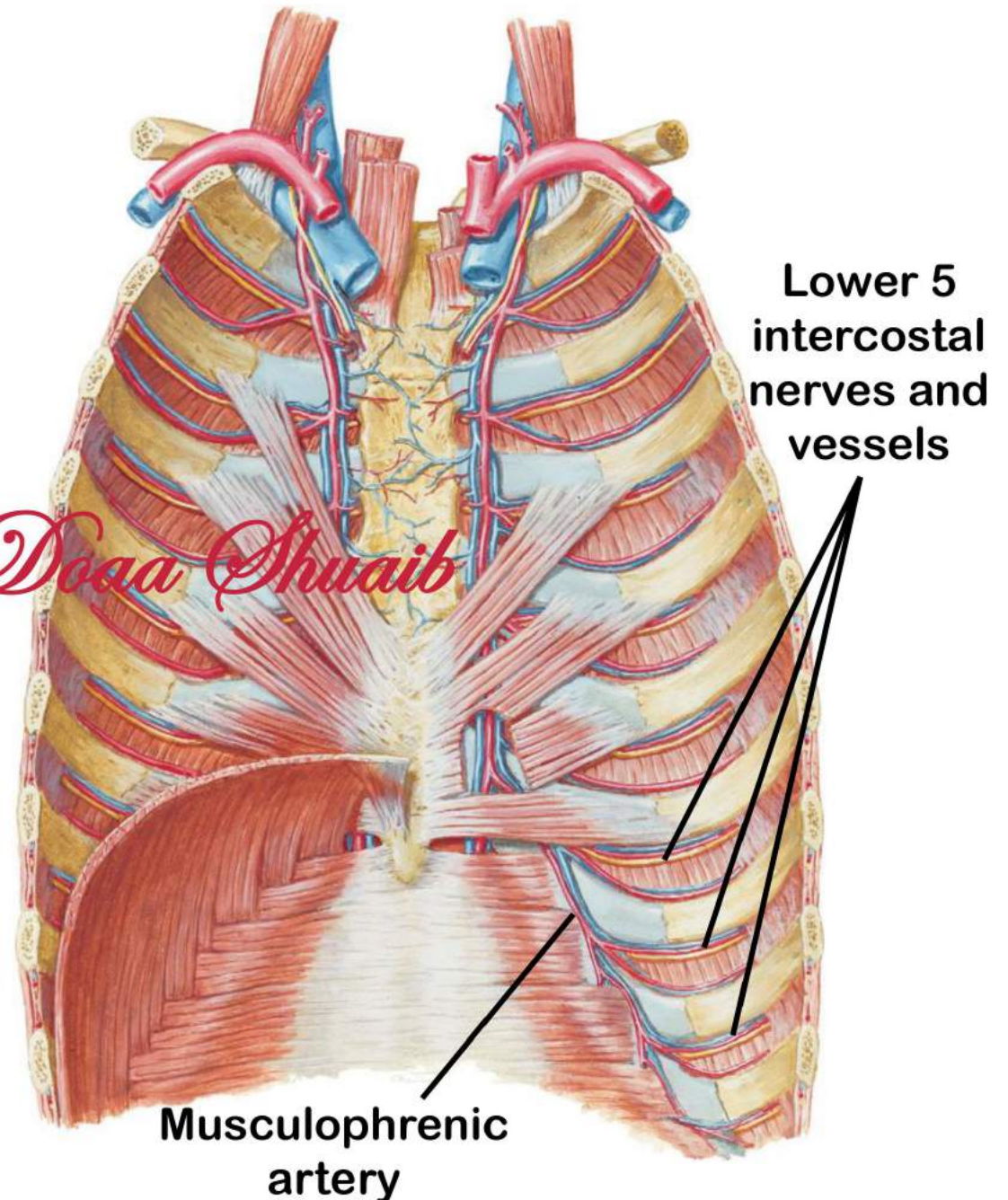
2. Musculophrenic artery:

Between the slips of origin of the diaphragm from 7th and 8th costal cartilages

3. Lower five intercostal nerves and vessels:

Between the slips of origin of the diaphragm from 7th and 8th costal cartilages

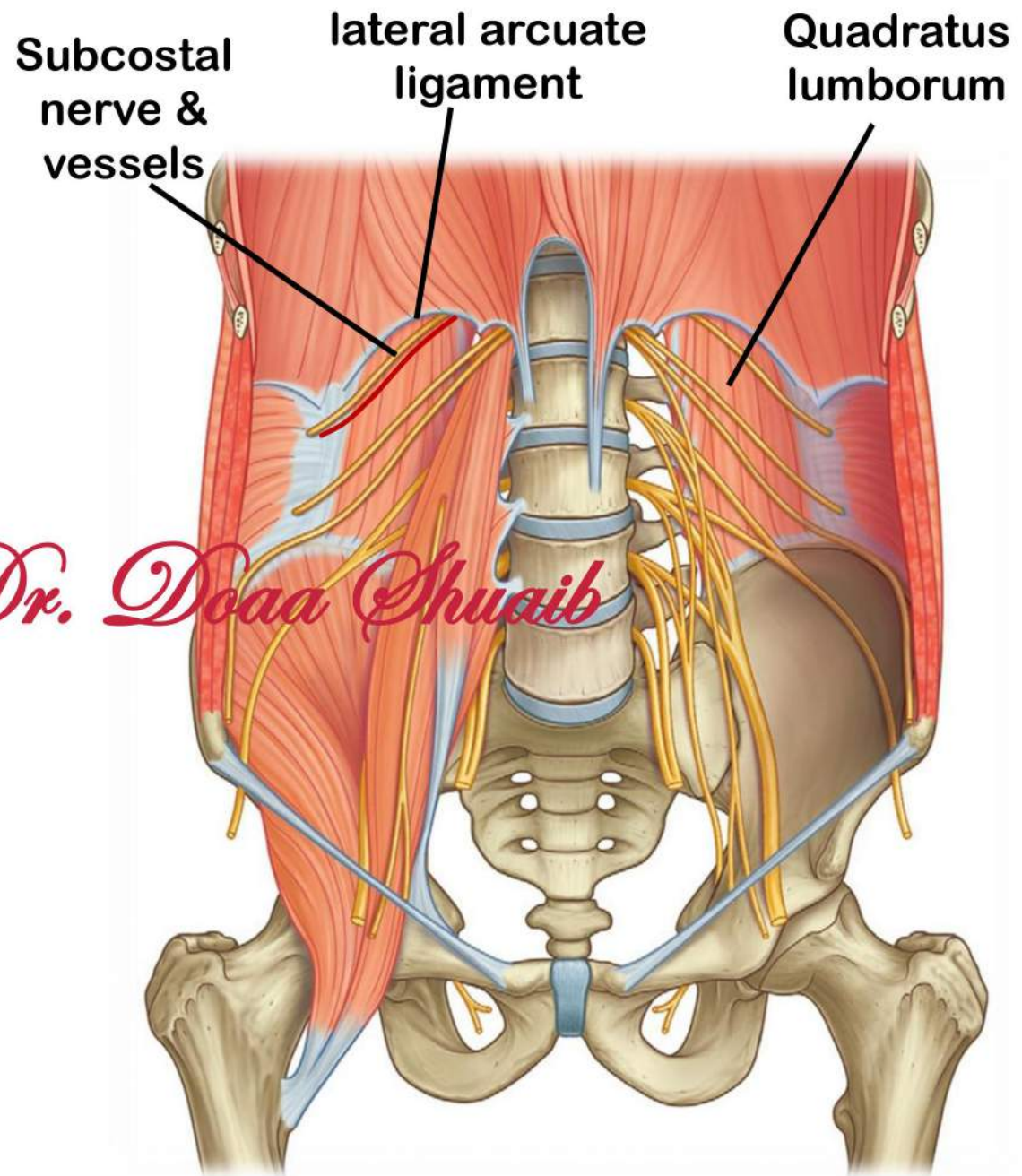
Dr. Doaa Shuaib



Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

Minor openings

4. Subcostal nerve, subcostal vessels, quadratus lumborum: behind the lateral arcuate ligament

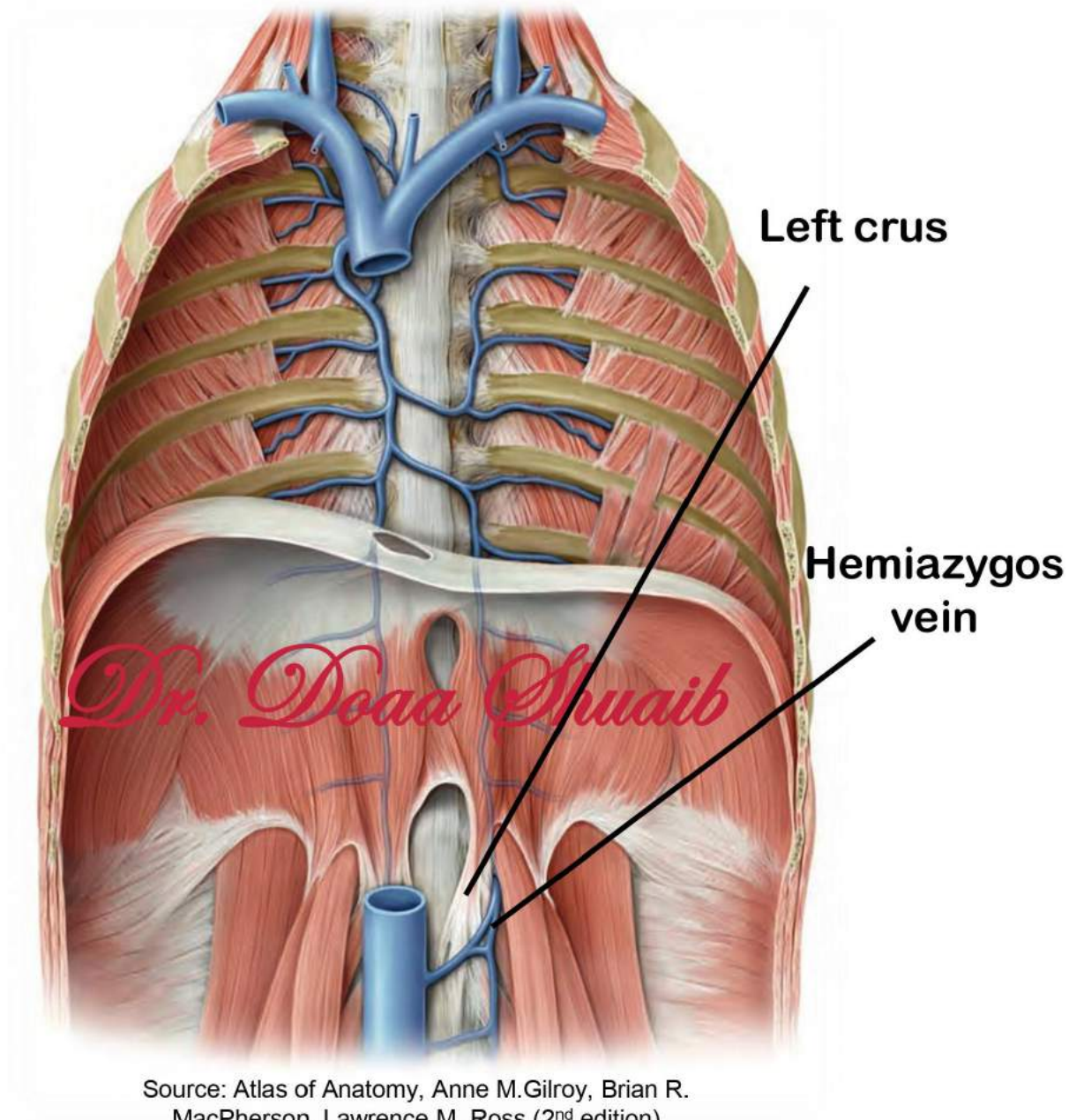


Dr. Doaa Shuaib

Source: Gray's Basic Anatomy - Richard L. Drake, Wayne Vogl, Adam W.M. Mitchell

Minor openings

5. Hemiazygos vein:
pierces the left crus to enter the chest



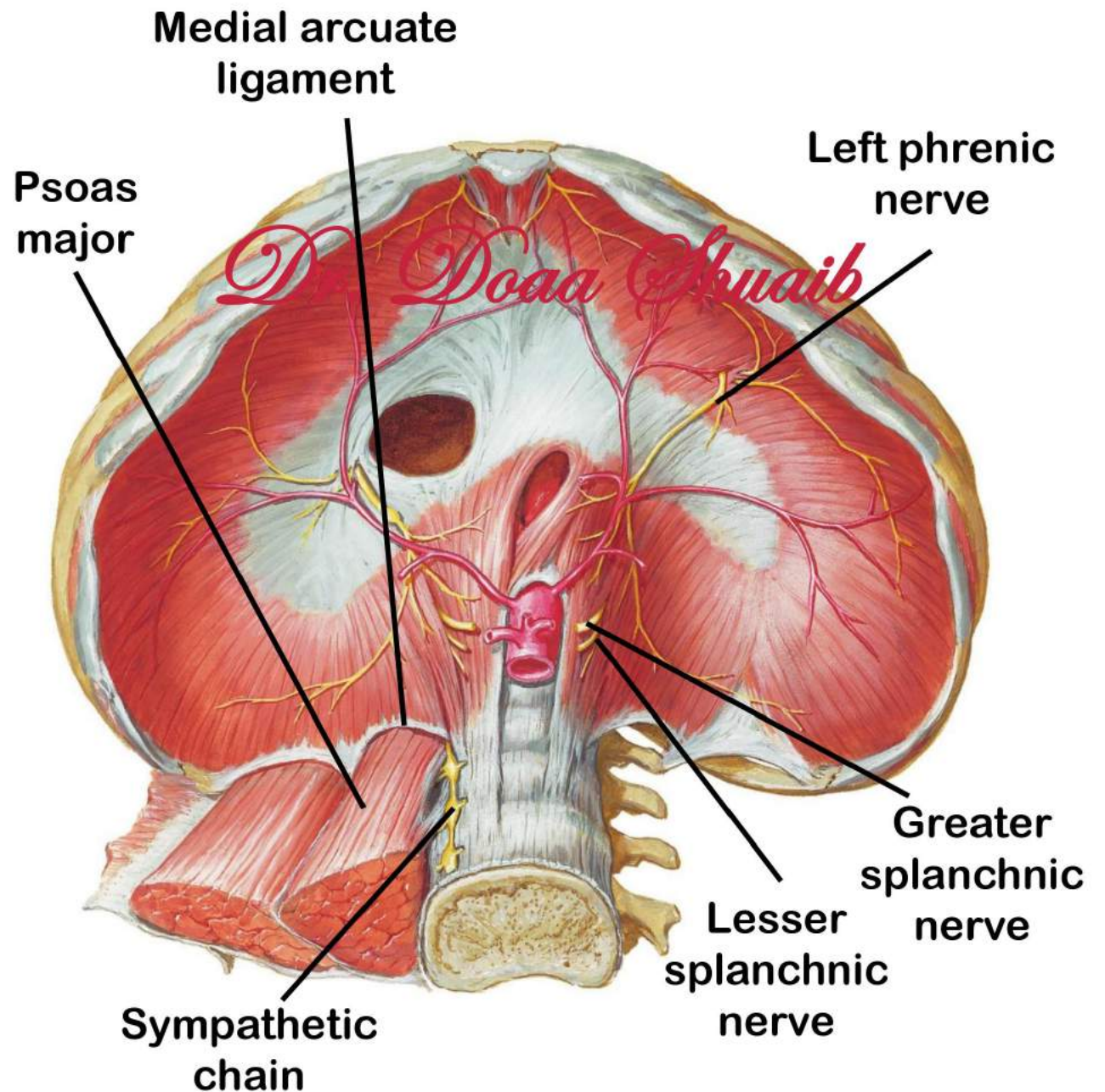
Source: Atlas of Anatomy, Anne M. Gilroy, Brian R. MacPherson, Lawrence M. Ross (2nd edition)

Minor openings

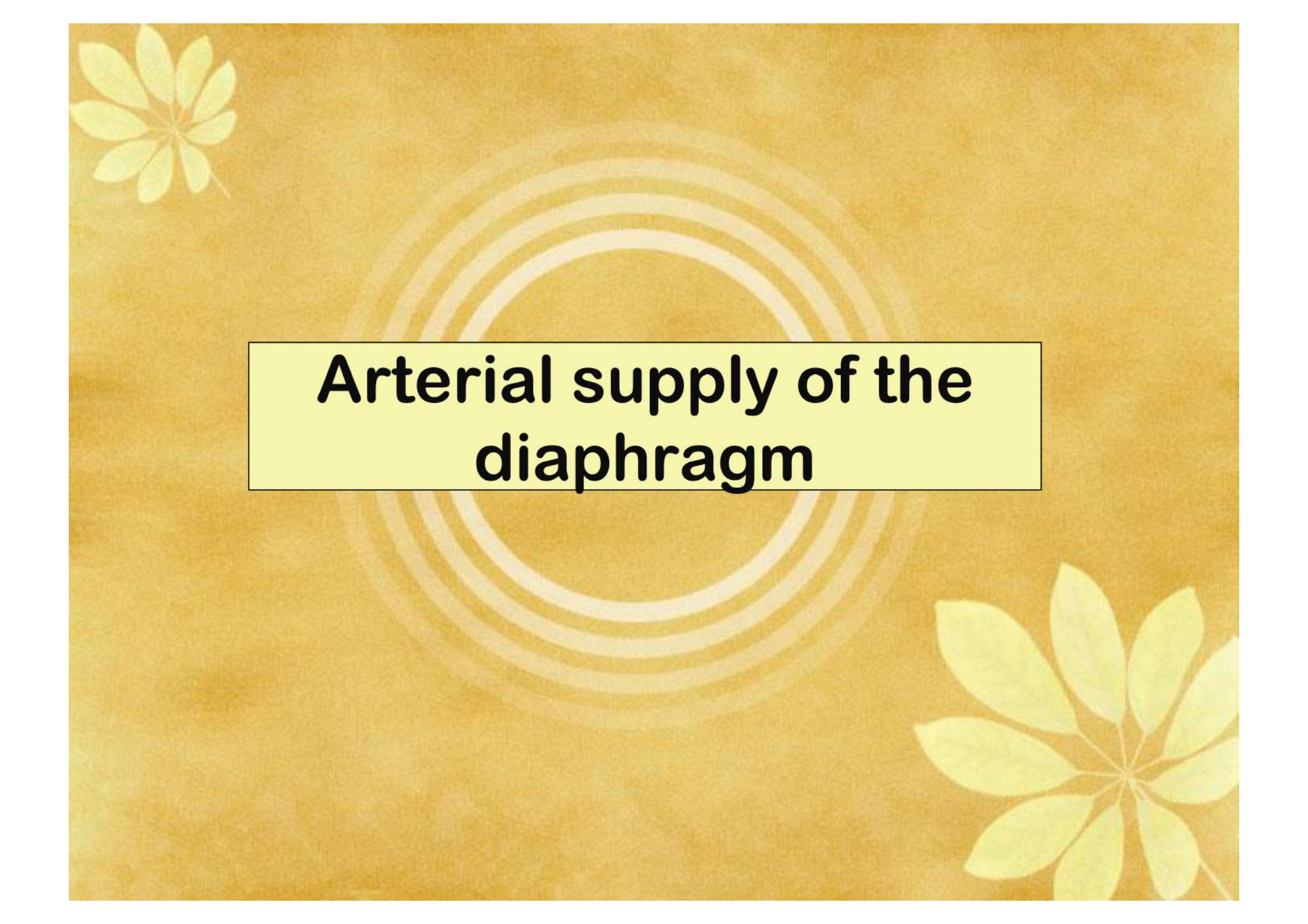
6. Sympathetic chain and psoas major muscle:
Behind the medial arcuate ligament.

7. Greater and Lesser splanchnic nerves:
pierce the crus of the corresponding side.

8. Left phrenic nerve:
It pierces the left cupola

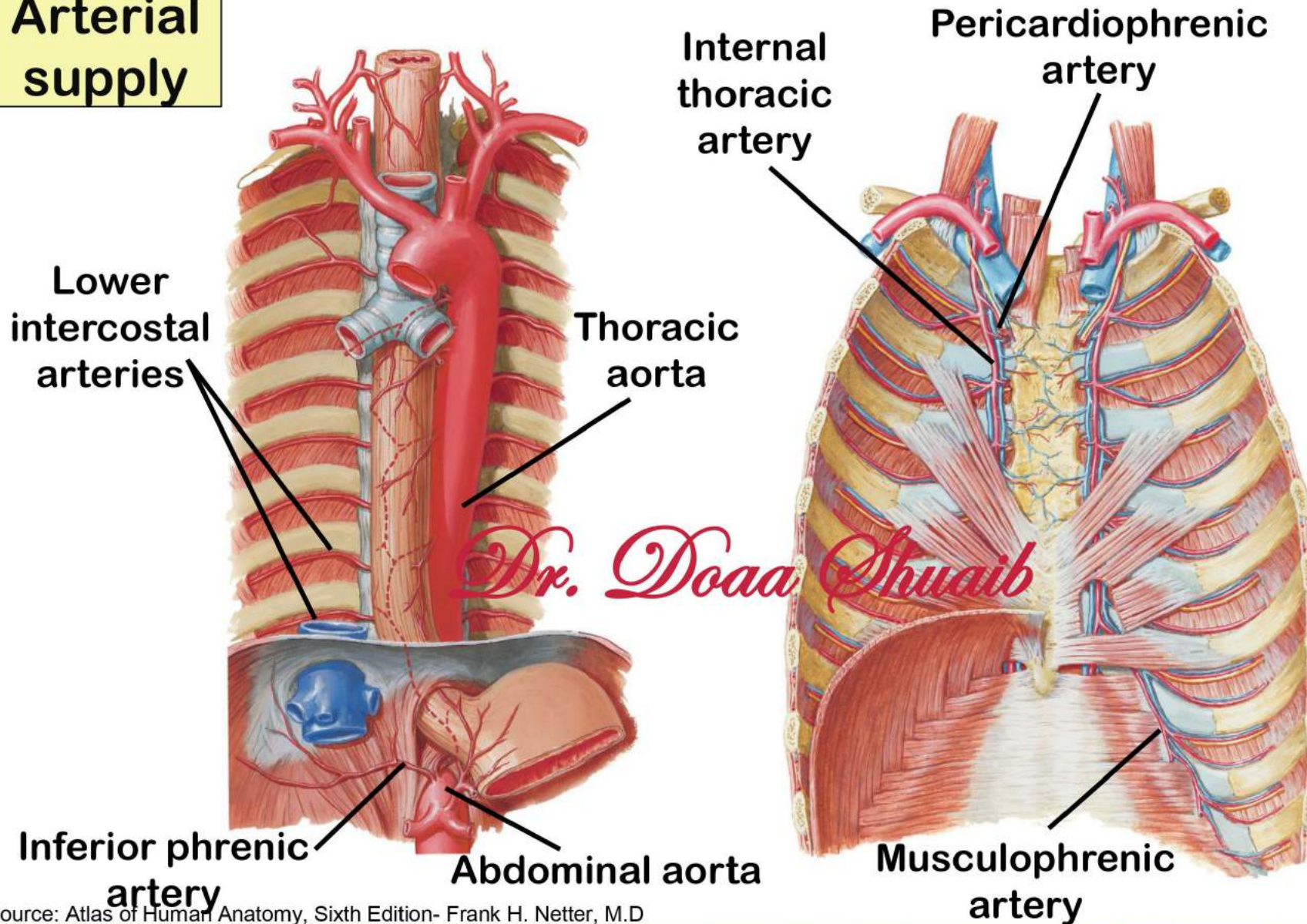


Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

The background is a solid mustard yellow color. In the center, there are several concentric circles in a lighter, cream-colored shade. In the top-left and bottom-right corners, there are stylized floral motifs with multiple pointed petals in a light yellow-green color.

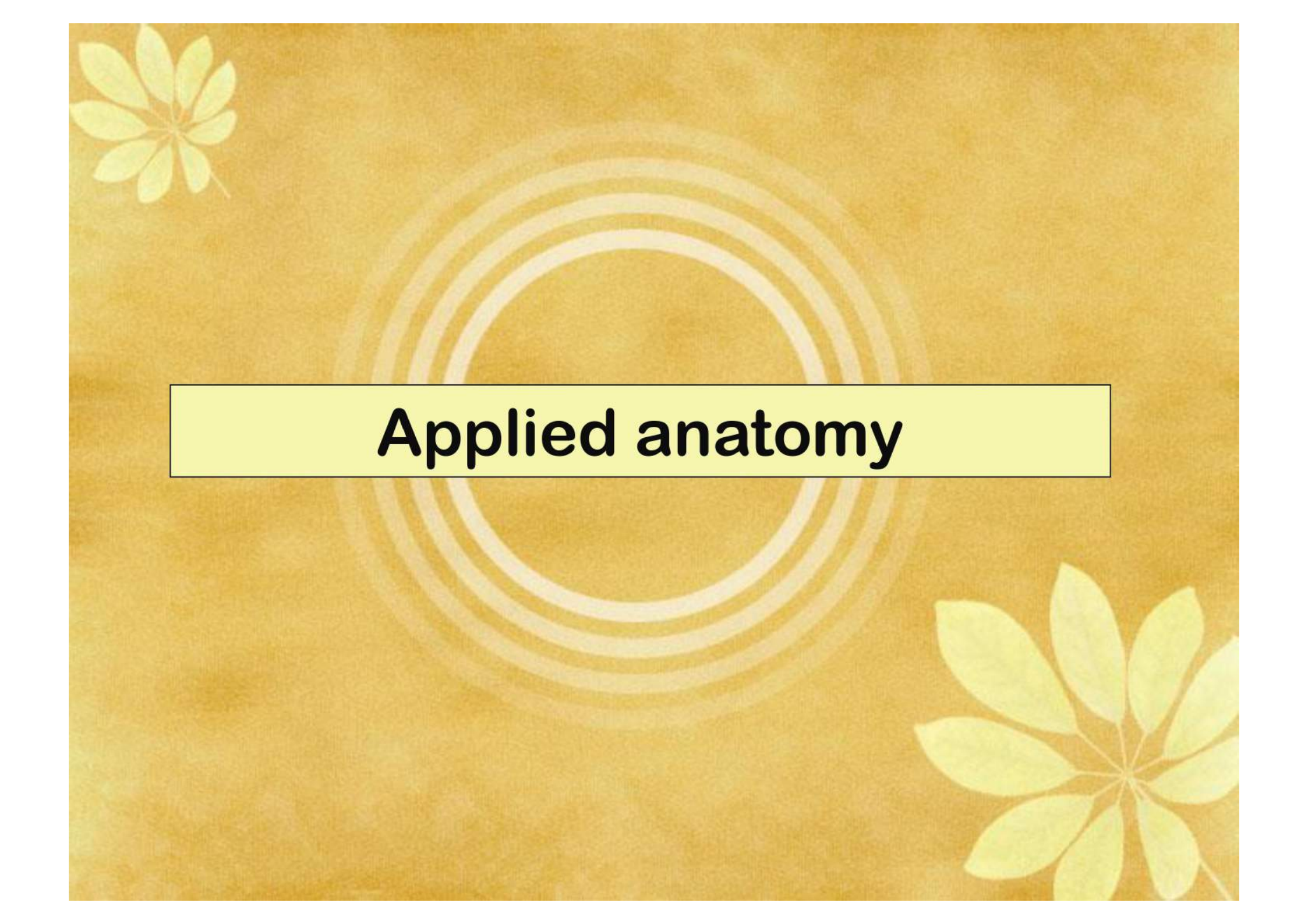
Arterial supply of the diaphragm

Arterial supply

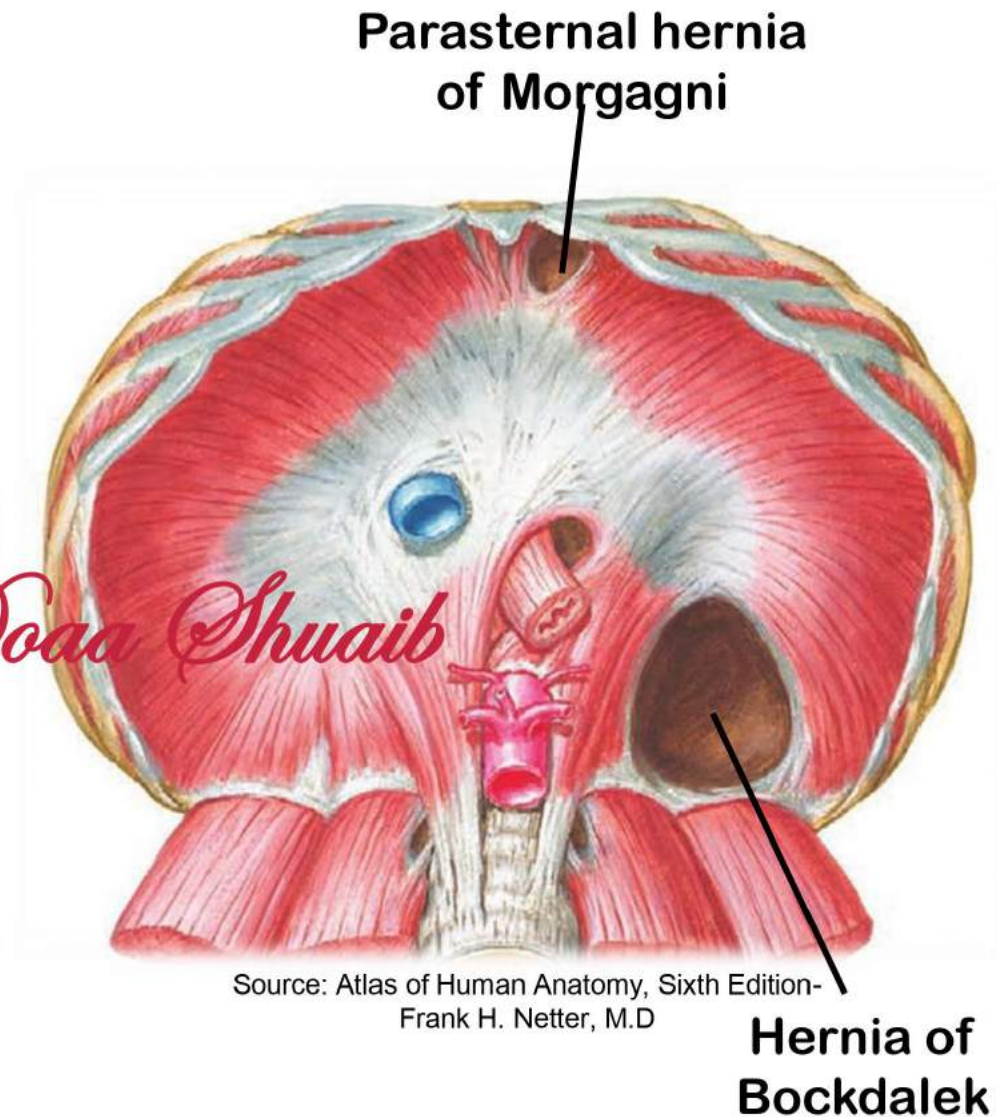
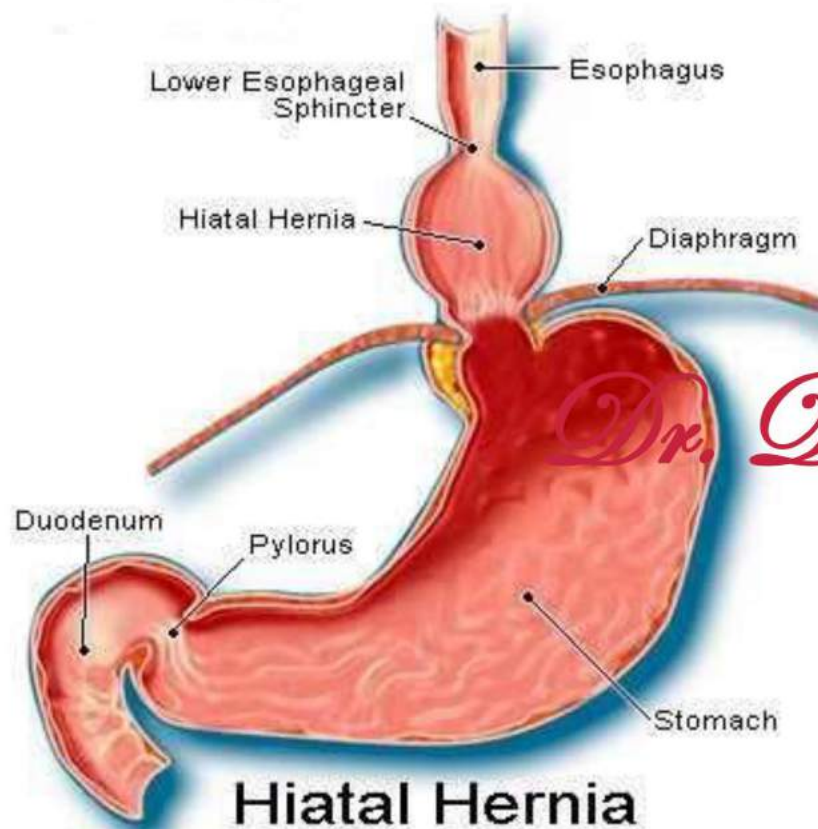


Source: Atlas of Human Anatomy, Sixth Edition- Frank H. Netter, M.D

1. Superior phrenic artery from thoracic aorta.
2. Lower intercostal arteries from thoracic aorta.
3. Inferior phrenic artery from abdominal aorta.
4. Musculophrenic artery from internal thoracic artery.
5. Pericardiophrenic artery from internal thoracic artery.

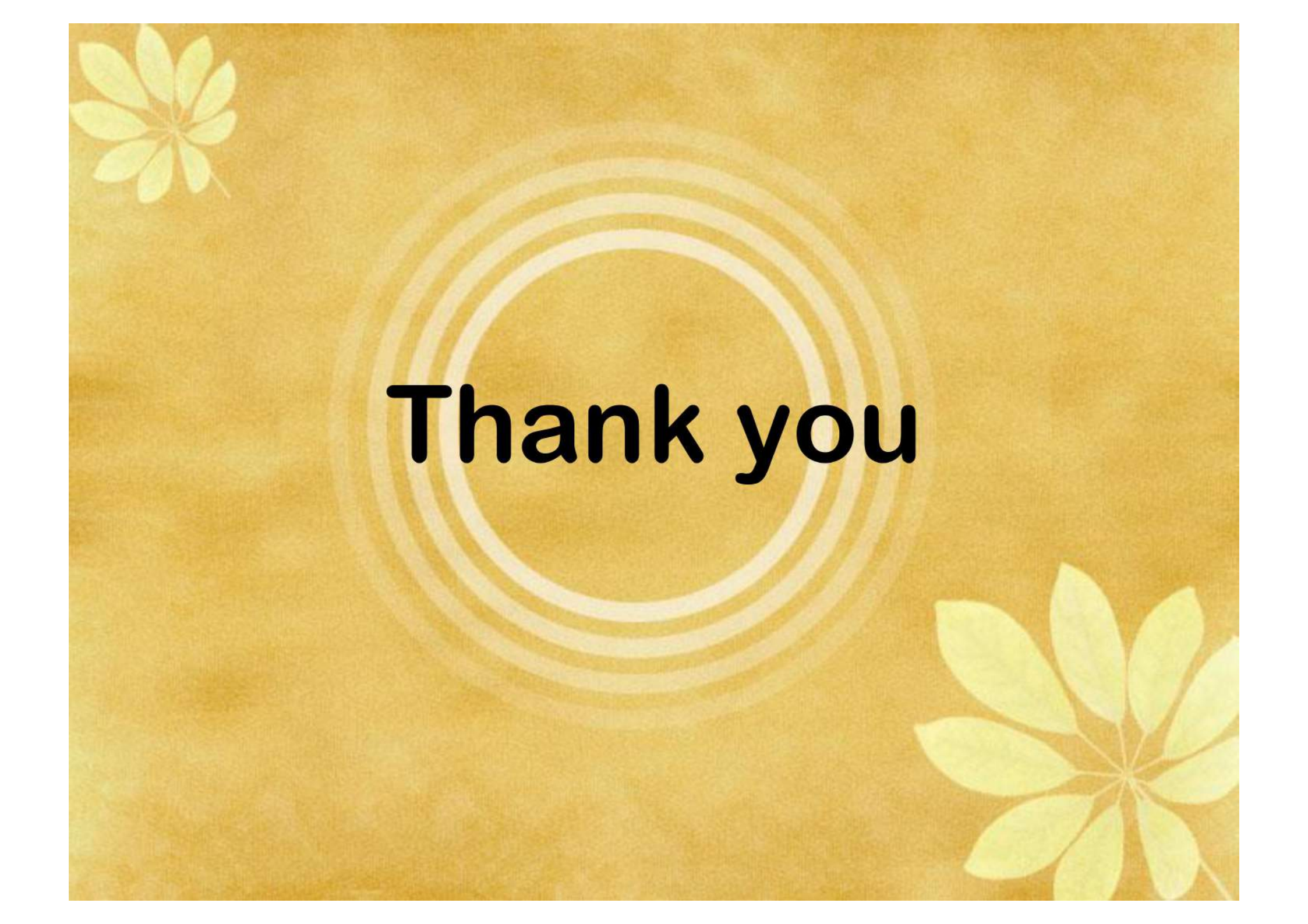
The background is a textured, golden-yellow surface. In the center, there are several concentric circles in a lighter shade of yellow. In the top-left and bottom-right corners, there are stylized floral motifs with multiple pointed petals.

Applied anatomy



Diaphragmatic hernia may be one of the following:

1. **Hiatus hernia:** stomach passes through the oesophageal opening.
2. **Hernia of Bochdalek:** between the costal & vertebral origins
3. **Parasternal hernia of Morgagni:** between the sternal & costal origins of the diaphragm.



Thank you