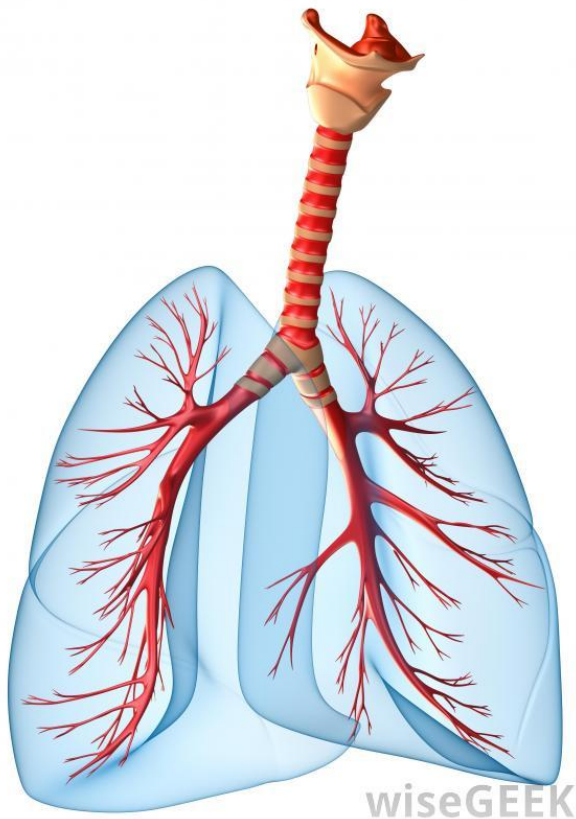




Anatomy Team

433

King Saud University
College of medicine
Respiratory Block



wiseGEEK

MUSCLES INVOLVED IN RESPIRATION



Done By:

*shahad almuhaideb &
Hanan Aldosri*

For Any comments Please
don't hesitate to contact With
us by:

anatomy433@live.com

Objectives

- ❖ ***Describe the components of the thoracic cage and their articulations.***
- ❖ ***Describe in brief the respiratory movements.***
- ❖ ***List the muscles involved in inspiration and in expiration.***
- ❖ ***Describe the attachments of each muscle to the thoracic cage and its nerve supply.***
- ❖ ***Describe the origin, insertion, nerve supply of diaphragm.***



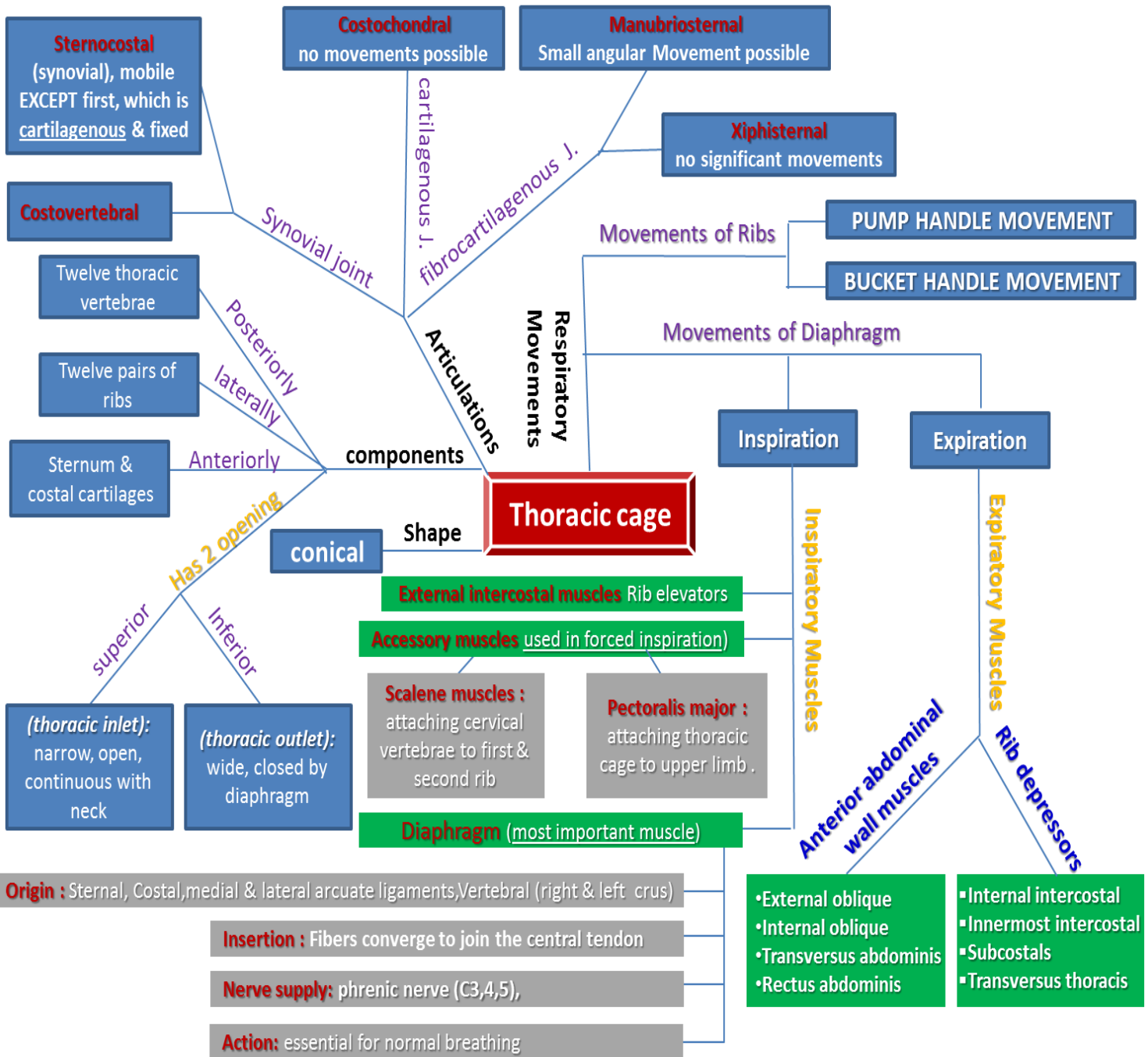
Color Index

- **Red : Important.**
- **Violet: Explanation.**
- **Gray: Additional Notes.**

Other colors are for
Coordination

Say "bismillah" then start

Mind Map



THORACIC CAGE

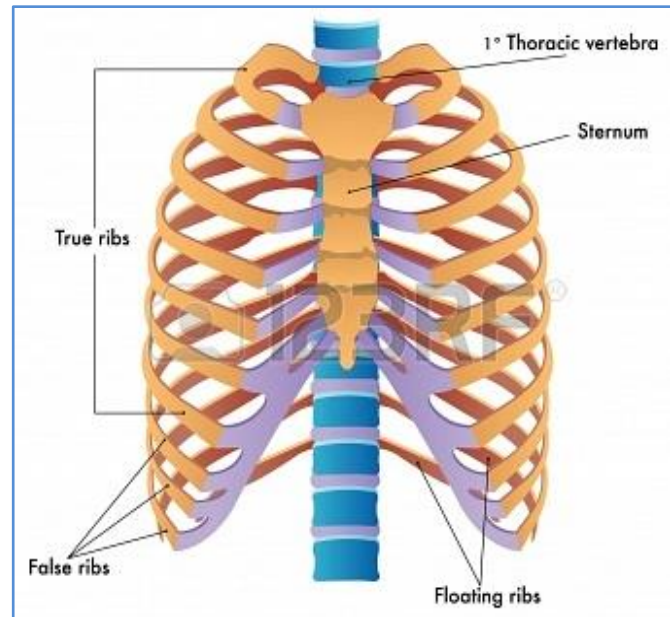
❖ **Shape** :Conical in shape (مخروطي الشكل)

❖ **Formed of:**

- **Anteriorly:** Sternum & costal cartilages^{*1}
- **Laterally:** Twelve (12) pairs of ribs
- **Posteriorly:** Twelve(12) thoracic vertebrae

❖ **Has 2 apertures (openings):**

1. **Superior:** (**thoracic inlet**^{*2}): narrow, open, continuous with neck
2. **Inferior:** (**thoracic outlet**^{*3}): wide, closed by diaphragm



Note:^{*1}costal cartilage: is the cartilages that connect the sternum and the ends of the ribs; its elasticity allows the chest to move in respiration. It has two part **Sternocostal & Costochondral**

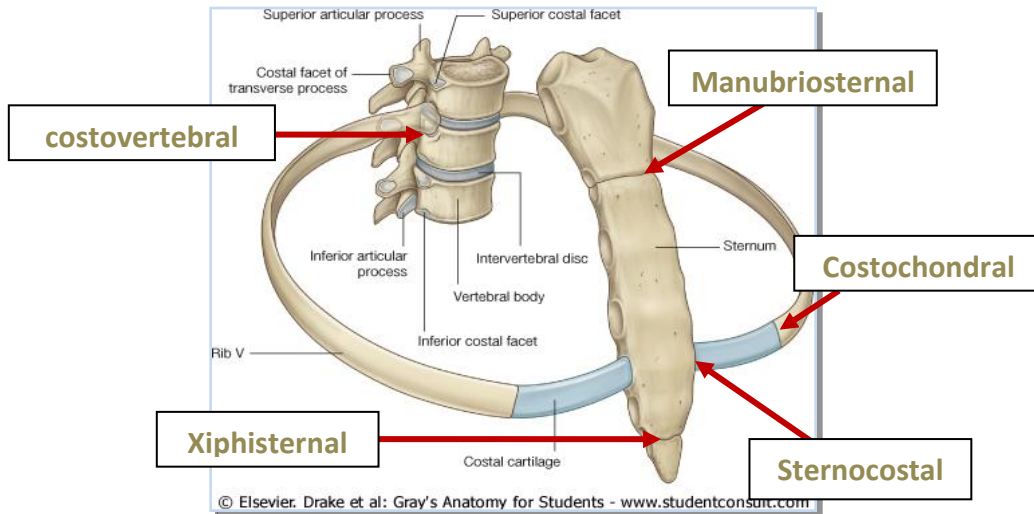
^{*2}Thoracic inlet : the intersection of the neck and thoracic cavity, consisting of the upper end of the sternum (the manubrium), the first thoracic vertebra, and the first ribs and their cartilages

Clinically, the superior opening of the thorax is called “Outlet” not theInlet.

^{*3}Thoracic outlet : an anatomical redefinition that makes clinical sense



Articulations (Joints)



Joint Name	Joint Type	Movement Possible	Comment
Costovertebral	Synovial	—	*Cost means: Any thing related to (Ribs)
Sternocostal	Synovial EXCEPT first rib, which is cartilaginous	Mobile EXCEPT first rib, which is fixed	*Often Synovial joints have susceptibility to motion
Costochondral	cartilagenous	No movements possible	*Chondral (cartilage) * Often Cartilagenous joint Have no possibility or very little range of movement
Manubriosternal	Fibrocartilagenous	Small angular Movement ^{*1} possible	*Manubrio from Manubrium which is the upper part of sternum *Often Fibrocartilagenous joint have no possibility or very little range of movement
Xiphisternal	Fibrocartilagenous	no significant movements	*Xiphi from Xiphoid process which is lower part of sternum *Fibrocartilagenous joint

Note :^{*1} Angular movement allow the body of the sternum to move on the manubrium “Inward and Outward”
The 2 joints are helping in respiration: *Sternocostal & Manubriosternal.*



Respiratory Movements

A- Movements of Diaphragm

Inspiration

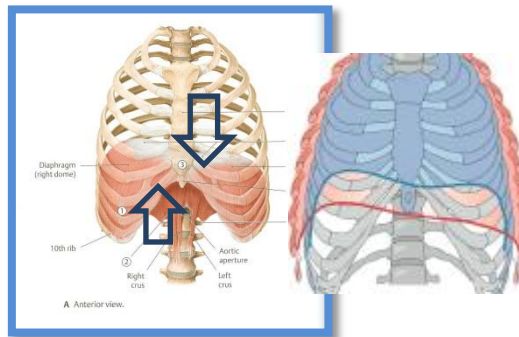
Contraction (**descent**) of diaphragm



Increase of vertical diameter of thoracic cavity

Expiration

Relaxation (**ascent**) of diaphragm)



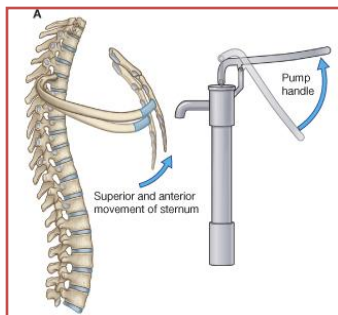
B- Movements of Ribs

PUMP HANDLE MOVEMENT

Elevation of ribs



Increase in antero-posterior diameter of thoracic cavity

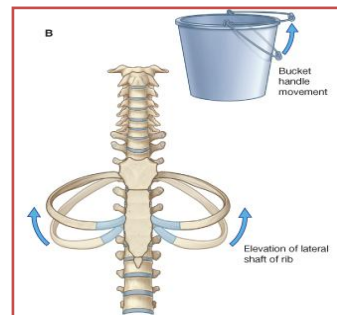


BUCKET HANDLE MOVEMENT

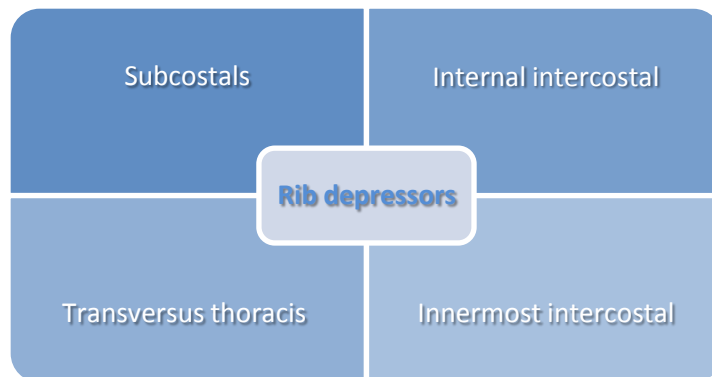
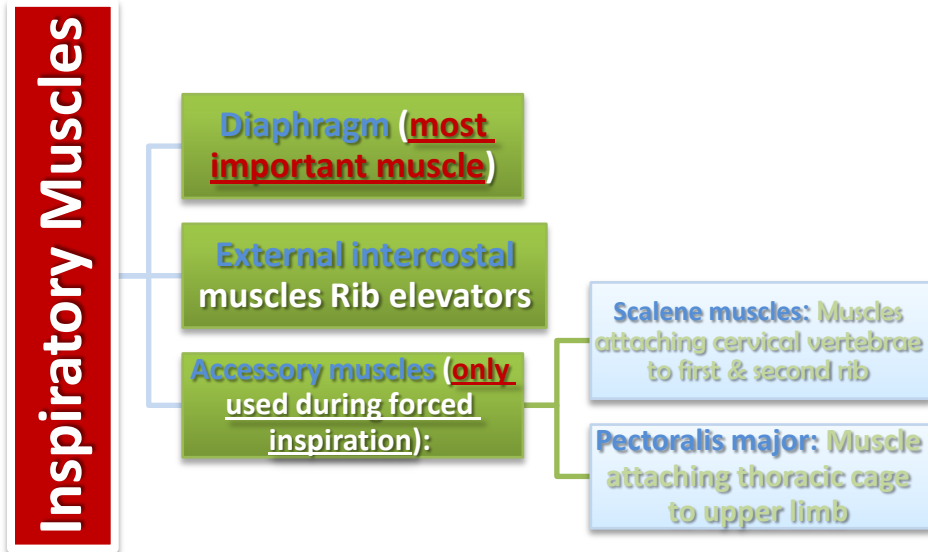
Elevation of ribs



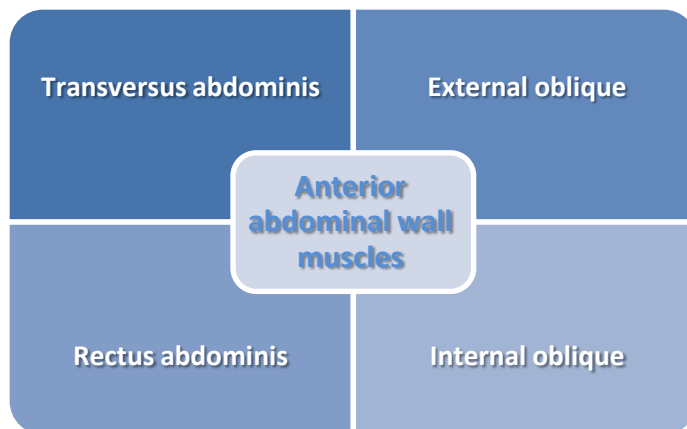
Increase in lateral diameter of thoracic cavity



Muscles



Expiratory Muscles 8

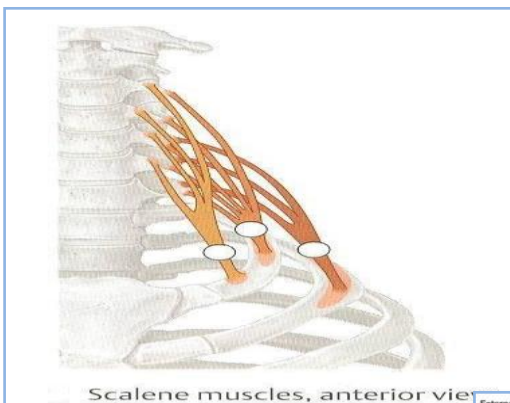


Inspiratory Muscles

Muscle	Description	Origin	Insertion	Nerve supply	Action
DIAPHRAGM	A musculotendinous partition between thoracic & abdominal cavity Convex toward thoracic & concave toward abdominal cavity	<p>*Sternal: xiphoid process of sternum</p> <p>*Costal: lower 6 costal cartilages & 12th rib.</p> <p>*medial & lateral arcuate ligaments.</p> <p>*Vertebral: right crus from upper 3 lumbar vertebrae. (largest crus) left crus from upper 2 lumbar vertebrae.</p>	Fibers converge to join the <u>central tendon</u>	phrenic nerve (C3,4,5)	Contraction (descent) of the diaphragm increases vertical diameter of thoracic cavity (essential for normal breathing)

NOTE : phrenic: Is any thing or structure related to Diaphragm

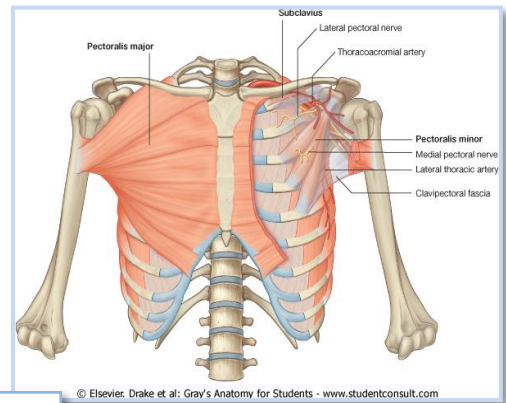
Crus : leglike parts or structures



Scalene muscles, anterior view

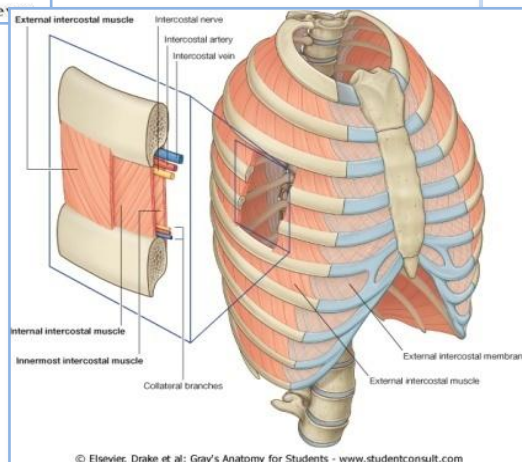
Scalene muscle

In The Next Page



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Pectoral's major



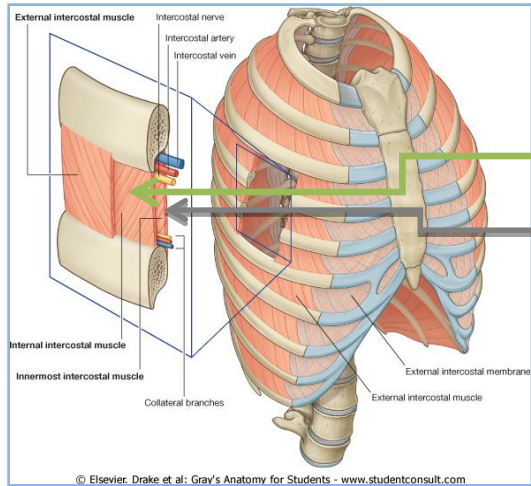
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External intercostal

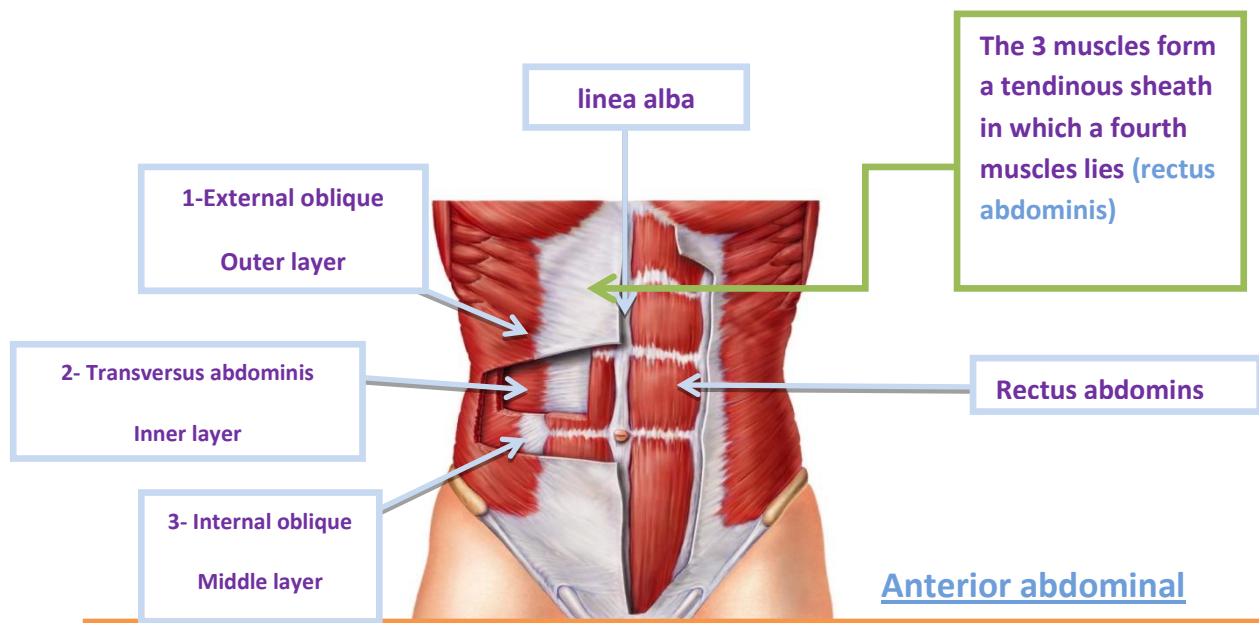
Muscle	Origin	Insertion	Nerve supply	Action	direction
EXTERNAL INTERCOSTAL	—	from lower border of rib above to upper border of rib below	intercostal nerves	rib elevators (inspiratory)	downward & medially
SCALENE MUSCLES: 1-Scalenus anterior 2-Scalenus medius 3-Scalenus posterior	cervical vertebrae	1st & 2nd ribs	—	elevate 1st & 2nd ribs (inspiratory)	—
PECTORAILIS MAJOR *1	sternum + costal cartilages	humerus	—	increases antero-posterior diameter of thoracic cavity, when arm is fixed (inspiratory)	—
Expiratory Muscles (Rib Depressors 8)	Act only during forced expiration				
	Nerve supply		Direction		
Internal * intercostal	intercostal nerves (ventral rami of T1-T11)		upward & medially		
Innermost * intercostal					
* Subcostals					
*Transversus thoracis					
Anterior abdominal wall muscles: (Rib Depressors)	Act only during forced expiration				
	Attachment	Nerve supply	Action	Direction	
External oblique <i>outer layer</i>	sternum, costal cartilages and ribs + hip bones	intercostal nerves (T7 – T11), subcostal nerve (T12) and first lumbar nerve.	Compression of abdominal viscera to help in ascent of diaphragm	downward & medially	
Internal oblique <i>middle layer</i>				upward & medially	
Transversus abdominis <i>inner layer</i>				transverse	
Rectus abdominis				vertical	

***1 – The Pectoralis Minor is an accessory muscle (only used during forced inspiration) BUT, it is not as important as PECTORAILIS MAIOR**

Rib depressors



- 1-Internal intercostal
- 2. Innermost intercostal

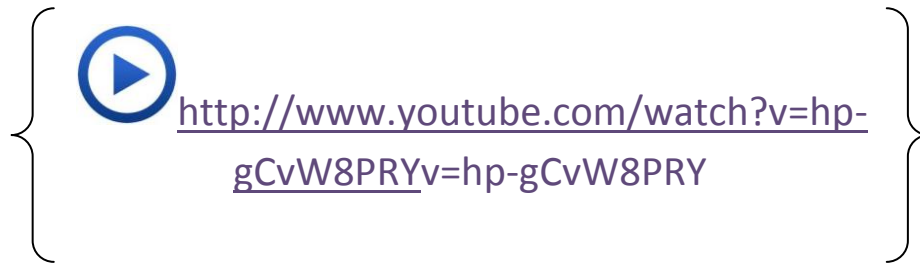


* Is formed of 3 layers of muscles of fibers running in different directions (to increase strength of anterior abdominal wall).

* The 3 muscles form a tendinous sheath in which a fourth muscles lies (rectus abdominis) .

The aponeurosis of the 3 muscles on both sides fuse in the midline to form linea alba*

Watch this video (diaphragm function)



Remember That:

- ✓ Each costal cartilage has 2 joints: one with the Sternum “**Sternocostal**” and the other with the Rib “**Costochondral**”
- ✓ All the Sternocostal joints are **SYNOVIAL** so they are MOBILE Except the first rib which is Fixed and cartilaginous.
- ✓ The 2 joints are helping in respiration: **Sternocostal and Manubriosternal**.
- ✓ **Diaphragm** (most important muscle) in respiration
- ✓ **The normal Expiration needs no muscles**
- ✓ **Thickening of the deep fascia is forming the lateral and medial arcuate ligaments.**
- ✓ Some fibers arising from the right and left sides of the lumbar vertebra to form gap for the **Aorta passage**
- ✓ Right crus is longer than the left crus and it attach to (L_{1,2} and 3) while the left crus attach to (L₁ and L₂).
- ✓ The aponeurosis of the 3 muscles on both sides fuse in the
- ✓ midline to form **linea alba**



Multiple Choice Questions

1- Synovial joints of the thoracic cage:

A- sternocostal and costochondral

B- sternocostal and costovertebral

2-The only Cartilaginous joint is:

A-costochondra

B-sternocostal

c- costovertebral

D- Manubriosternal

3- All of these are origin of the diaphragm EXCEPT:

A-upper 6 costal cartilages

B-medial and lateral arcuate ligaments

C-right and left crus

D- Manubrium of sternum

4- Which nerve supplies the external intercostal?

A- -Phrenic nerve
nerve

B- subcostal nerve

C- intercostal

d- first lumbar

5-The Passive Expiration Accour during execcises :

A- T B- F

6- Scalene muscles attach to cervical vertebrae of the first & second ribs:

A-T

B- F

7-Phrenic nerve supplies which muscle & what is the root value of it?

A- diaphragm muscle (c3,4,6)

B- intercostal muscle (T7 – T11)

C- diaphragm muscle (c3,4,5)

Note: Passive Means: the progress happened without muscle contraction. Here heppened with elastic recoil.

Q Ans. :

1- B . 2- A . 3- A . 4-C . 5- B . 6-A . 7- C