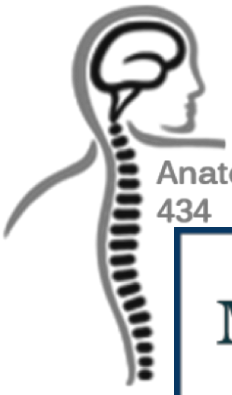


Muscles involved in respiration

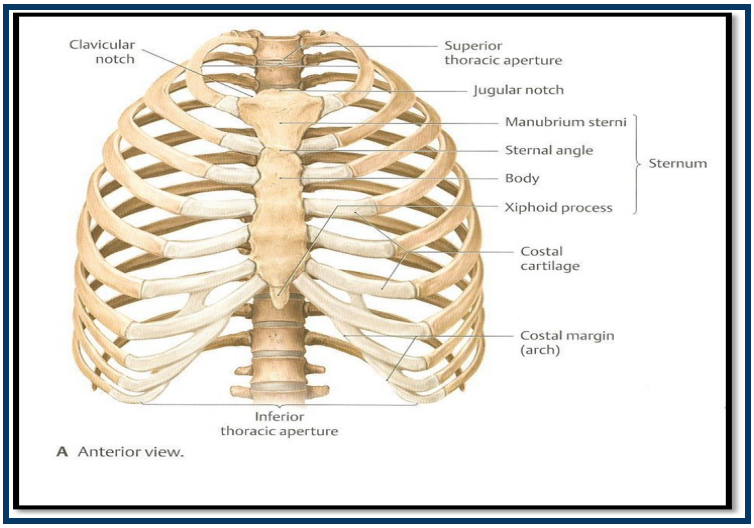
Objectives

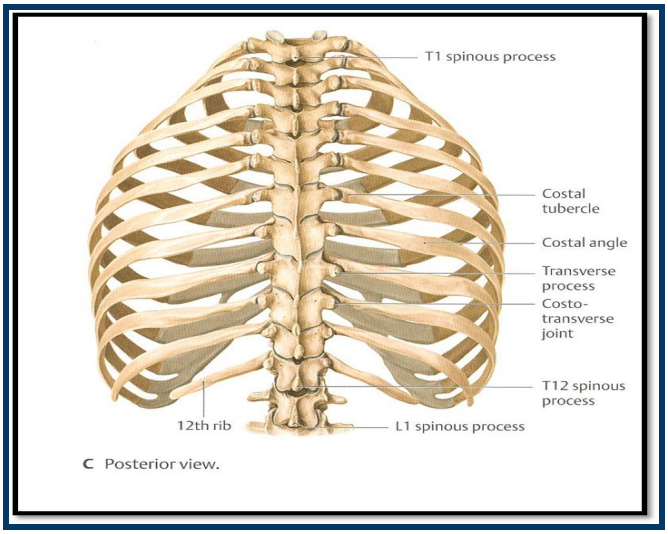
- *Describe the components of the thoracic cage and their articulations.*
- *Describe in brief the respiratory movements.*
- *List the muscles involved in inspiration and in expiration.*
- *Describe the attachments of each muscle to the thoracic cage and its nerve supply.*
- *Describe the origin, insertion,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

New terms

1-**Conical -> (مخروطي)**
2-**Diaphragm -> a thin musculomembranous dome-shaped muscle that separates the thoracic and abdominal cavities(الحجاب الحاجز)**
3-**phrenic**-> relating to the diaphragm
4-**SCALENE-> (a triangle) having sides unequal in length.**
5- **linea alba-> The aponeurosis of the Anterior abdominal wall muscles on both sides fuse in the midline**

MUSCLES INVOLVED IN RESPIRATION





THORACIC CAGE:

thoracic cage is:

#Conical in shape.

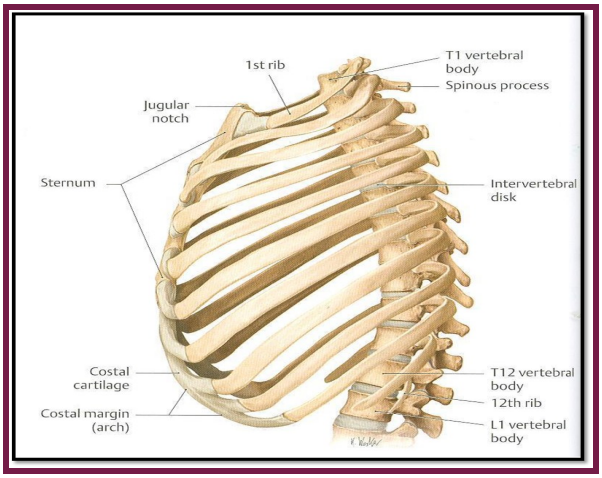
#Has 2 apertures (openings):

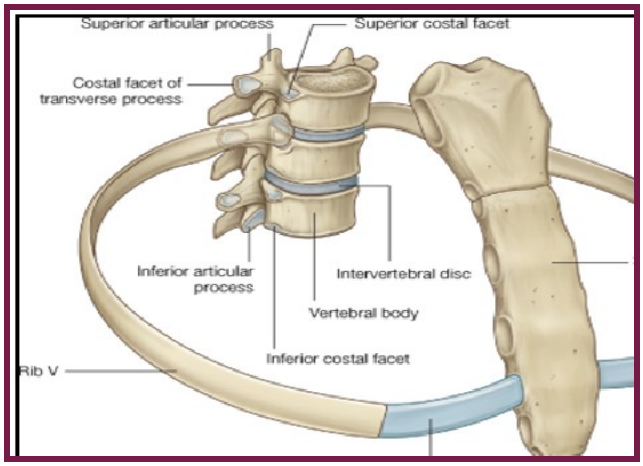
1. Superior *(thoracic outlet):* narrow, open, continuous with neck.
2. Inferior: wide, closed by diaphragm.

#Formed of:

1. Sternum & costal cartilages: *anteriorly.*
2. Twelve pairs of ribs: *laterally.*
3. Twelve thoracic vertebrae: *posteriorly.*

ARTICULATIONS

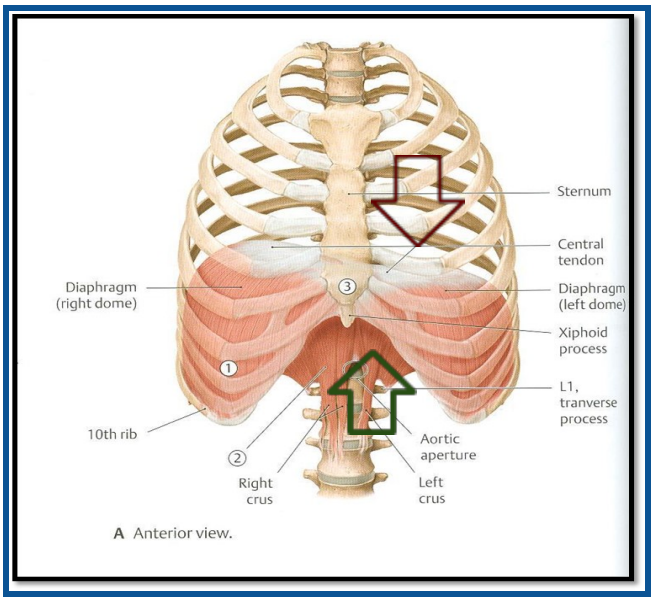




1. sternocostal:between costal cartilages and sternum.
2. costochondral:between costal cartilages & ribs.
3. costovertebral:between ribs & thoracic vertebrae.

Respiratory Movement

A- MOVEMENTS OF DIAPHRAGM:



Inspiration:

Contraction (descent) of diaphragm. leading to Increase of vertical diameter of thoracic cavity.

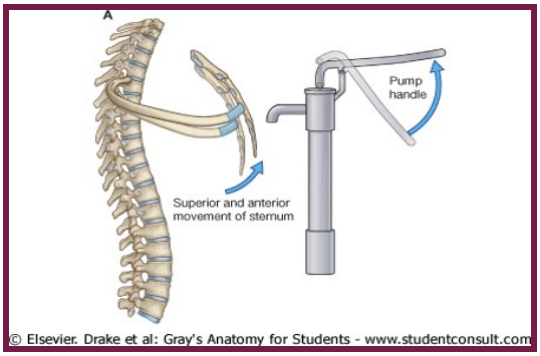
Expiration:

Relaxation (ascent) of diaphragm.

B- MOVEMENTS OF RIBS: (in normal inspiration)

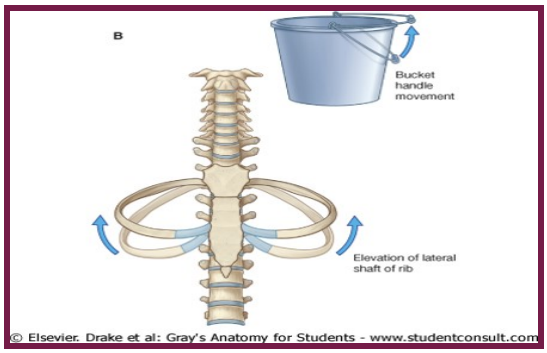
1. **PUMP HANDLE MOVEMENT:**

Elevation of ribs >> Increase in antero-posterior diameter of thoracic cavity.



2.BUCKET HANDLE MOVEMENT:

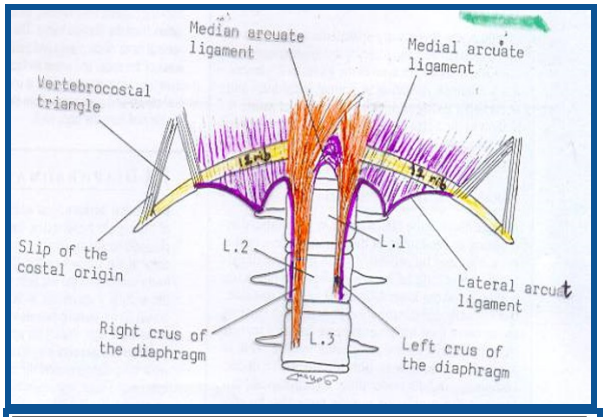
Elevation of ribs >> Increase in lateral diameter of thoracic cavity.



INSPIRATORY MUSCLES

- Diaphragm (most important muscle)
- Rib elevators: external intercostal muscles
- Accessory muscles (only during forced inspiration):

1. Muscles attaching cervical vertebrae to first & second rib: scalene muscles
2. Muscles attaching thoracic cage to upper limb: pectoralis major.

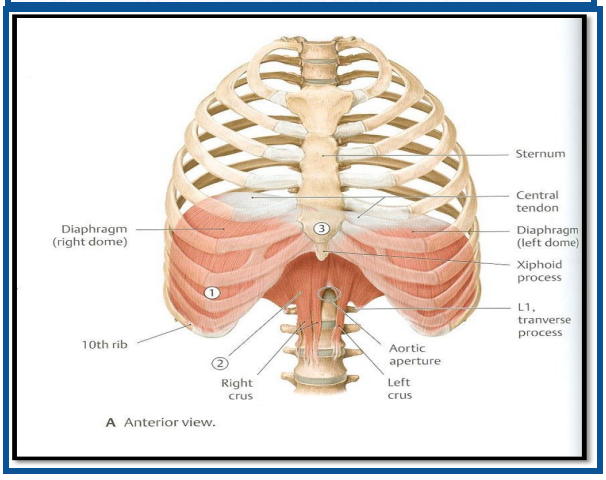


ORIGIN OF DIAPHRAGM:

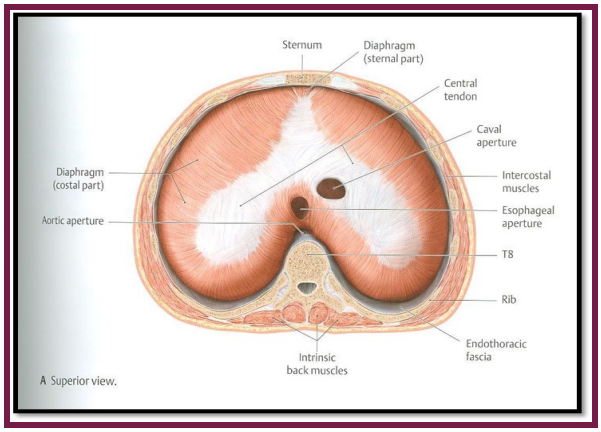
1) Costal: lower 6 costal cartilages

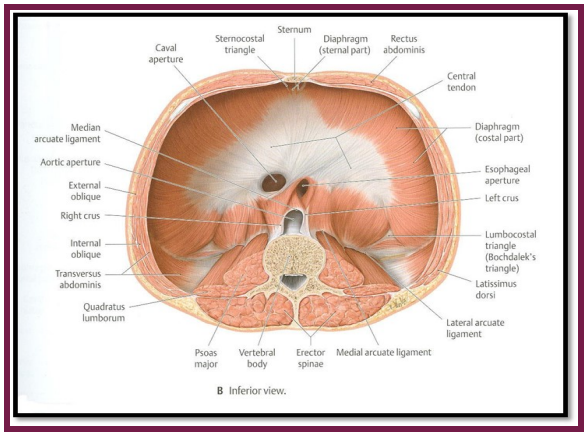
2) Vertebral: upper 3 lumbar vertebrae (right & left crus + arcuate ligaments)

3) Sternal: xiphoid process of sternum



INSERTION OF DIAPHRAGM (CENTRAL TENDON):



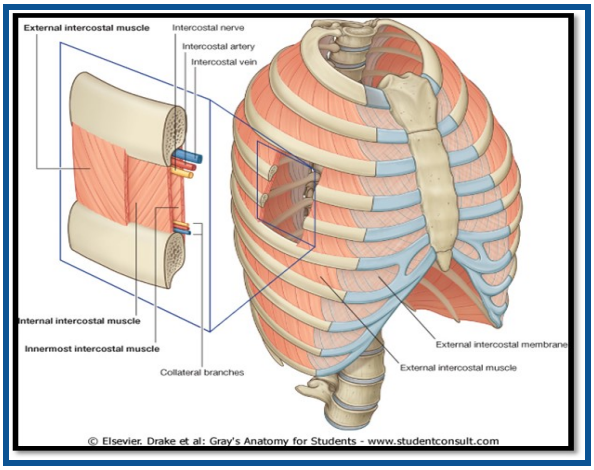


central tendon: lies at the level of xiphisternal joint, at 9th thoracic Vertebra

DIAPHRAGM:

- A musculotendinous partition between thoracic & abdominal cavity
- Convex toward thoracic & concave toward abdominal cavity
- Attached to: sternum, costal cartilages, 12th rib & lumbar vertebrae
- Fibers converge to join the central tendon
- Nerve supply: phrenic nerve (C3,4,5), penetrates diaphragm & innervates it from abdominal surface.

Action: contraction (descent) of diaphragm increase vertical diameter of thoracic cavity (essential for normal breathing)



EXTERNAL INTERCOSTAL(Inspiratory Muscle):

- Attachments: from lower border of rib above to upper border of rib below.
- Direction of fibers: downward & medially.
- Nerve supply: intercostal nerves.
- Action: rib elevators (inspiratory).

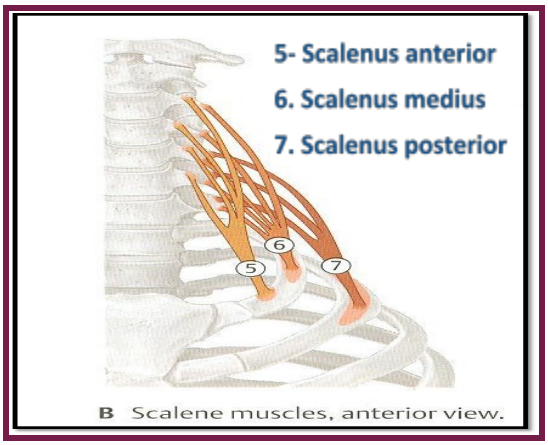
accessory muscles:

- **SCALENE MUSCLES(In Forced Inspiration):**

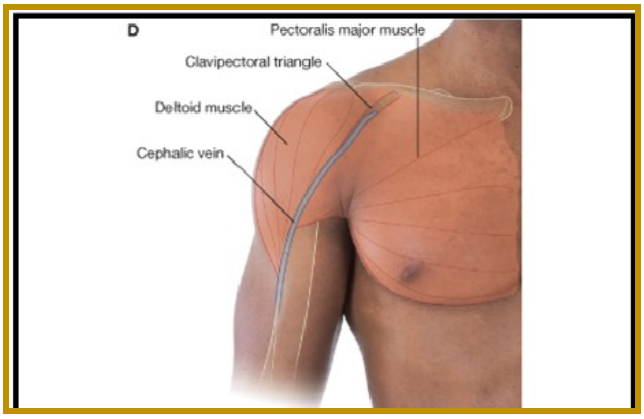
Origin: cervical vertebrae

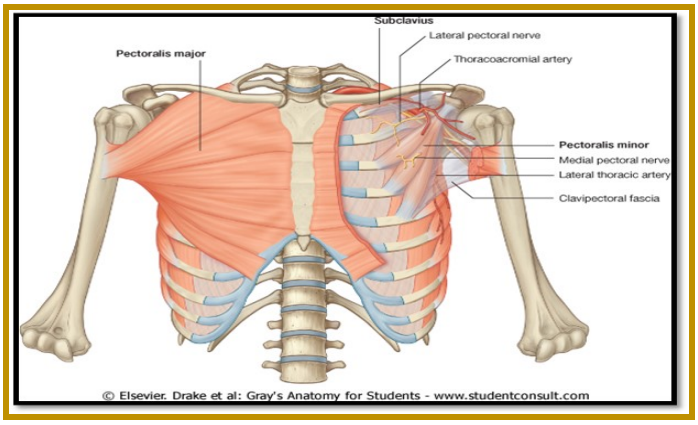
Insertion: 1st & 2nd ribs

Action: elevates 1st & 2nd ribs (inspiratory).



- **PECTORALIS MAJOR**(In Forced Inspiration):
- Origin: sternum + costal cartilages
- Insertion: humerus
- Action: increases antero-posterior diameter of thoracic cavity, when arm is fixed (inspiratory)





EXPIRATORY MUSCLES

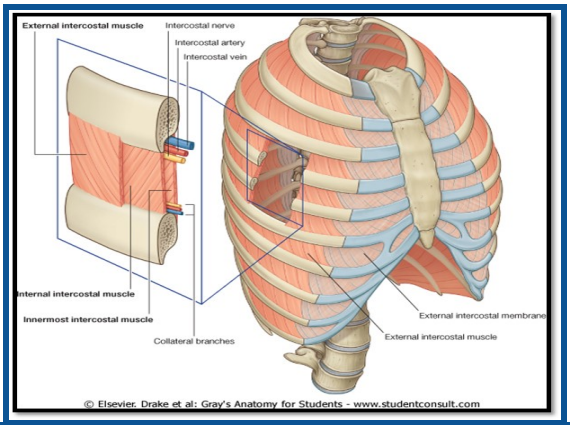
Act only during forced expiration.

•Rib depressors:

1. Internal intercostal
2. Innermost intercostal
3. Subcostals
4. Transversus thoracis

•Anterior abdominal wall muscles:

1. External oblique
2. Internal oblique
3. Transversus abdominis
4. Rectus abdominis

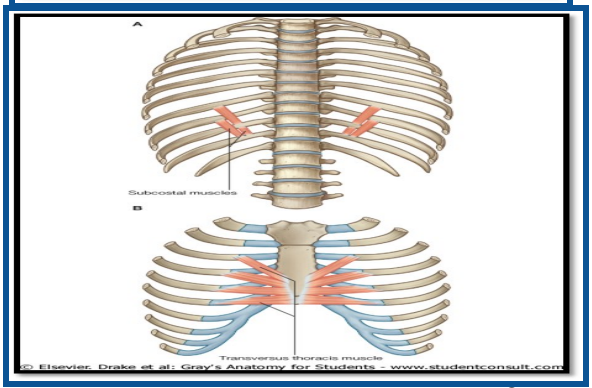


RIB DEPRESSORS: (REST OF INTERCOSTAL MUSCLES)

1. Internal intercostal
2. Innermost intercostal
3. Subcostal
4. Transversus thoracis

Direction: upward & medially.

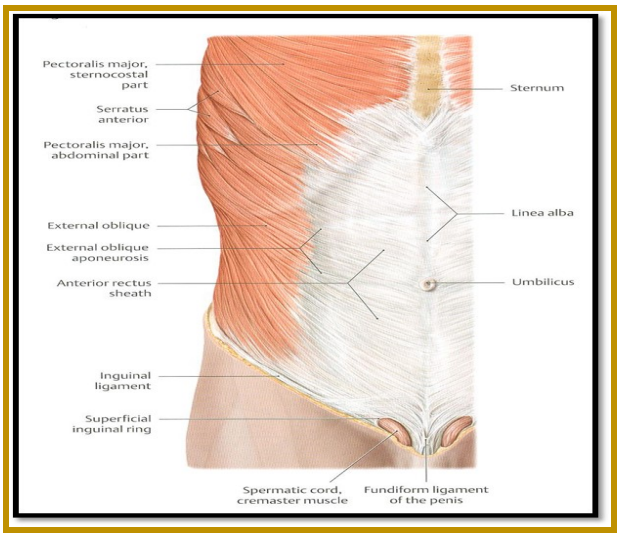
Nerve supply: intercostal nerves (ventral rami of T1-T11)



MUSCLE OF THE ANTERIOR ABDOMINAL WALL:

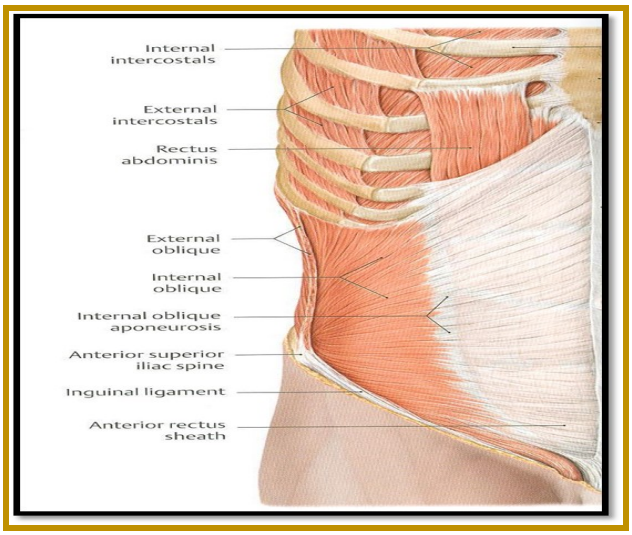
- External oblique (outer layer)

Direction: downward & medially.



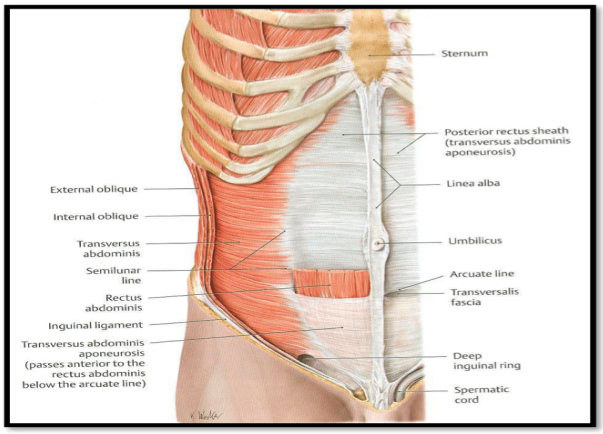
Internal oblique (middle layer)

Direction: upward & medially.



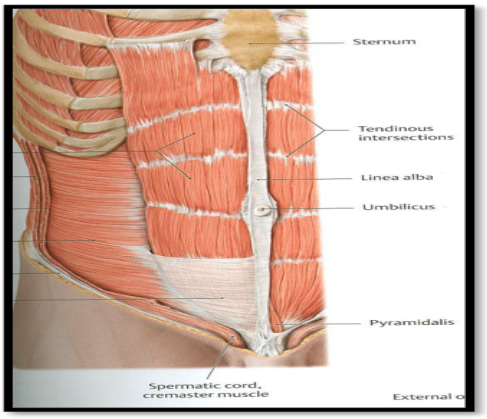
- Transversus abdominis (inner layer)

Direction: transverse.



Rectus abdominis

Direction: vertical.



ANTERIOR ABDOMINAL WALL:

1. Is formed of 3 layers of muscles of fibers running in different directions (to increase strength of anterior abdominal wall)
2. The 3 muscles form a sheath in which a fourth muscles lies (rectus abdominis)
3. Muscles are attached to: sternum, costal cartilages and ribs + hip bones
4. The aponeurosis of the 3 muscles on both sides fuse in the midline to form **linea alba**
5. Action (during forced expiration): Compression of abdominal viscera to help in ascent of diaphragm (during forced expiration)
6. Nerve supply: lower intercostal nerves (T7 – T11), subcostal nerve (T12) and first lumbar nerve.

INSPIRATORY MUSCLES	EXPIRATORY MUSCLES

• **Diaphragm** (most important muscle)
• **Rib elevators:** ***external intercostal muscles***
• **Accessory muscles** (only during forced inspiration):
  • Muscles attaching cervical vertebrae to first & second rib: ***scalene muscles***
  • Muscles attaching thoracic cage to upper limb: ***pectoralis major***
	Rib depressors :
	1. Internal intercostal
	2. Innermost intercostal
	3. Subcostals
	4. Transversus thoracis
	
	Anterior abdominal wall muscles :
	1. External oblique
	2. Internal oblique
	3. Transversus abdominis
	4. Rectus abdominis

1- The posterior wall of the thoracic cage is made up of:

A. 10 thoracic vertebrae
B. 12 thoracic vertebrae
C. Sternum
D. 12 pairs of ribs

2- The articulation between the vertebrae and the rib is called:

A. Vertebral ligaments
B. Costal ligaments
C. Costovertebral articulation
D. Costochondral articulation

3- During inspiration the diaphragm ....., and the vertical diameter ..... :

A. Contracts, decreases
B. Contracts, increases
C. Relaxes, decreases
D. Relaxes, increases

4- The most important muscle in inspiration is :

A. External intercostal
B. Scalene muscle
C. Pectoralis major
D. Diaphragm

5- Which one is the vertebral origin of the diaphragm :

A. Lower 6 ribs and Xiphoid process
B. Lower 3 thoracic vertebrae and upper 2 lumbar vertebrae
C. Central tendon of the diaphragm
D. Right and left crus and the arcuate ligaments

6- The direction of fiber in the external intercostal is :

A. Downward and medially
B. Downward and laterally
C. upward and medially
D. upward and laterally

7- Which one of the scalene muscles attaches to the 2nd rib:

A. Scalenus anterior
B. Scalenus posterior
C. Scalenus medius
D. Scalenus minimus

8- Pectoralis major is an ..... muscle and it ..... diameter :

A. Expiratory, decreases the antero-posterior
B. Expiratory, decreases the vertical
C. Inspiratory, increases the antero-posterior
D. inspiratory, increase the vertical

9- Which one of these muscles is NOT an anterior abdominal wall muscle :

A. Rectus abdominis
B. internal oblique
C. External oblique
D. Transverse thoracis

10- During quiet expiration (passive) which action is true :

A. Elastic recoil of the lung
B. Contraction of anterior abdominal wall muscles
C. Descend of diaphragm
D. Elevation of ribs

Done by Anatomy Team ^_*