

# Pranayama

Teachers Training

Level 1 2023

Anatomy & Physiology

Class 3

Effects of the Pranayama

from the

Level 1 Class Protocol



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ॐ ॐ ॐ

श्री गुरुभ्यो नमः हरिः ॐ

Om Om Om

Sri Gurubhyo Namah Harih Om

Salutations to the Gurus!

ॐ सह नाववतु ।  
सह नौ भुनक्तु ।  
सह वीर्यं करवावहै ।  
तेजस्वि नावधीतमस्तु मा विद्विषावहै ।  
ॐ शान्तिः शान्तिः शान्तिः ॥

oṃ saha nāvavatu saha nau bhunaktu  
saha vīryaṃ karavāvahai  
tejasvi nāvadhītamastu mā vidviṣāvahai  
oṃ śāntiḥ śāntiḥ śāntiḥ

May that Brahman protect us together. May it nourish us together. May we both gain great vitality. May our learning be brilliant. May we never argue. Om peace, peace, peace.

# Pranayama - Levels of Organization

## 1. Causal - Karana Sharira

Source - point of origin and return / Universe breathes itself into creation.

## 2. Subtle - Sukshma Sharira

Pranas, Nadis, Indriyas, Antahkarana / Lying down and relax, less effort, more effort more 'ahamkara' involved will build tension.

## 3. Physical - Sthula Sharira

### 1. Biomechanical

Respiratory, Cardiovascular, Myofascial & Lymphatic Systems

### 2. Biochemistry

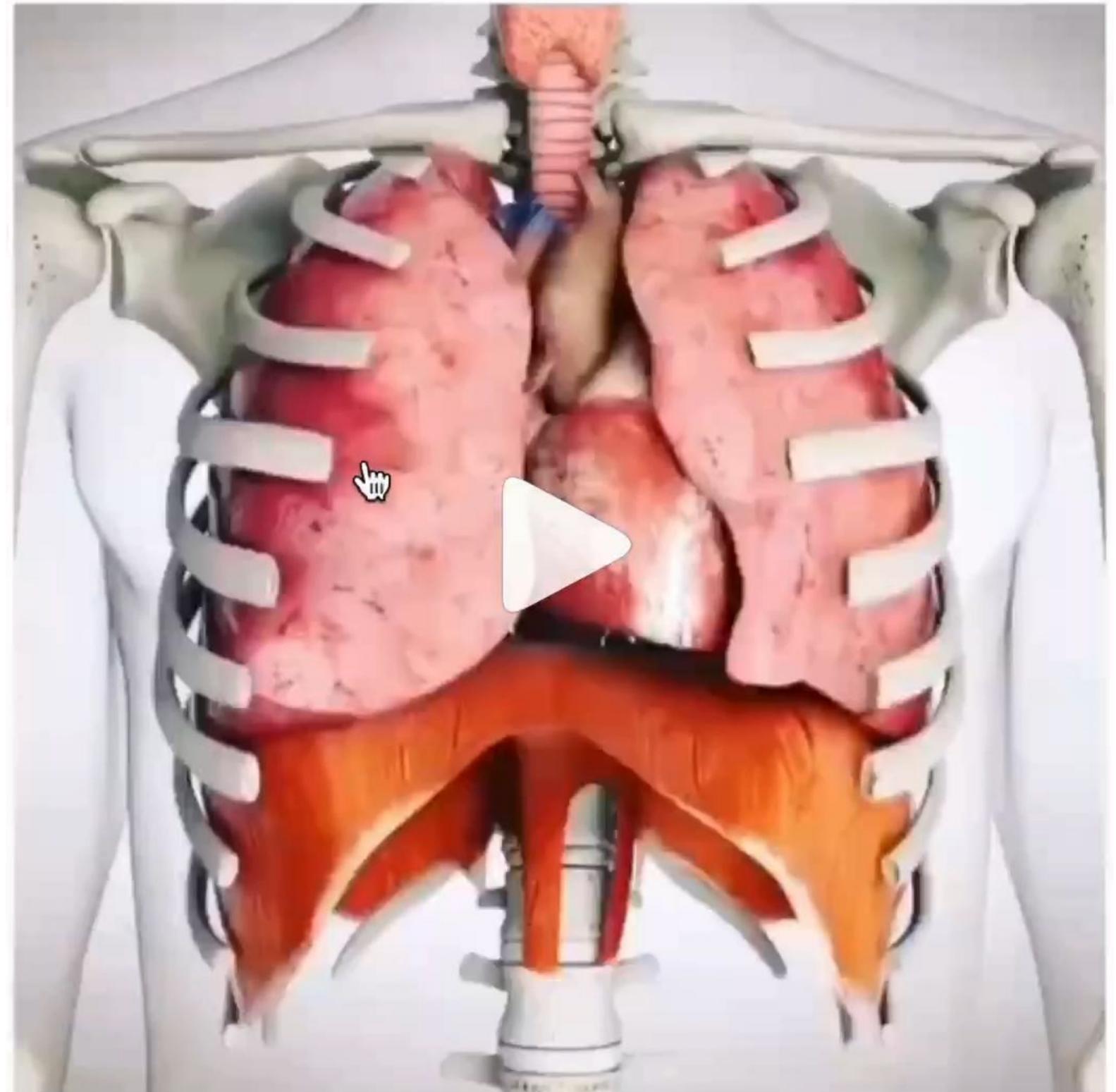
Oxygen, Carbon dioxide, Nitric oxide, Blood pH

### 3. Psychophysiology

Nervous and Endocrine Systems

# Biomechanics

1. Contraindications for lying on your back
2. Internal organ pressures
3. Lung surface area
4. Alternatives:
  - Propping back with pillows
  - Leaning against a wall with pillows



Source: Unknown Instagram

# Respiratory System - Nose to pharynx

Nose

Nasal cavity

Nasal sinuses

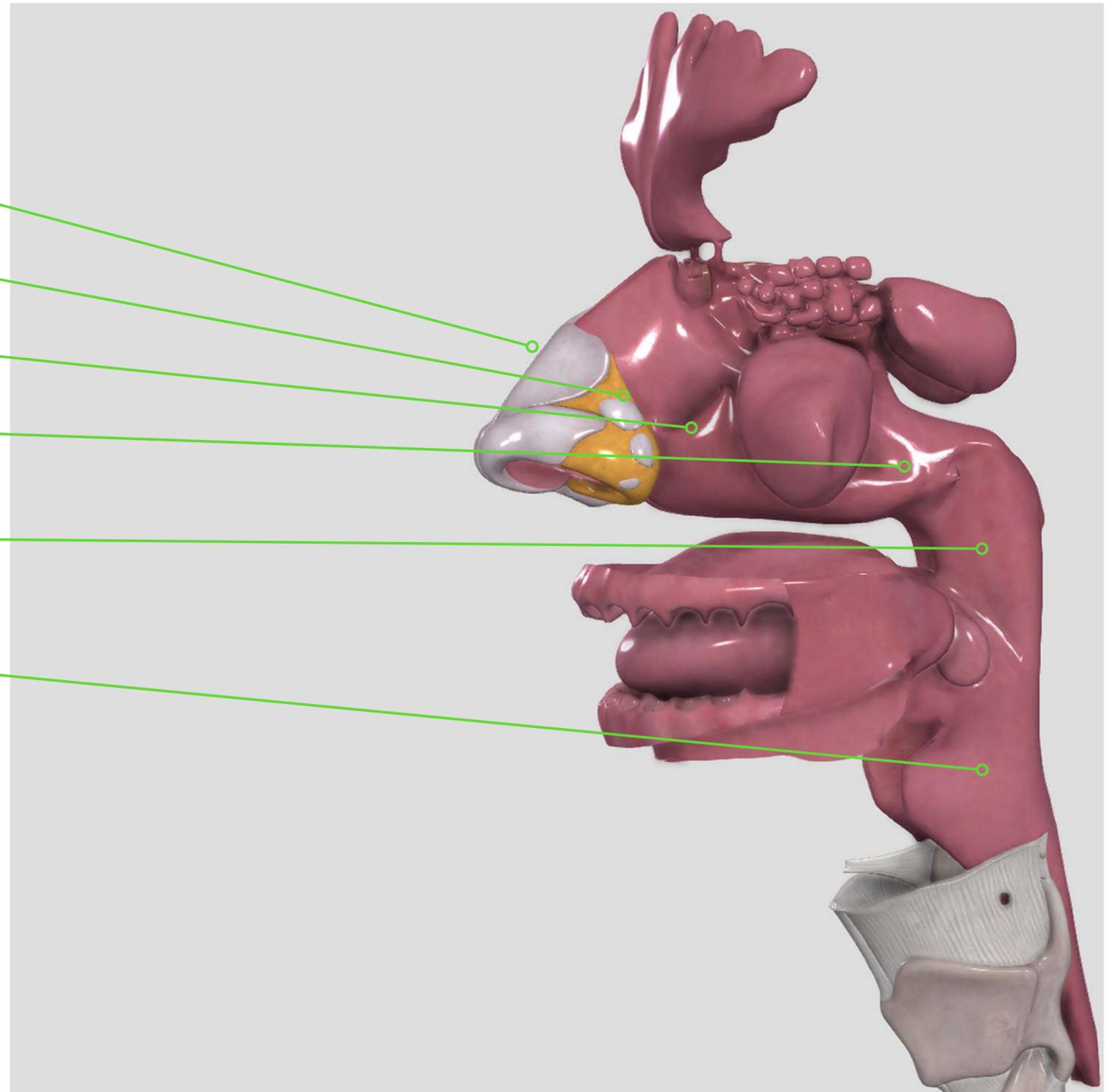
Nasopharynx

Oropharynx

Laryngopharynx

**Will cover in more detail later**

Nasal cavities is where the sound of humming occurs and also where Nitric Oxide is generated and transported



# Respiratory System - Larynx, trachea, bronchi, lungs

Larynx (voice box)

Trachea

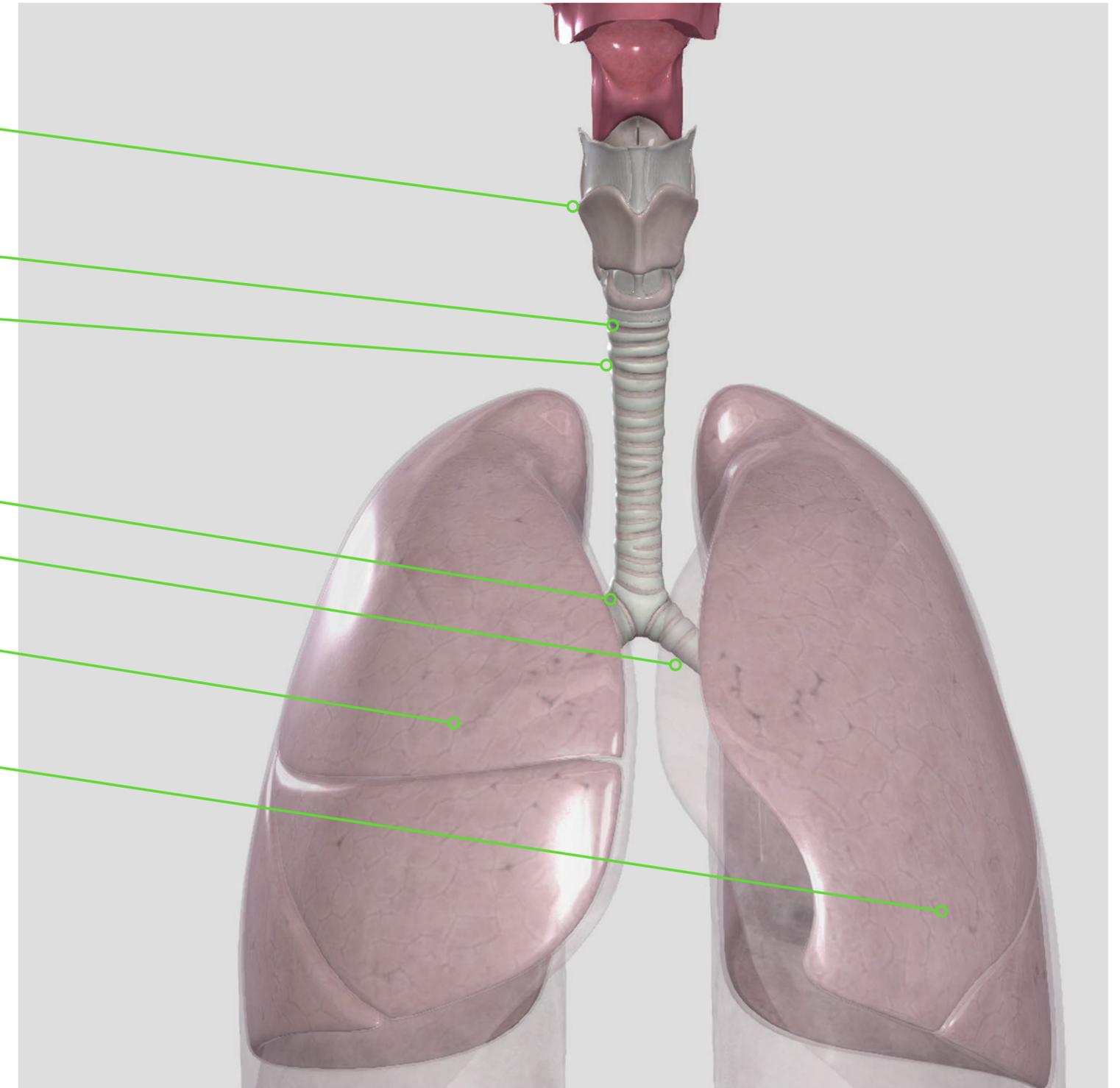
Tracheal cartilages

Bronchi

Right lung

Left lung

Humming will start larynx and trachea and it occurs due to internal pressure changes



# Respiratory System - Bronchi

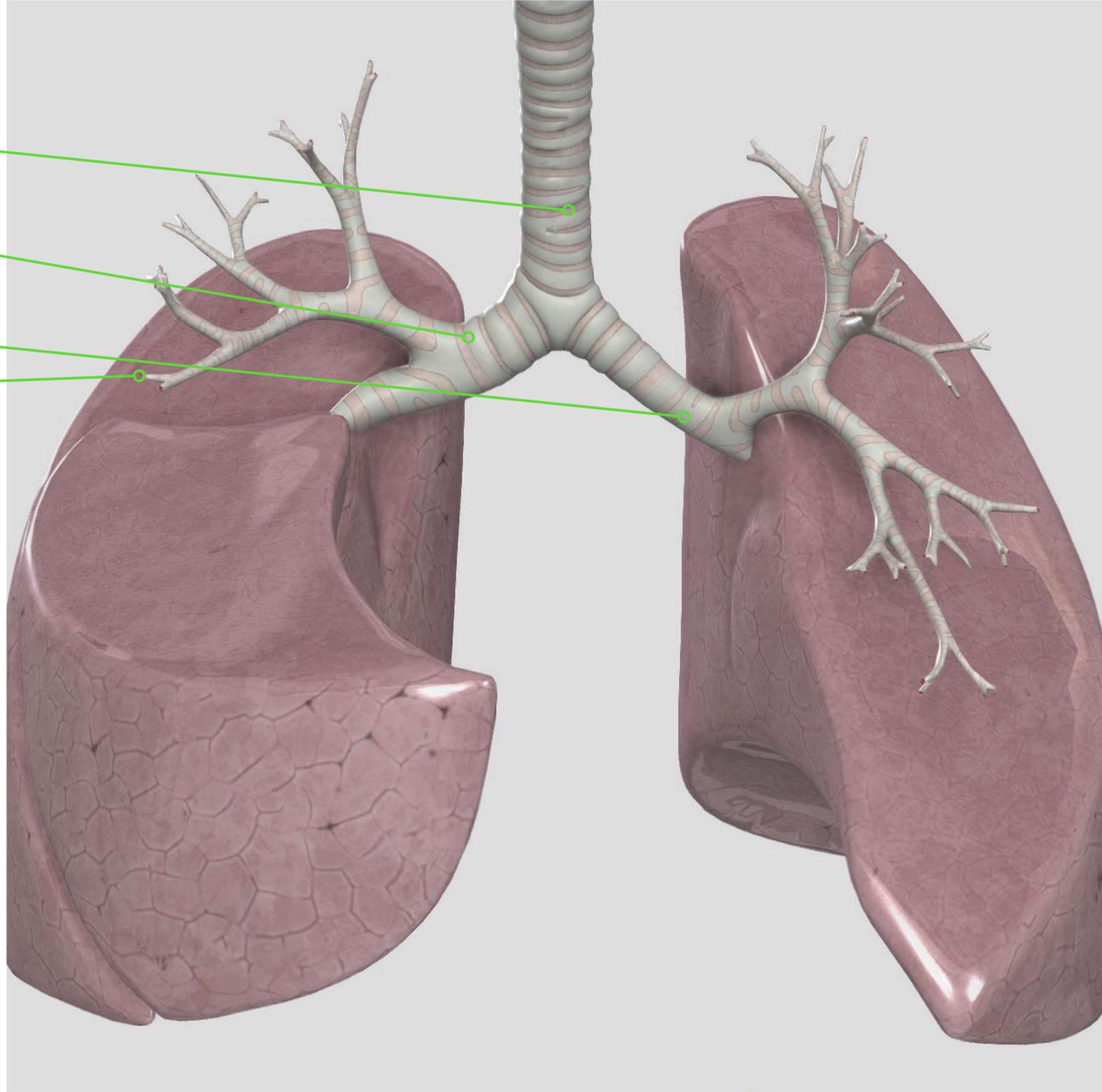
Trachea

Right main bronchus

Left main bronchus

Bronchial tree

Slow even breathing in a calm and steady manner trains the relaxation mechanism of the bronchial tubes



# Respiratory System - Bronchial tree & alveoli

Branch of pulmonary vein

Branch of pulmonary artery

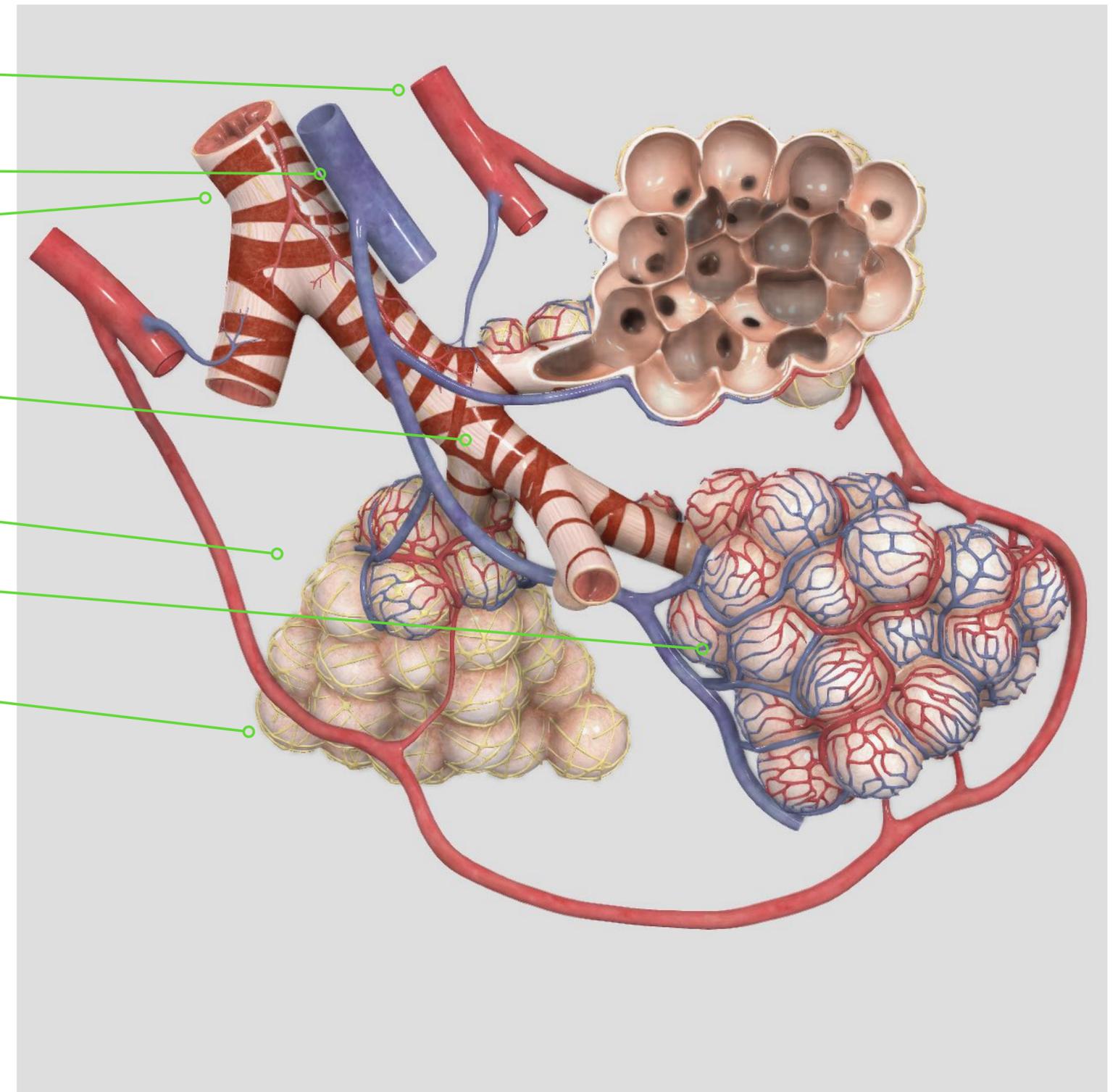
Terminal bronchiole

Respiratory bronchiole

Alveoli

Capillary network

Elastic fibers



Kaplabhati potentially same effect as the mechanism of the double sigh

All the long slow deliberate breaths are like stretching for everything in your lungs

# Thorax and abdomen: Effect on the internal organs

Larynx

Trachea

Right lung

Left lung

Heart

Diaphragm

Liver

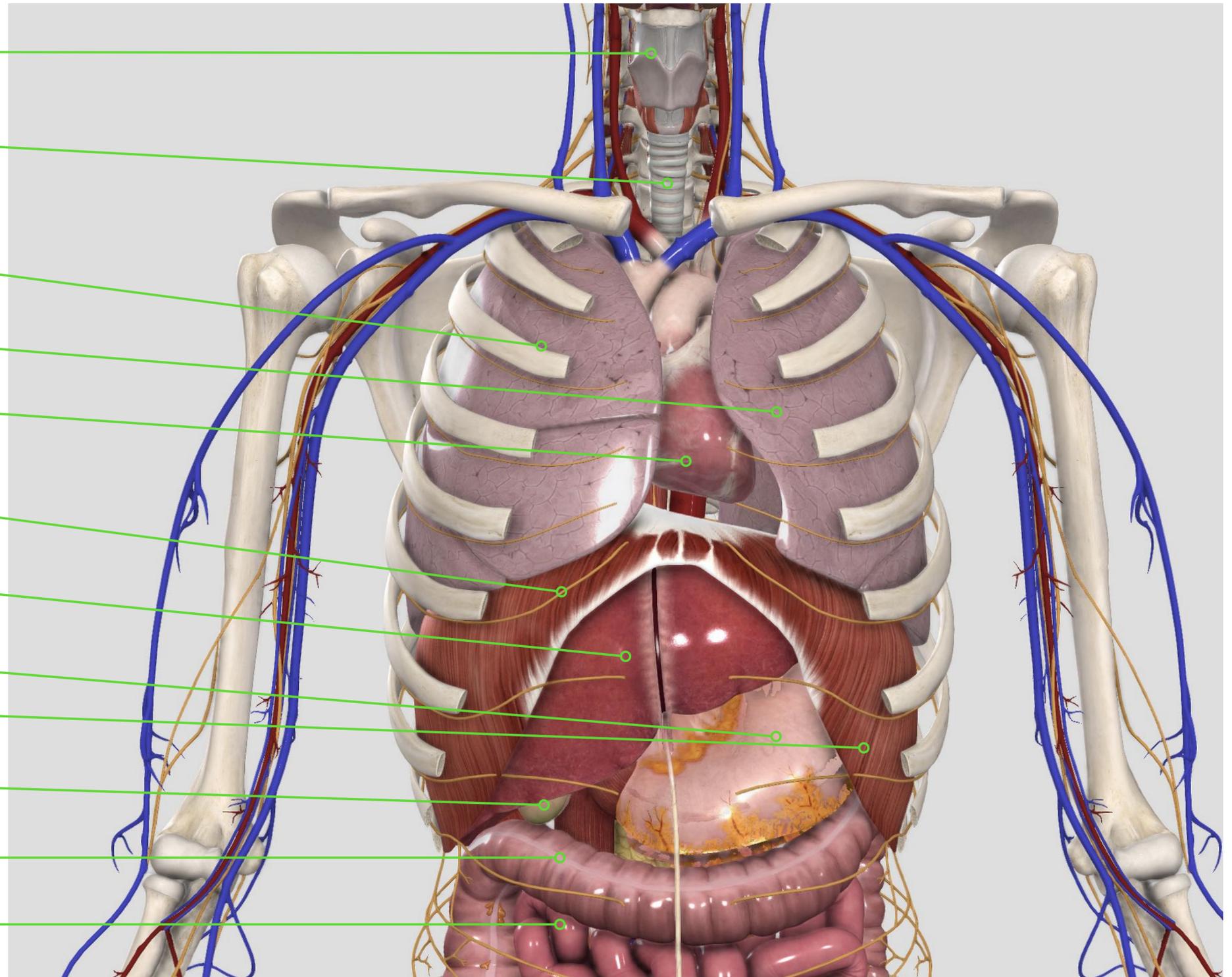
Stomach

Spleen

Gall bladder

Large intestine

Small Intestine



# Muscles of the respiratory system

Scalenes

Sternocleidomastoids

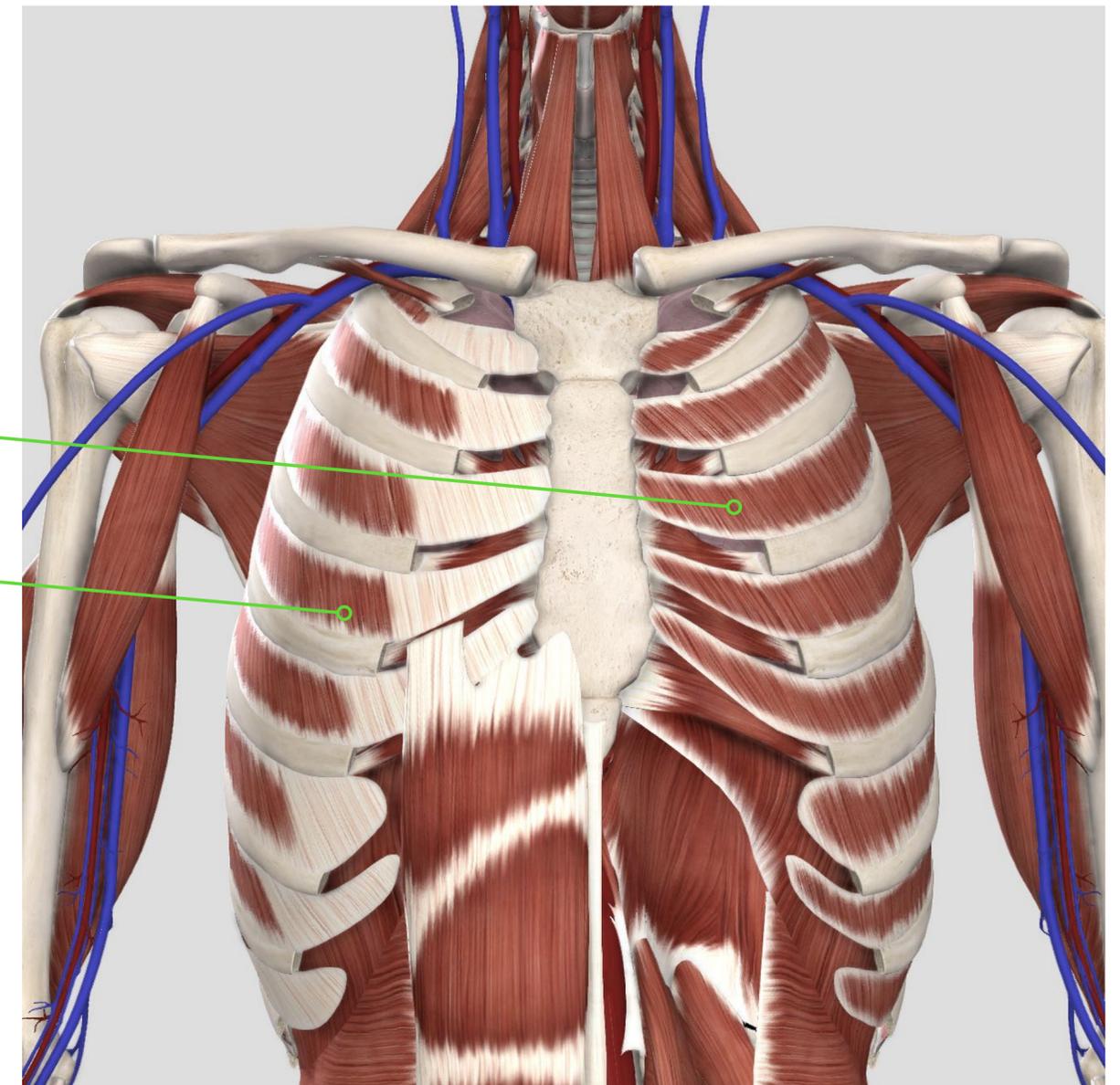
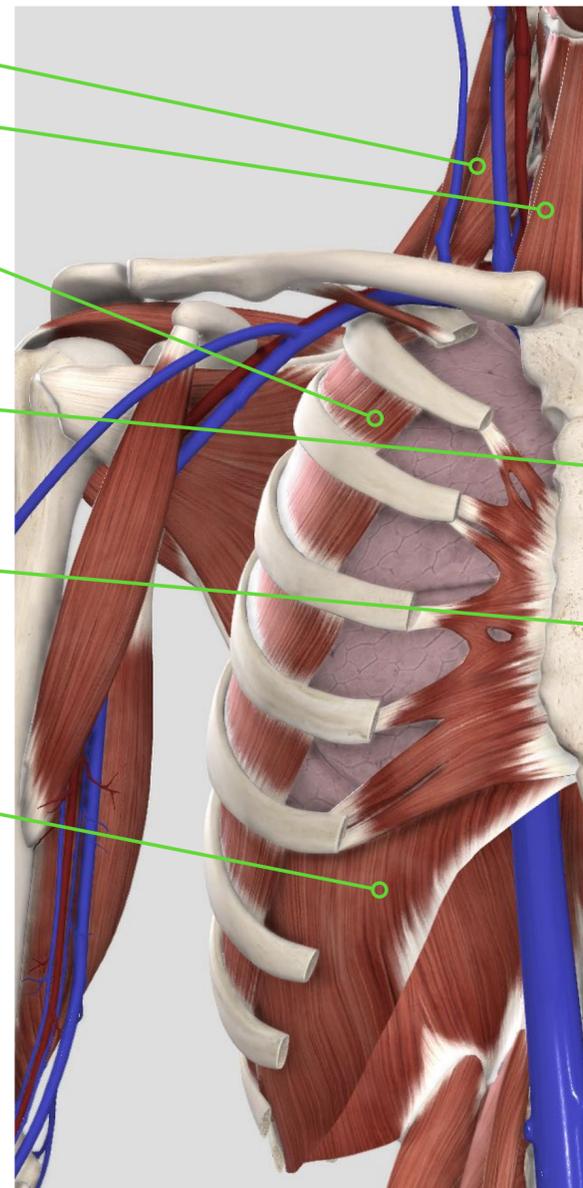
Inner internal intercostals

Internal intercostals

External intercostals

Diaphragm

The pranayama will help keep the connective tissues, joints and muscles supple



# Intercostal muscles

## Inner internal intercostals

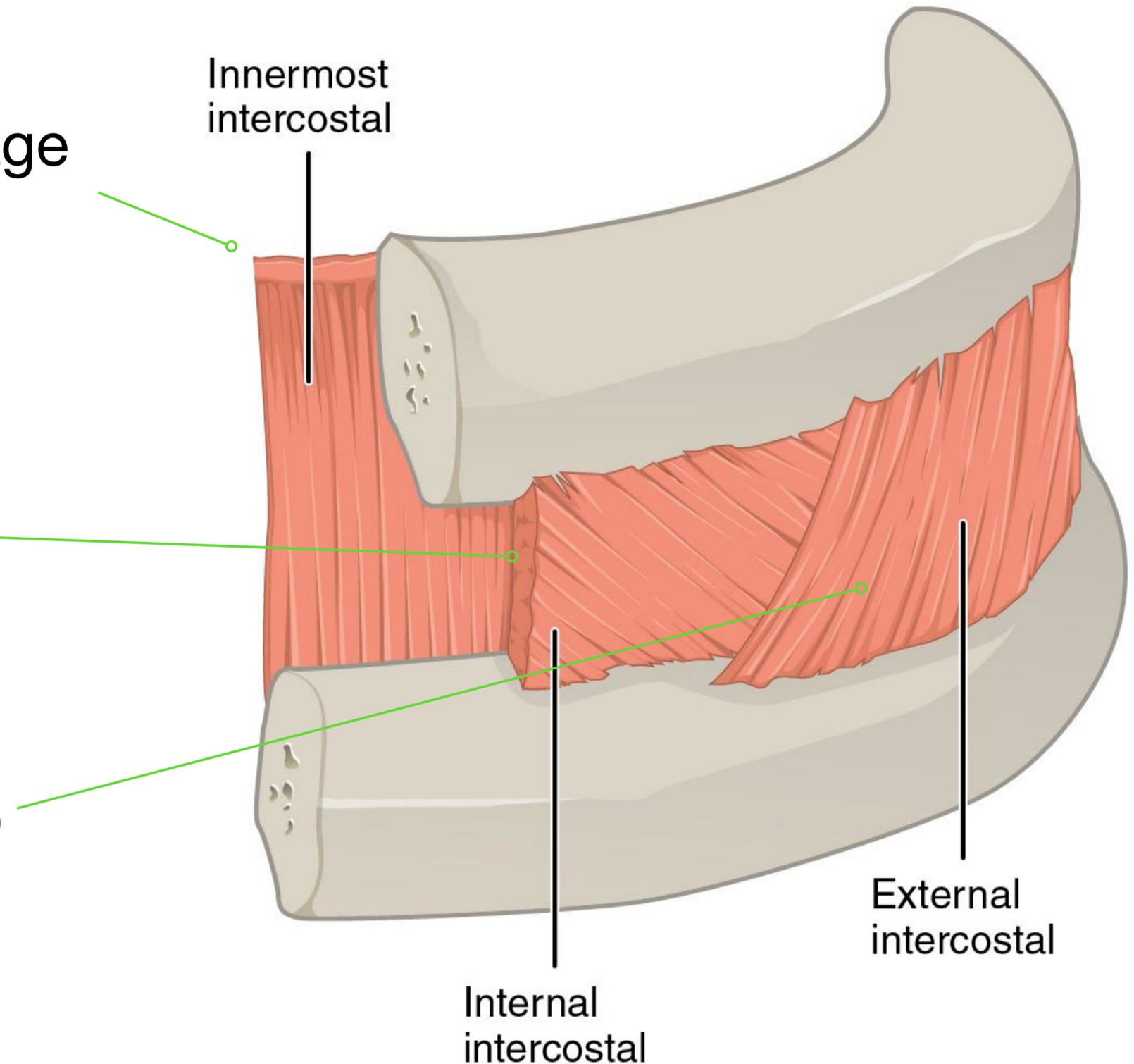
(Not present higher up in the rib cage and aid in forced expiration -quiet expiration is passive)

## Internal intercostals

(Aid in forced expiration)

## External intercostals

(Aid in quiet and forced inspiration)



# Pleurals

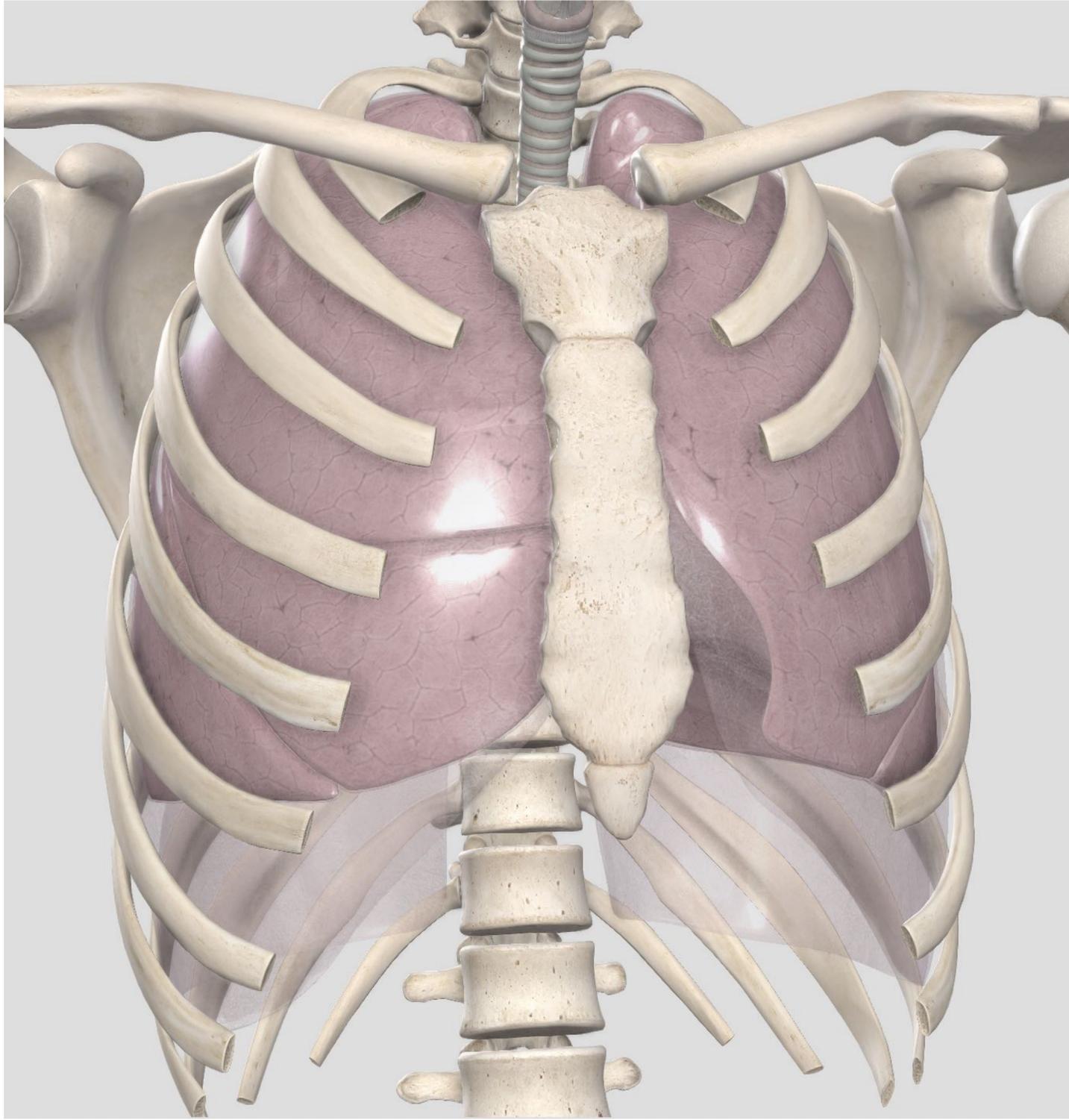
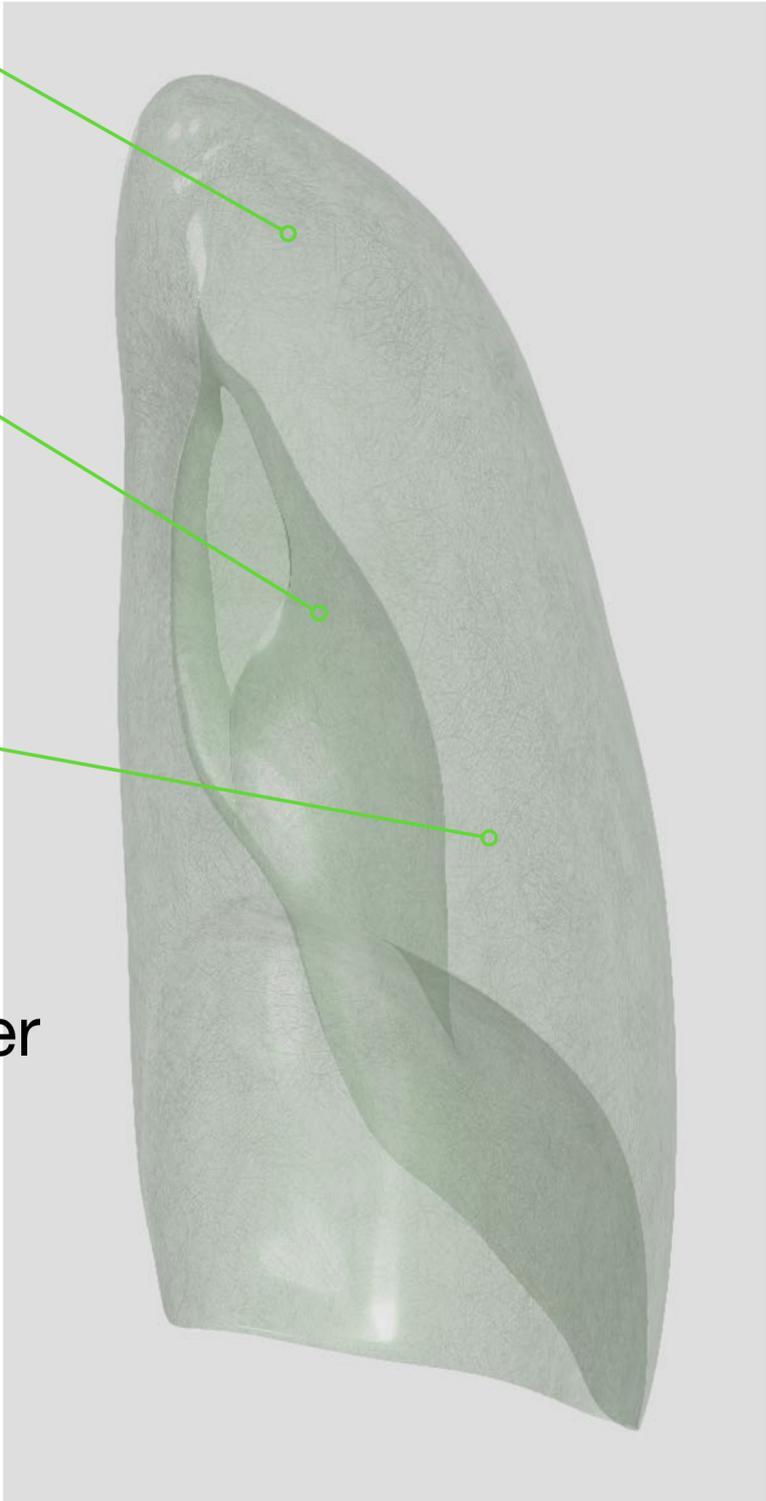
Outer parietal layer

Inner visceral layer

Pleural cavity

(serous fluid)

Deliberate movement keeps fluids circulating and healthy. Flowing river is healthy, if blocked it stagnates



# Pressures balance the pairs of opposites

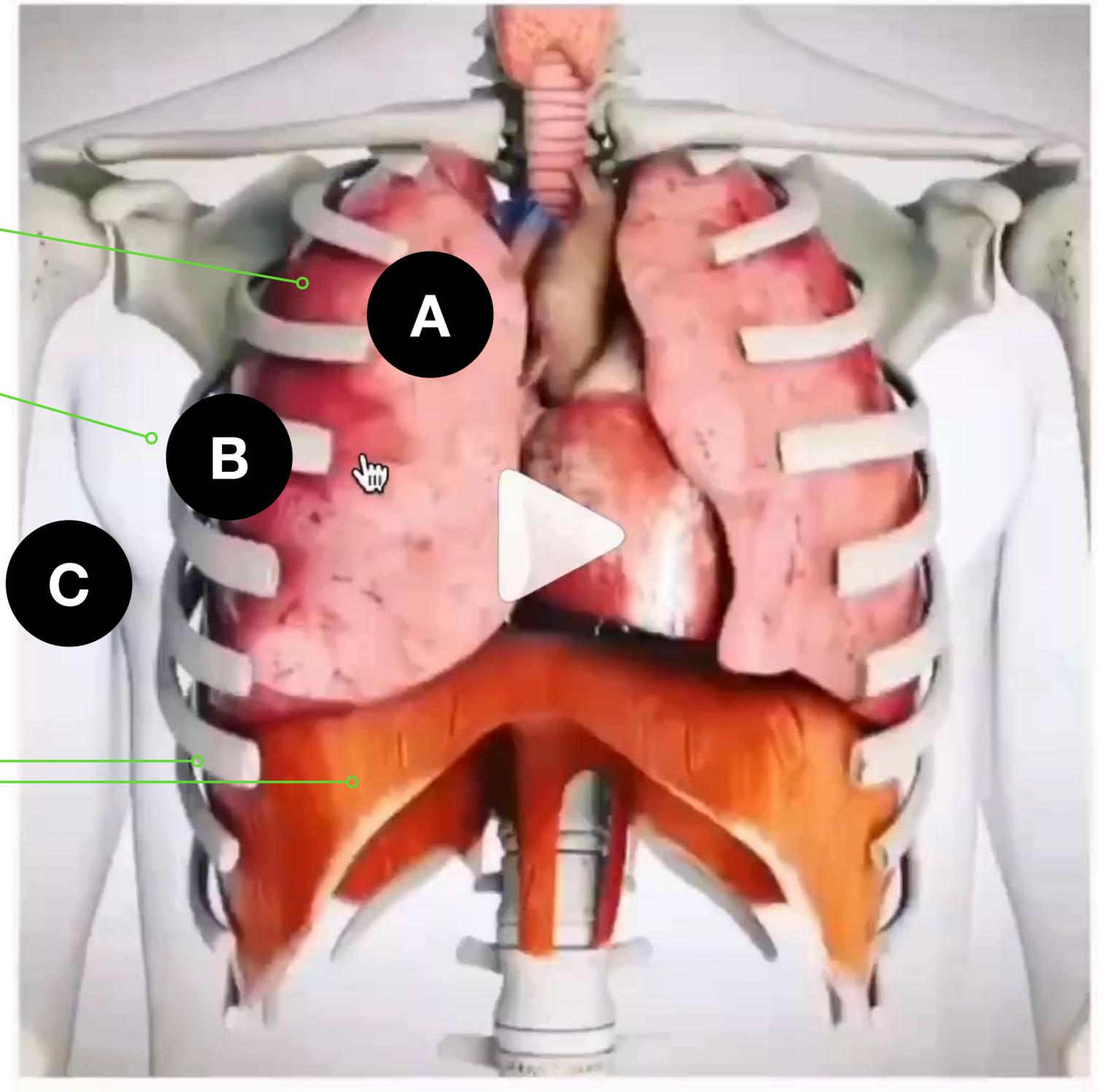
A = Intra pulmonary pressure  
Pressure in the alveoli  
(Intra-alveolar pressure).

B= Intra pleural pressure  
Pressure between the pleura

C = Atmospheric pressure  
or Barometric pressure  
Pressure outside the body

Ribs with intercostals, diaphragm

Nature appears to be an interplay of  
complementary forces. An exercise for eg.



# Boyle's Law

1. Boyle's law is often used as part of an explanation of how the breathing system works in the human body in conjunction with the external environment
2. Air must flow in to equalize the pressure within the lungs to the atmospheric pressure outside the body
3. Simply put this means that when the thoracic cavity expands the volume increases and the atmospheric pressure within the lungs decreases

# Boyle's Law

1. The opposite occurs on the exhalation
2. When the thoracic cavity contracts the volume decreases and the atmospheric pressure within increases
3. Air must flow out to equalize the pressure within the lungs to the atmospheric pressure outside the body
  1. **More space - Oxygen in**
  2. **Less space - Carbon dioxide out**

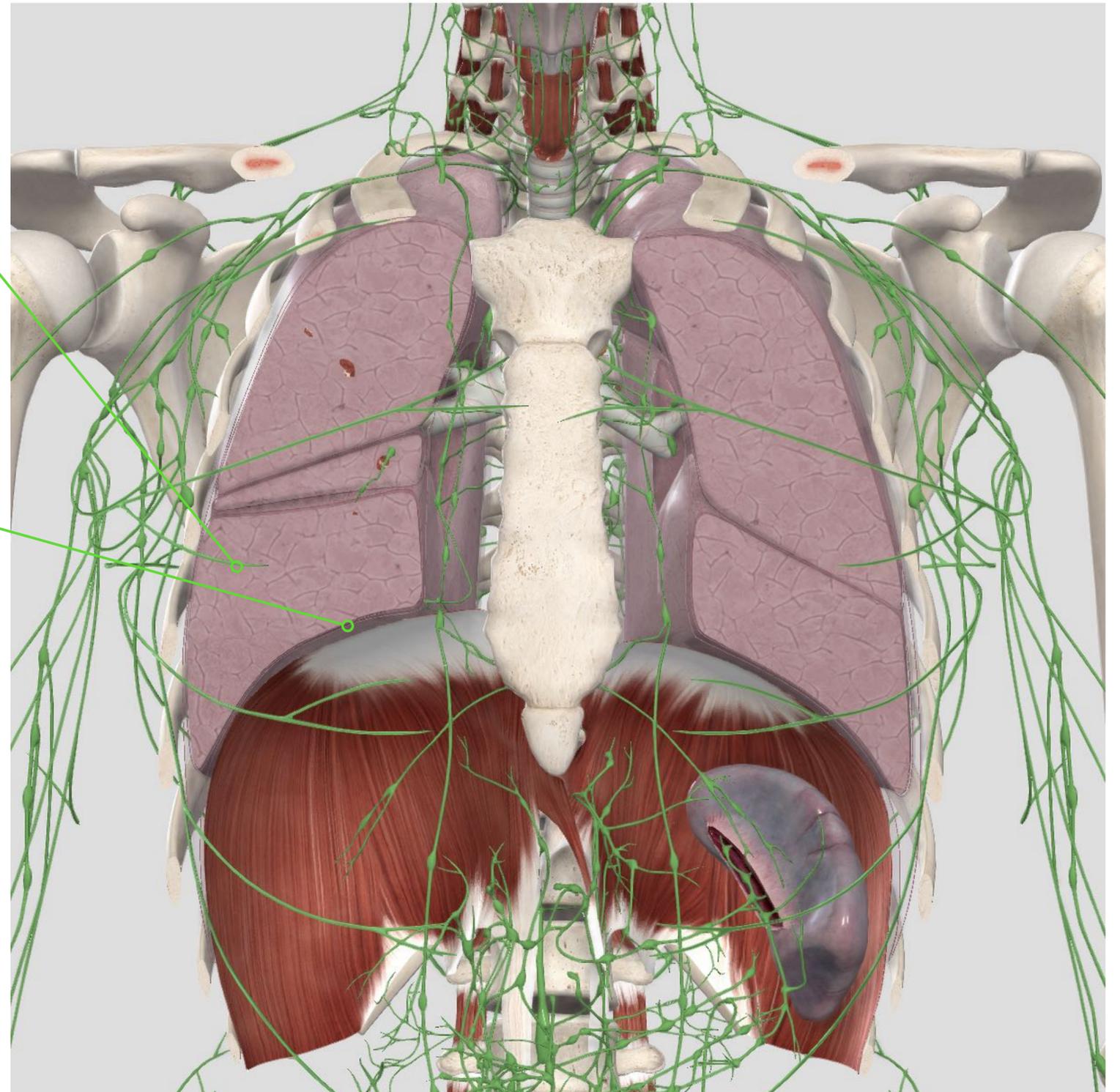
*Boyle's Law states that a fixed mass of an ideal gas kept at a fixed temperature, pressure and volume are inversely proportional (reference)*

# Lymphatic drainage & gravity

Lymphatic fluid is constantly being drained from the intrapleural cavity to help maintain pressure balance

Gravity tends to pull the diaphragm downwards and the pressure in the the intrapleural cavity is thus not uniform throughout.

The deliberate action of pranayama will expand the muscular action of the diaphragm supporting drainage and circulation



# References

1. <https://3d4medical.com> The App used in the Lessons.

Illustrations used in the slides are from **Complete Anatomy** by Elsevier unless otherwise noted

2. [https://en.wikipedia.org/wiki/Main\\_Page](https://en.wikipedia.org/wiki/Main_Page)

3. <https://www.ninjanerd.org>

Respiration: <https://www.ninjanerd.org/lecture-category/respiratory>

4. Crash Course in Anatomy & Physiology: YouTube channel: <https://www.youtube.com/watch?v=uBG12BujkPQ>

Crash Course in Anatomy & Physiology: Respiration

Part 1: <https://youtu.be/bHZsvBdUC2I> Part 2: <https://youtu.be/Cqt4LjHnMEA>

5. <https://www.alilamedicalmedia.com>

6. <https://teachmeanatomy.info>

7. <https://elitehrv.com>

ॐ सर्वे भवन्तु सुखिनः  
सर्वे सन्तु निरामयाः ।  
सर्वे भद्राणि पश्यन्तु  
मा कश्चिद्दुःखभाग्भवेत् ।  
ॐ शान्तिः शान्तिः शान्तिः ॥

oṃ sarve bhavantu sukhinaḥ  
sarve santu nirāmayāḥ  
sarve bhadrāṇi paśyantu  
mā kaścid duḥkha bhāgbhavet  
oṃ śāntiḥ śāntiḥ śāntiḥ

May all be happy, may all be free from disease, may all see goodness,  
may none suffer from sorrow.

ॐ असतो मा सद्गमय ।  
तमसो मा ज्योतिर्गमय ।  
मृत्योर्मा अमृतं गमय ।  
ॐ शान्तिः शान्तिः शान्तिः ॥ हरिः ॐ तत्सत् ॥

asato mā sadgamaya  
tamasomā jyotir gamaya  
mrityormāamritam gamaya  
Om śhānti śhānti śhāntiḥ harih om tat sat

Lead me from changing existence to unchanging being,  
lead me from the darkness of tamas to the light of knowledge,  
lead me from death to immortality. Harih om that is truth.