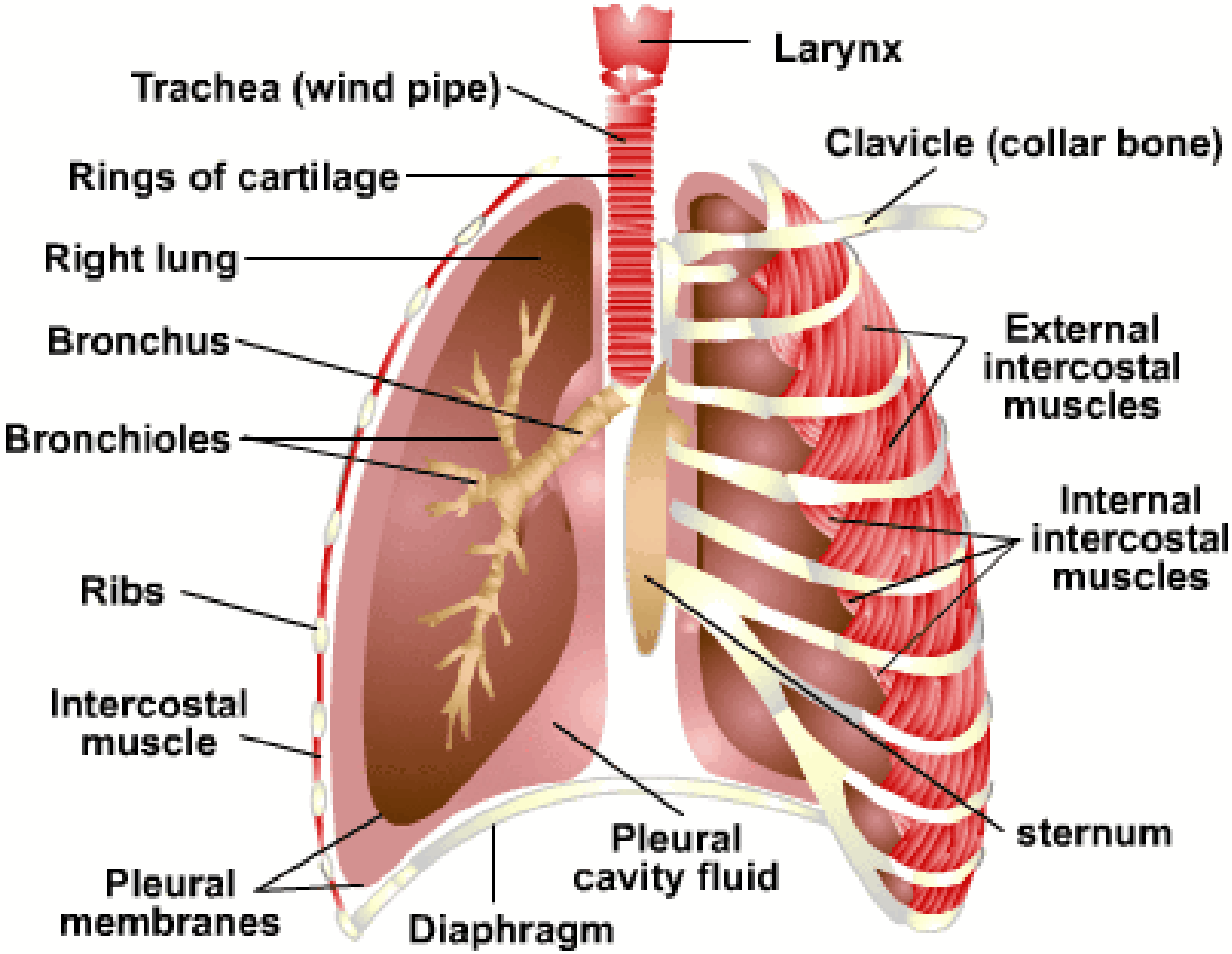
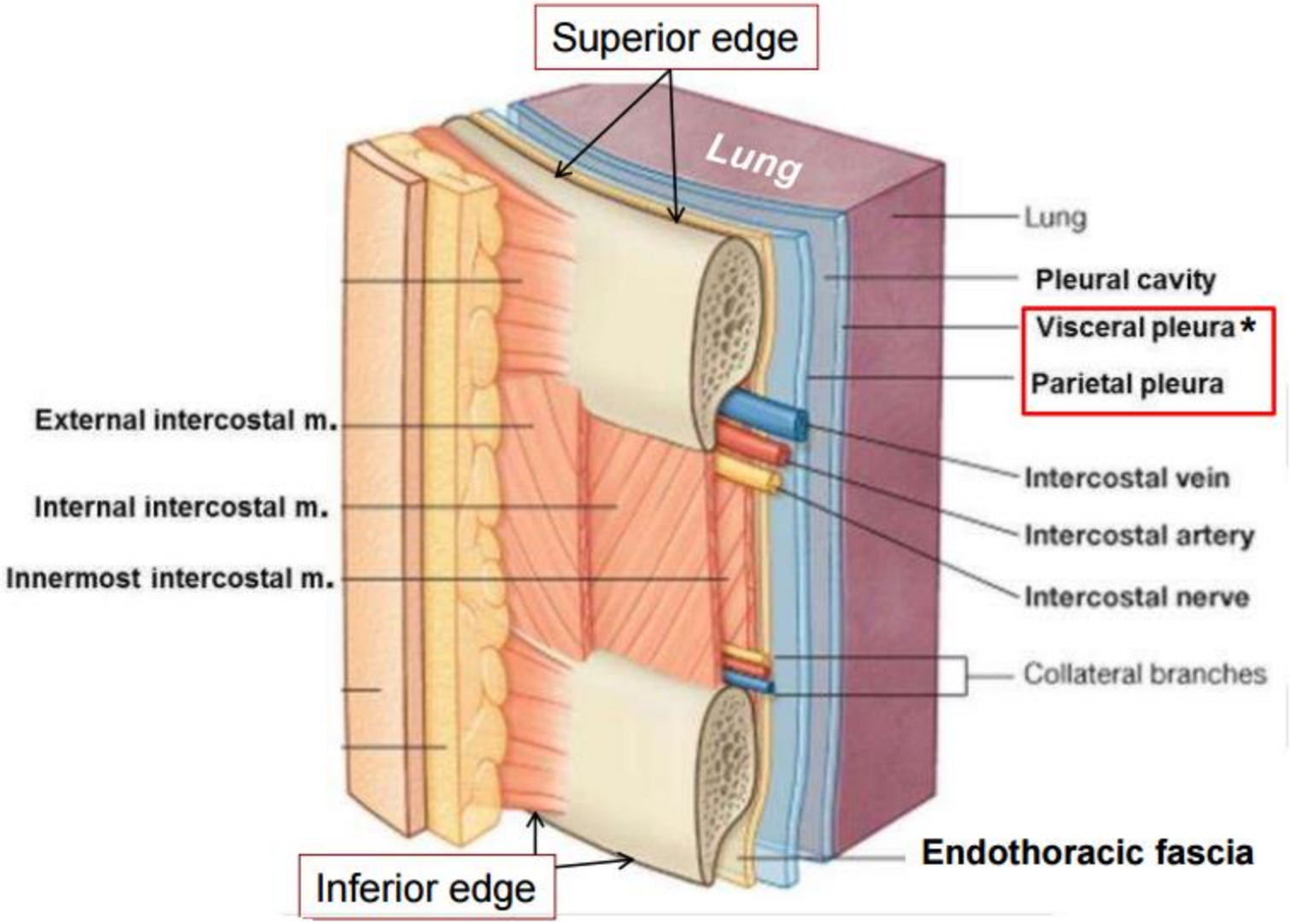
Mechanism of breathing


Larynx
Trachea (wind pipe)
Clavicle (collar bone)
Rings of cartilage
Right lung
Bronchus
External intercostal muscles
Bronchioles
Internal intercostal muscles
Ribs
Intercostal muscle
sternum
Pleural cavity fluid
Pleural membranes
Diaphragm


Superior edge
Lung
Lung
Pleural cavity
Visceral pleura *
Parietal pleura
External intercostal m.
Internal intercostal m.
Innermost intercostal m.
Intercostal vein
Intercostal artery
Intercostal nerve
Collateral branches
Endothoracic fascia
Inferior edge

Mechanism of breathing

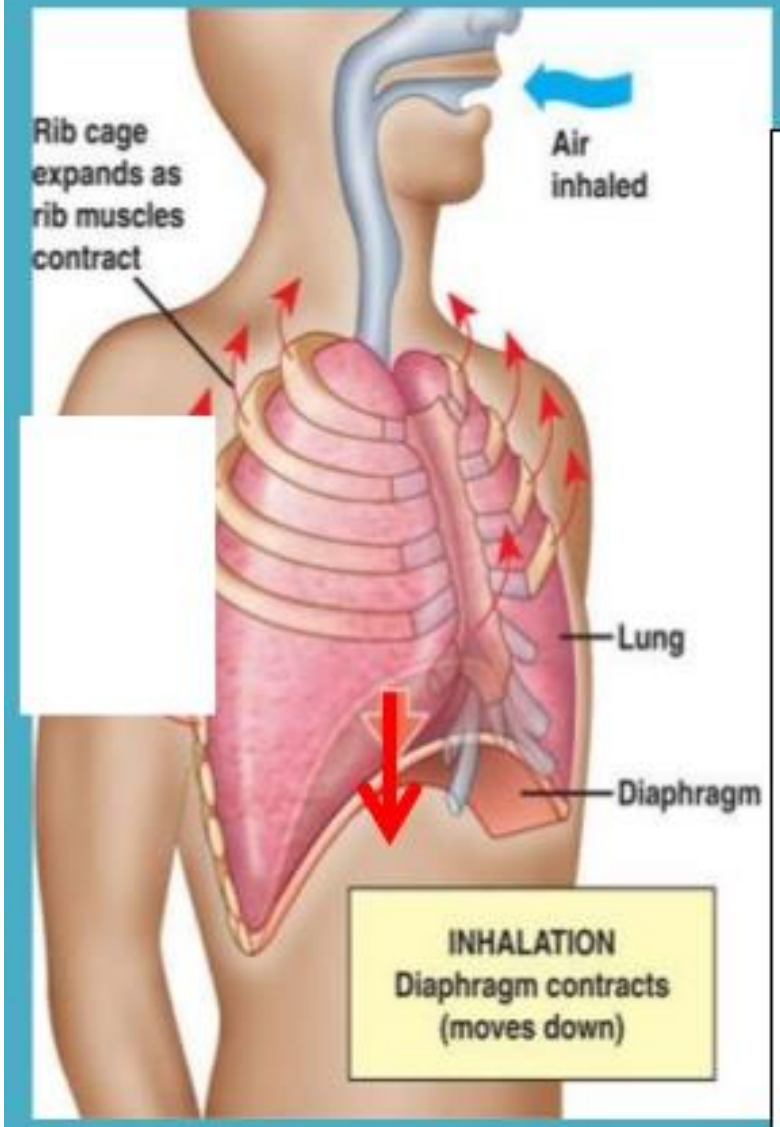
- Internal intercostal muscle
- External intercostal muscle
- Rib cage
- Diaphragm
- Volume of thoracic cavity
- Air pressure in alveoli
- Air moves in @ out

Mechanism of breathing

- **Inspiration**
- Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external inter-costal muscles lifts up the ribs and the sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume. An increase in pulmonary volume decreases the intra-pulmonary pressure to less than the atmospheric pressure which forces the air from outside to move into the lungs, i.e., inspiration.

- **Expiration**
- Relaxation of the diaphragm and the inter-costal muscles returns the diaphragm and sternum to their normal positions and reduce the thoracic volume and thereby the pulmonary volume. This leads to an increase in intra-pulmonary pressure to slightly above the atmospheric pressure causing the expulsion of air from the lungs, i.e., expiration.

INHALATION



Internal intercostal muscle relaxed

↓

External intercostal muscle contract

↓

Rib cage moves upwards & outwards

↓

Diaphragm contracts & flattens

↓

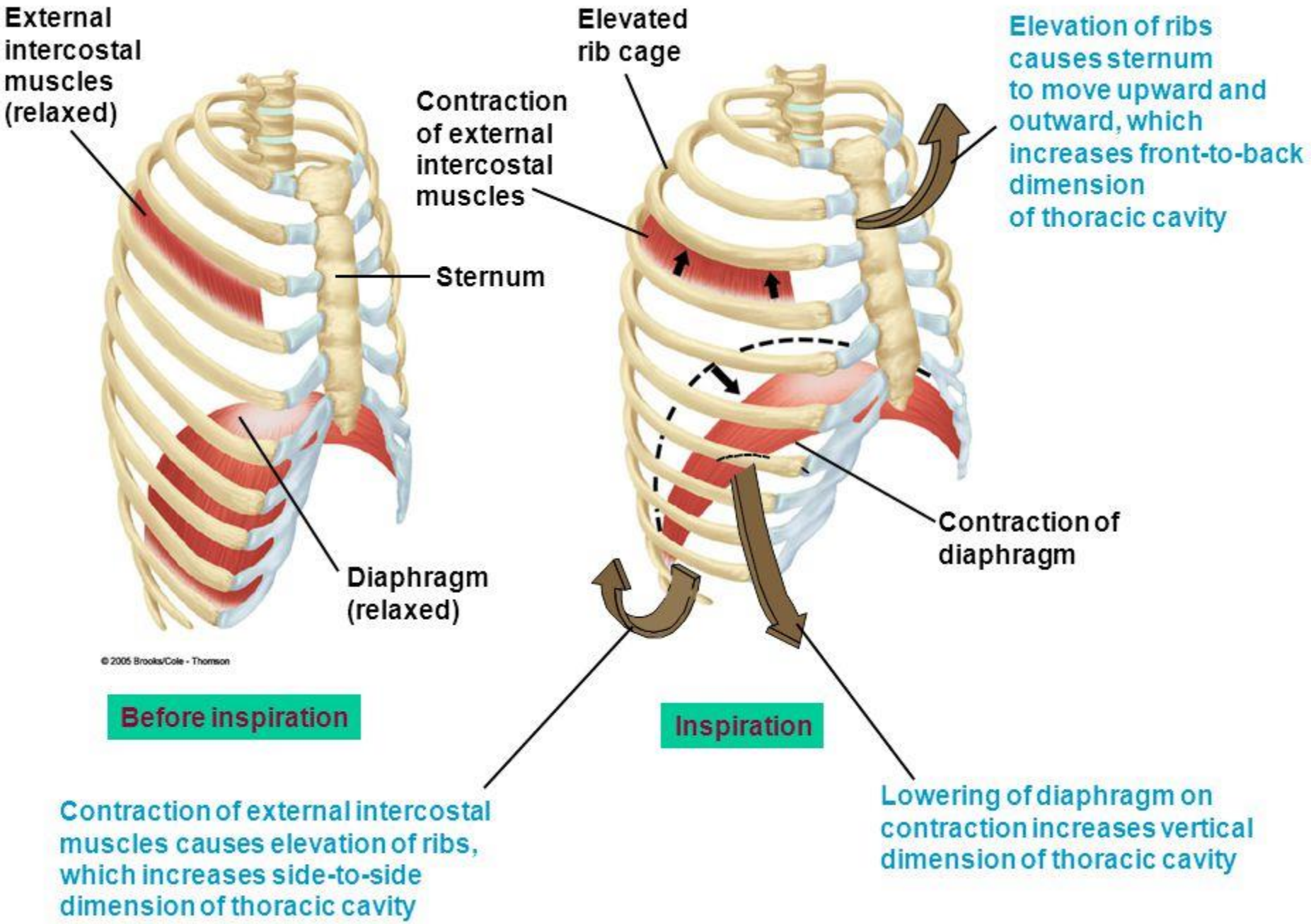
Volume of thorax cavity increase

↓

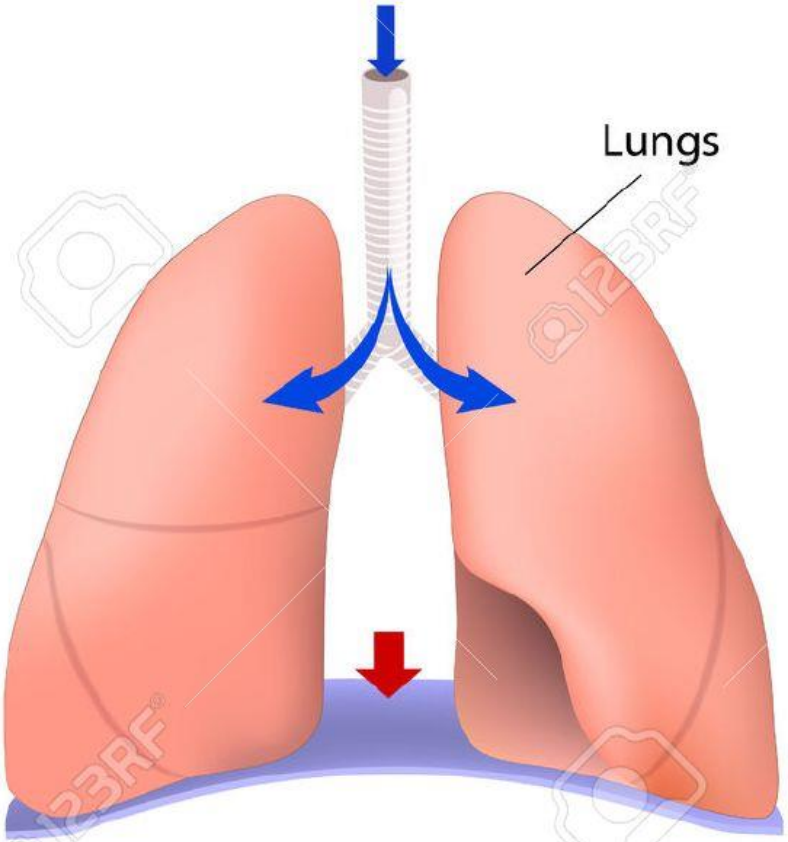
Pressure in alveoli decrease

↓

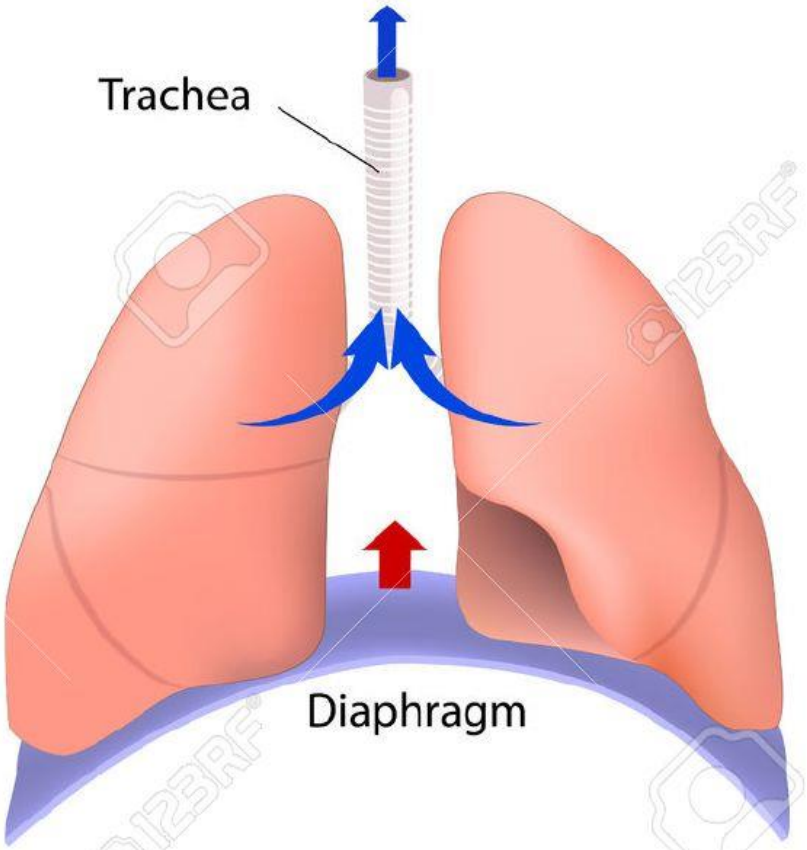
Air moves in


External intercostal muscles (relaxed)
Sternum
Diaphragm (relaxed)
© 2005 Brooks/Cole - Thomson
Before inspiration
Elevated rib cage
Contraction of external intercostal muscles
Elevation of ribs causes sternum to move upward and outward, which increases front-to-back dimension of thoracic cavity
Contraction of diaphragm
Inspiration
Contraction of external intercostal muscles causes elevation of ribs, which increases side-to-side dimension of thoracic cavity
Lowering of diaphragm on contraction increases vertical dimension of thoracic cavity

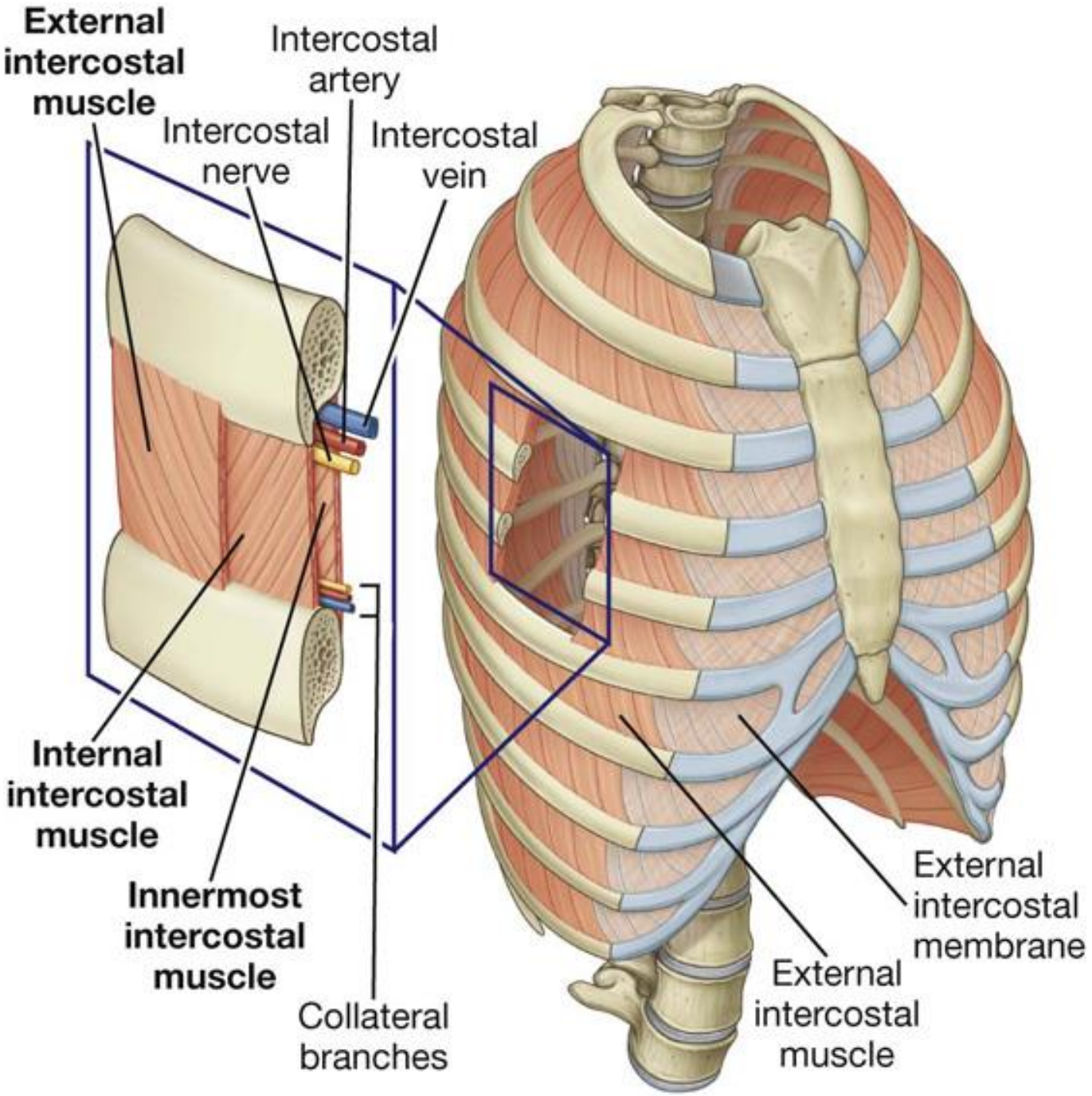
The diaphragm functions in breathing



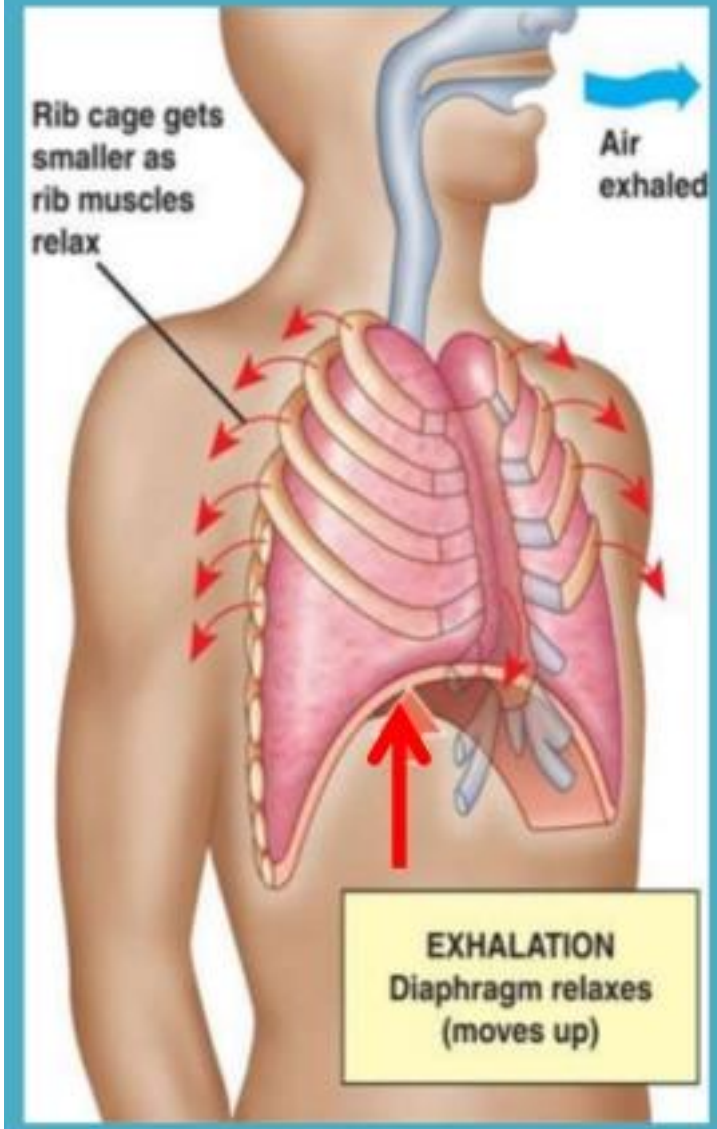
Breath



Exhalation


External intercostal muscle
Intercostal artery
Intercostal nerve
Intercostal vein
Internal intercostal muscle
Innermost intercostal muscle
Collateral branches
External intercostal membrane
External intercostal muscle

EXHALATION



Internal intercostal muscle contract

↓

External intercostal muscle relaxed

↓

Rib cage moves downwards & inwards

↓

Diaphragm relaxes

↓

Volume of thorax cavity decrease

↓

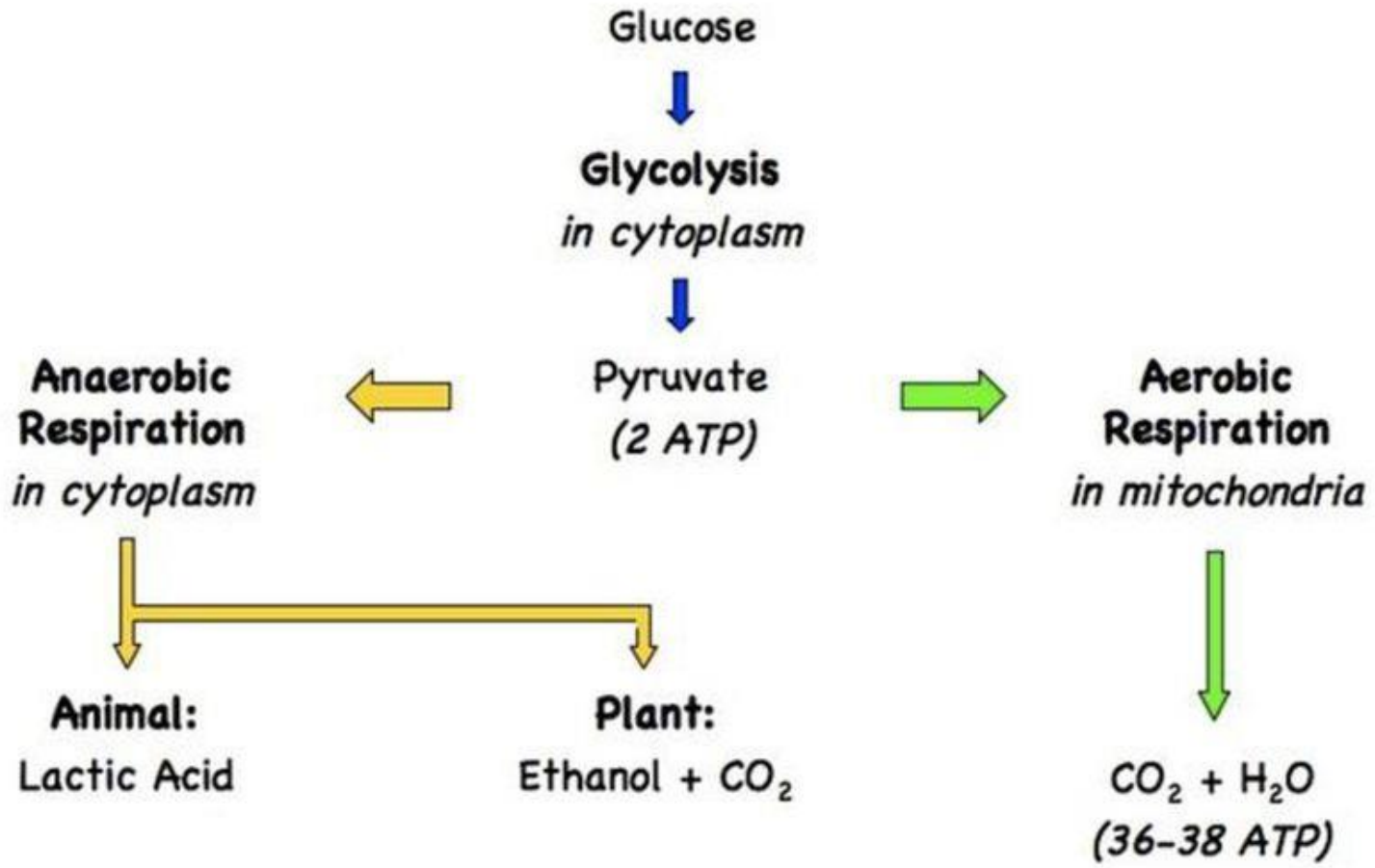
Pressure in alveoli increase

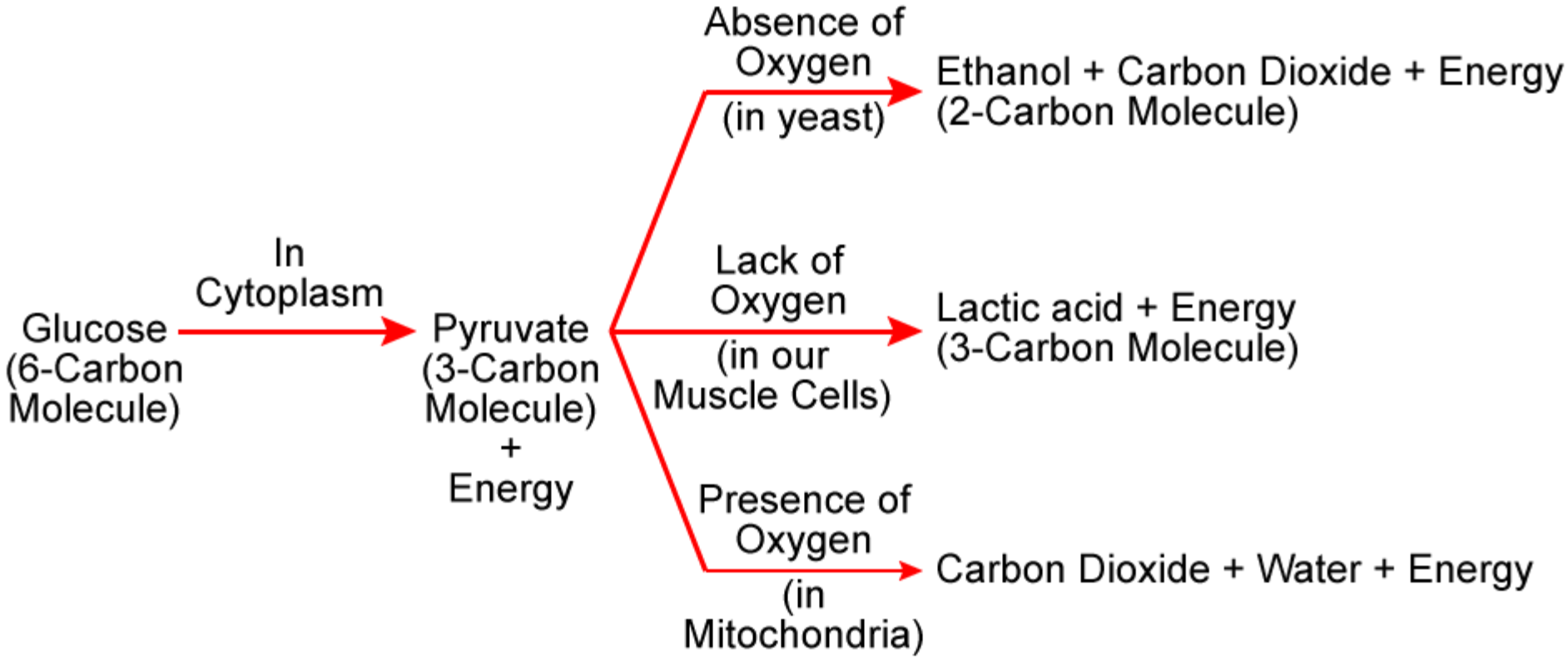
↓

Air moves out

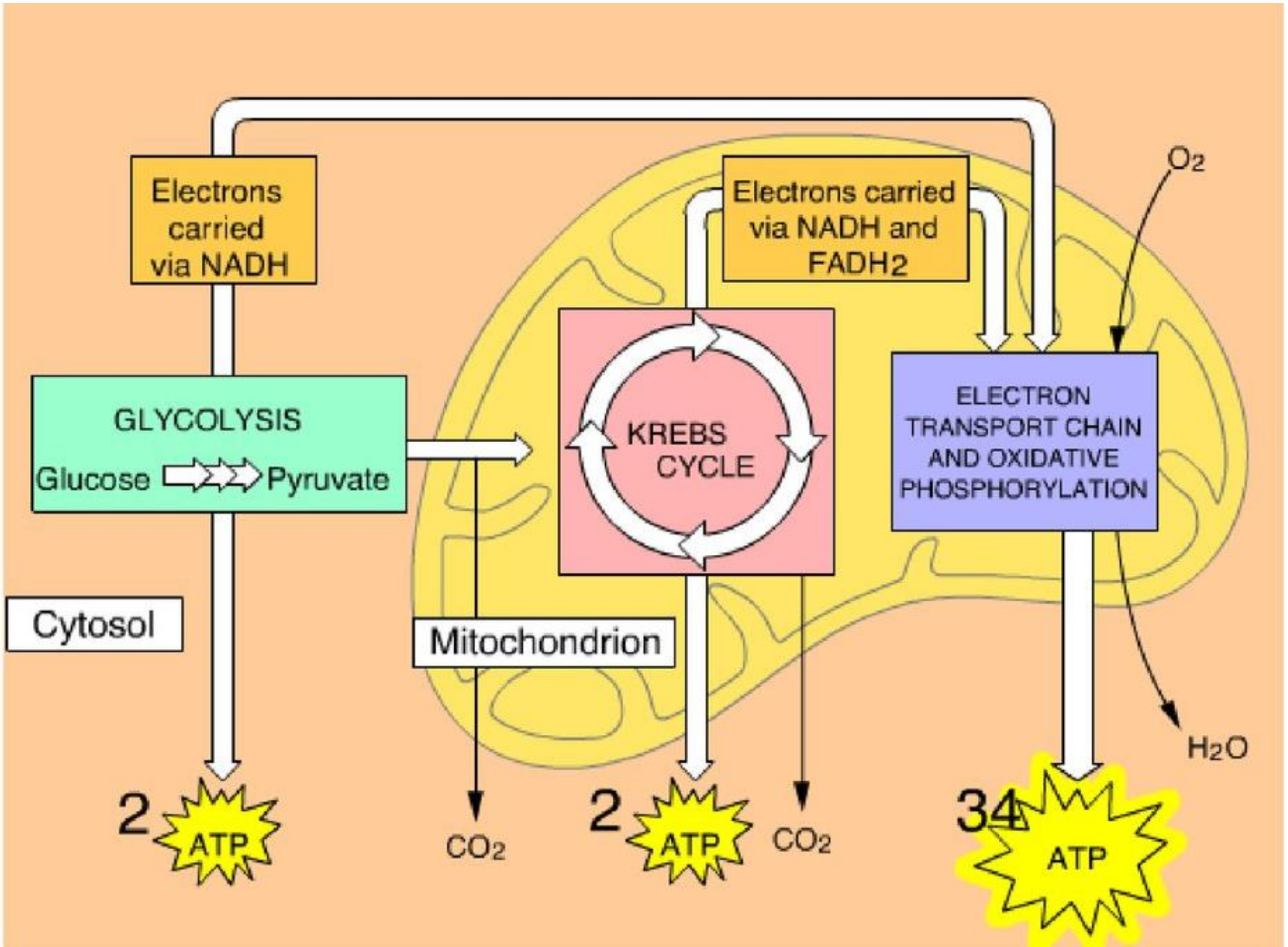
Cellular Respiration

CELL RESPIRATION




Glucose
(6-Carbon
Molecule)
In
Cytoplasm
Pyruvate
(3-Carbon
Molecule)
+
Energy
Absence of
Oxygen
(in yeast)
Ethanol + Carbon Dioxide + Energy
(2-Carbon Molecule)
Lack of
Oxygen
(in our
Muscle Cells)
Lactic acid + Energy
(3-Carbon Molecule)
Presence of
Oxygen
(in
Mitochondria)
Carbon Dioxide + Water + Energy

Aerobic Respiration



GLYCOLYSIS

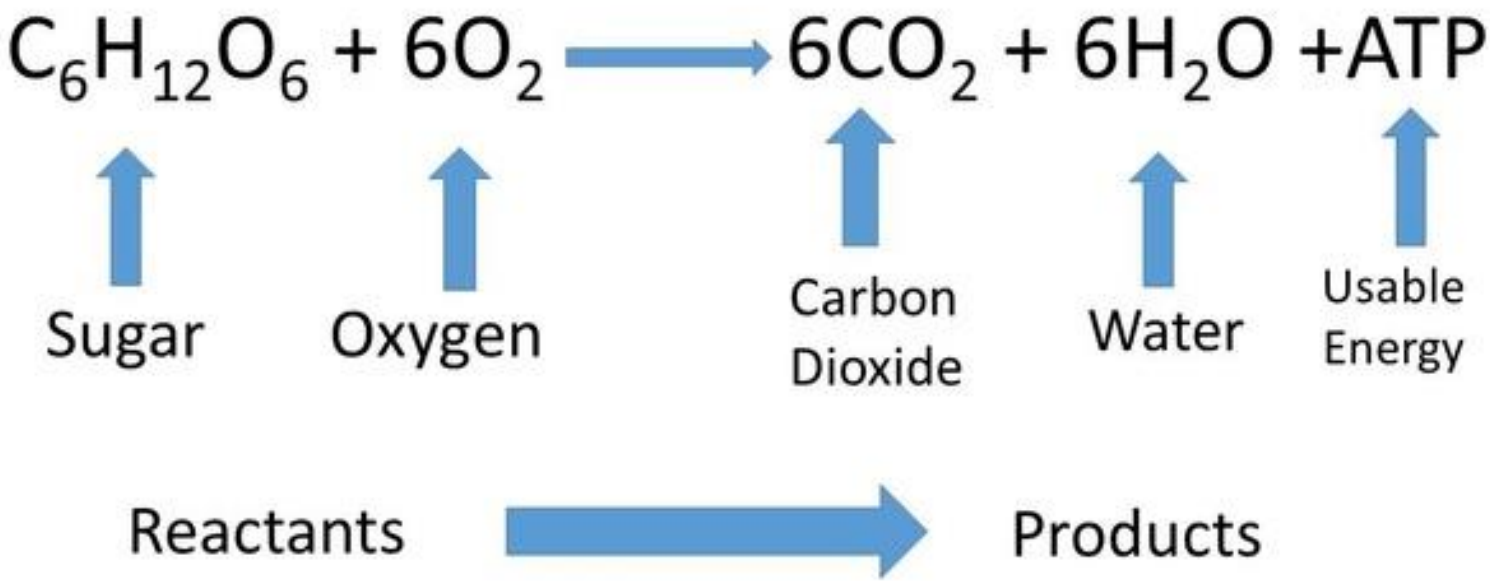
- Glycolysis occurs **without the use of oxygen**
- Occurs in the **cytoplasm**
- One glucose molecule is converted into **two pyruvate molecules**.
- *2 ATP* molecules are used but *4 ATP* are produced, so there is a **net yield of 2 ATP**.
- 2 NAD^+ are converted into **2 NADH** + H^+

ANAEROBIC RESPIRATION

- **Location:**
  in the **cytosol** of the cell
- **Energy yield:**
  a **small** yield of ATP (only the **2 ATP** molecules from glycolysis)
- **Oxygen requirement:**
  oxygen absent
- **Results in:**
  - **lactic acid** (animal cells)
  - **ethanol + CO_2** (plant cells = fermentation)

Chemical Equation

C=Carbon, H=Hydrogen, O=Oxygen



S. No.	Aerobic respiration	Anaerobic respiration
1.	It takes place in presence of oxygen.	It does not require oxygen.
2.	It always releases carbon dioxide.	It may or may not release carbon dioxide.
3.	It provides much more energy (38 ATP molecules).	It provides less energy (just 2 ATP molecule).
4.	It occurs both in cytoplasm (glycolysis) & in the mitochondria (Kreb's cycle & electron transport chain).	It takes place in the cytoplasm, certain tissues and cells of higher animals.
5.	Examples - In most plants and animals.	Examples – In anaerobic bacteria, yeasts, muscles and parasitic worms like, *Ascaris*, *Fasciola*, *Taenia* and germinating seeds.