

# Dýchanie

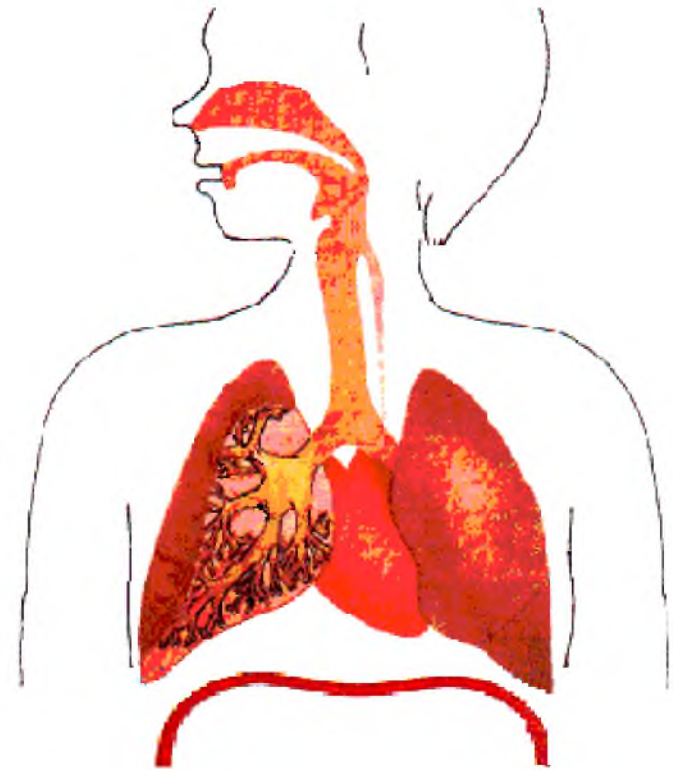
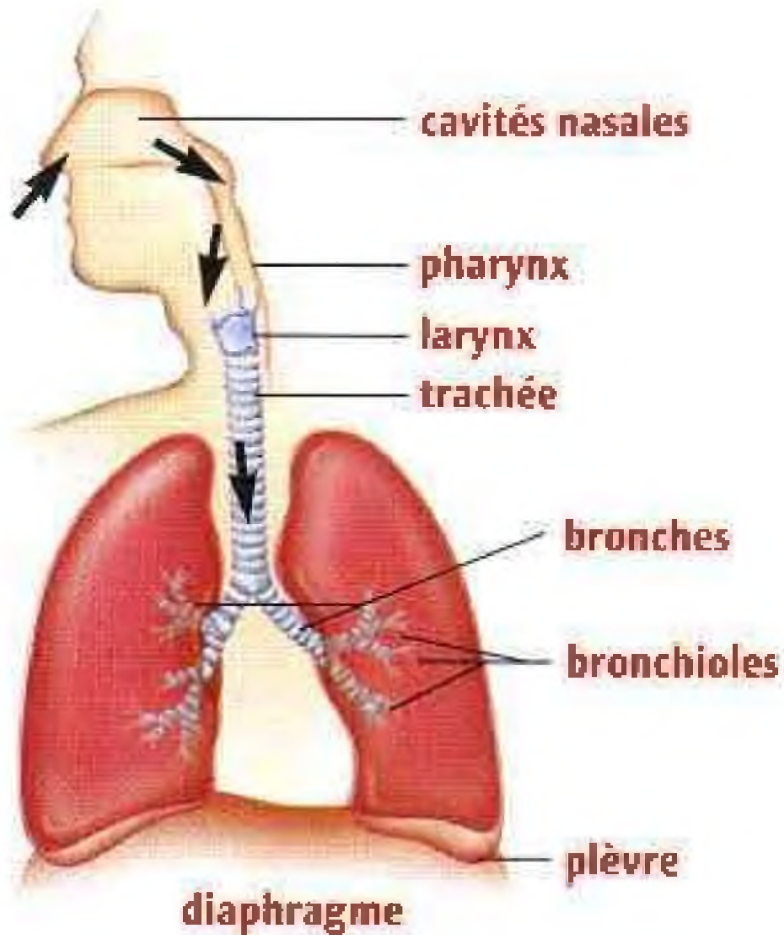
Biológie živočíšnej produkcie

Katedra fyziológie živočíchov, FBP, SPU v Nitre

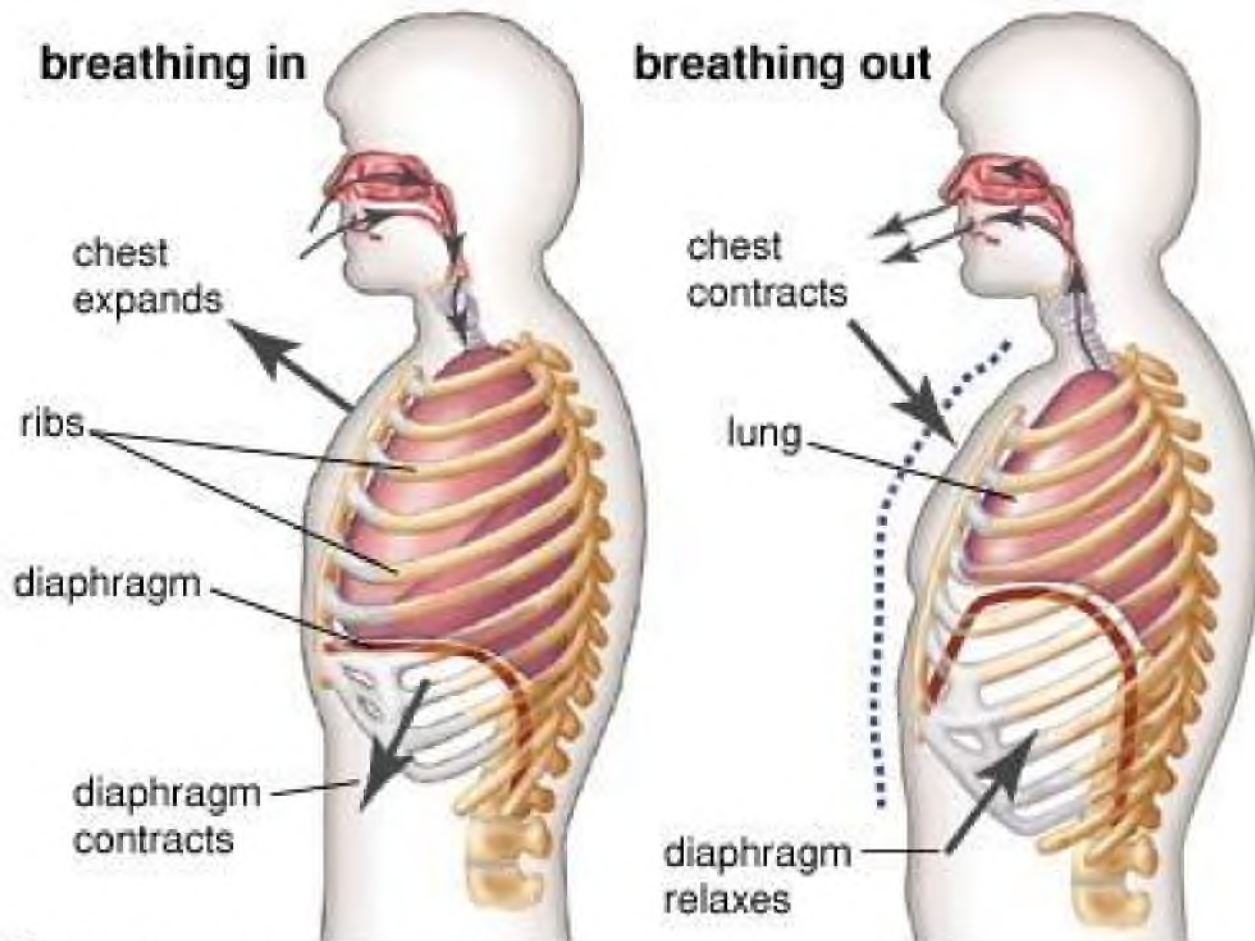
# Dýchanie

- súhrn zložitých fyziologických dejov, ktoré sú dôležité pre výmenu plynov medzi vnútorným a vonkajším prostredím
- **dýchacie cesty**
  - horné dýchacie cesty (nosová dutina; hltan; hrtan; trachea)
  - dolné dýchacie cesty (priedušky; priedušničky; alveolárne chodbičky; alveoly)
- **pleurálny priestor**
  - priestor medzi popľúcnicou a pleurou, vyplnený malým množstvom čirej tekutiny
  - záporný tlak voči tlaku vonkajšieho prostredia – trvalé napnutie pľúc

# Dýchacie cesty



# Dýchacie cesty



# THE RESPIRATORY SYSTEM

**Facial Sinuses**

**Anterior View**

- Sphenoid sinus
- Maxillary sinus
- Frontal sinus
- Ethmoidal sinuses
- Sphenoidal sinus
- Maxillary sinus
- Frontal sinus

**Lateral View**

- Sphenoid sinus
- Maxillary sinus
- Frontal sinus
- Ethmoidal sinuses

**Conducting System**

The conducting system comprises all of the passages through which air must flow to reach the lungs. Every part of the airway is lined with a mucous membrane. The conducting system is a pathway through which air is drawn from the atmosphere and into the lungs.

**Larynx**

**Muscles**

- Digastric
- Cricopharyngeus
- Cricothyroid
- Thyrohyoid
- Thyroarytenoid
- Cricoventricle
- Vocalis
- Transverse arytenoid
- Oblique arytenoid
- Posterior cricoarytenoid
- Anterior cricoarytenoid

**Cartilages**

- Epiglottic
- Thyroid
- Cricoid
- Arytenoid
- Tricunebral
- Annular
- Hyoid

**Respiratory Mucosa**

- Columnar epithelium
- Goblet cells
- Basophilic granules
- Microvilli
- Submucosa
- Elastic fibers
- Capillaries
- Lymphatics

**Lungs and Pleurae**

The pleurae are the membranes that line the thoracic wall and the surface of the lungs. This cavity is the pleural cavity. The pleural cavity is the space between the two pleural membranes.

**Bronchopulmonary Segments**

**Anterior View**

- Right: Superior lobe, Middle lobe, Inferior lobe
- Left: Superior lobe, Inferior lobe

**Posterior View**

- Right: Superior lobe, Middle lobe, Inferior lobe
- Left: Superior lobe, Inferior lobe

**Lungs**

- Right bronchus and associated structures
- Left bronchus and associated structures
- Right and Left Pulmonary Arteries
- Right and Left Pulmonary Veins
- Right and Left Pleural Cavities
- Right and Left Pleural Membranes
- Right and Left Mediastinal Pleural Folds
- Right and Left Cardiac Pleural Folds
- Right and Left Bronchopulmonary Ligaments
- Right and Left Lymphatic Vessels
- Right and Left Nerves
- Right and Left Arteries
- Right and Left Veins

**Structure of Intrapulmonary Airways**

- Bronchiole
- Terminal bronchiole
- Respiratory bronchiole
- Alveolar duct
- Alveolar sac
- Alveolus
- Alveolar wall
- Capillary
- Endothelial cell
- Basophilic granules
- Nucleus
- Microvilli

**Cross Section of Alveolus**

- Terminal bronchiole
- Respiratory bronchiole
- Alveolar duct
- Alveolus
- Alveolar wall
- Capillary
- Endothelial cell
- Nucleus
- Microvilli
- Basophilic granules

**Ventilation**

During inspiration, air enters the respiratory system through the nostrils and mouth. The diaphragm contracts and moves downward, while the rib cage expands outward. This causes the volume of the thoracic cavity to increase, and the pressure to decrease. As a result, air is drawn into the lungs.

**Expiration**

During expiration, the diaphragm relaxes and moves upward, while the rib cage contracts. This causes the volume of the thoracic cavity to decrease, and the pressure to increase. As a result, air is drawn out of the lungs.

**Gas Exchange**

The respiratory system is the site of gas exchange. It is through the respiratory system that oxygen is taken from the atmosphere and delivered to the cells of the body. At the same time, carbon dioxide is taken from the cells and delivered to the atmosphere. This process is called gas exchange.

**DIFFERENTIAL**

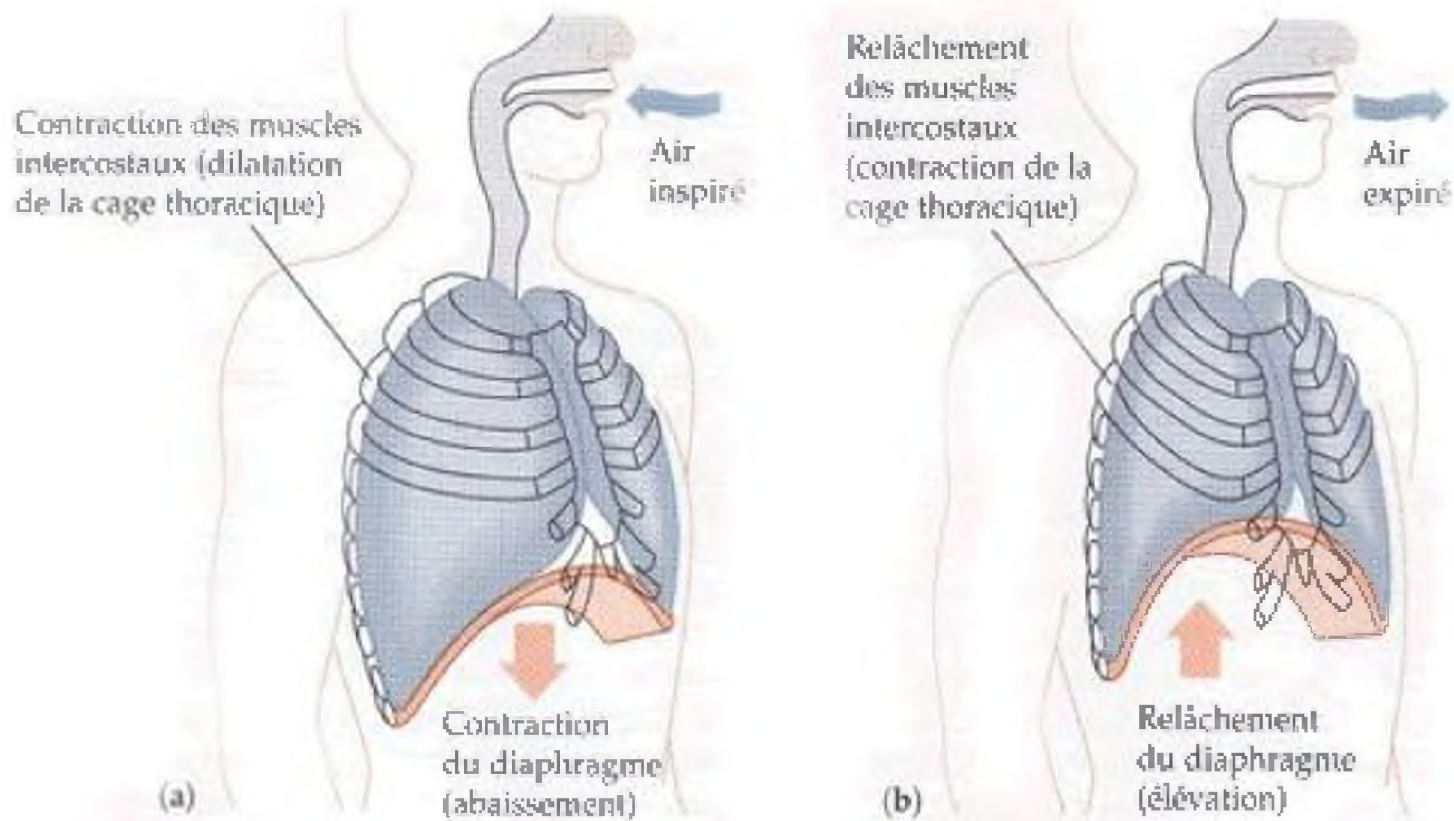
1. Location: The lungs are located in the thoracic cavity, while the trachea is located in the neck.

2. Function: The lungs are responsible for gas exchange, while the trachea is responsible for transporting air in and out of the lungs.

3. Structure: The lungs are highly vascularized and have a spongy texture, while the trachea is a rigid tube with cartilage rings.



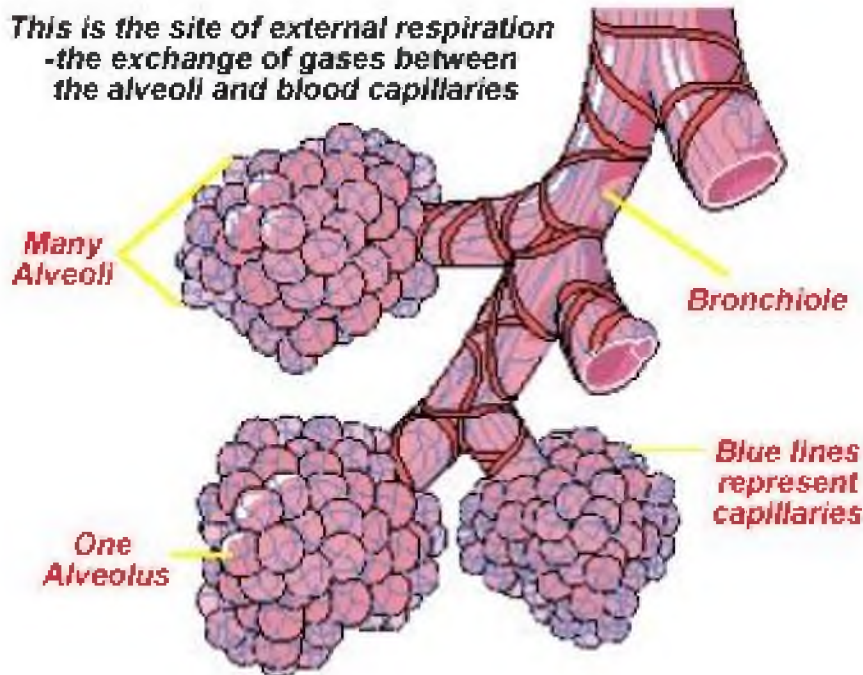
# Dýchacie cesty



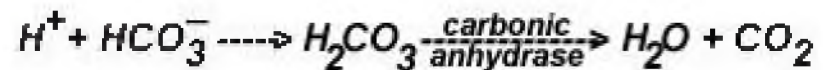
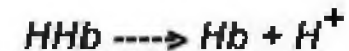
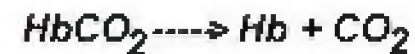
# Dýchacie cesty

## **Bronchiole with Alveoli** (each sphere is an individual alveolus)

This is the site of external respiration  
-the exchange of gases between  
the alveoli and blood capillaries



## **External Respiration** (Reactions)



# Dýchanie

- **krvné systémy (obehy) pľúc:**
  - funkčný krvný systém
  - výživný krvný systém (*a. bronchialis*)
- **stupne výmeny dýchacích plynov:**
  - pľúcna respirácia (vonkajšie dýchanie)
  - cirkulácia (prenos dýchacích plynov krvou)
  - tkanivová respirácia



# 1. Pľúcna respirácia (vonkajšie dýchanie)

- **ventilácia**

- inspirium ( $\uparrow$  záporného tlaku v pleurálnom priestore); expirium
- eupnoe; apnoe (■); hyperpnoe (prehĺbené); polypnoe (zrýchlené)
- hrudníkové (EQ, CA, HO); brušné (BO, HO); zmiešané (EQ)
- vitálna kapacita pľúc

- **distribúcia**

- dýchacie cesty – alveoly
- anatomický a fyziologický mŕtvy priestor

- **difúzia**

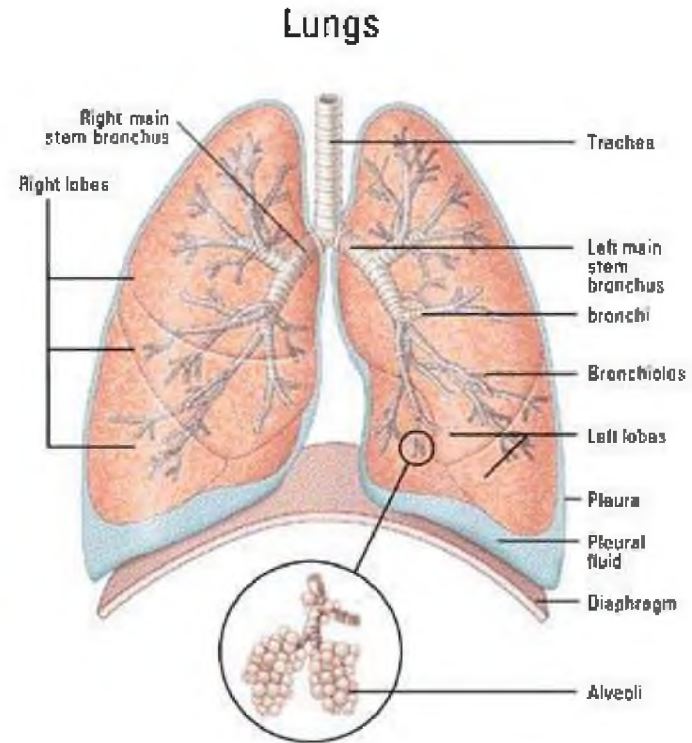
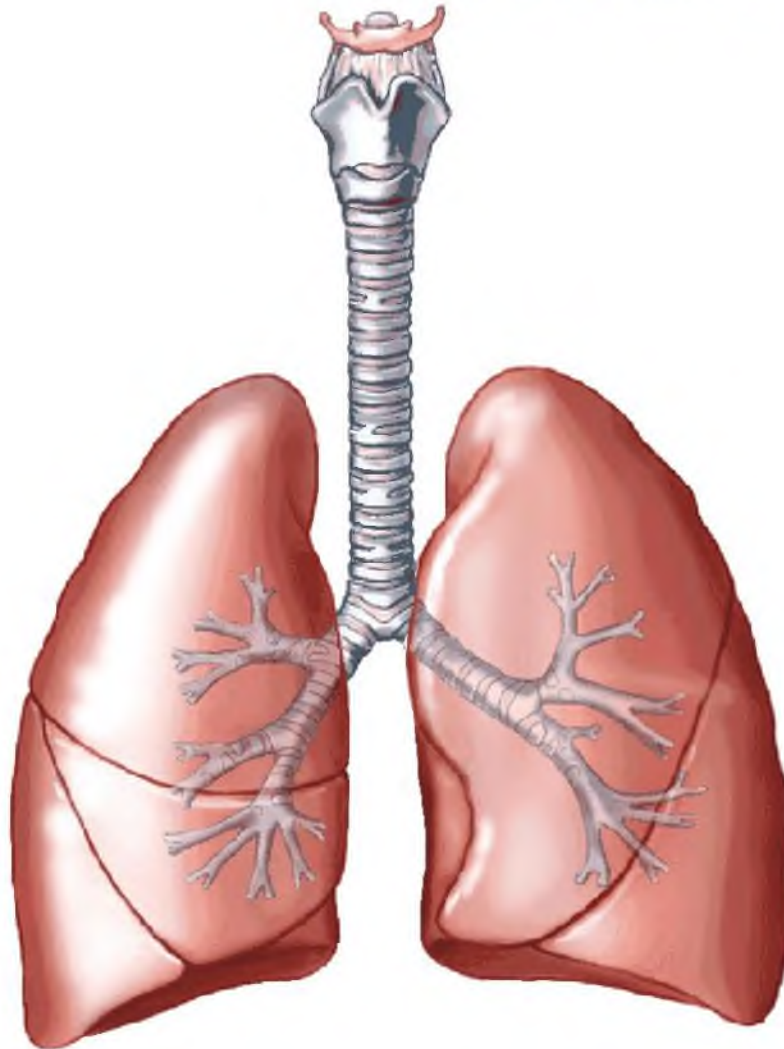
- alveolárno – kapilárna dvojvrstva

# Vitálna kapacita pľúc

$$VK = RO + IRV + ERV$$

- VK – **vitálna kapacita pľúc** – zmena objemu vzduchu v pľúcach meraná medzi úrovňou maximálneho vdychu a maximálneho výdychu
- RO – **respiračný objem** – množstvo vzduchu, ktoré sa v pľúcach vymení pri kludnom dýchaní
- IRV – **inspiračný rezervný objem** – množstvo vzduchu, ktoré sa dá vdýchnuť po kludnom vdychu
- ERV – **expiračný rezervný objem** – množstvo vzduchu, ktoré sa dá vydýchnuť po kludnom výdychu
- **reziduálny objem** – vzduch, ktorý zostáva v pľúcach aj po maximálnom výdychu
  - kolapsový – uvoľní sa z pľúc po otvorení hrudníka
  - minimálny – vzduch, ktorý možno vytlačiť z pľúc len mechanicky

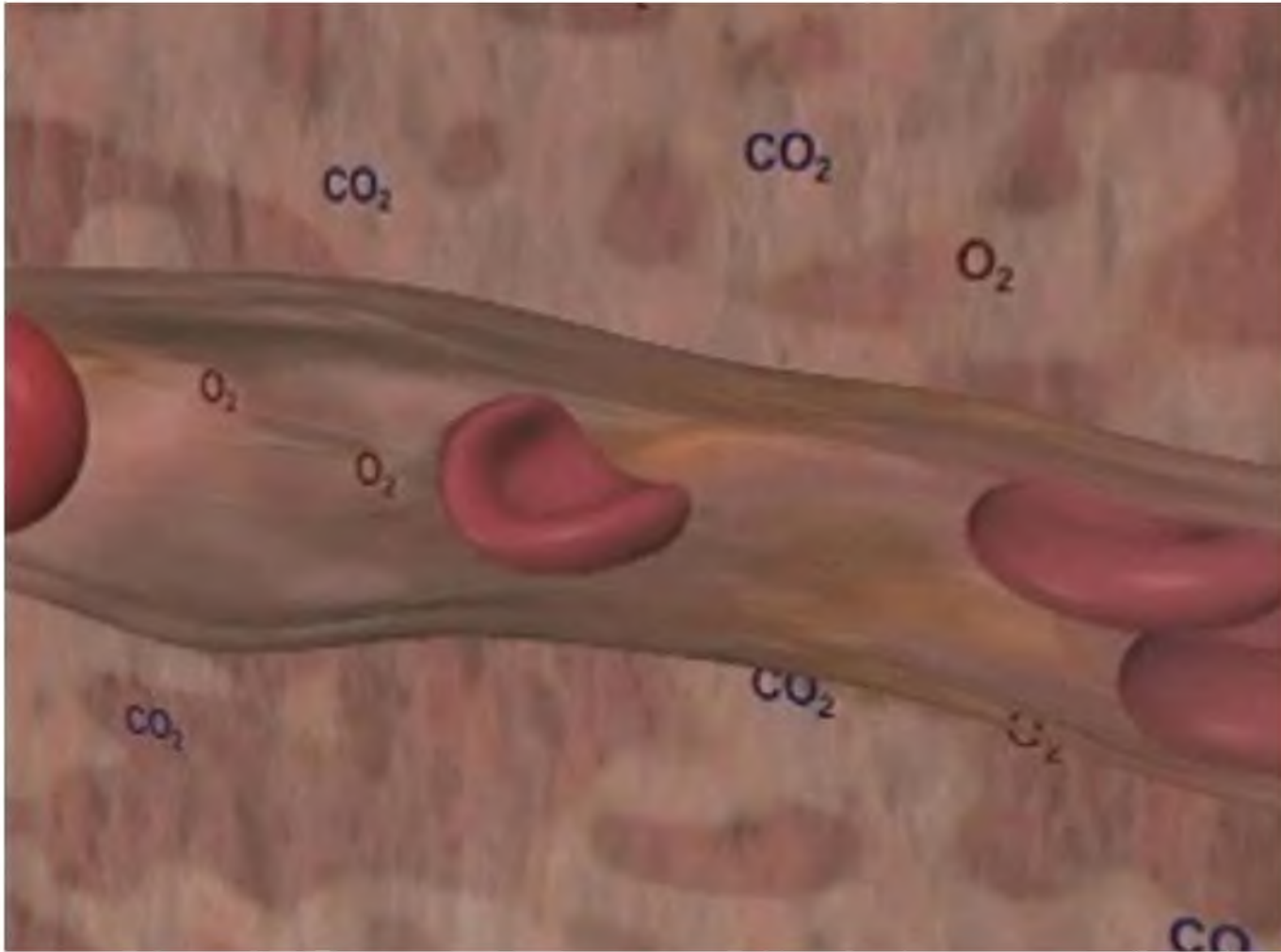
# Plúcna respirácia



## 2. Prenos dýchacích plynov krvou (cirkulácia)

- **väzba O<sub>2</sub>**
  - fyzikálne (v plazme asi 1%)
  - chemicky (Hb)
    - arterio–venózný rozdiel (AVR) – rozdiel obsahu O<sub>2</sub> v tepnovej a žilnej krvi
- **transport CO<sub>2</sub>**
  - prenos vo forme roztokov krvnou plazmou (5%)
  - prenos vo forme hydrouhličitanu (90%)
  - väzba na Hb a proteíny (5%)

# Prenos dýchacích plynů krvou





# 3. Tkanivová respirácia

- oxidačno–redukčné deje v tkanivách
- účasť enzýmov:
  - H<sub>2</sub>–kodehydrogenézy (NAD; NADP; FMN; FAD)
  - cytochrómy
  - ďalšie enzýmy

# Dýchanie v zmenených podmienkach

- anoxia –  $\square$   $O_2$
- hypoxia –  $\downarrow$   $O_2$
- hyperoxia –  $\uparrow$   $O_2$
- asfyxia – nedostatok  $O_2$  v organizme a hromadenie  $CO_2$



Ďakujem za pozornosť

