

Physiology of Respiratory System of Domestic Animals

What is Respiration ?

- **Respiration** includes all those chemical and physical processes by which an organisms exchange gases with its environment

- **Internal Respiration** is the exchange, which takes place at the tissue level.
- **Ventilation** The act of bringing air in and expelling air from the lungs.

Mammalian Respiratory System

- ✓ *Nasal passage*
- ✓ *Larynx*
- ✓ *Trachea*
- ✓ *Lungs*
- ✓ *Thoracic cavity*
- ✓ *Pleural Sac*

TRACHEA

■ Bronchi

Bronchi

■ Bronchioles

■ Alveolar duct

■ Atria

■ Alveolar Sac

■ Alveoli ----- single cells Structure



Important terms to remember

- Tidal volume
- **Complemental Volume**--- air inspired by deepest possible inspiration
- Supplemental volume
- Vital Capacity
- Residual Volume
- Respiratory /Minute Volume
- **Alveolar minute Volume** - air which directly comes in contact with circulation at the level of alveoli.
- **Total lung capacity** --Volume of air including vital capacity and residual volume

Dead space

- Area of respiratory tract that does not come in contact with circulation.
- **Anatomical** - area from external naris to the alveolus.
- **Physiological**

Intra alveolar/ Intrapulmonary pressure

- During inspiration its **reduced** due to the expansion of the lungs, as compared to the atmospheric pressure.
- Inspiration - 2 to - 3 mm Hg

Intra - thoracic pressure / Intra pleural pressure

- Intra thoracic pressure always remains **negative** during inspiration as well as during expiration.
- At Inspiration → - 19 mm Hg
- At Expiration → - 04 mm Hg
- **Physiological significance** → Venous return
Vomition ,Defecation Regurgition
& Parturition

Surfactant

- Mixture of lipoprotein and is secreted by alveolar epithelium into alveoli and respiratory passage.
- This fluid contains phospholipid and lecithin.

Common Terms

- **Eupnea** is normal quiet type of breathing.
- **Apnea** is transient cessation in the respiration
- **Hyperpnea** is the increase in rate and depth of respiration.
- **Polypnea** is rapid shallow type of respiration.
- **Dysnea** is difficult (labored) respiration.
- **Pneumothorax** is collapse of thoracic cavity due to the entry of air.

RESPIRATORY MEMBRANE

- Thickness - $> 1 \mu$
- Surface area - 70 Sq. meters
- Diameter - 7μ
- Carbondioxide diffuses 20 times faster than oxygen.
- Thickness - Fibrosis
- Surface area

Mechanism of Respiration

- **Contraction of Diaphragm** →
Inspiration longitudinal diameter is increased
- **Movement of ribs** → antero-posterior diameter of chest cage greater by 20 % during inspiration as compared to expiration
- **Abdominal Muscles**
 - Sternum Muscle : lifting of sternum
 - Anterior Serratus : Helps to lift ribs
 - Scaleni Muscle : lifting first two ribs.

DIFFUSION OF GASES

Oxygen

Carbondioxide

Transport of Oxygen

97% is transported by chemical combination with hemoglobin and
only **3%** through dissolved state

Transport of Carbondioxide

- **Dissolved state:** At an average P_{CO_2} of 45 mm Hg, 100 ml of blood contains 2.7 ml of CO_2 in various blood. In arterial blood 100 ml contains 2.4 ml of CO_2 at 40 mm Hg, so 0.3 ml CO_2 is transported in dissolved state. It accounts for 7% of CO_2 transport.
- **Transport in form of HCO_3^- ions:** In blood CO_2 reacts with water and forms Carbonic acid in presence of enzyme Carbonic anhydrase

REGULATION OF RESPIRATION



Nervous

Chemical

- Reticular substance of medulla and pons.
 1. Medullary rhythmicity area
 2. Apneustic area
 3. Pneumoxic area

Chemical Regulation

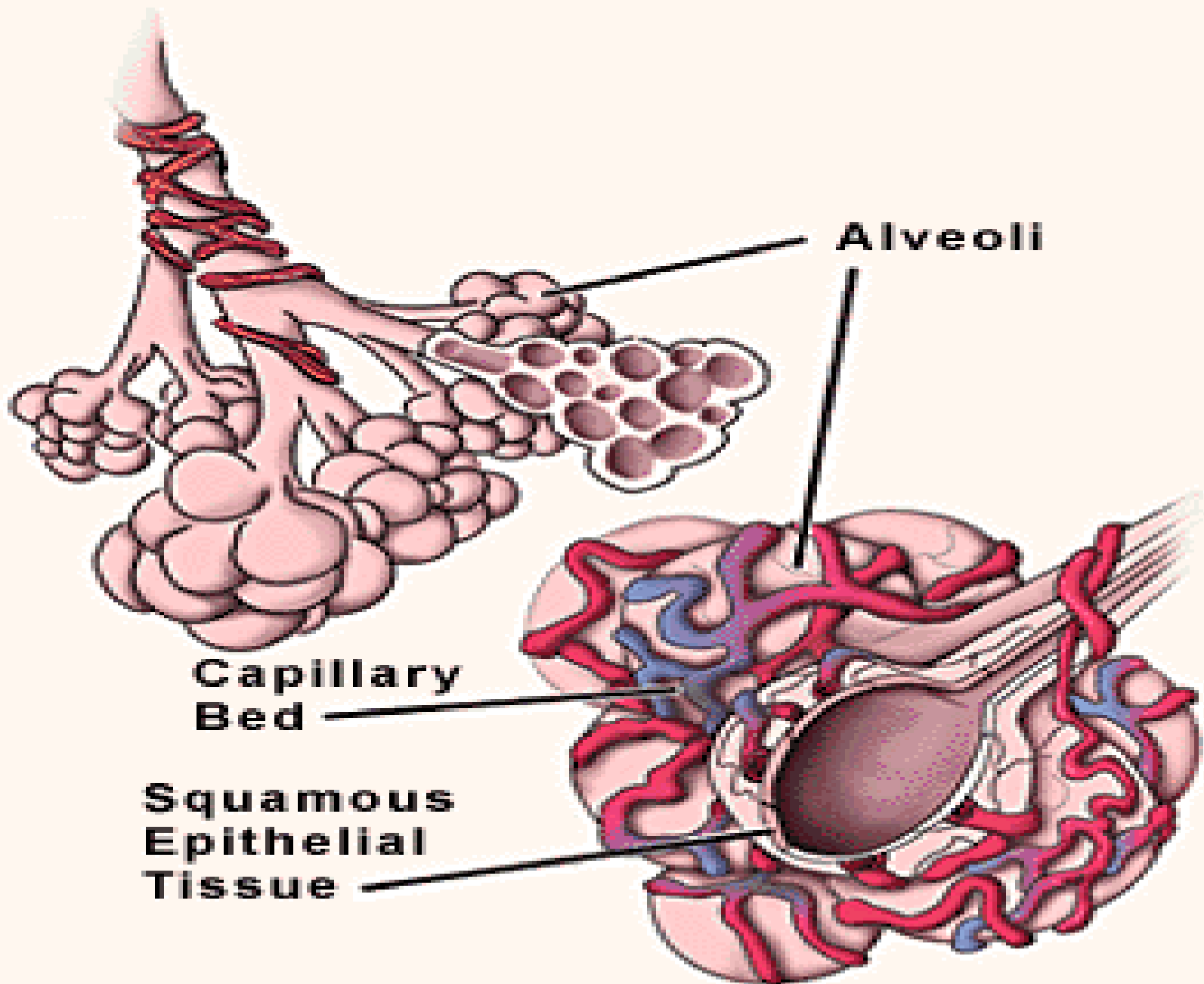
- $\uparrow \text{Co}_2 \longrightarrow$ Respiration rate increases
- $\text{H}^+ \uparrow \longrightarrow$ Respiration rate increases
- $\text{H}^+ \downarrow$ Respiration rate decreases.
- In case of increased Co_2 concentration in blood it diffuses into CSF but not H^+

Factors affecting respiratory center

- Walking
- Talking
- Sudden entry to shower
- Excitation by prick
- Some thing happening suddenly

Hering-Bruer Reflex

Stretch receptors are located in the walls of bronchi and alveoli, which transmits the signals through vagus into dorsal respiratory group of neurons when lungs becomes over stretched, thus inspiration is stopped, this is called as hering – breuer inflation reflex.



Non- Respiratory functions

- Olfaction
- Vocalization
- Prevention from dust particles
- Defence mechanism
- Water balance
- Body temp regulation
- Acid base balance

- Anticoagulant function
- Activation of angiotensin – I
- Synthesis of hormones

