



Effects of Anaesthesia on respiratory system functions

Anaesthesia affects all aspects of respiratory system function.

1. The control of breathing
2. Chemoreceptors
3. Upper airway
4. Respiratory muscles
5. Lung mechanics (lung volume & airway resistance)

The impact of these factors on:

- a. Ventilation.
- b. Perfusion.

Effect of Anaesthesia on Control of Breathing

- **Nervous Control**
- **Nervous Control of Respiratory Movements**

Normal respiratory movements are involuntary.

The movement is transported automatically in the form of nervous impulse from centers in the brain.

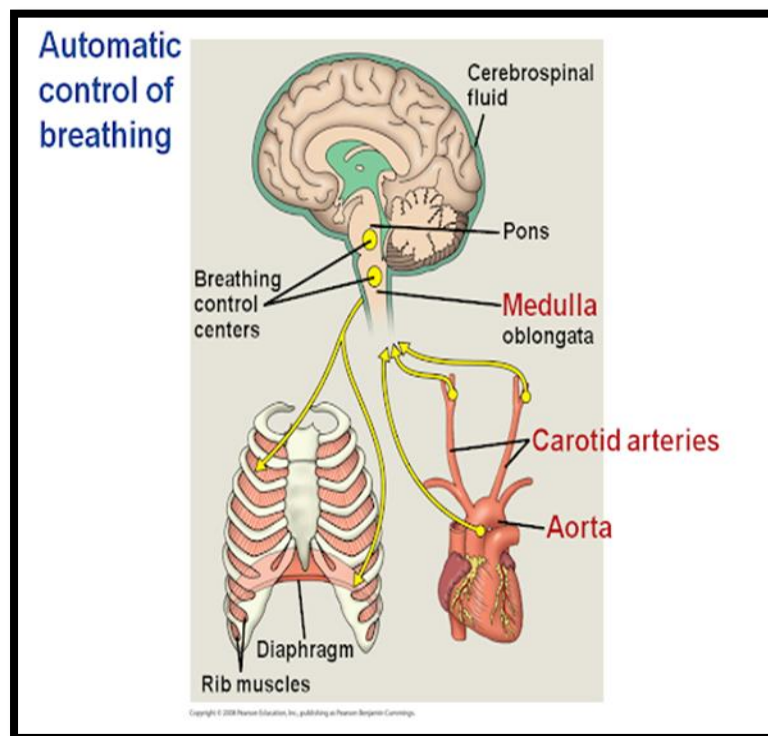
Respiratory centers which are located in the pons and the medulla receive input from the following **afferents**:

Chemoreceptors, Cortex, Hypothalamus, Pharyngeal mechanoreceptors, Vagus nerve.

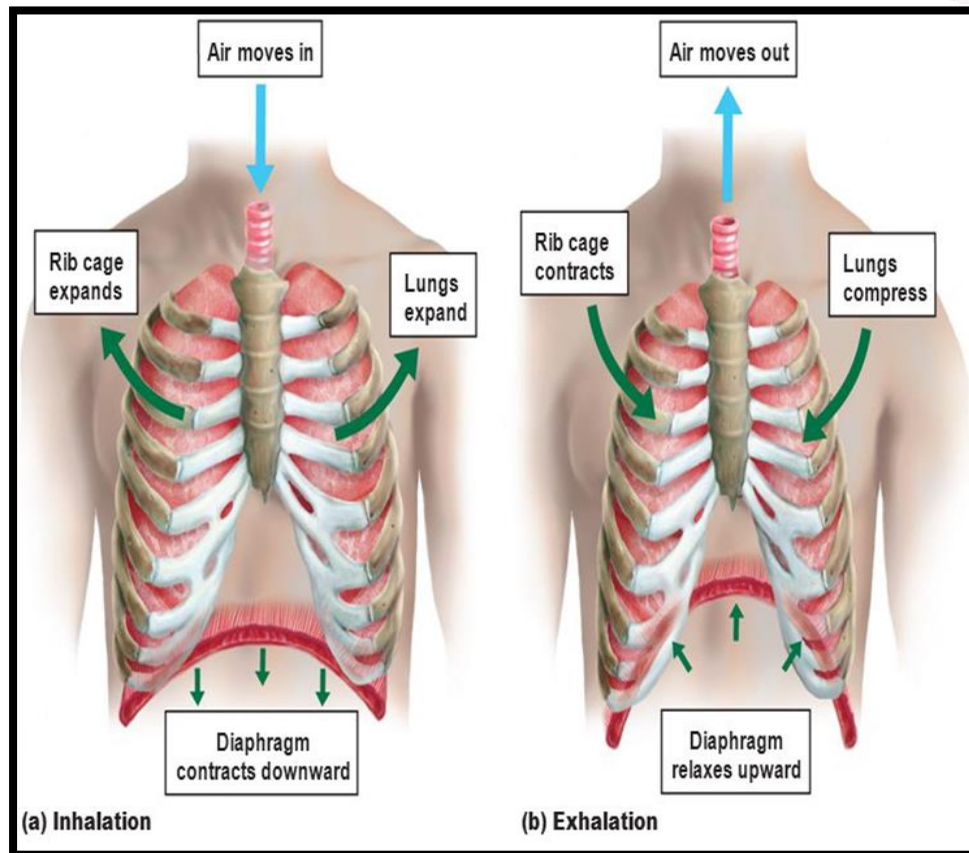


A- Control of Inspiration Process

Group of cells from the inspiratory centers sends stream of impulses down the spinal cord to the cervical segments no.3,4 and 5 using **phrenic nerves** to **Diaphragm**, and from thoracic segments no. 3,4,5, and 6 using the **Intercostal nerves** to the **intercostal muscles**.



This will lead to the contraction of the inspiratory muscles and to the **expansion of the thorax cage** volume allowing air to enter the lungs.



B. Control of Expiration Process

During inspiration, the pneumotaxic centers (Respiratory movements centers) at the Pons receive impulses from the inspiratory centers which reach its highest frequency at maximum inspiration.

- The pneumotaxic centers supply excitation to the expiratory centers at the upper part of the Medulla oblongata. They, in turn, send **inhibitory impulses to the inspiratory centers** to withdraw the inspiration impulses and cause relaxation of the inspiratory muscles and **tighten the thorax cage forcing air to leave out the lungs.**

C. Reflexes Controlling Respiration

I- Respiratory Reflexes

- Respiratory reflexes from the Carotid and Aorta when stimulated by hypertension can inhibit respiration.



II. Protective Respiratory Reflexes

- Reflexes that protect the respiratory passage ways and lungs from **food particles** or **interfering gasses**. For example, stimulation of **Larynx mucous** inhibit inspiration and stimulate expiration and induce coughing.

III. Muscular Exercises

Stress may lead to increase in rate & depth of respiration and hence increase pulmonary ventilation. It can also increase the chemical stimulation of airways due to increase in metabolic rate.

• Chemical Control of Respiration

A- Direct effect on respiratory centers

- Activity of respiratory centers are affected by the blood chemistry & temperature.

1- Effect of CO₂:

Increase CO₂ lead to increased **acidity** which stimulates the neurons at the centers and increase respiratory depth and rate. Reduced CO₂ in blood depresses the centers activity leading to surface respiration.

2- Effect of Temperature:

Increased temperature accelerate the rate but not the depth. Reduced temperature slow the rate of respiration.

3- Effect of changes in O₂ amount

Sever lack of O₂ depresses the centers. Very sever lack ceases respiration.



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B. Indirect effects by means of Chemo- receptors

Deficiency of O₂, Increased CO₂ , Low pH

Stimulates chemoreceptors and sends impulses to Cranial nerves no. 9 and 10 and then to respiratory centers.

The impulses reach muscles and cause the reflex stimulation of respiration.

Control of Breathing Respiratory cycle

The respiratory centers contain many different types of inspiratory and expiratory neurons that fire during the three phases of the respiratory cycle:

- 1- **Inspiratory phase**: A sudden onset is followed by a ramp increase in discharge to the inspiratory muscles and the dilator muscles of the pharynx.
- 2- **Post-inspiratory phase**: A gradual decline of discharge to the inspiratory muscles leads to a gradual reduction in tone which modulates expiratory flow.
- 3- **Expiratory phase**: Both expiratory and inspiratory muscles are silent unless forced expiration or high ventilation is required.

Effect of Anaesthesia on Control of Breathing

Anaesthetic agents influence:

1. Rate of discharge.
2. Rhythm of discharge.
3. Intensity of discharge from the respiratory centers.