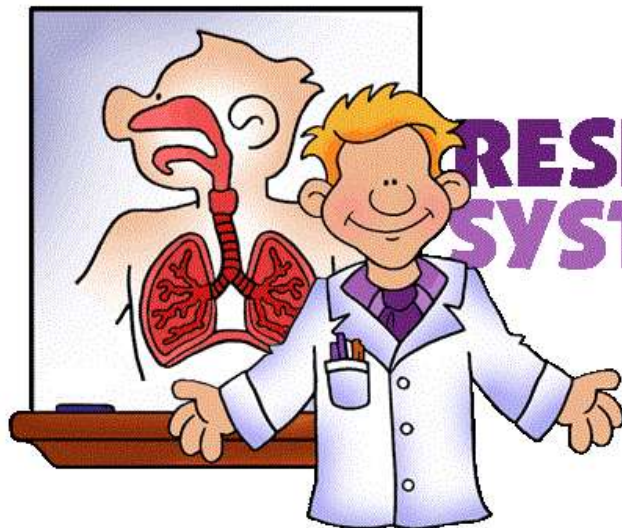




Physiology Team 432



RESPIRATORY SYSTEM

8th Lecture

Control of Breathing

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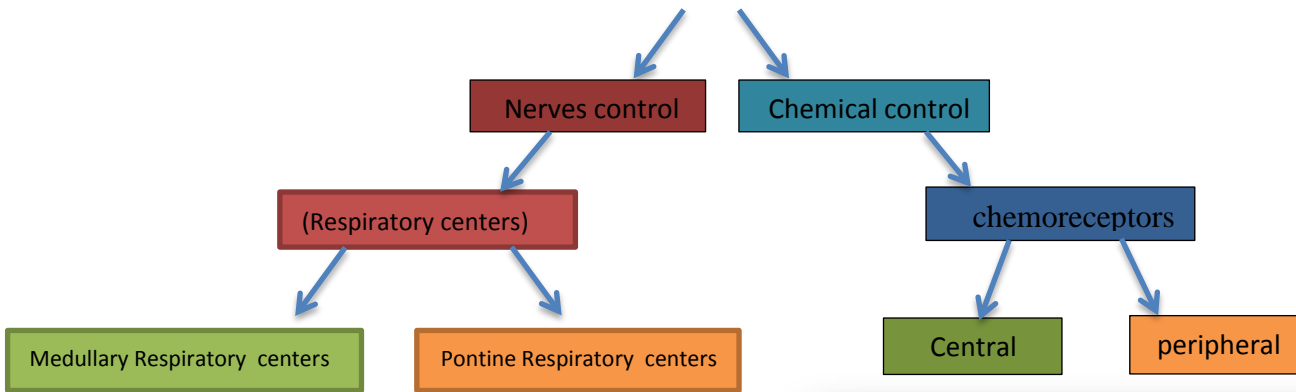
Abdulrahman AL-Shiban - Eman AL-Bedea

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Khulood Al-Raddadi & Mohammad Jameel

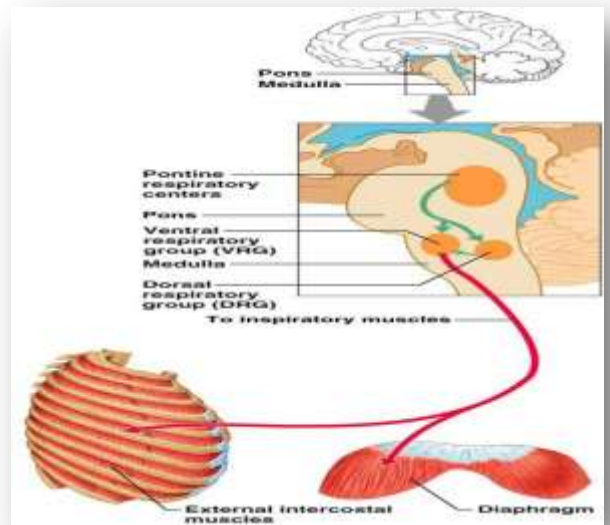
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Control of Breathing



Controls of rate and depth of respiration

- Arterial PO₂
 - When PO₂ is VERY low (Hypoxia), ventilation increases
- Arterial PCO₂ (**the most important**)
 - The most important regulator of ventilation is PCO₂, small increases in PCO₂, greatly increases ventilation
- Arterial pH
 - As hydrogen ions increase (acidosis), alveolar ventilation increases.



❖ Medullary Respiratory centers (control the respiratory muscles)

- 1- Inspiratory area (Dorsal Respiratory Group) DRG:
 - Determines basic rhythm of breathing. (ايقاع ضربات القلب)
 - Causes contraction of diaphragm and external intercostals.
 - 2- Expiratory area (Ventral Respiratory Group) VRG:
 - Inactive during normal quiet breathing
 - Activated **by inspiratory area during forceful breathing** .
 - Causes contraction of internal intercostals and abdominal muscles
- ✓ The medullary respiratory center stimulates **basic inspiration** for about **2 seconds** and then **basic expiration** for about **3 seconds** (5sec/breath= 12breaths/min).

❖ pontine Respiratory centers

- ✓ Transition between inhalation and exhalation is controlled by:
 - 1- **Pneumotaxic area:**
 - Inhibits inspiratory (stimulate the expiration) area of medulla to stop inhalation
 - Breathing is more rapid when pneumotaxic area is active
 - 2- **Apneustic area:**
 - stimulates inspiratory area of medulla to prolong inhalation.

١- زي ما قلنا فوق.. عملية inspiration هي عملية مستمرة، ولا تتوقف الا عن طريق :

a- Pneumotaxicarea

b- Vegus nerv (Hering-Breuer inflation reflex)
 في الطبيعي الـ inspiration مدته ٢ ثانية ، اذا
 حينما نزيد المدة يزيد الـ Apneustic area

Chemical regulation

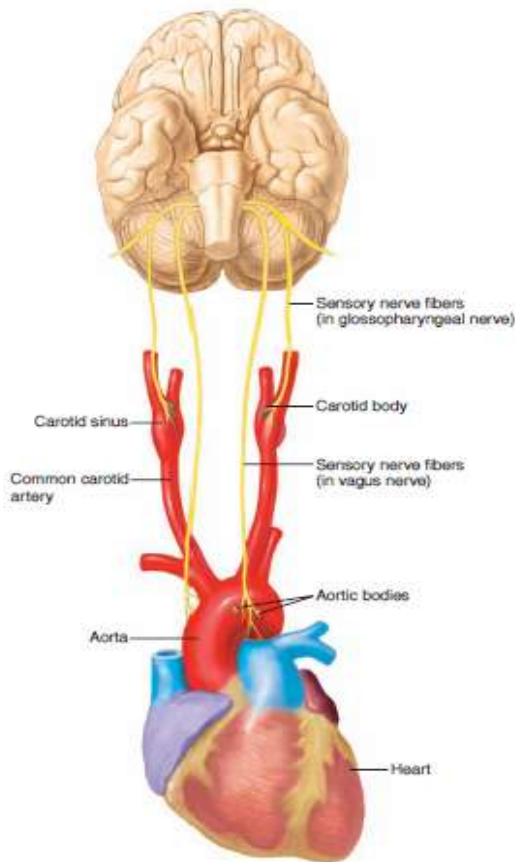


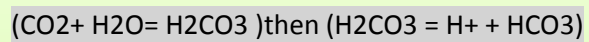
Figure 16.25 Sensory input from the aortic and carotid bodies. The peripheral chemoreceptors (aortic and carotid bodies) regulate the brain stem respiratory centers by means of sensory nerve stimulation.

chemoreceptors

Central

peripheral

Central : they are located in the chemo sensitive area in the medulla, when the CO_2 increase in blood $\gg CO_2$ cross the brain blood barrier and interact with H_2O



the reaction happed in the CSF \gg then H^+ inter the medulla and stimulate the receptors in the sensitive area \gg send impulse to medulla \gg increase ventilation

Peripheral: they are two:

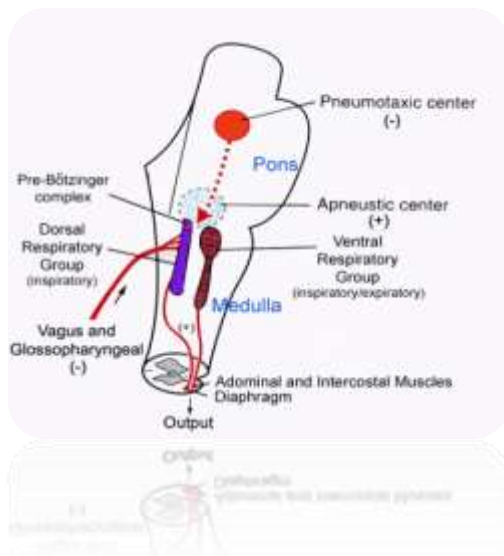
1- carotoid body , 2- aortic body. They are sensitive to :

- Decrease arterial O_2 (hypoxia).(1)
- Increase arterial CO_2 (hypercapnia)
- Increase H^+ = decrease PH.(acidosis)(also in the arterial blood)

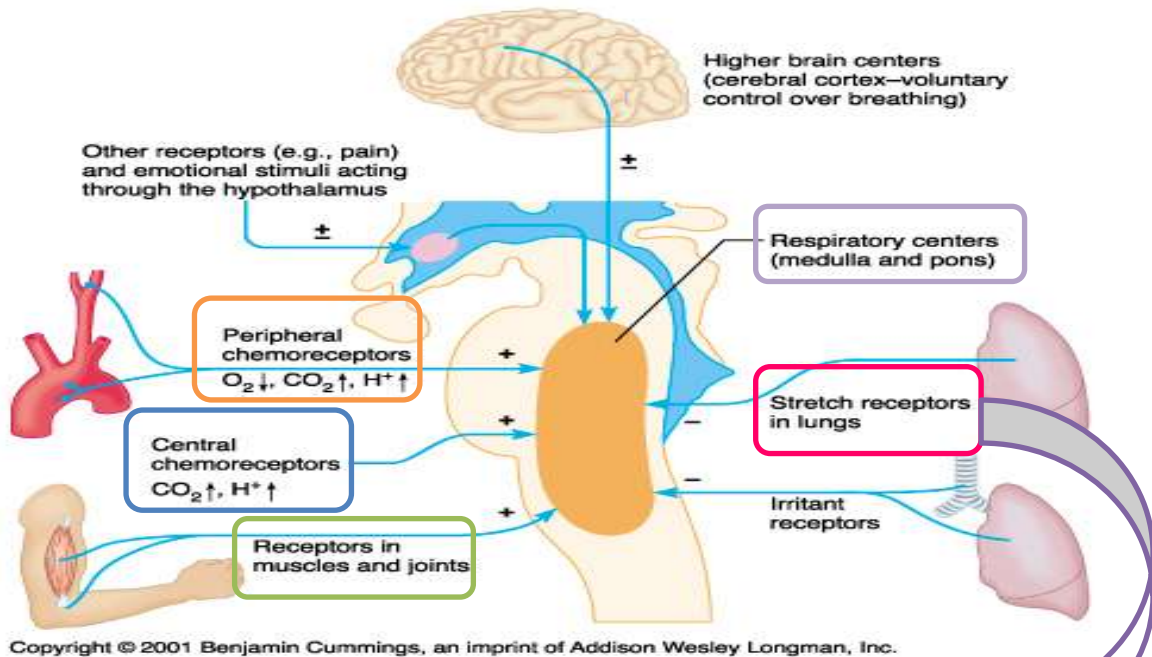
If one of the above happed, the peripheral receptors (carotid & aortic bodies) will stimulate the medulla(increased ventilation) by Vagus in Aortic bodies, Glossopharyngeal in Carotid bodies.

طبعا الرستبرز هذي في الارتريز وليس الفينز.

وأكثر شي يحفز التنفس هو زيادة CO_2 في الارتريز وهو اهم واحد.

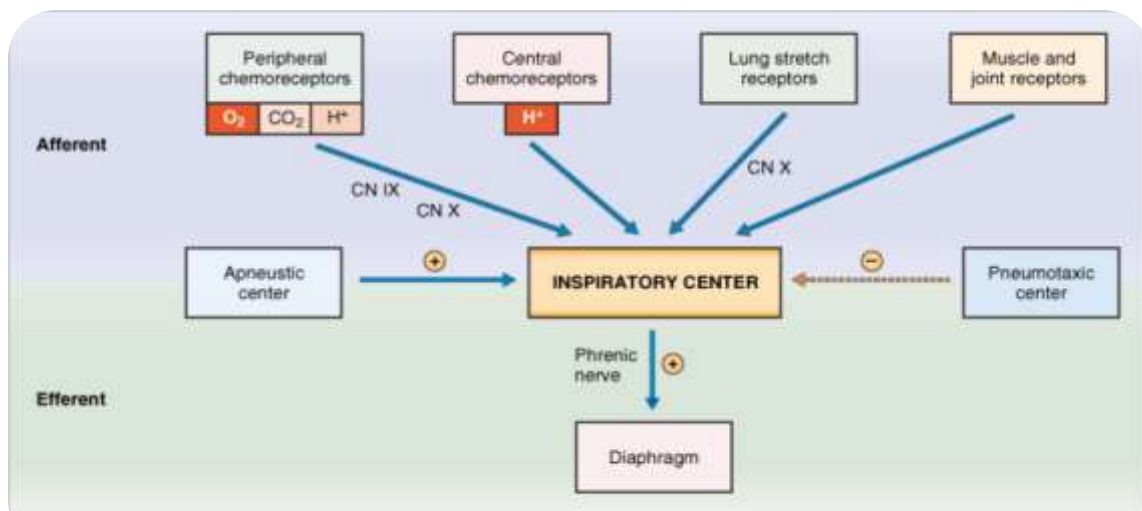


Factors Influencing Respiration



Hering-Breuer inflation reflex:

- When the lung becomes overstretched (tidal volume is **1 L or more**), **stretch receptors** located in the wall bronchi and bronchioles transmit signals through **vagus nerve** to DRG producing effect similar to pneumotaxic center stimulation >> Switches off inspiratory signals and thus stops further inspiration.
- This reflex also **increase the rate of respiration** as does the pneumotaxic center.



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Respiratory Acidosis:

- Hypoventilation.
- Accumulation of CO₂ in the tissues.
- Pco₂ increases.
- PH decreases.

Respiratory Alkalosis:

- Hyperventilation.
- Excessive loss of CO₂.
- PCO₂ decreases (35 mmHg).
- PH increases

Metabolic Acidosis:

- Ingestion, infusion, or production of a fixed acid.
- Decreased renal excretion of hydrogen ions.
- loss of bicarbonate or other bases from the extracellular compartment

Metabolic Alkalosis:

- Excessive loss of fixed acids from the body.
- Ingestion, infusion, or excessive renal reabsorption of bases such as bicarbonate.
- PH increases.

The respiratory system can compensate for metabolic acidosis or alkalosis by altering alveolar ventilation.

Hyper-ventilation : increase in the rate and depth of the respiration ..

Hypo-ventilation : : decrease in the rate and depth of the respiration ..

في حالة عملية التنفس يشتغل الـ CO₂ كوجه آخر للـ H⁺ عشان
ينظم مستوي الـ PH للدم .

Objectives

- **By the end of this lecture you should be able to: -**
- Understand the role of the **medulla oblongata** in determining the basic pattern of respiratory activity.
- List **some factors that can modify the basic breathing pattern** like e.g.
 - a-The Hering-Breuer reflexes.
 - b-The proprioceptor reflexes.
 - c-The protective reflexes, like the irritant, and the J-receptors.
- Understand the **respiratory consequences of changing PO₂, PCO₂, and pH.**
- Describe the locations and roles of **the peripheral and central chemoreceptors.**

GOOD LUCK