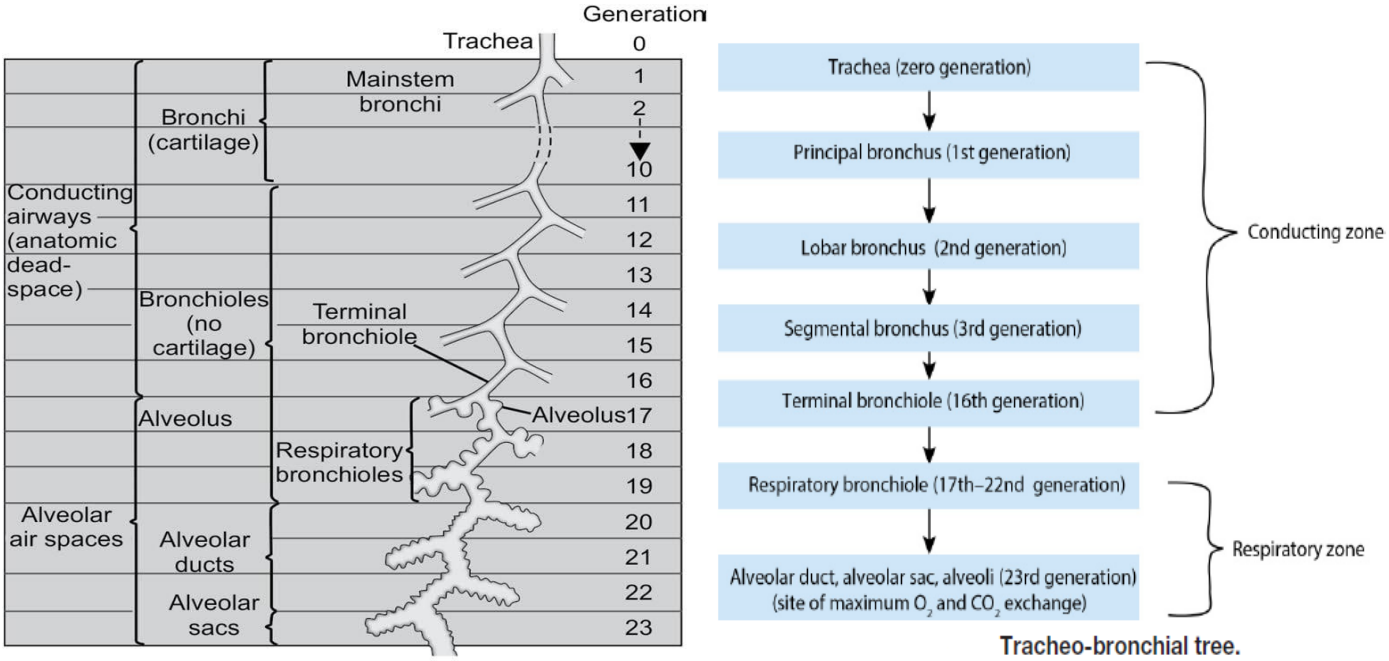
Diagrams & Flowcharts – Respiratory System

Instruction: 26/12/2023

1. Write the diagrams/flow charts neatly with proper Labeling in 100page unruled notebook
2. Submit your assignment to the respective Table Teacher on time
3. Clarify your doubts with teacher concerned.
4. **Submit Assignment by 24/01/2024**

1. WEIBEL'S MODEL OF TRACHEO-BRONCHIAL TREE:



Tracheo-bronchial tree.

2. MECHANICS OF RESPIRATION / MECHANICS OF BREATHING/ MECHANISM OF BREATHING:

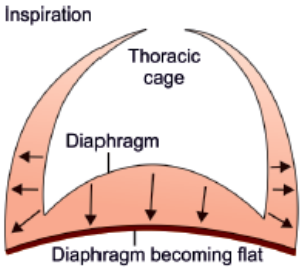
Respiratory Movements
A- Movements of Diaphragm

Inspiration

Contraction (descent) of diaphragm

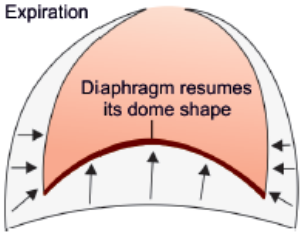
⬇

Increase of vertical diameter of thoracic cavity



Expiration

Relaxation (ascent) of diaphragm)



RESPIRATORY MOVEMENTS
B- MOVEMENTS OF RIBS
(In Normal Inspiration)

PUMP HANDLE MOVEMENT

Elevation of ribs

⬇

Increase in antero-posterior diameter of thoracic cavity

2^{nd} to 6^{th} rib

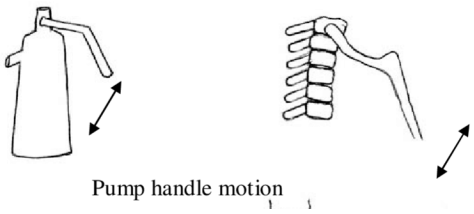
BUCKET HANDLE MOVEMENT

Elevation of ribs

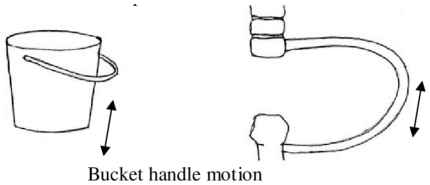
⬇

Increase in lateral (transverse) diameter of thoracic cavity

7^{th} to 10^{th} rib



Pump handle motion

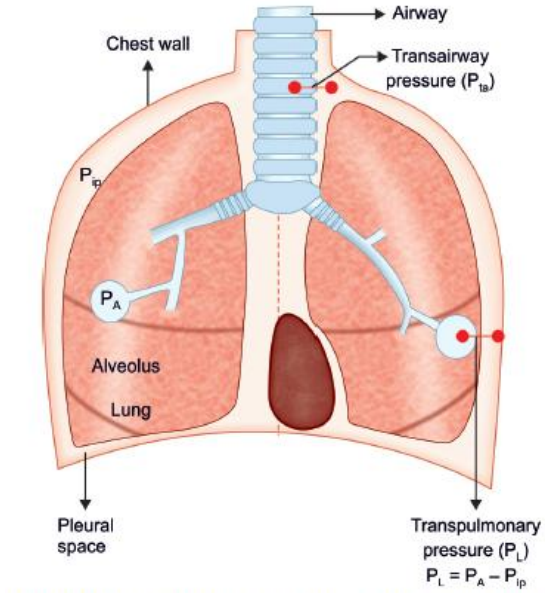


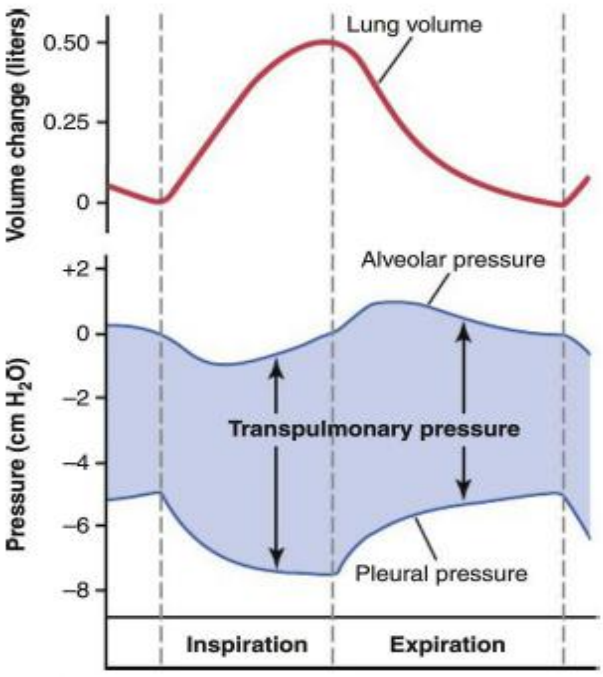
Bucket handle motion

Mechanism of Inspiration & Expiration

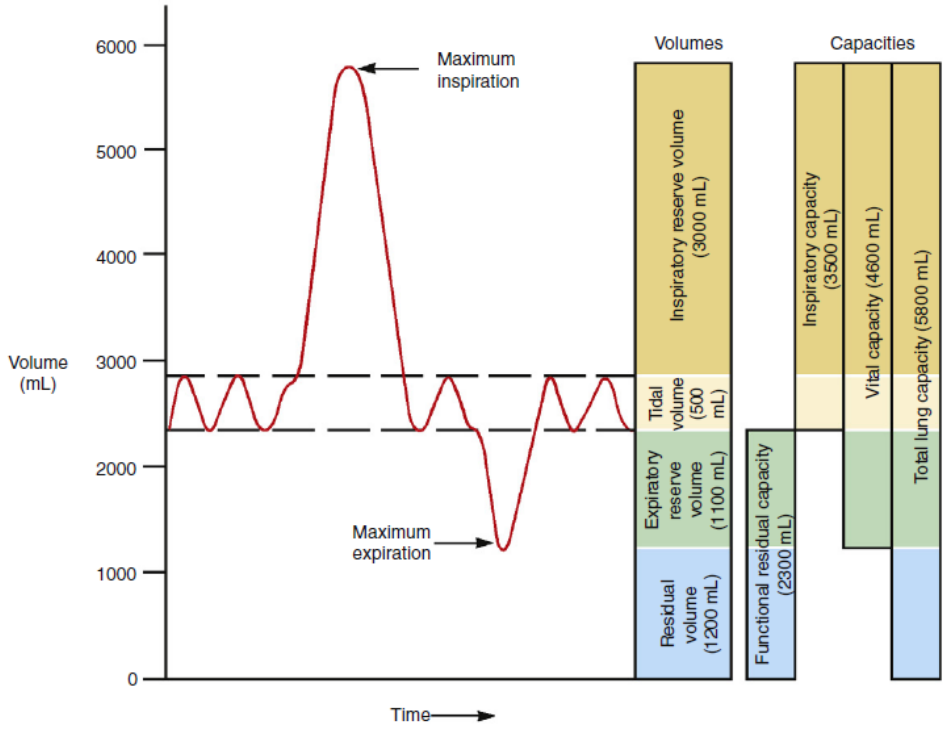
Inspiration	Expiration
Respiratory centers initiate the stimuli for inspiration	Respiratory centers terminate the inspiratory impulses
These impulses are carried via nerves to the inspiratory muscles	The diaphragm (and/or other inspiratory muscles) relax
The diaphragm (and/or other inspiratory muscles) contract	The chest wall retracts and decreases the volume of the thorax
The chest wall expands increasing the volume of the thorax	The intrapleural pressure becomes less negative
The intrapleural pressure becomes more negative	The alveolar pressure increases above the atmospheric pressure
The alveolar pressure decreases below the atmospheric pressure	The alveoli undergo elastic recoil forcing air out
The alveoli inflate as air flows into them until the alveolar pressure reaches atmospheric pressure	The alveoli deflate as air flows out until the alveolar pressure reaches atmospheric pressure

PRESSURE CHANGES DURING VENTILATION

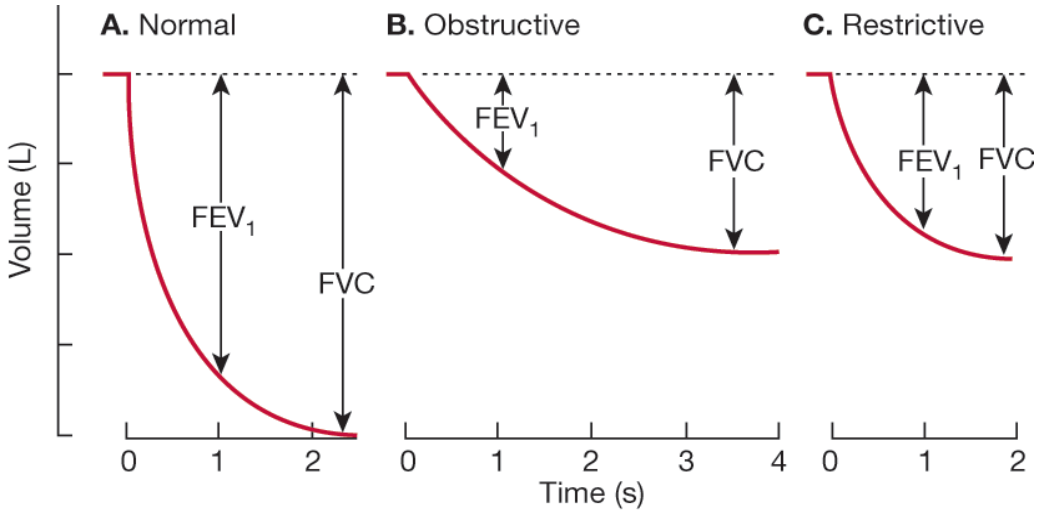




3. LUNG VOLUMES AND CAPACITIES:



4. TIMED VITAL CAPACITY IN NORMAL SUBJECTS, OBSTRUCTIVE AND RESTRICTIVE LUNG DISEASES.



A. Normal	B. Obstructive	C. Restrictive
$FEV_1 = 3.3$	$FEV_1 = 1.0$	$FEV_1 = 1.8$
$FVC = 4.0$	$FVC = 2.0$	$FVC = 2.0$
$FEV_1/FVC = 83\%$	$FEV_1/FVC = 50\%$	$FEV_1/FVC = 90\%$

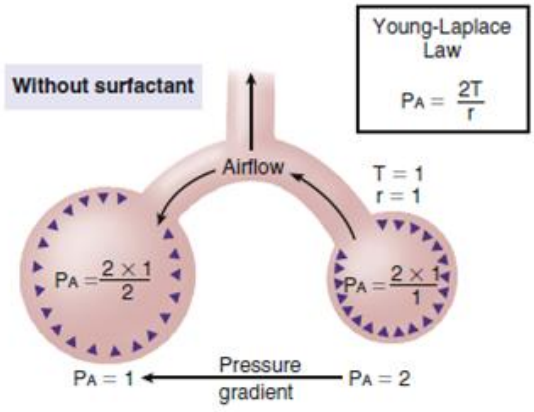
	NORMAL	RESTRICTIVE	OBSTRUCTIVE
FVC	5.0 L	Lower	Norm. or Low
FEV1	3.75L	Lower	Much Lower
FEV1/FVC	70-75%	Higher	Lower
% PREDICTED FVC	80-100%	Lower	Normal

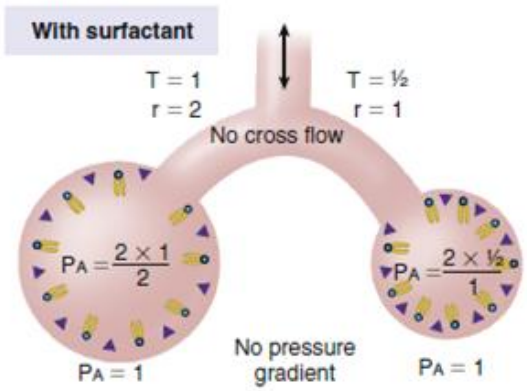
Differences between obstructive and restrictive lung diseases

Features	Obstructive Lung Disease	Restrictive Lung Disease
Definition	Partial or complete airway obstruction	Lung parenchymal damage and restriction in lung expansion with stiff lungs, weak musculature or damage to the nerves.
Flow rate	↓	↑
Airway resistance	↑	↓
Total lung capacity	Normal or ↑	↓
FVC	↓↓	↓↓
FEV_1	↓↓	↓
FEV_1/FVC	↓↓	Almost normal or ↑
Examples	Bronchial asthma, COPD (chronic obstructive pulmonary disease—emphysema, chronic bronchitis, bronchiectasis), cystic fibrosis	Interstitial lung disease, pulmonary fibrosis, sacrcoidosis, obesity, amyotropic lateral sclerosis

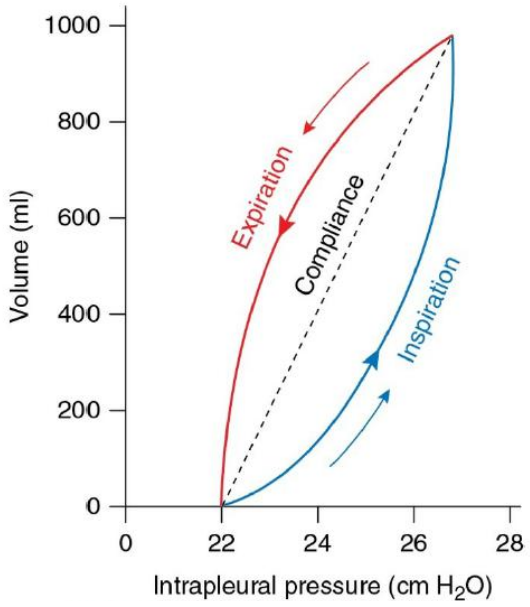
↑, Increase; ↓, Decrease.

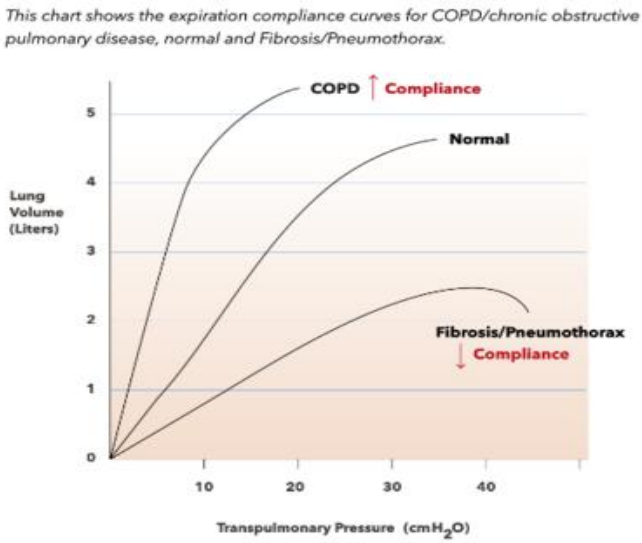
5. ALVEOLAR SURFACE TENSION:



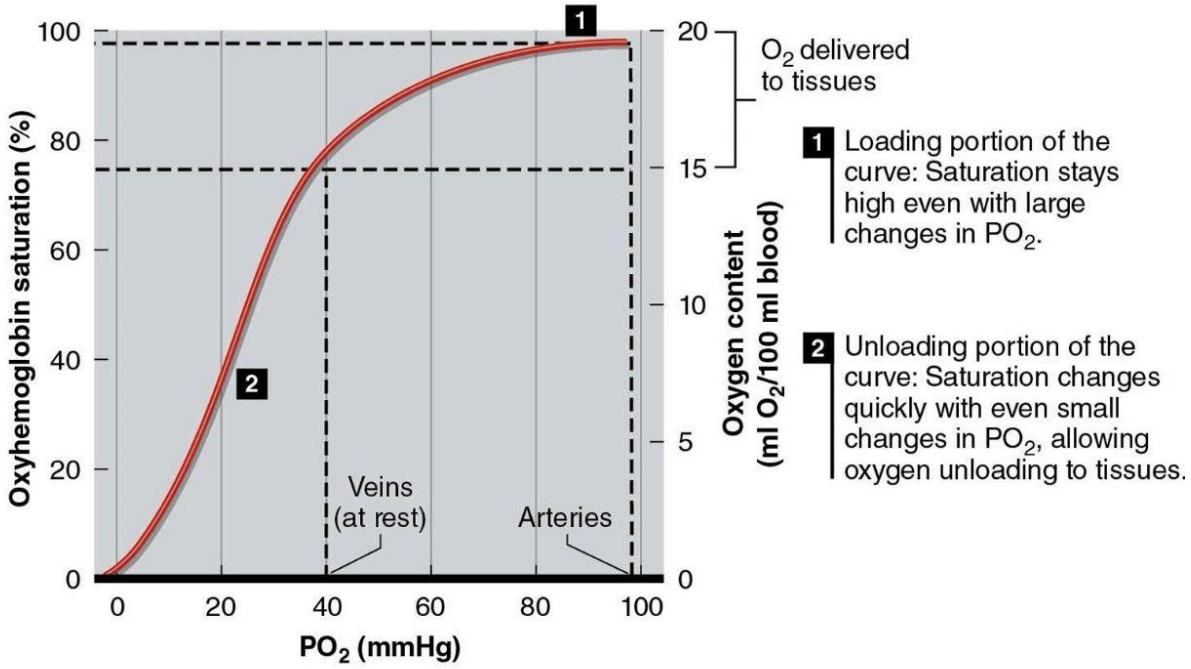


6. COMPLIANCE :

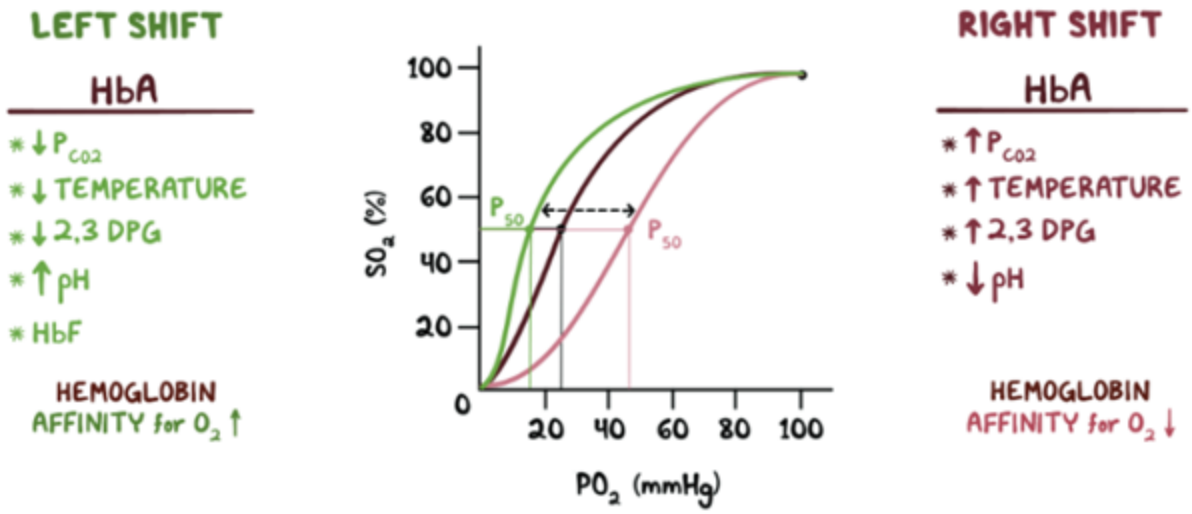




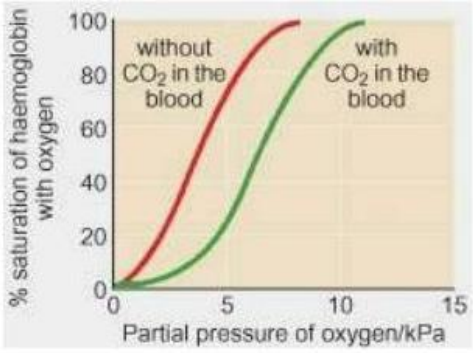
7. OXYGEN HEMOGLOBIN DISSOCIATION CURVE:



Factors affecting oxygen -hemoglobin dissociation curve



8. BOHR EFFECT:



Increase in C02/ H^+ concentration - ---- decreases the affinity of Hb to O2----- unloading of oxygen in tissues.

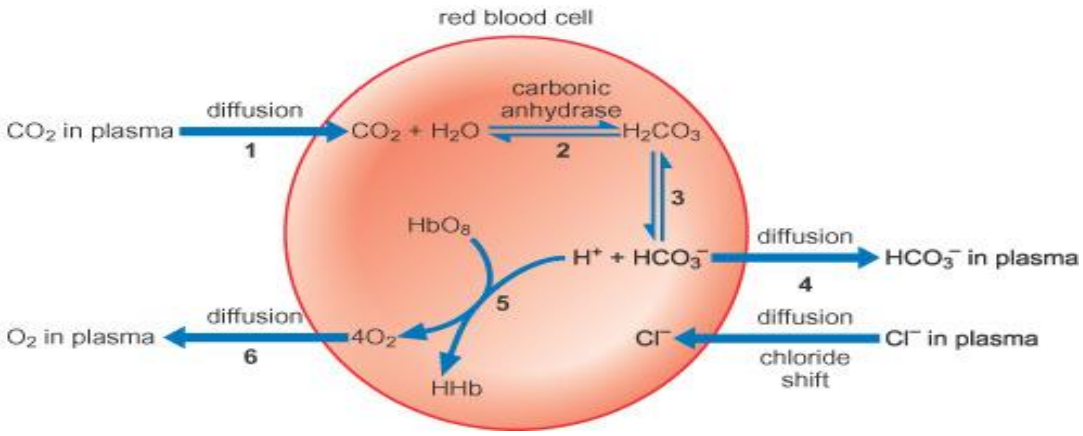
9. HALDANE EFFECT:

Binding of O2 to Hb -------- release of CO2 from Hb---------- occurs in the lungs

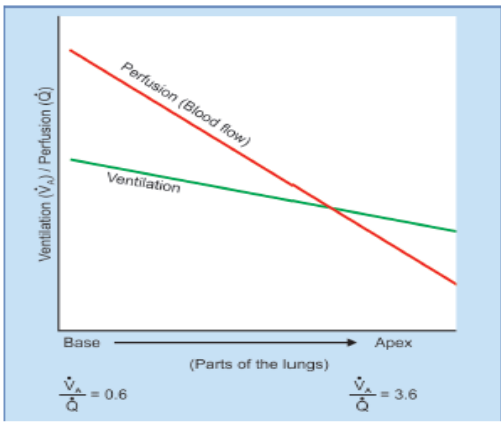
THE BASICS OF THE BOHR AND HALDANE EFFECTS

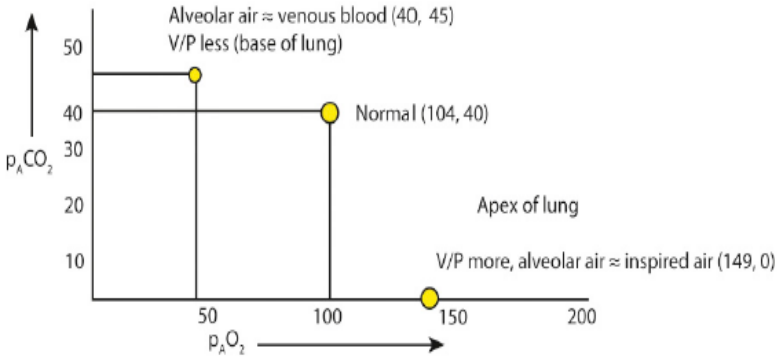
Bohr Effect	Haldane Effect
CO_2 and H^+ binding to Hb → decreased Hb affinity for O_2	Deoxygenation of Hb → increased Hb affinity for CO_2
Shifts O_2-hemoglobin curve RIGHT	Shifts CO_2-blood curve LEFT

10.CHLORIDE SHIFT/ HAMBURGER PHENOMENON:



11. VENTILATION-PERFUSION RATIO:

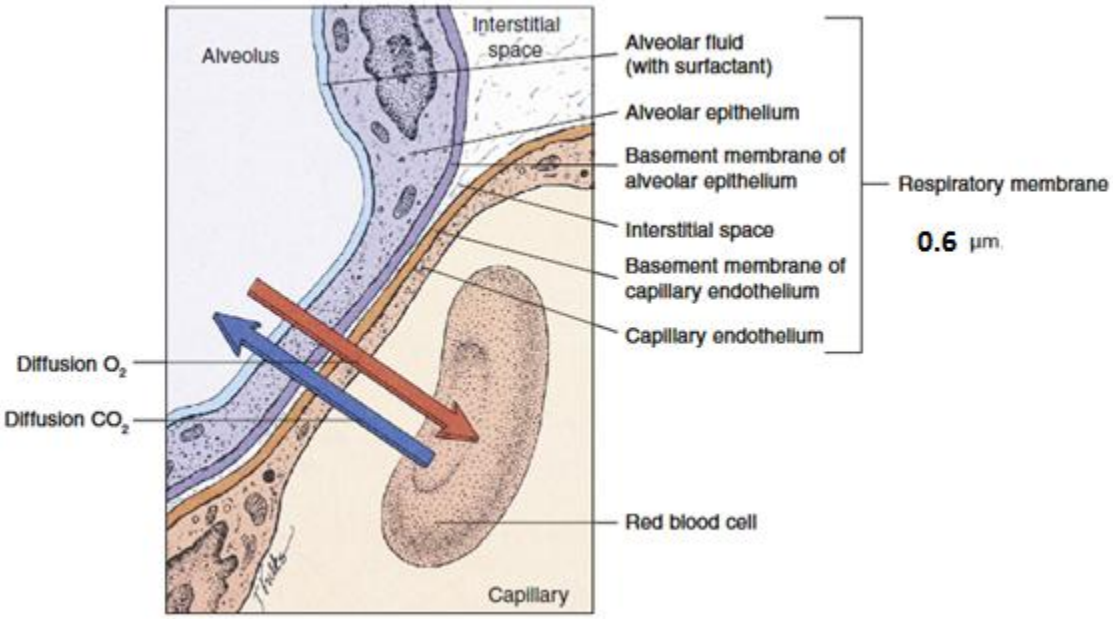




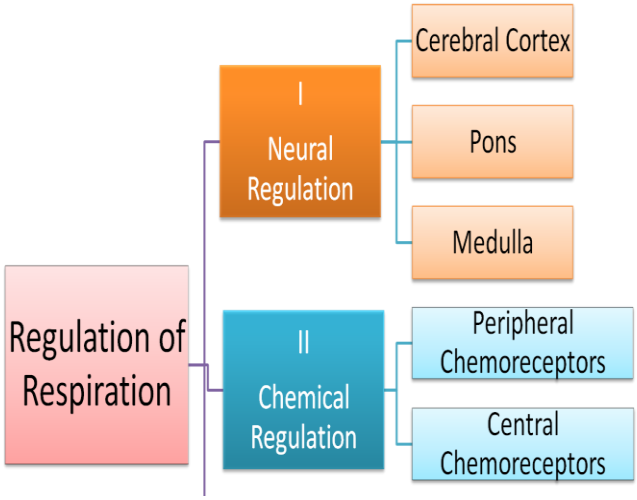
Effects of changes in V/P ratio on p_ACO_2 and p_AO_2 in an alveolus

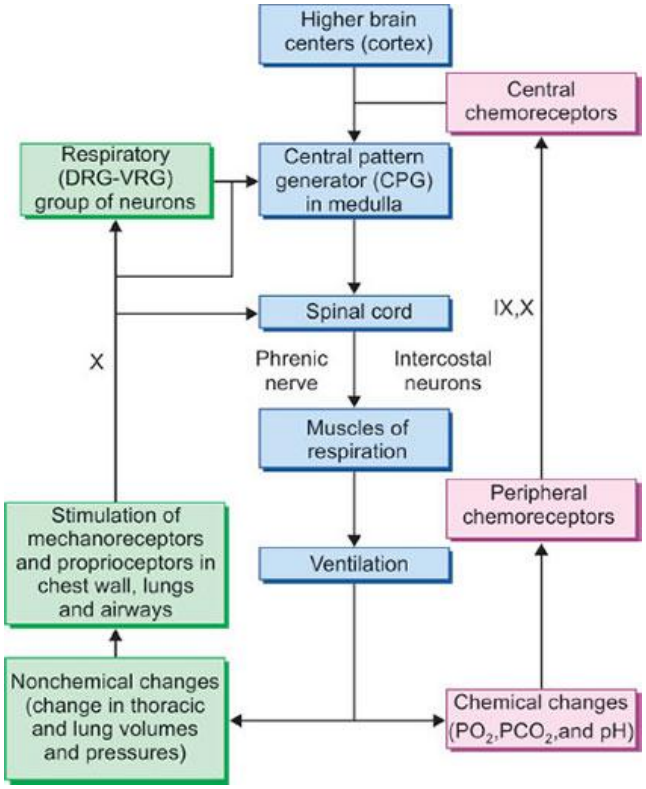
Zone	Alveolar ventilation (L/min)	Perfusion (L/min)	V/P ratio	pO_2 (mm Hg)	pCO_2 (mm Hg)	pN_2 (mm Hg)	pH_2O (mm Hg)
Apex	2	0.6	3.3	132	28	553	47
Middle	4	5	0.8	100	40	573	47
Base	6	10	0.6	89	42	582	47

12.RESPIRATORY MEMBRANE:



13.REGULATION OF RESPIRATION:

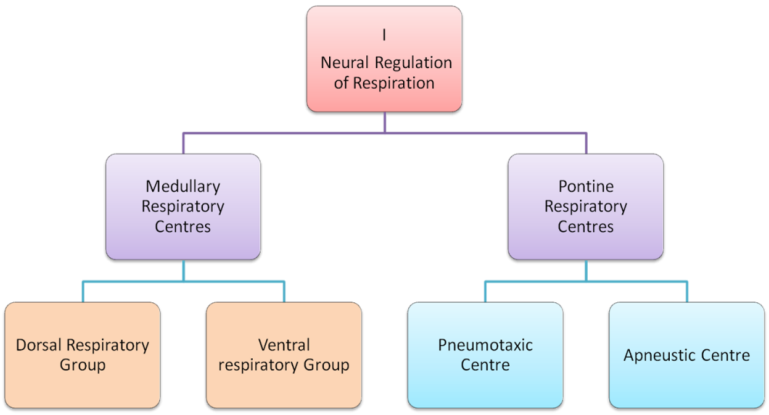


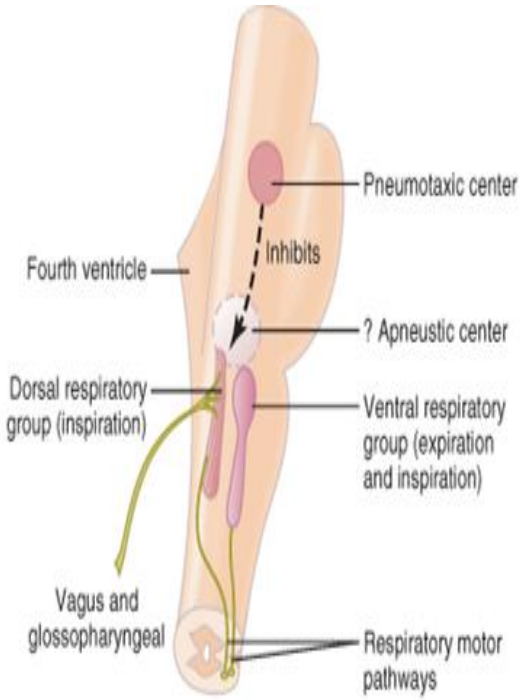


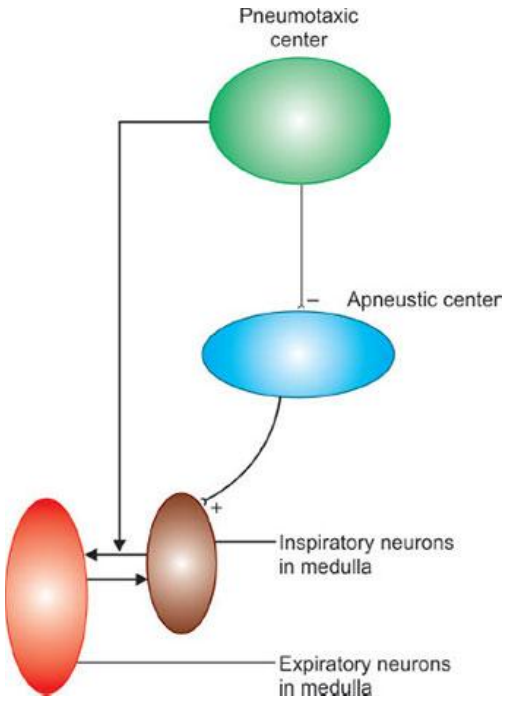
SUMMARY OF VENTILATION REGULATION	
System Component	**Function**
Medullary respiratory center	Sets basic rhythm of breathing
Ventral respiratory group(VRG)	Generates the breathing rhythm & integrates data coming into medulla
Dorsal respiratory group(DRG)	Integrates input from the stretch receptors & the chemoreceptors in the periphery
Pontine respiratory group (Pneumotaxic & Apneustic center)	Influencea & modifies the medulla oblongata's function
Aortic body	Monitors blood PCO2, PO2 & pH
Carotid body	Monitors blood PCO2, PO2 & pH
Hypothalamus	Monitors emotional state & body temperature

OVERVIEW OF REGULATION OF RESPIRATION

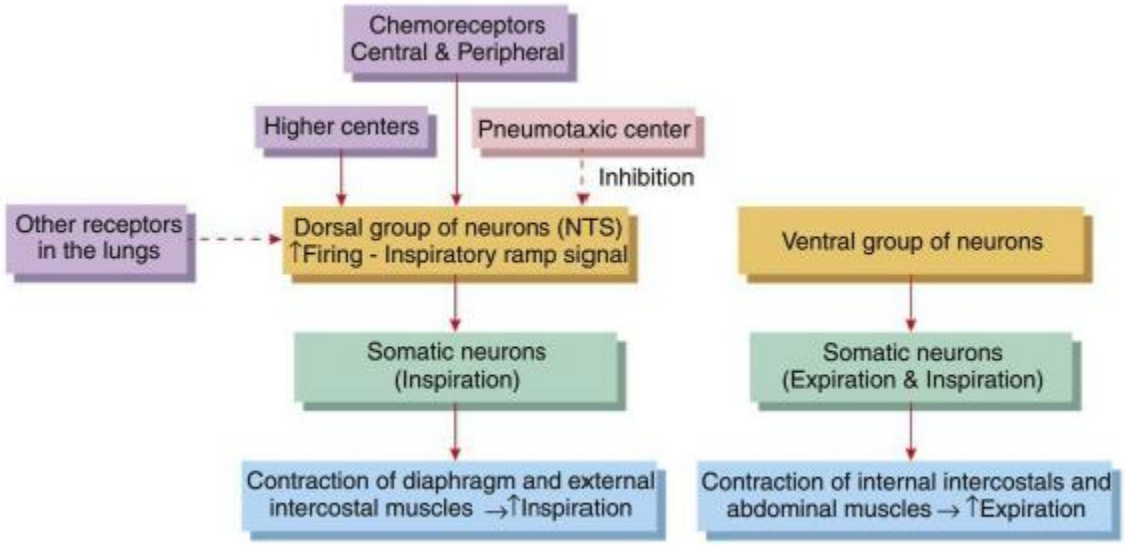
A. NEURAL REGULATION OF RESPIRATION





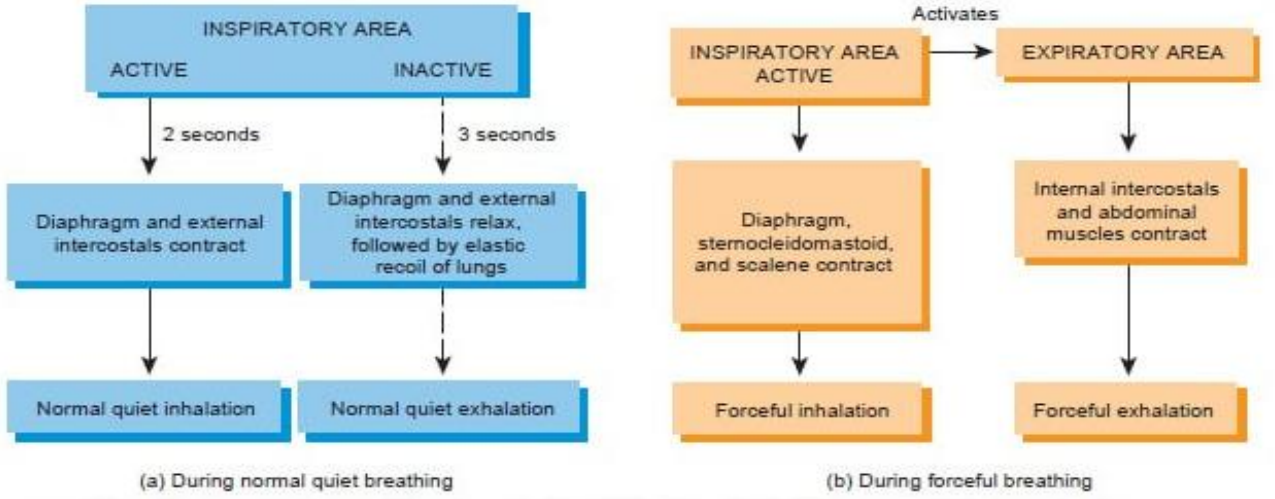


ROLE OF MEDULLARY AND PONTINE RESPIRATORY CENTERS



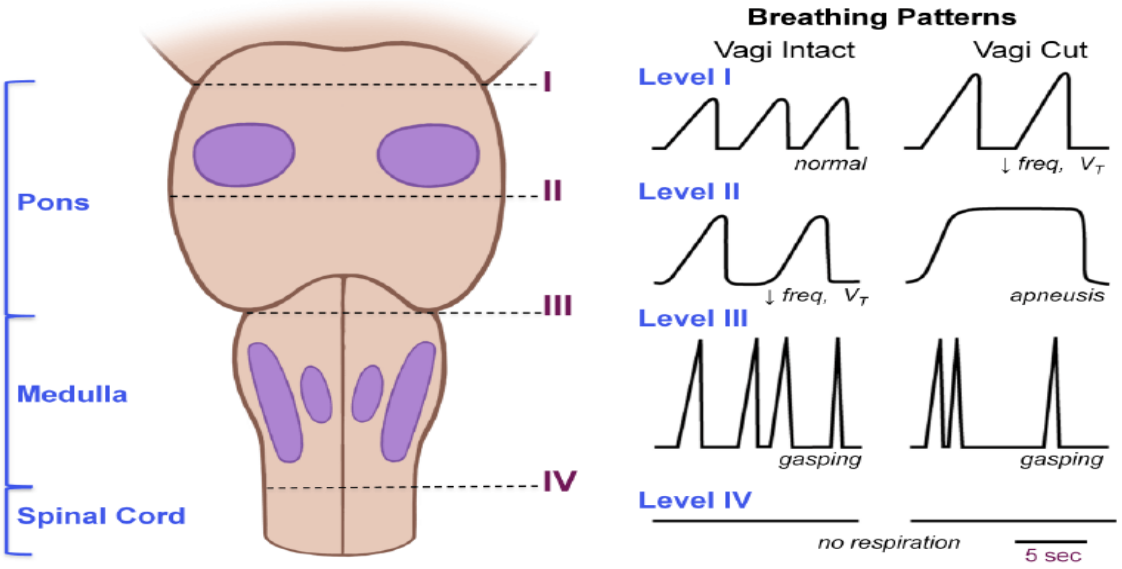
Neural control of respiration.

Activities of the medullary rhythmicity area. Roles of the medullary rhythmicity area include controlling (a) the basic rhythm of respiration and (b) forceful breathing.

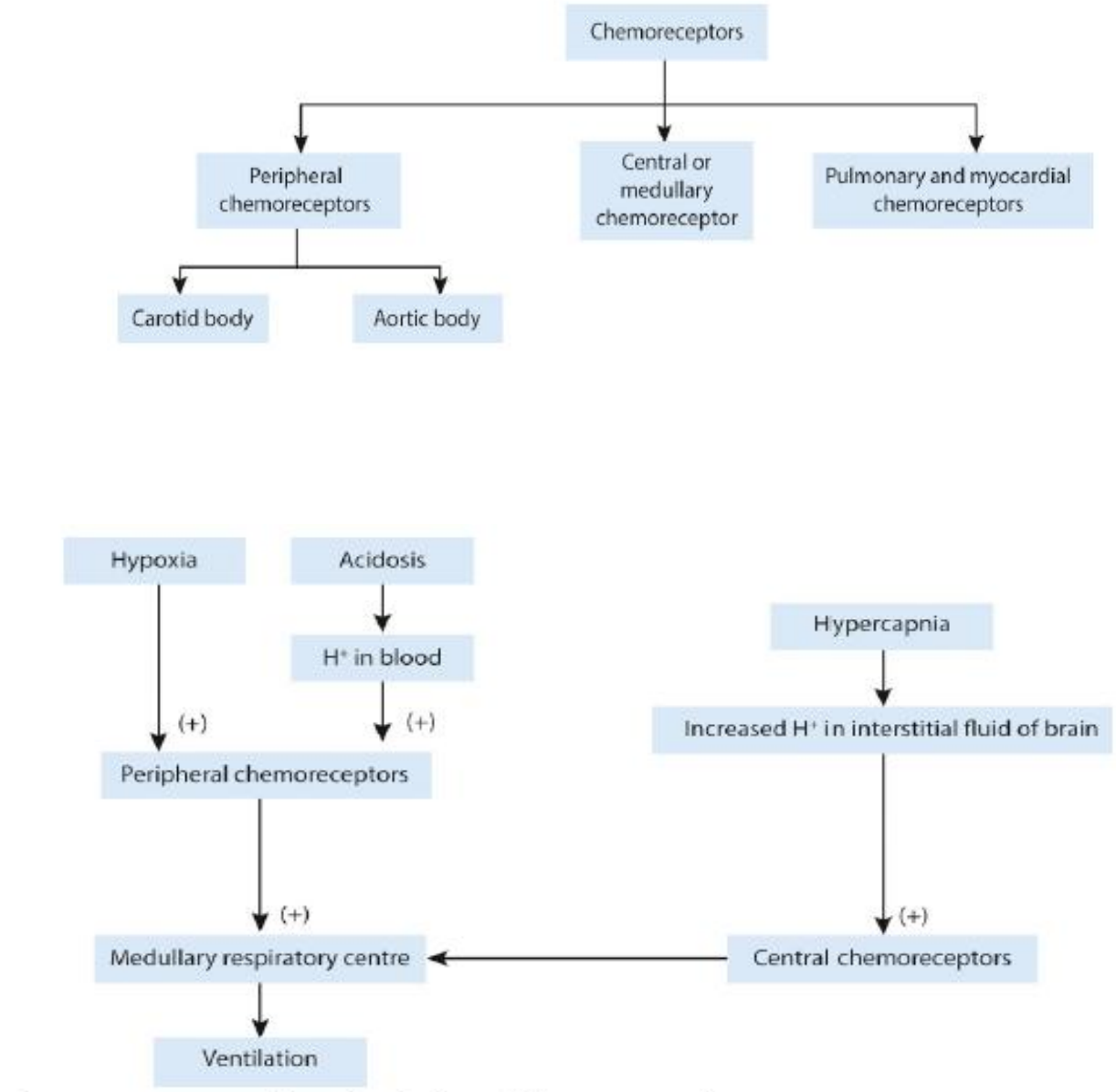


During normal, quiet breathing, the expiratory area is inactive; during forceful breathing, the inspiratory area activates the expiratory area.

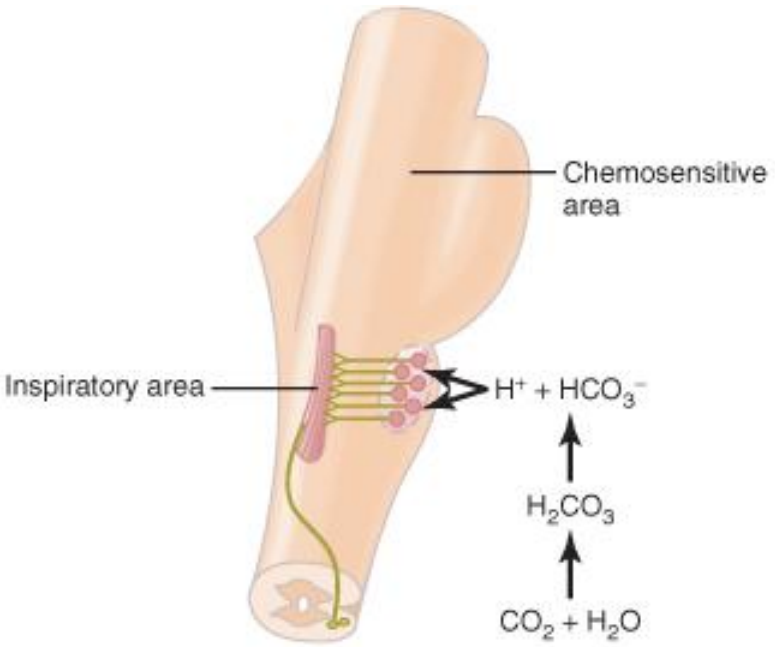
Effects of Transections on Breathing Patterns



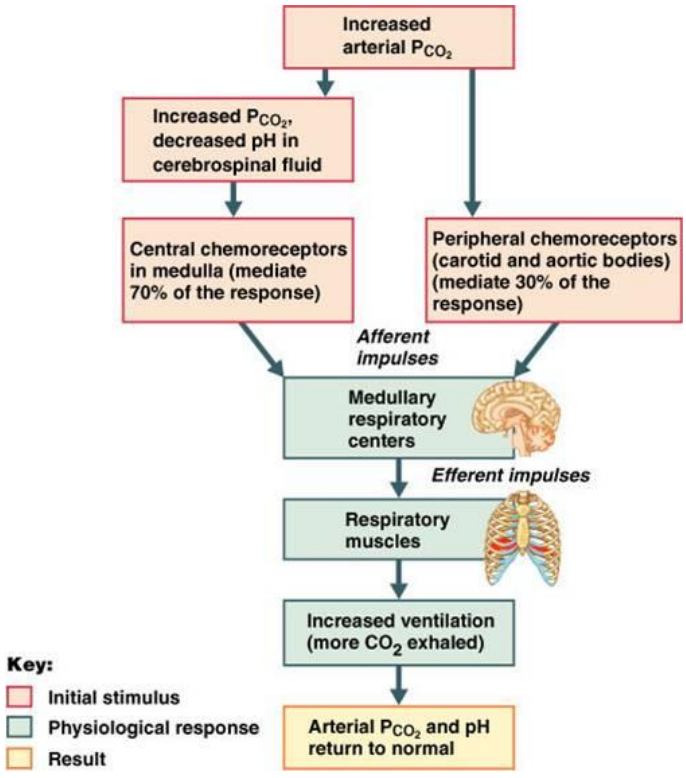
B.CHEMICAL REGULATION OF RESPIRATION



Summary representing stimulation of chemoreceptors.

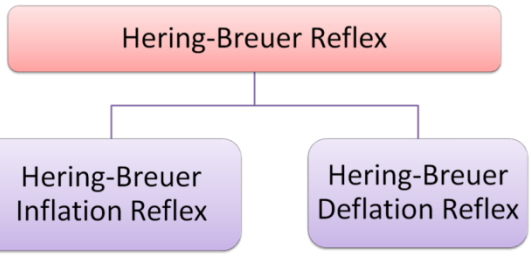


Mechanism of action of CO2 on Medullary chemoreceptor

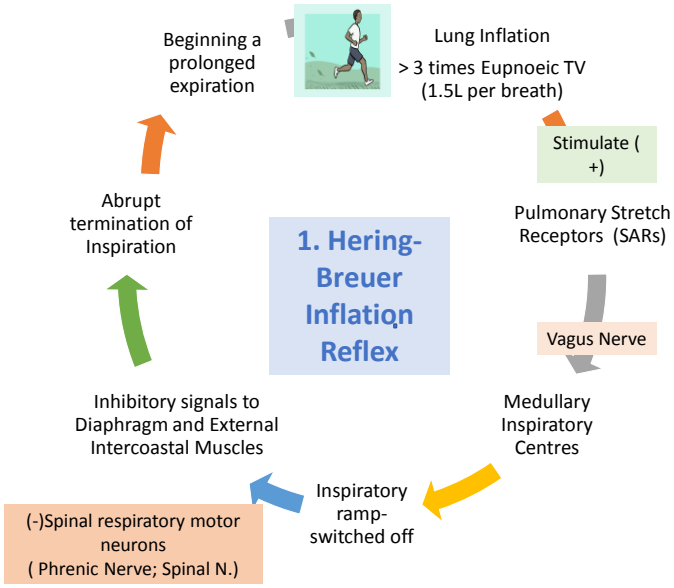


Overview of Chemical Regulation of Respiration

C.RESPIRATORY REFLEXES

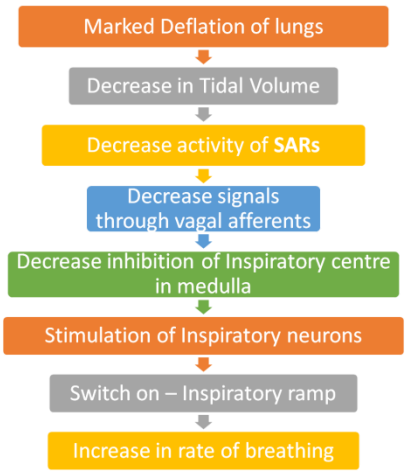


1. Hering-Breuer Inflation Reflex



Example:
Exercise
COPD

2. Hering-Breuer Deflation Reflex



Example:
Yawning
Lung collapse
Pneumothorax

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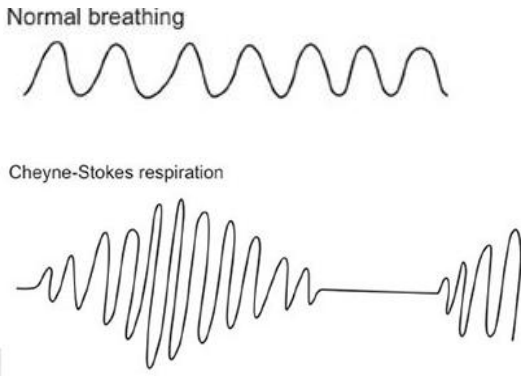
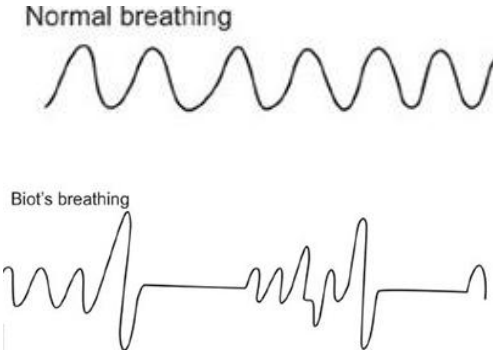
14. APPLIED ASPECT- ABNORMAL BREATHING PATTERNS:

1. **CHEYNE STOKES RESPIRATION:**



Example:
Voluntary hyperventilation
Sleep
Cerebrovascular disease

2. **BIOT'S BREATHING:**

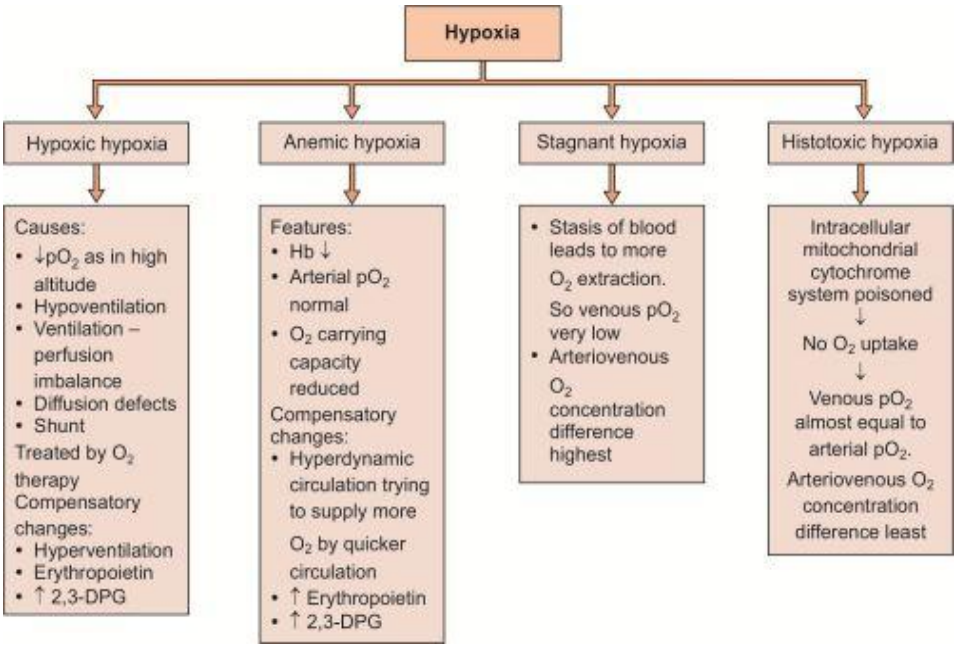


Example:
Meningitis

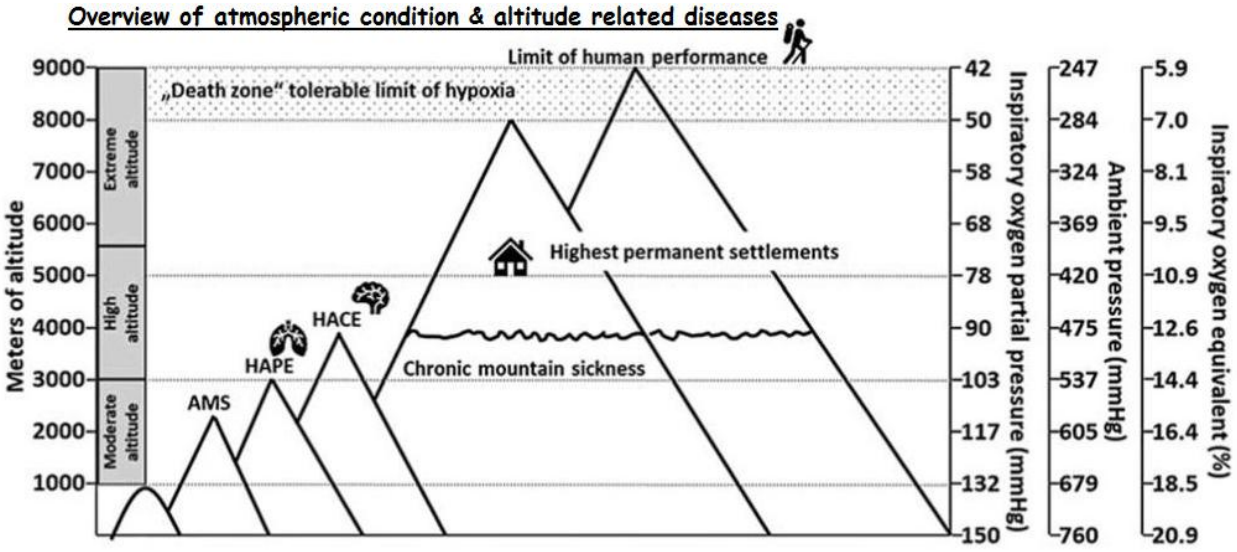
Different Types of Abnormal Breathing

Type of Abnormal Breathing	Description	Causes
Cheyne–Stokes breathing	The person breathes deeply for a short interval and then breathes slightly or not at all for an additional interval	Severe cardiac failure, increased negative feedback gain in respiratory control areas
Biot's breathing	Quick bouts of shallow respiration followed by unpredictable periods of apnea	Lesions in the medulla oblongata
Apneustic breathing	Characterized by a prolonged inspiratory gap with a pause at full inspiration	Caused by lesions at the dorsolateral lower half of the pons
Kussmaul breathing	Characterized by very deep labored regular breathing	Caused by metabolic acidosis or diabetic ketoacidosis

15. HYPOXIA:



16. HIGH ALTITUDE & RELATED DISEASES:



AMS - Acute mountain sickness, HAPE- high altitude pulmonary edema, HACE - high altitude cerebral edema