

# 呼吸治療師在宅急症照護實務應用及運作培訓課程

## 在宅急症居家呼吸困難及喘的評估及處理

劉文德 醫師/工程博士

大安丰采睡眠醫學診所院長

臺北醫學大學 醫學院兼任副教授

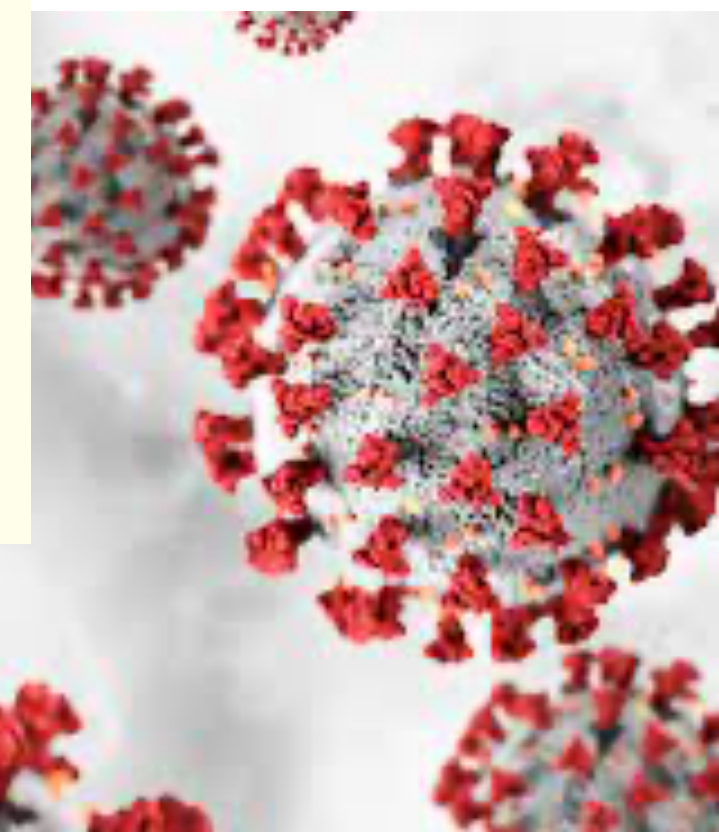
衛生福利部雙和醫院 睡眠中心/胸腔內科 兼任主治醫師

e-mail: lion5835@gmail.com

# COVID-19及變異株Delta、Omicron比較

	COVID-19原始株	變異株Delta	變異株Omicron
症狀	<ul style="list-style-type: none"><li>▶ 虛弱</li><li>▶ 肌肉痛</li><li>▶ 呼吸急促</li><li>▶ 注意力不集中</li><li>▶ 無活動力</li><li>▶ 頭痛</li><li>▶ 睡眠障礙</li><li>▶ 焦慮</li><li>▶ 記憶問題</li><li>▶ 暈眩</li></ul>	<ul style="list-style-type: none"><li>▶ 發燒</li><li>▶ 咳嗽</li><li>▶ 喉嚨痛</li><li>▶ 鼻塞／流鼻涕</li><li>▶ 呼吸困難</li></ul>	<ul style="list-style-type: none"><li>▶ 流鼻涕</li><li>▶ 頭痛</li><li>▶ 疲勞</li><li>▶ 打噴嚏</li><li>▶ 喉嚨痛</li><li>▶ 持續咳嗽</li><li>▶ 聲音沙啞</li><li>▶ 打冷顫</li><li>▶ 發燒</li><li>▶ 頭暈</li><li>▶ 腦霧</li><li>▶ 嗅覺異常</li><li>▶ 眼睛痠</li><li>▶ 不尋常肌肉痠痛</li><li>▶ 食慾不振</li><li>▶ 失去嗅覺</li><li>▶ 胸痛</li><li>▶ 腺體腫脹</li><li>▶ 情緒低落</li></ul>

哪一種～比較危險？ ～比較不舒服？



首頁 > 看文章 > 新冠肺炎 > 新冠肺炎

# 「隱形缺氧」年輕人也難逃！3徵兆自我檢測，走路6分鐘會喘就要當心

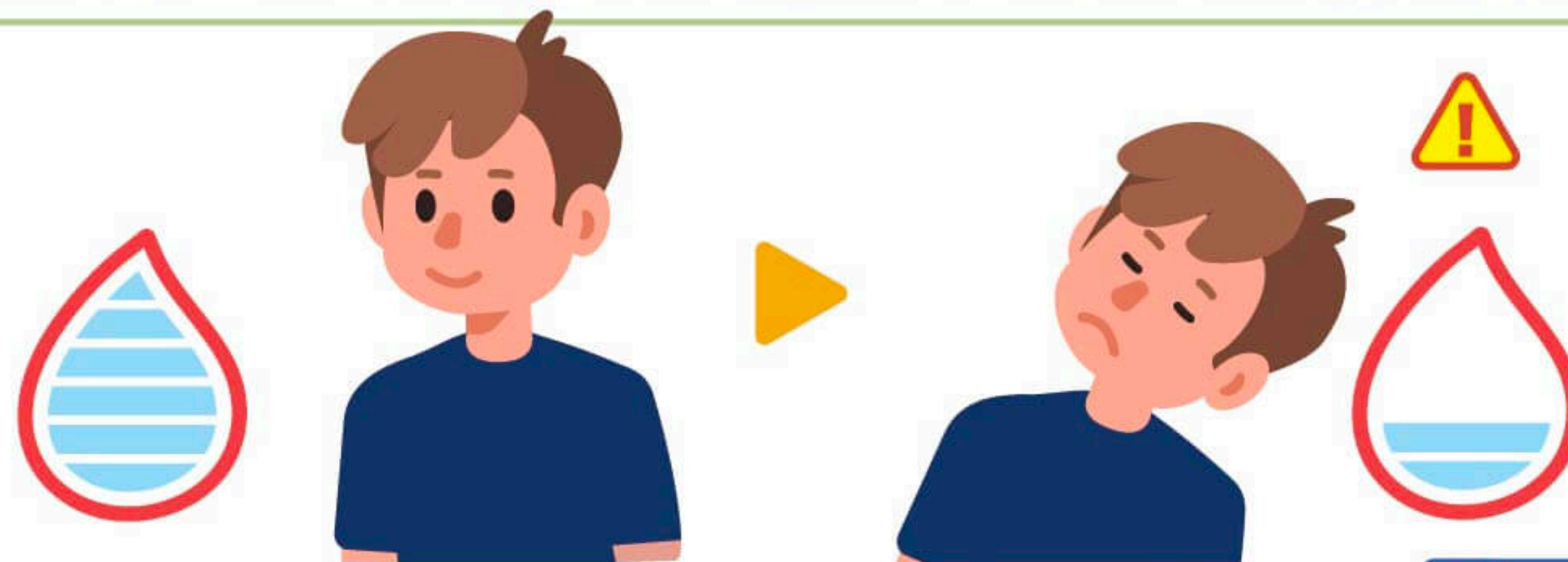
收藏

LINE 讀

讚 227

今健康

## 早上無症狀、晚上心跳停止！ 醫揭「快樂缺氧」危險：2症狀速就醫



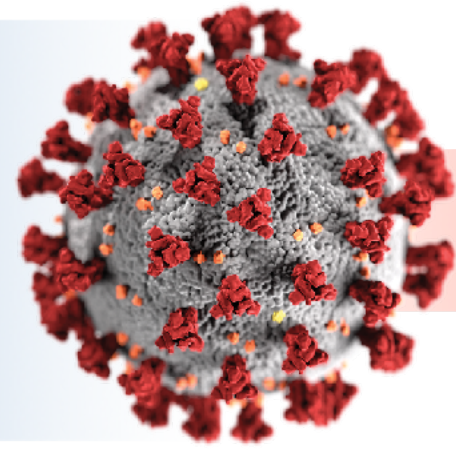
資訊來源：胸腔內科/重症醫學 黃軒醫師

Q

今健康

肺部浸潤  
肺水腫

Chemoreceptors:  
 $O_2$ ,  $CO_2$ ,  $H^+$



Mechanoreceptors:  
Stretch,  
Irritantant, etc.

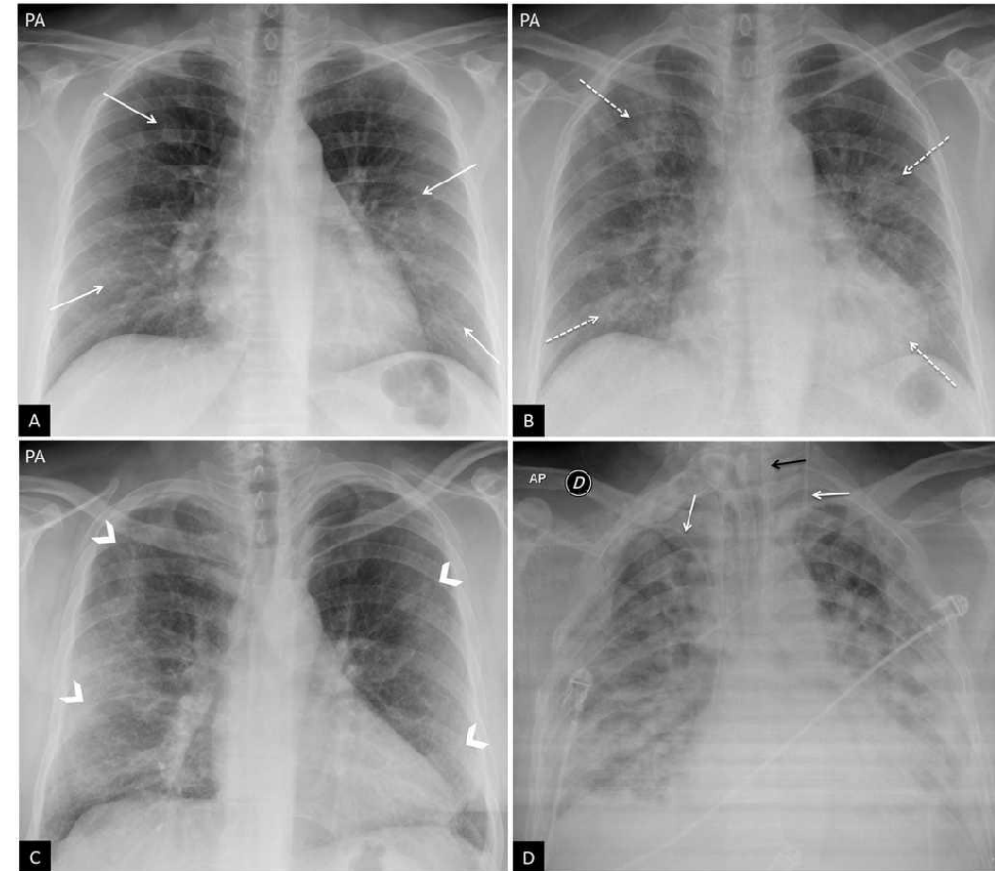
氣喘發作  
肺阻塞  
鼻塞  
胸廓束縛

血中氧氣下降

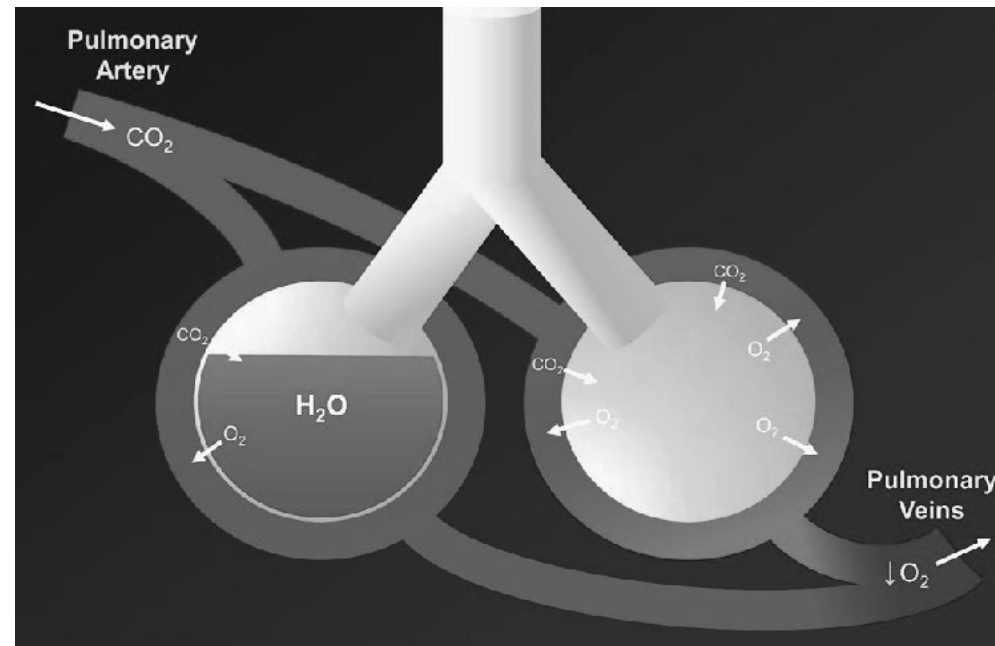
提高換氣量

血液 $CO_2$ 下降

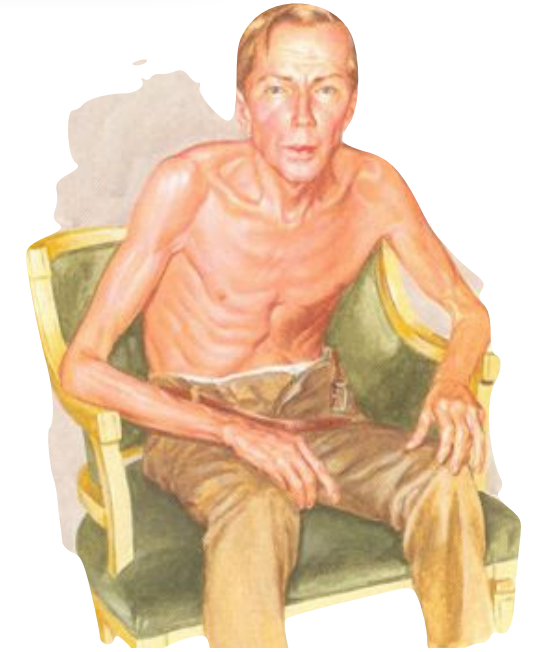
換氣量下降，  
不敷身體需求



Delta: 危險



呼吸氣流  
阻力增加



Omicron: 難受

Pharyngitis



1  
流鼻涕

2  
頭痛

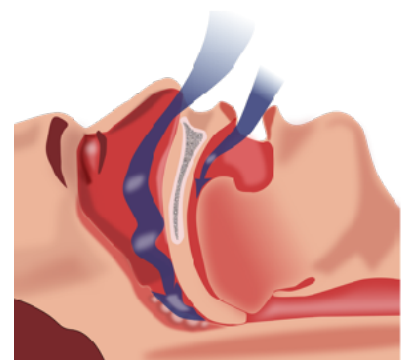
3  
疲勞

4  
打噴嚏

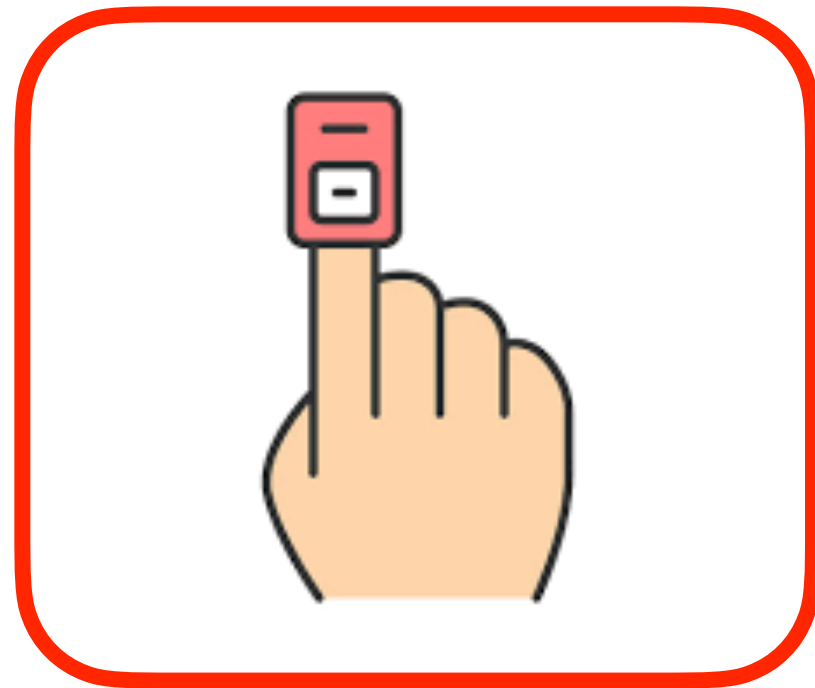
5  
喉嚨痛



睡眠呼吸  
中止症



# 呼吸困難及喘的時候：要思考什麼？



缺氧



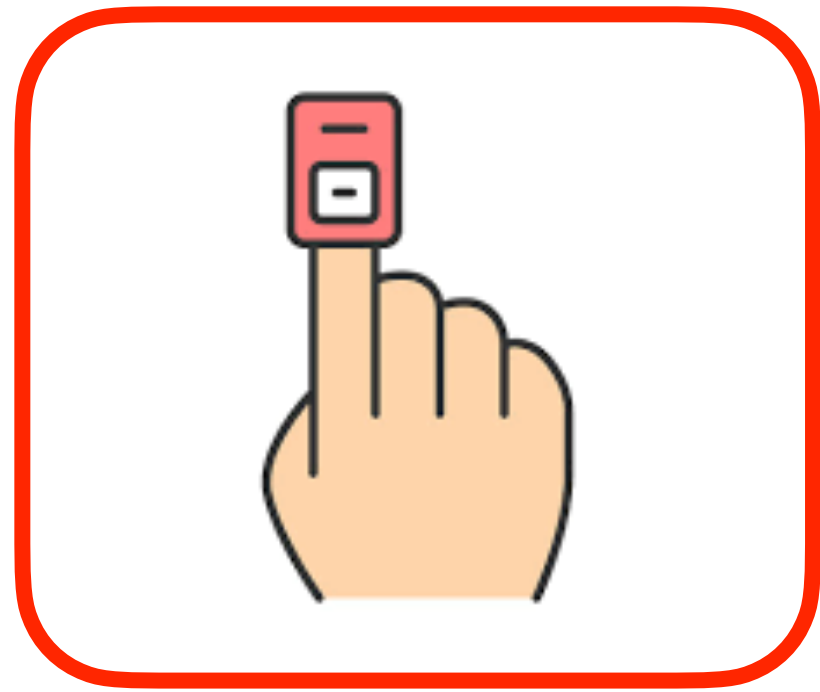
喘



咳嗽



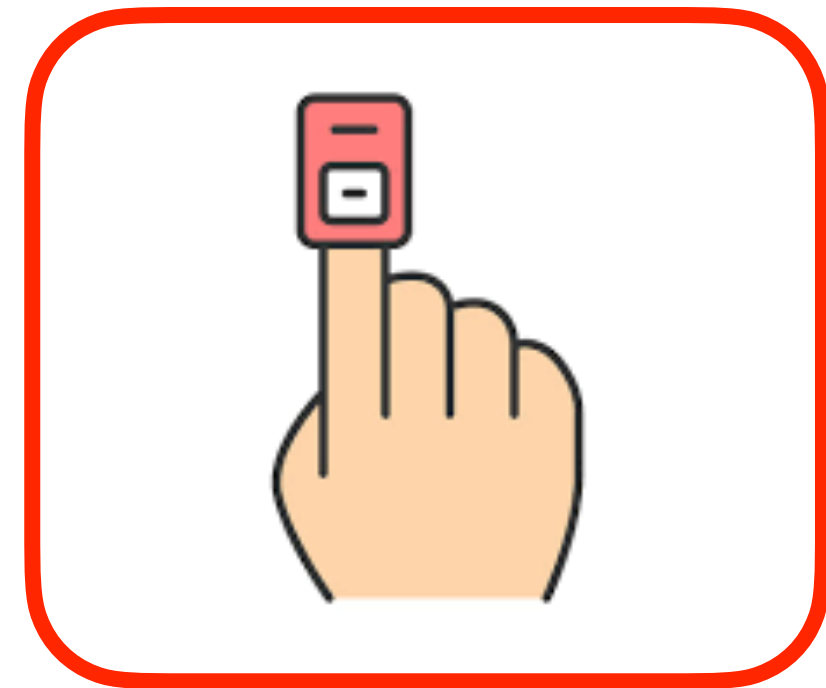
多痰



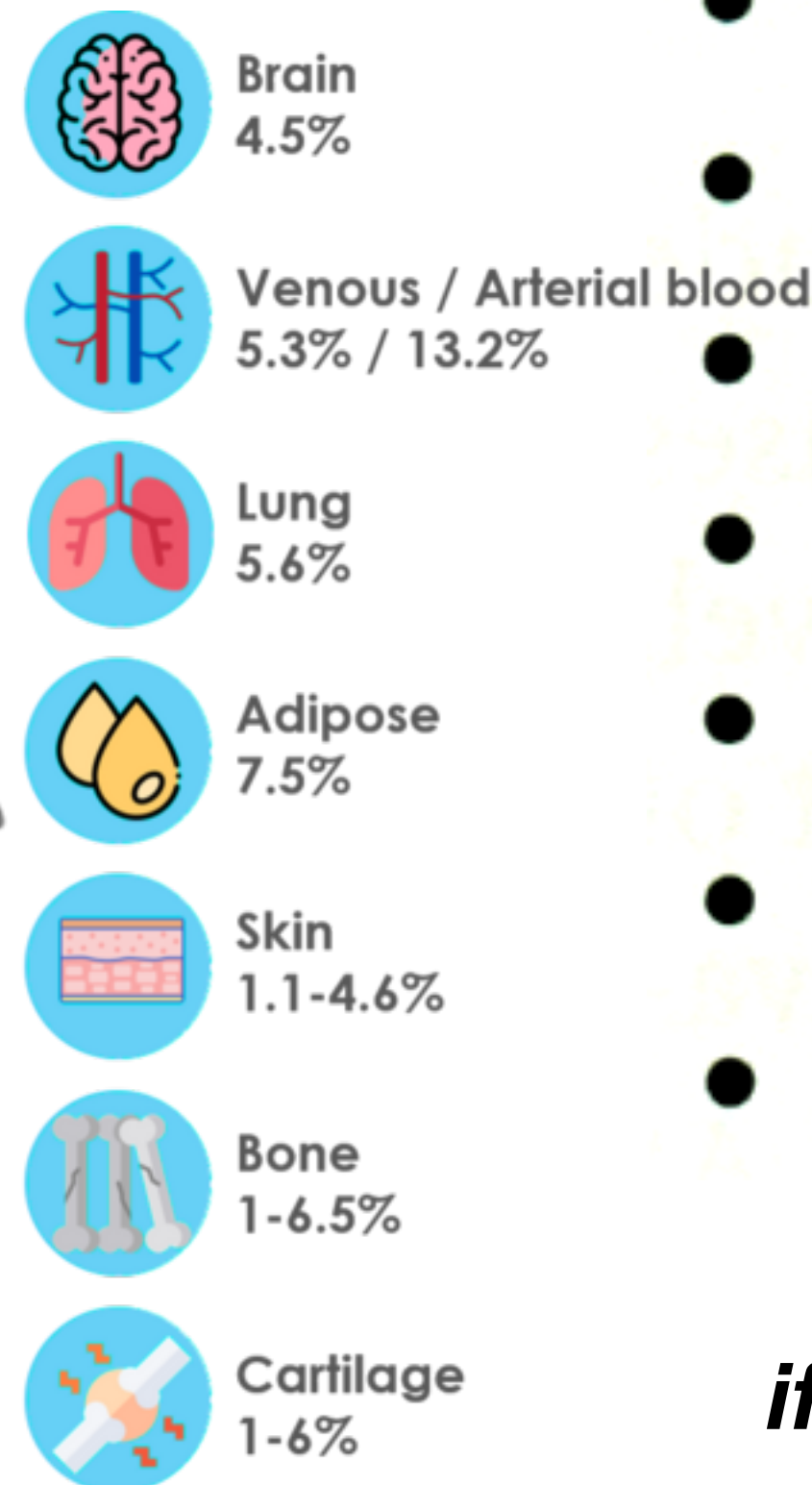
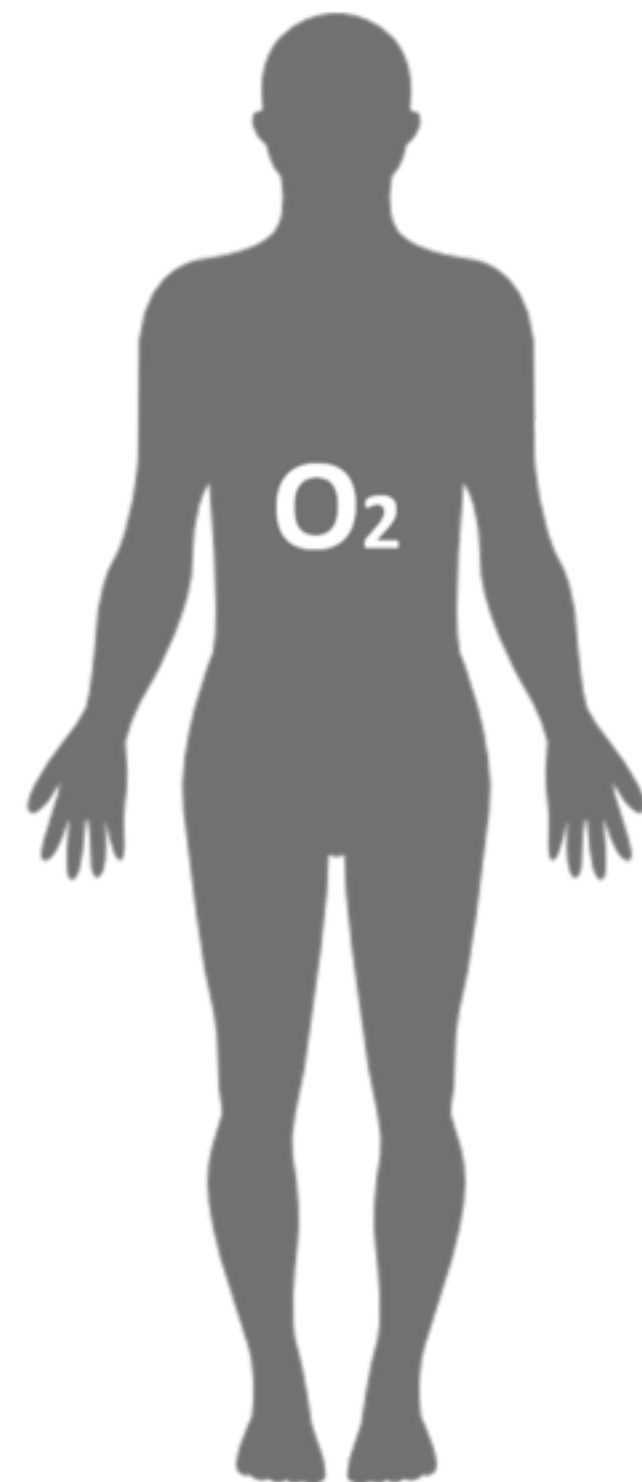
缺氧

缺氧會有什麼症狀？

# Clinical Signs and Symptoms of Acute Hypoxemia



缺氧



- Tachycardia *Mild nausea, light-headedness, dizziness*
- Increased minute ventilation
- Restlessness and irritability
- Mild hypertension
- Peripheral vasoconstriction
- Muscular incoordination
- Confusion
- Cyanosis
- Bradycardia and arrhythmias
- Hypotension
- Loss of consciousness

心跳加速

過度換氣

躁動不安

50~60 mmHg

SpO2 < 90%

35~50 mmHg

SpO2: 70-85%

發紺

心跳變慢

心律不整

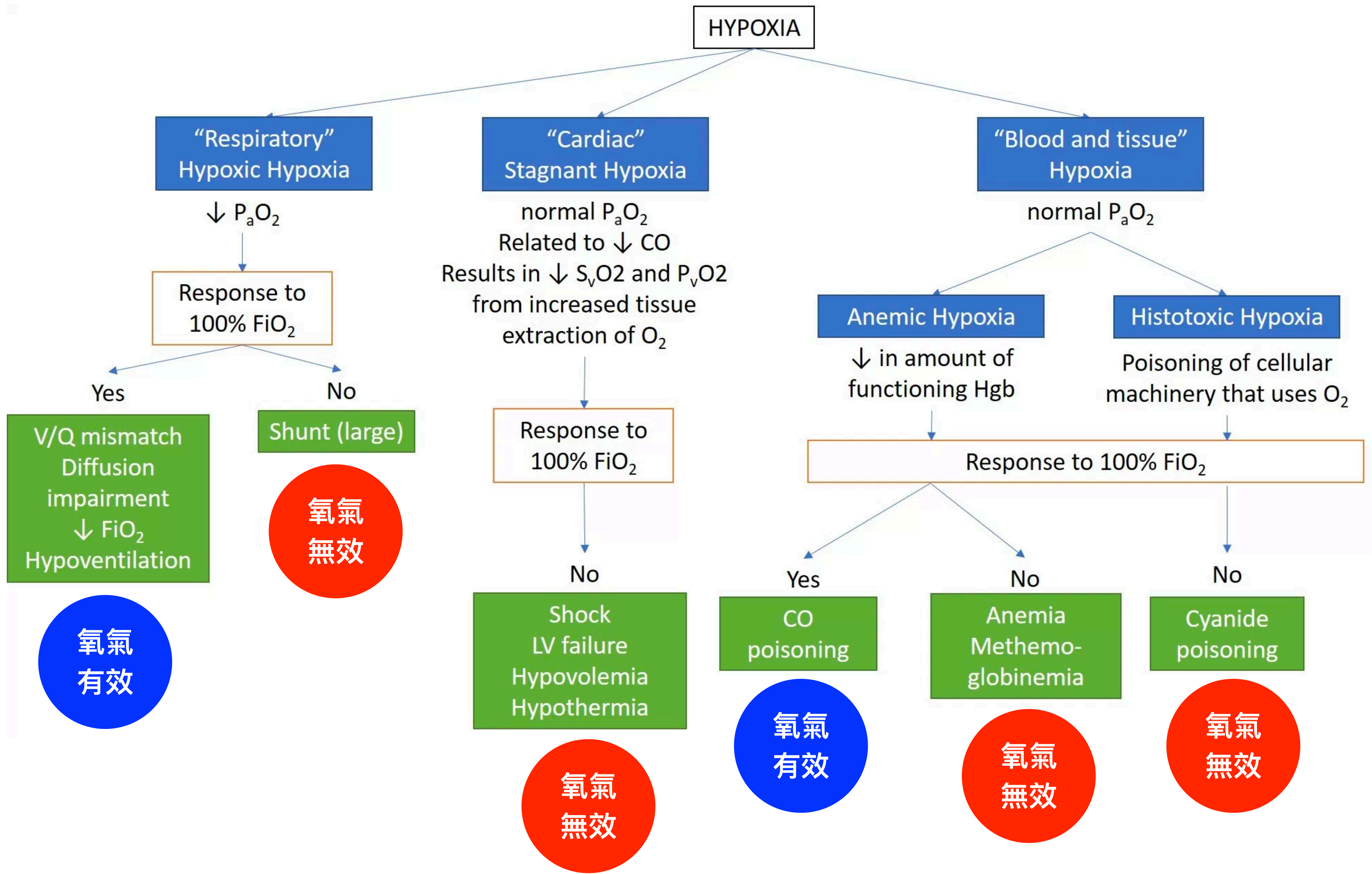
25~35 mmHg

SpO2: 50-70%

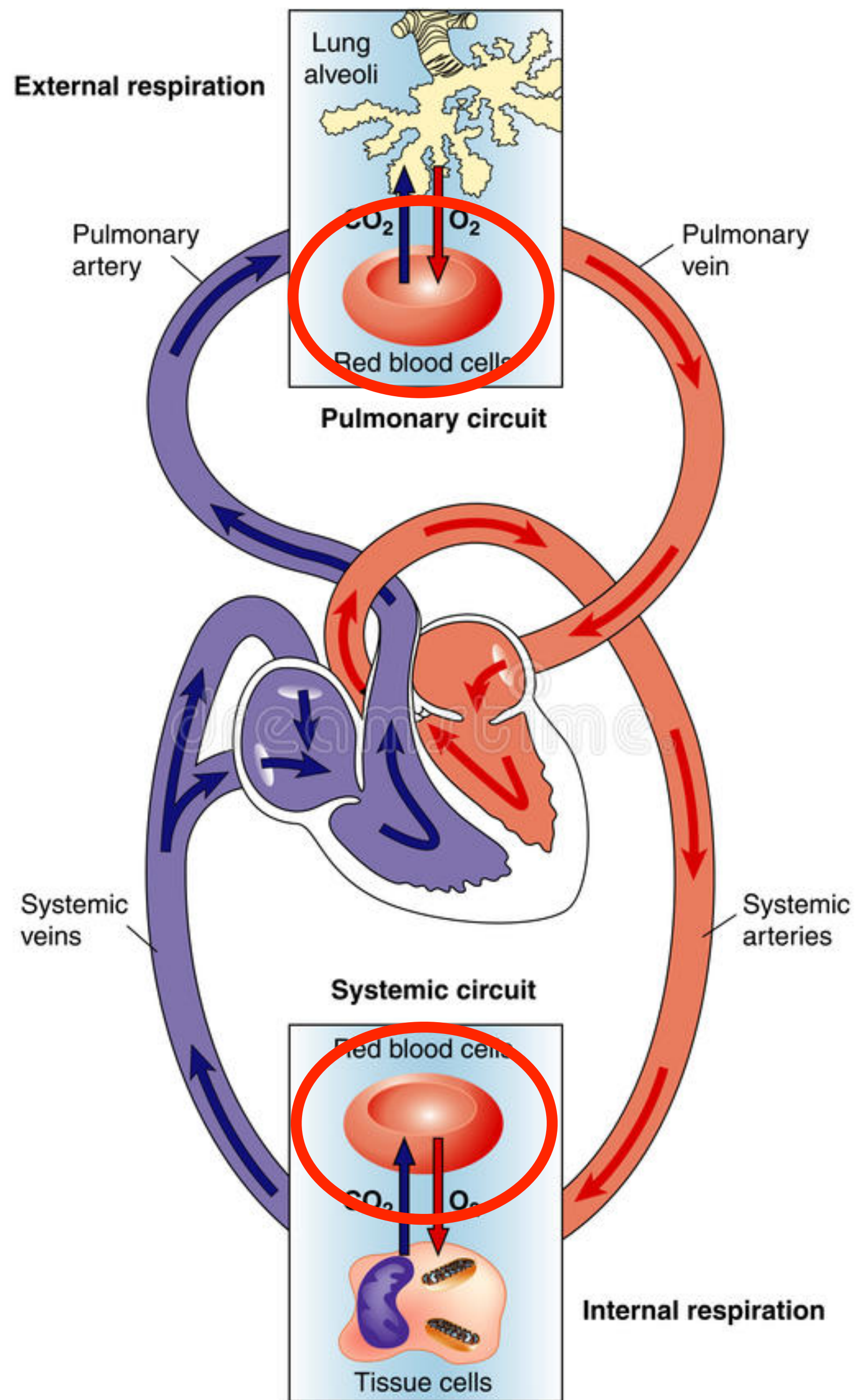
昏迷

< 25 mmHg

*if Anemia or Cardiac insufficiency → symptoms occur at higher PaO<sub>2</sub>*







病人出現身體缺氧的現象



$\text{PaO}_2/\text{SpO}_2$  正常

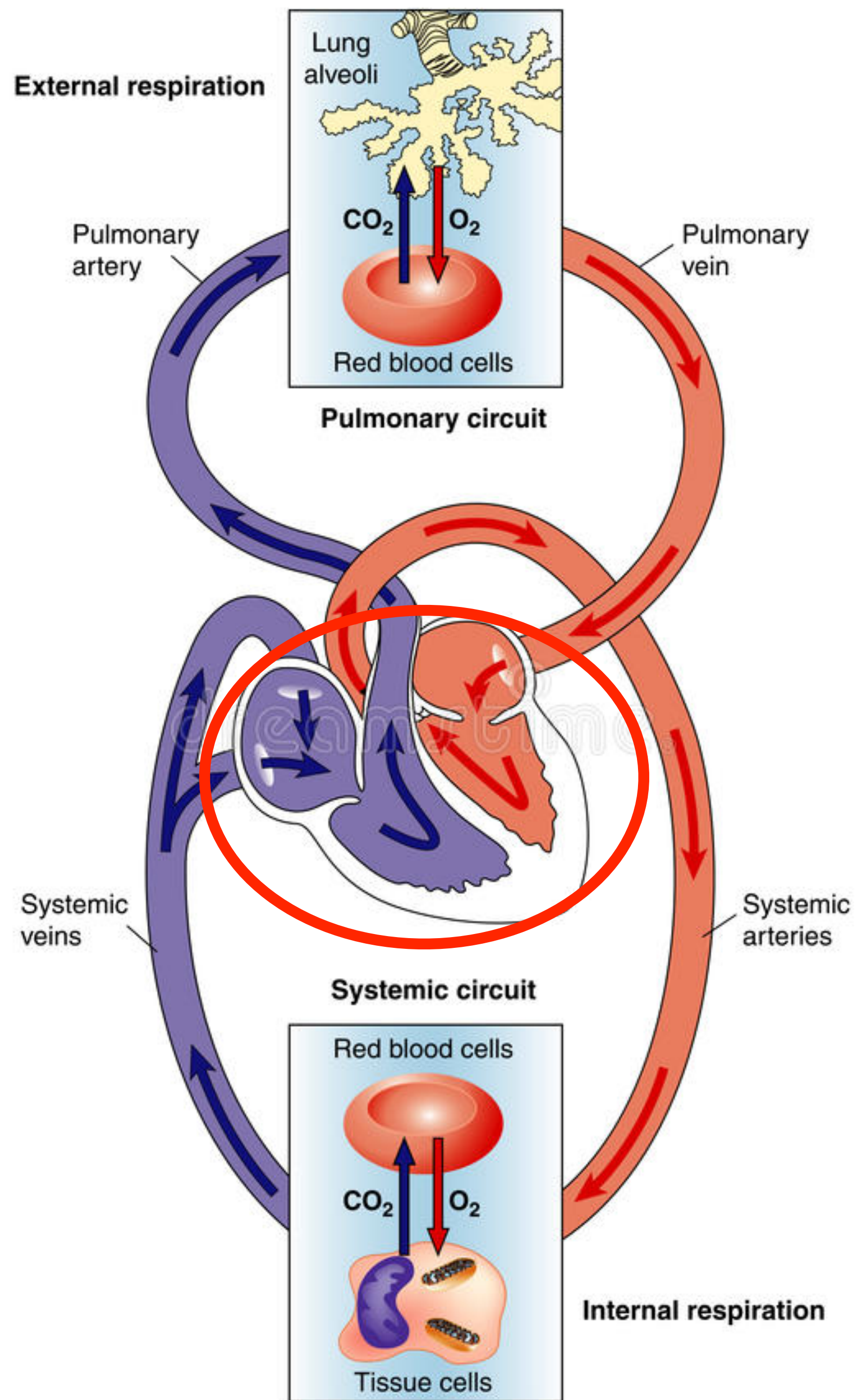


Hemoglobin (Hb) 血紅素不足



**Anemic hypoxia**  
貧血性缺氧





病人出現身體缺氧的現象



$\text{PaO}_2/\text{SpO}_2$  正常



Hemoglobin (Hb) 血紅素正常



心臟功能不足  
Cardiac output不足

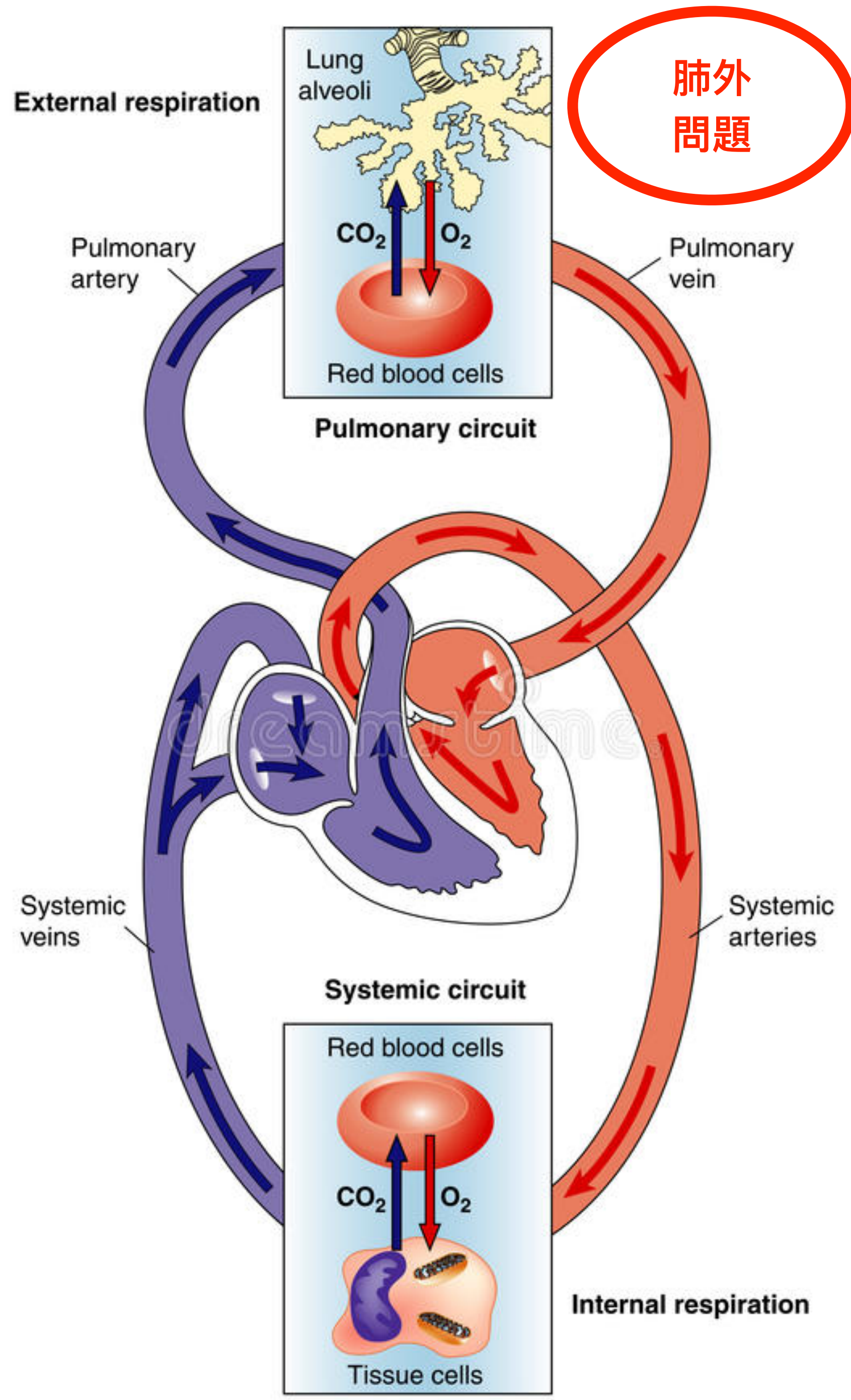


組織無法使用氧氣  
一氧化碳中毒



組織無法使用氧氣  
氰化物中毒等





病人出現身體缺氧的現象

↓  
PaO<sub>2</sub>/SpO<sub>2</sub> 不足

↓  
A-a gradient 正常 (10mmHg)

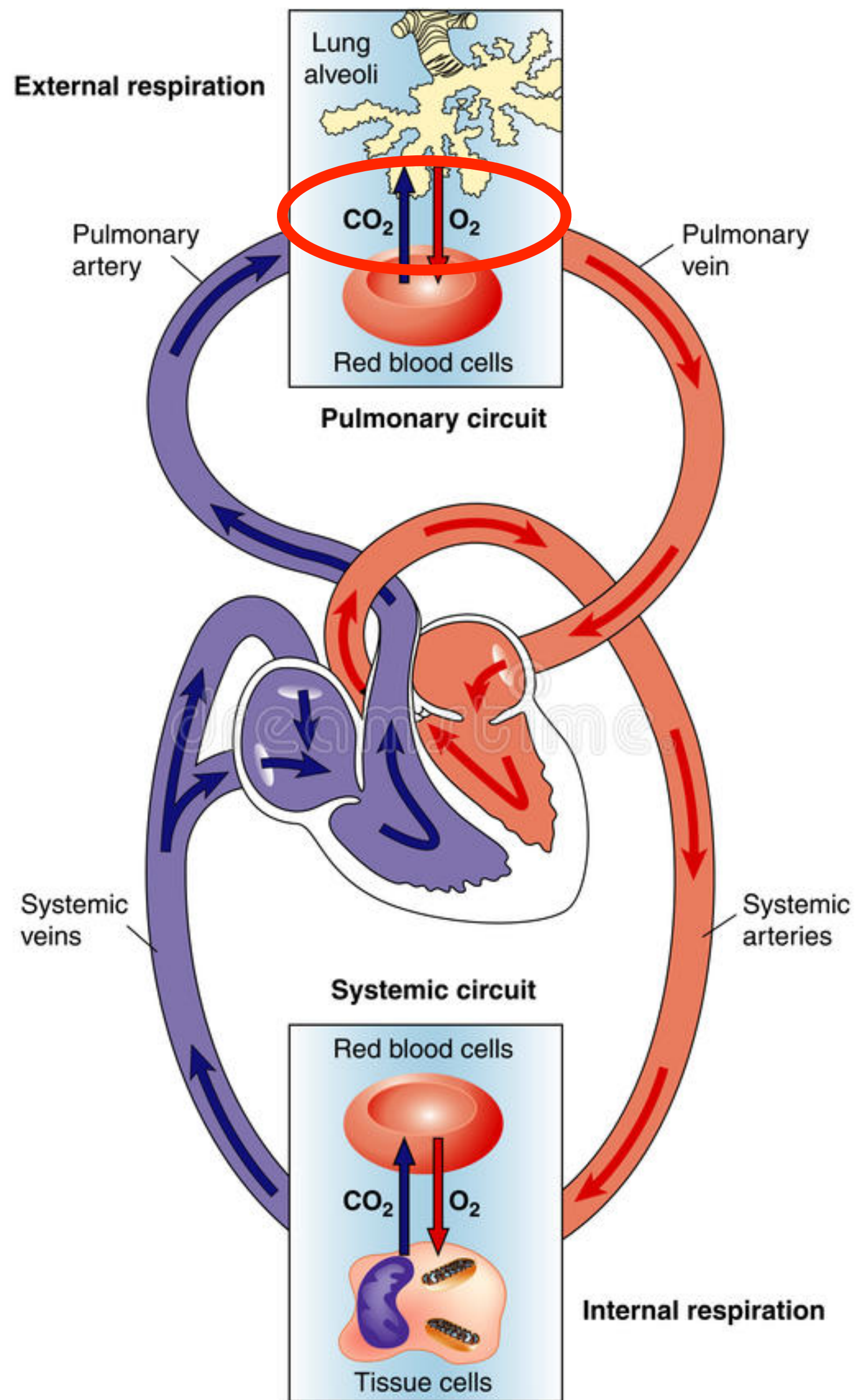
↓  
FiO<sub>2</sub> 供氧不足  
高山空氣稀薄

氧氣有效

↓  
Hypoventilation  
呼吸驅動力不足  
呼吸肌肉無力  
肥胖/胸腔結構

氧氣有效

CO<sub>2</sub> 過高



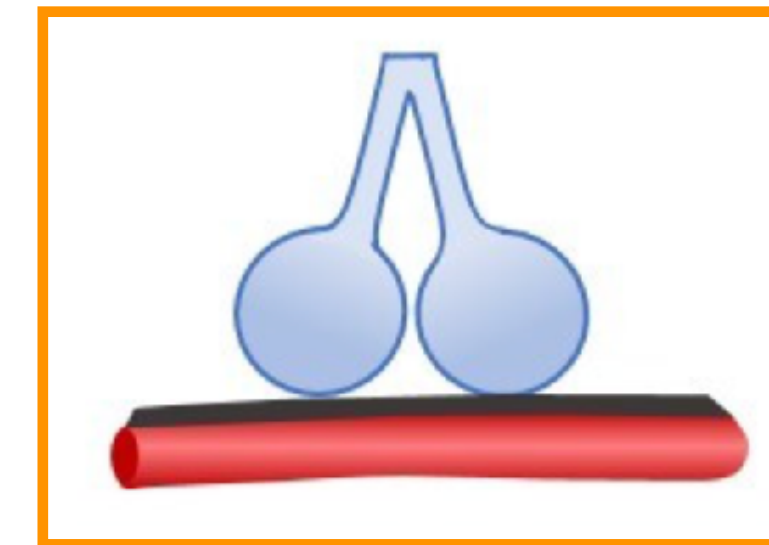
病人出現身體缺氧的現象



PaO<sub>2</sub>/SpO<sub>2</sub> 不足



A-a gradient 過高 (>10mmHg)



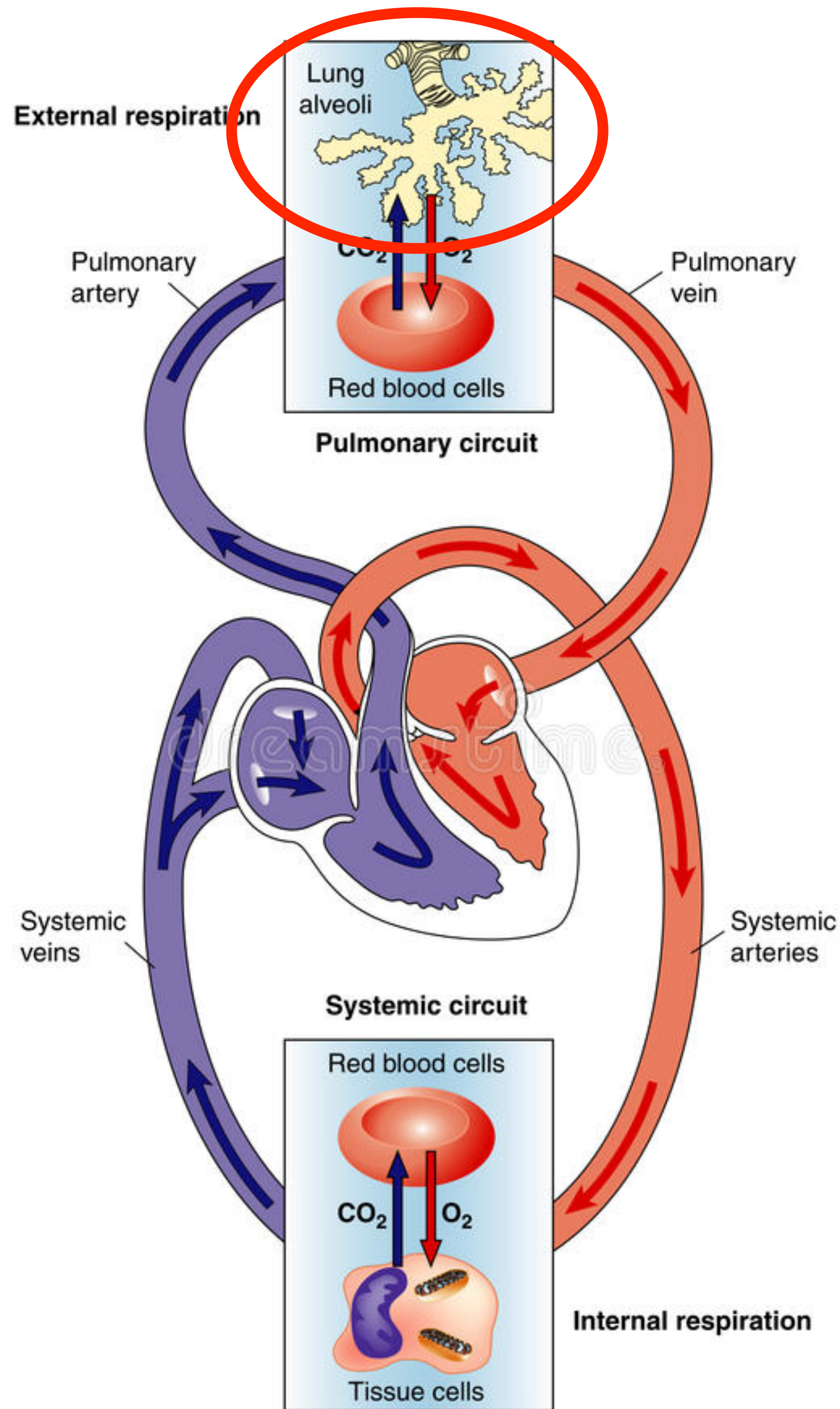
Diffusion impaired

肺水腫、肺纖維化

間質性肺炎

肺氣腫

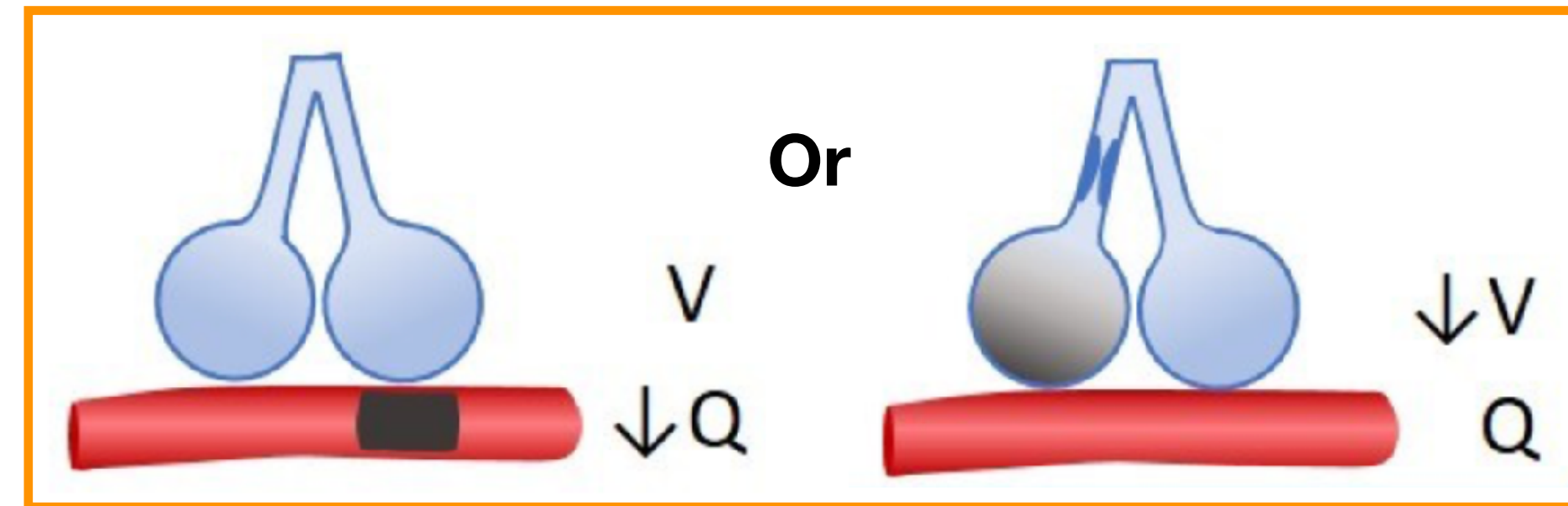
氧氣  
有效



病人出現身體缺氧的現象

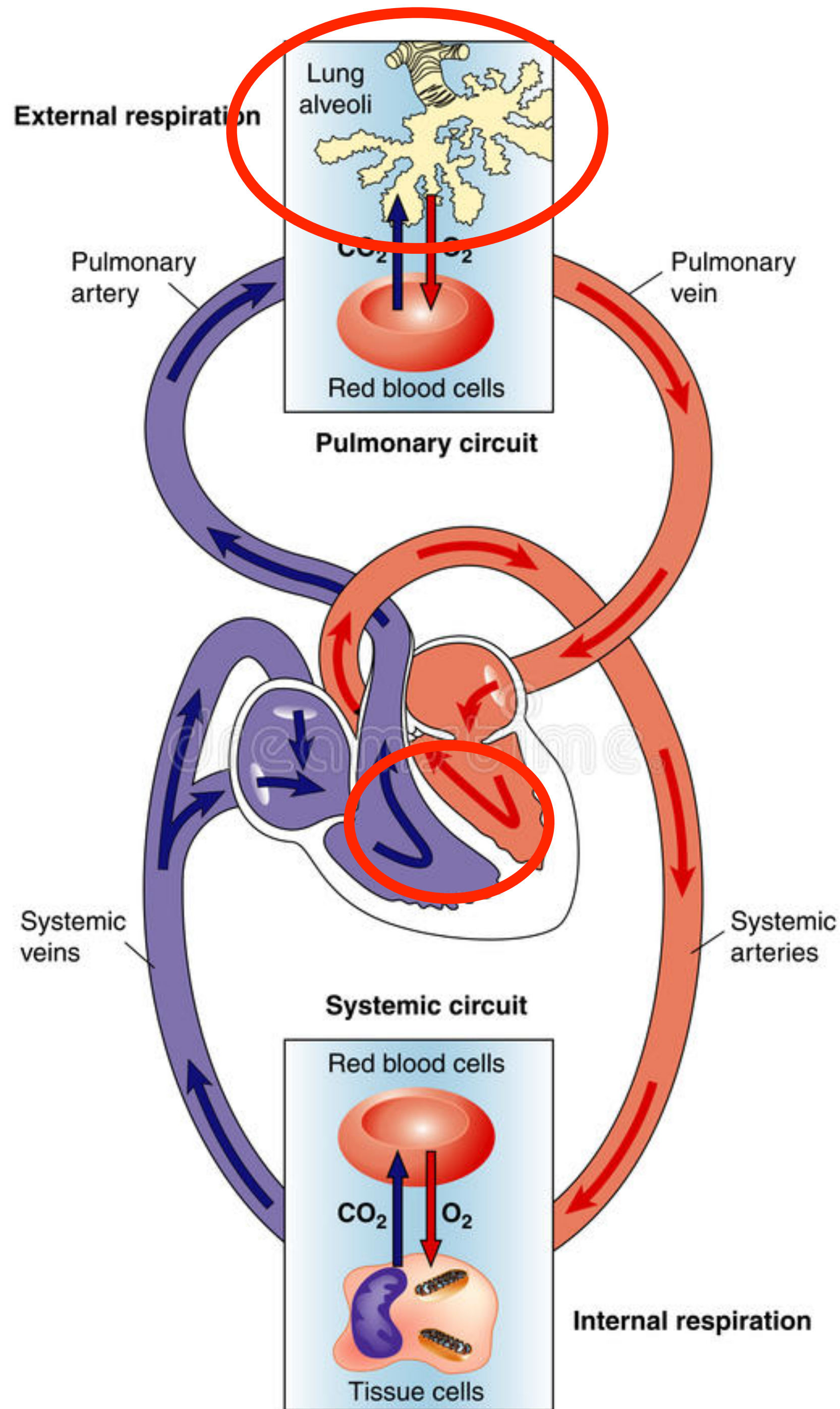
↓  
PaO<sub>2</sub>/SpO<sub>2</sub> 不足

↓  
A-a gradient 過高 (>10mmHg)



**V/Q mismatch**  
COPD, Asthma  
輕度肺泡填塞、肺臟發炎  
肺動脈栓塞

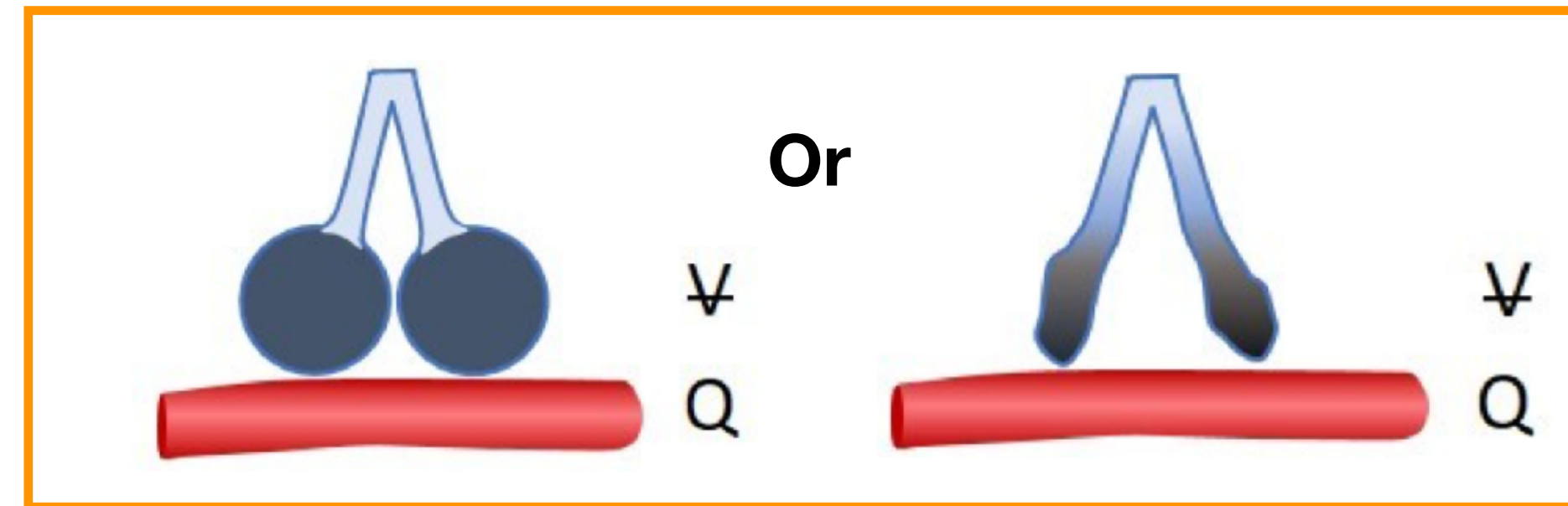
氧氣  
有效



病人出現身體缺氧的現象

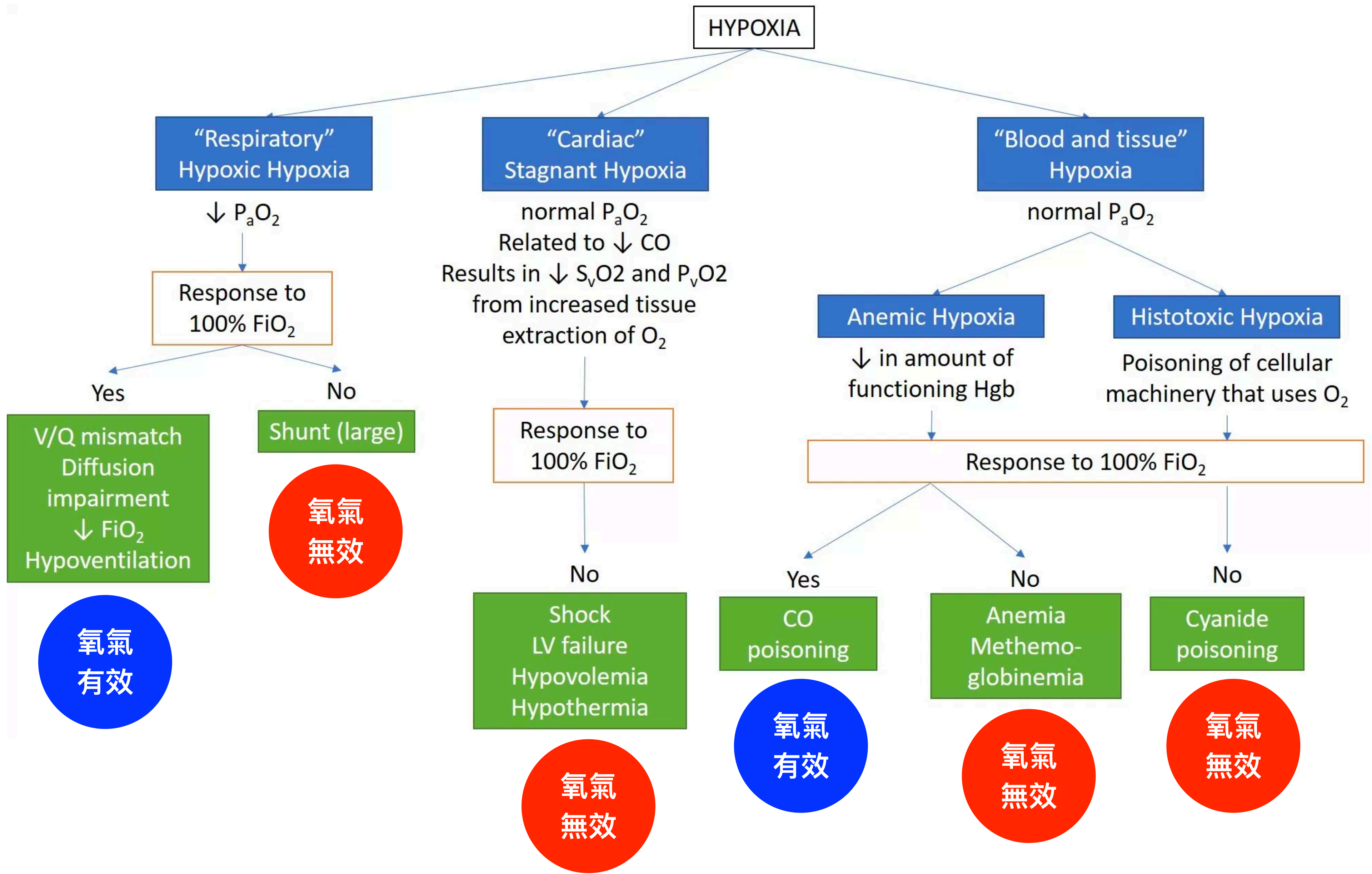
$\text{PaO}_2/\text{SpO}_2$  不足

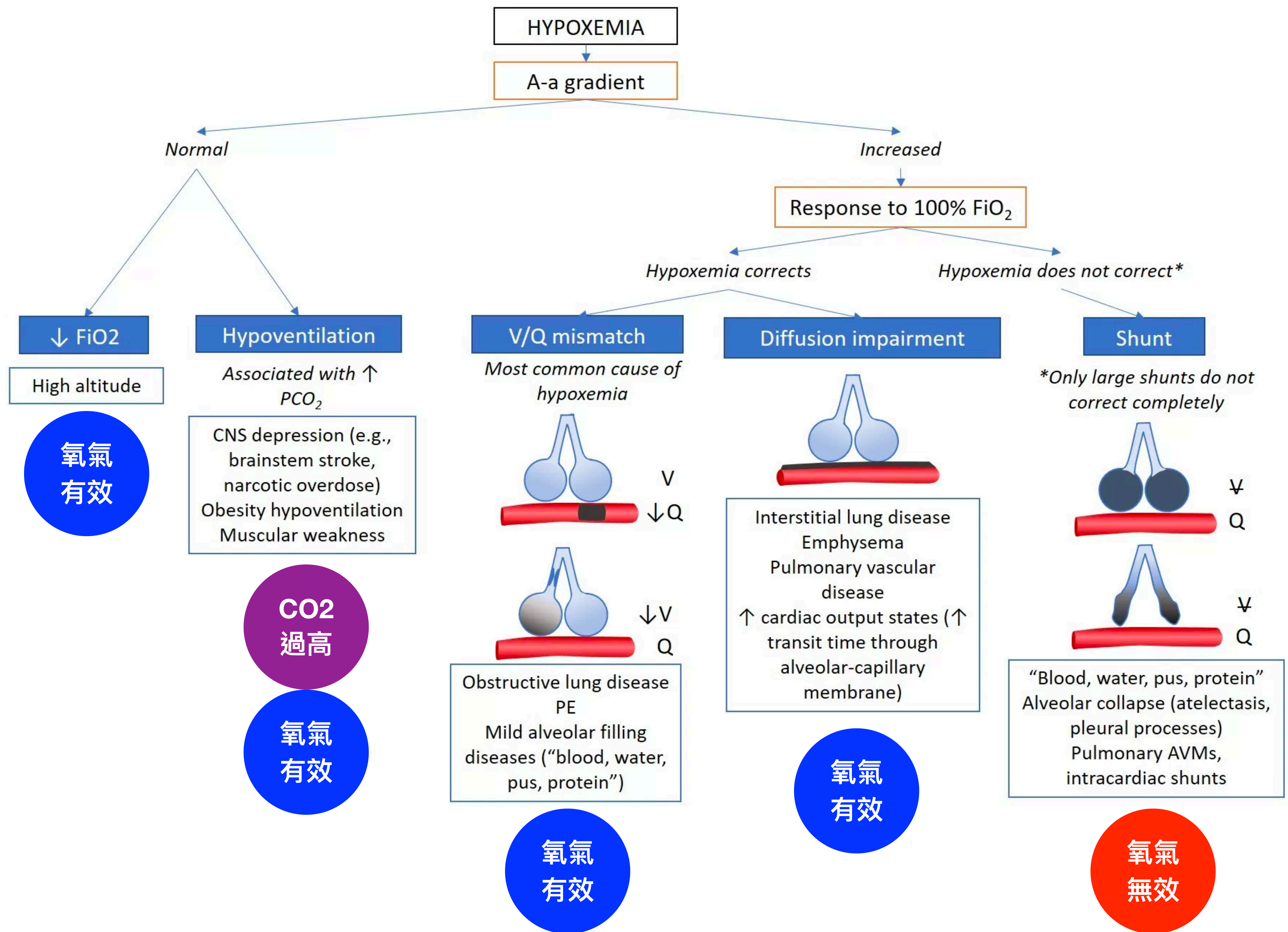
A-a gradient 過高 (>10mmHg)



**Shunt**  
 嚴重肺泡填塞、塌陷  
 Intracardiac shunt  
 Pulmonary AVMs

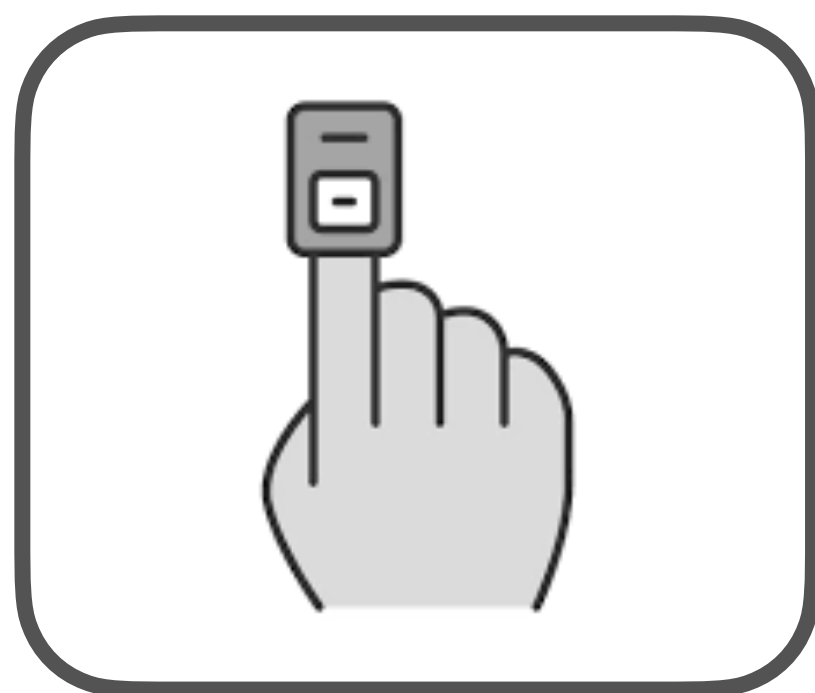
氧氣  
無效







# 常見呼吸疾病症狀？



缺氧



喘



多痰



咳嗽

喘的呼吸生理要如何思考？

# The reason(s) of dyspnea on exertion?

1. Air-trapping (dynamic hyperinflation)
2. Poor breathing pattern
3. Respiratory muscle impairment
4. Limb muscle impairment



**Case 1**

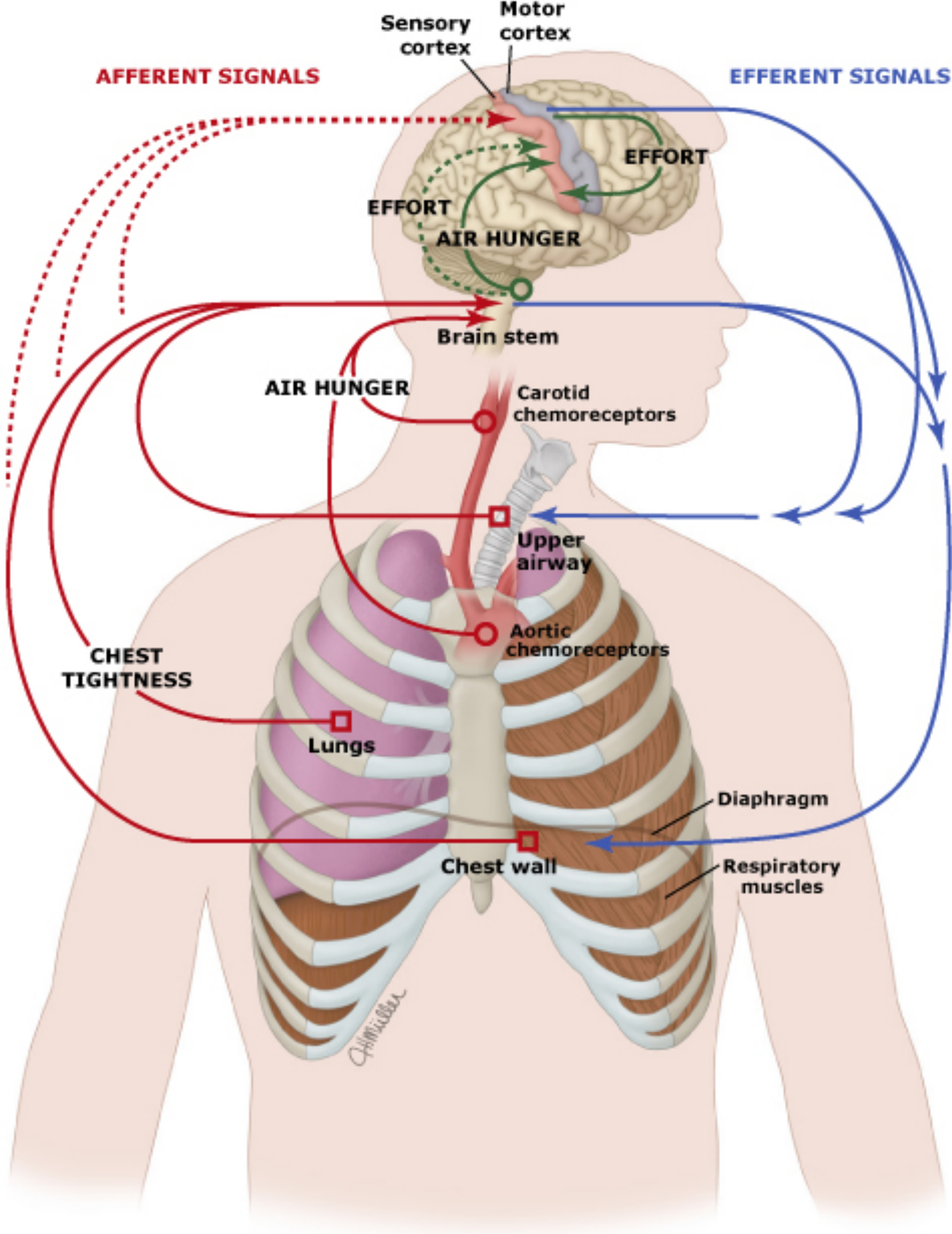


**Case 2**

Respiratory failure  
vs.  
Dyspnea

呼吸衰竭 與 呼吸困難

# Efferent and Afferent signals that contribute to the sensation of dyspnea

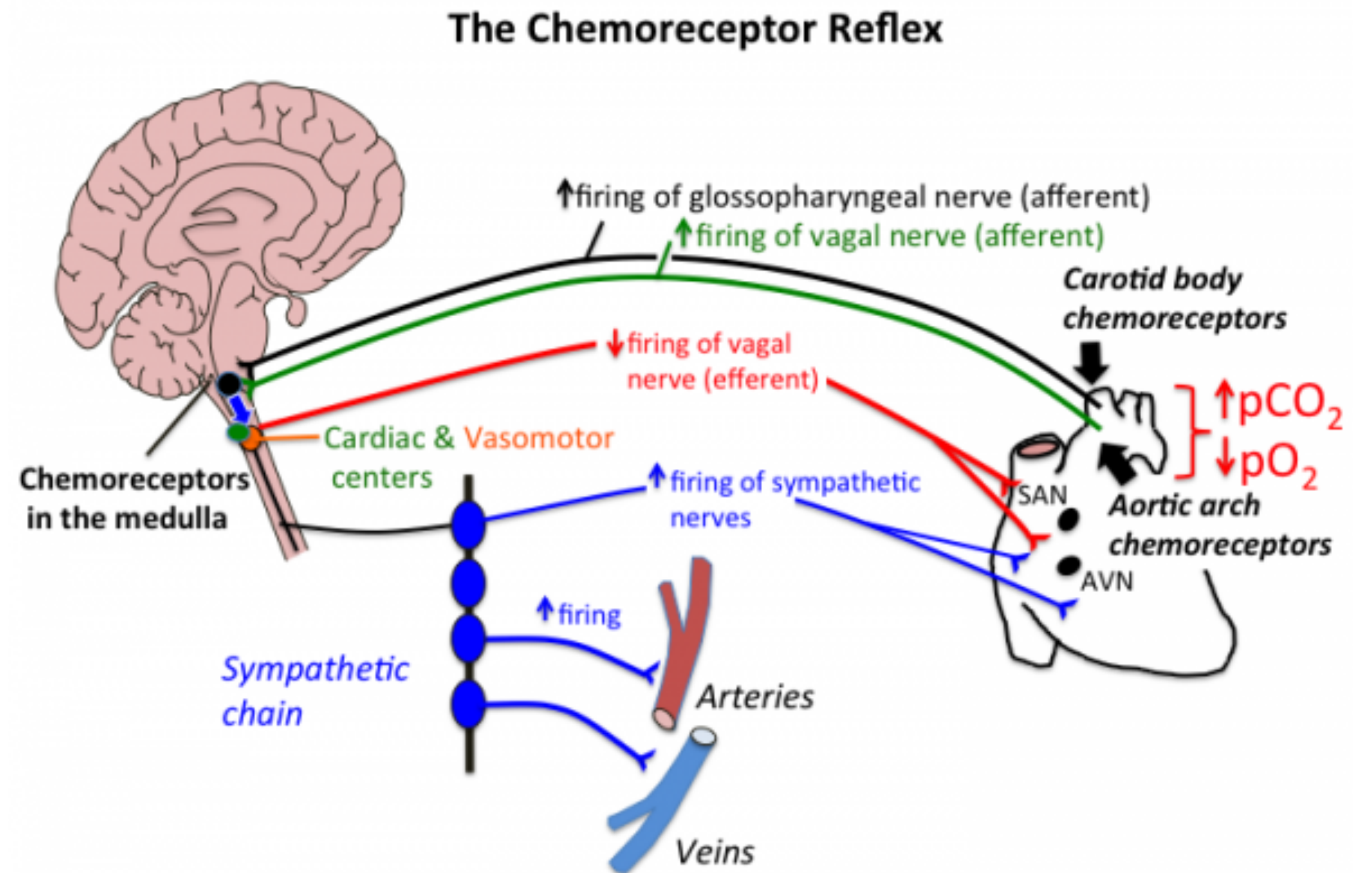
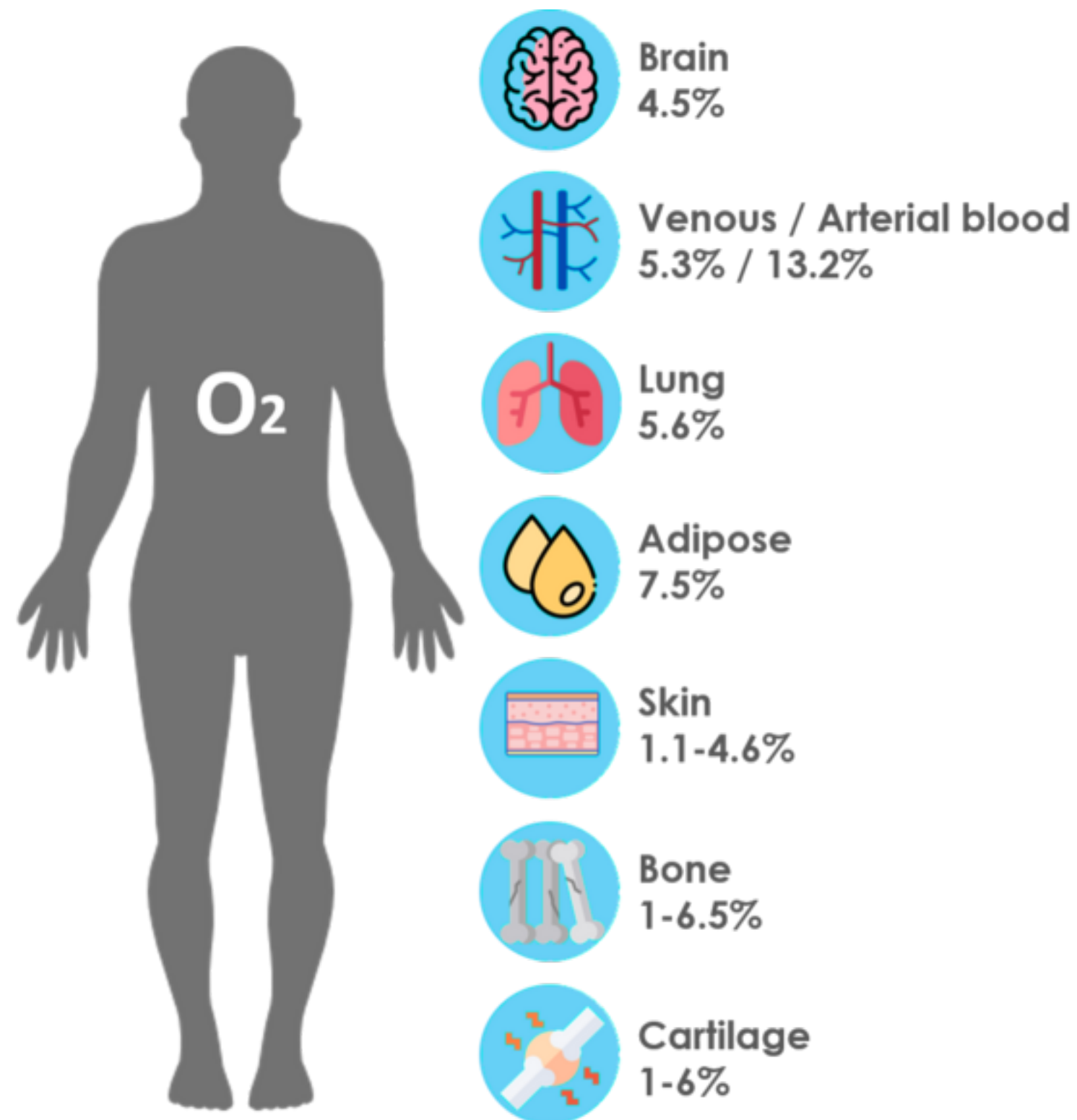


# Dyspnea

- **Respiratory centers: increased output**
  - Chemoreceptor:  $PO_2$ ,  $PCO_2$
- **Stimulation of mechanoreceptors:**
  - Upper airway receptors: Trigeminal nerve (CN5)
  - Pulmonary receptors: Stretch, Irritant, C-fibers
  - Chest wall receptors: M. spindles
- **Mechanical loading of the respiratory system: dyspnea vs. effort**
- **Neuromechanical dissociation**
- **Impaired oxygen delivery or utilization**
  - Anemia
  - Cardiovascular deconditioning
- **Neural activation associated with breathing discomfort**
  - Sensory dimension: intensity, quality, time course
  - Affective dimension: immediate unpleasantness, evaluative and emotional response

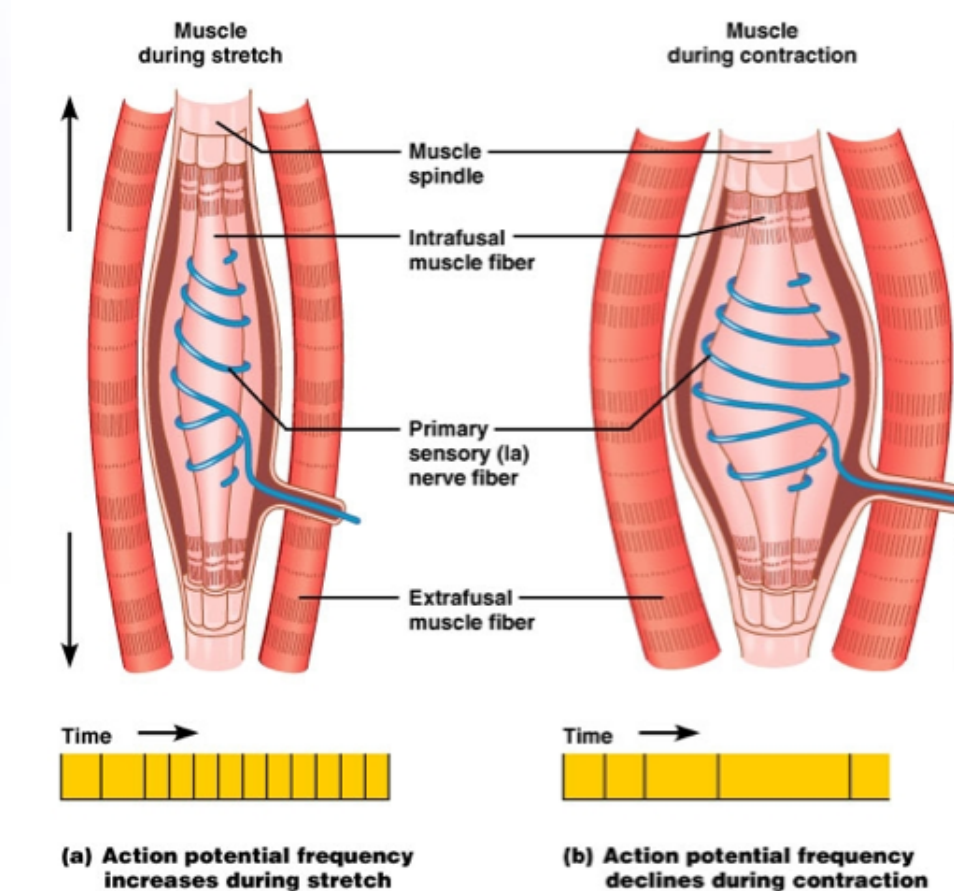
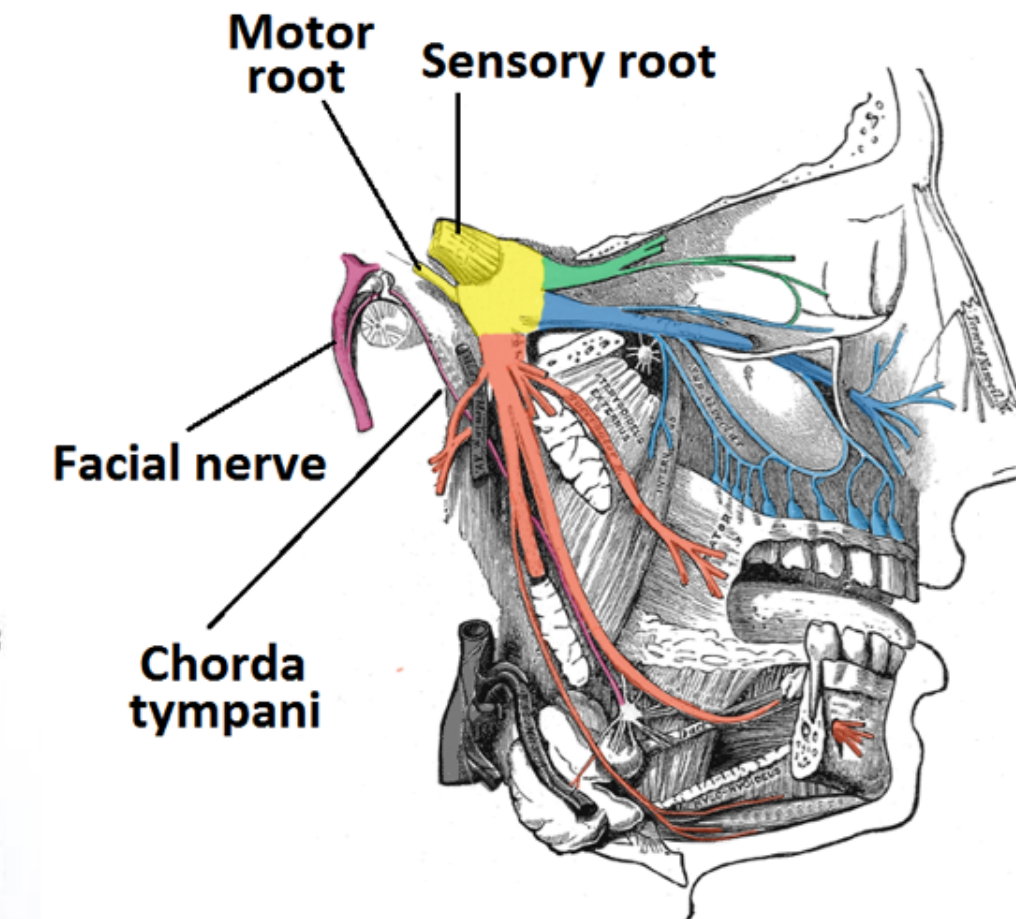
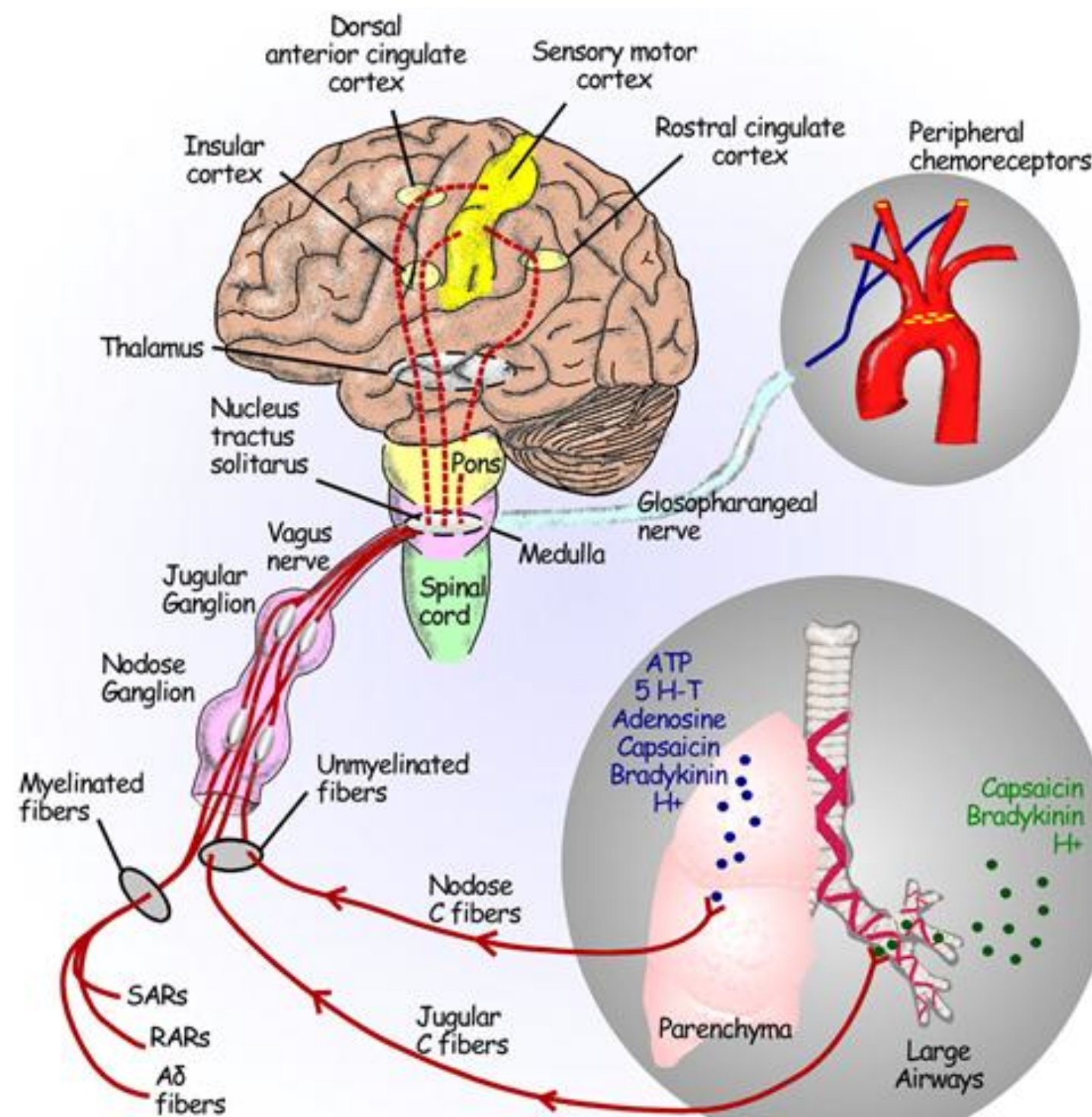
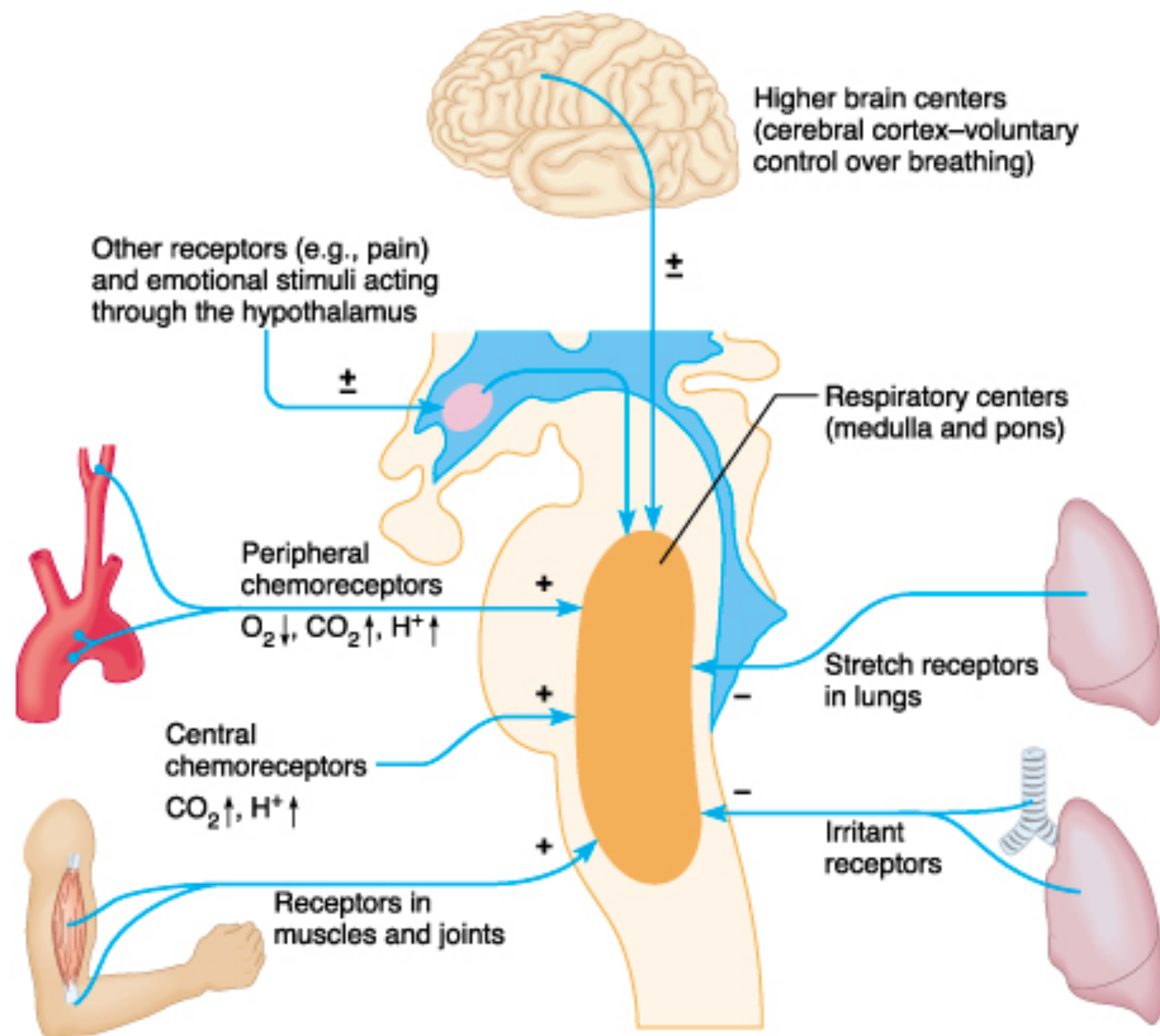
# Dyspnea

- **Respiratory centers: increased output**
  - Chemoreceptor:  $PO_2$ ,  $PCO_2$



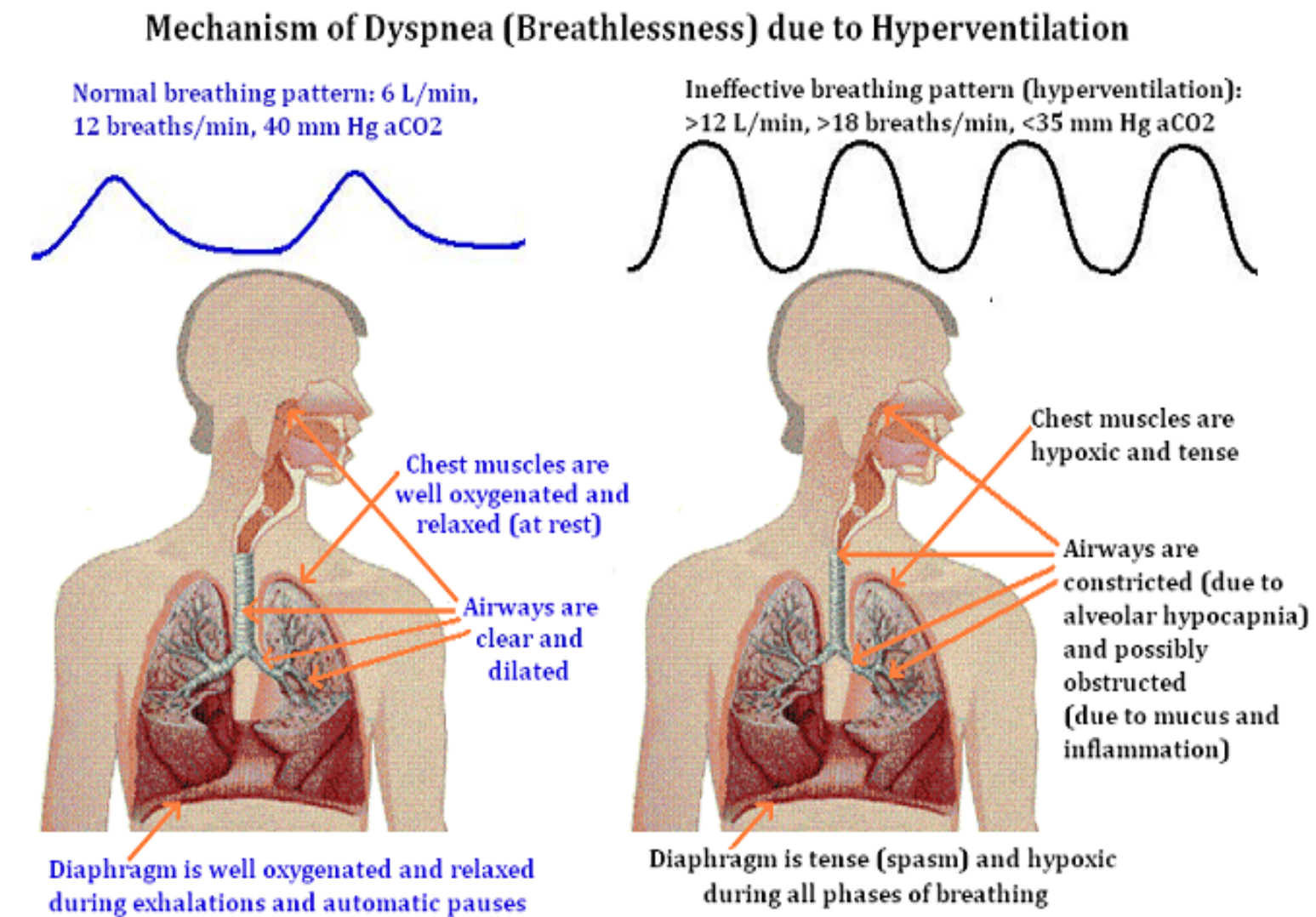
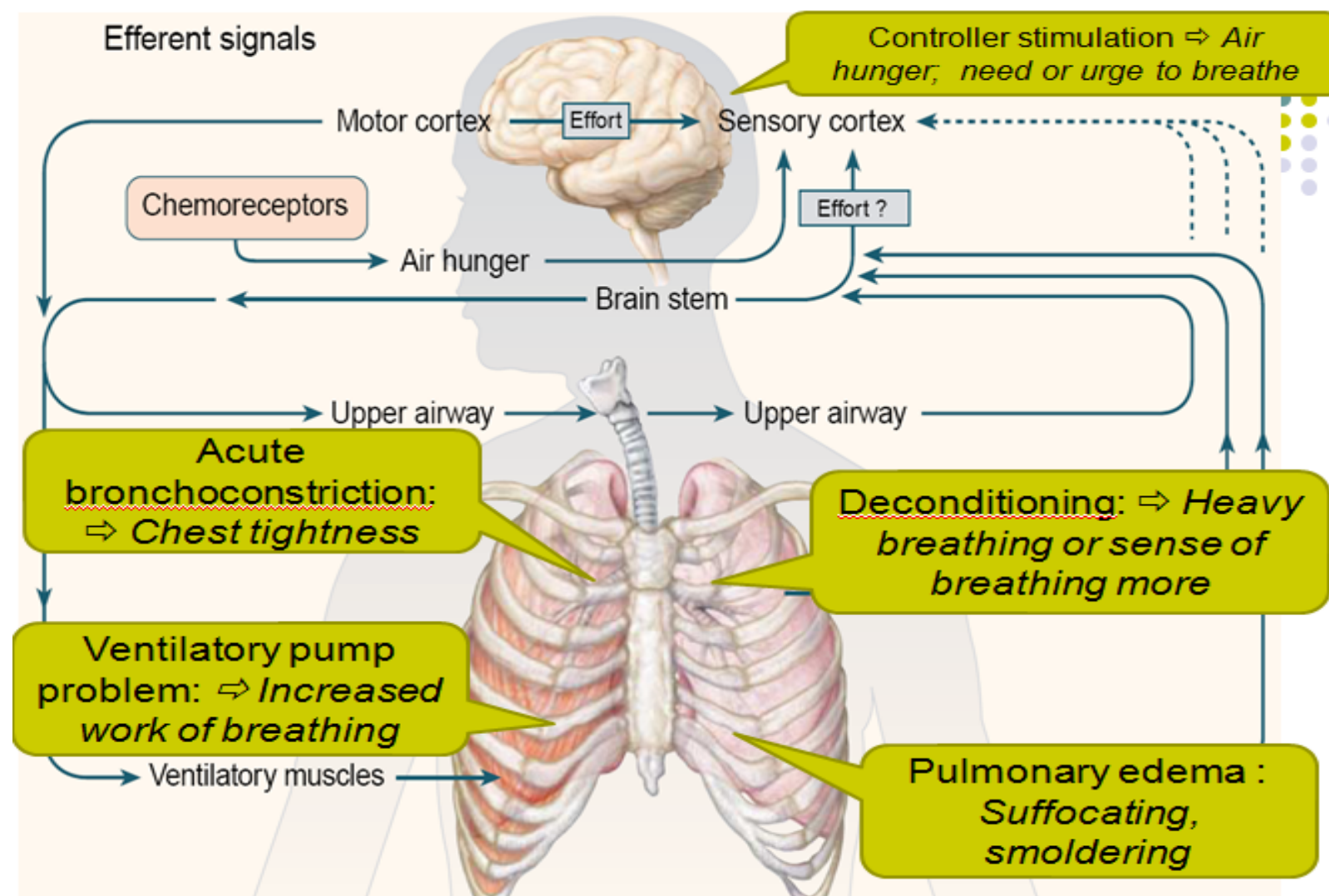
# Dyspnea

- **Stimulation of mechanoreceptors:**
  - Upper airway receptors: Trigeminal nerve (CN5)
  - Pulmonary receptors: Stretch, Irritant, C-fibers
  - Chest wall receptors: M. spindles



# Dyspnea

- **Mechanical loading of the respiratory system:**  
dyspnea vs. effort



*Pressure generated by the ventilatory muscles*

**The sense of effort:**

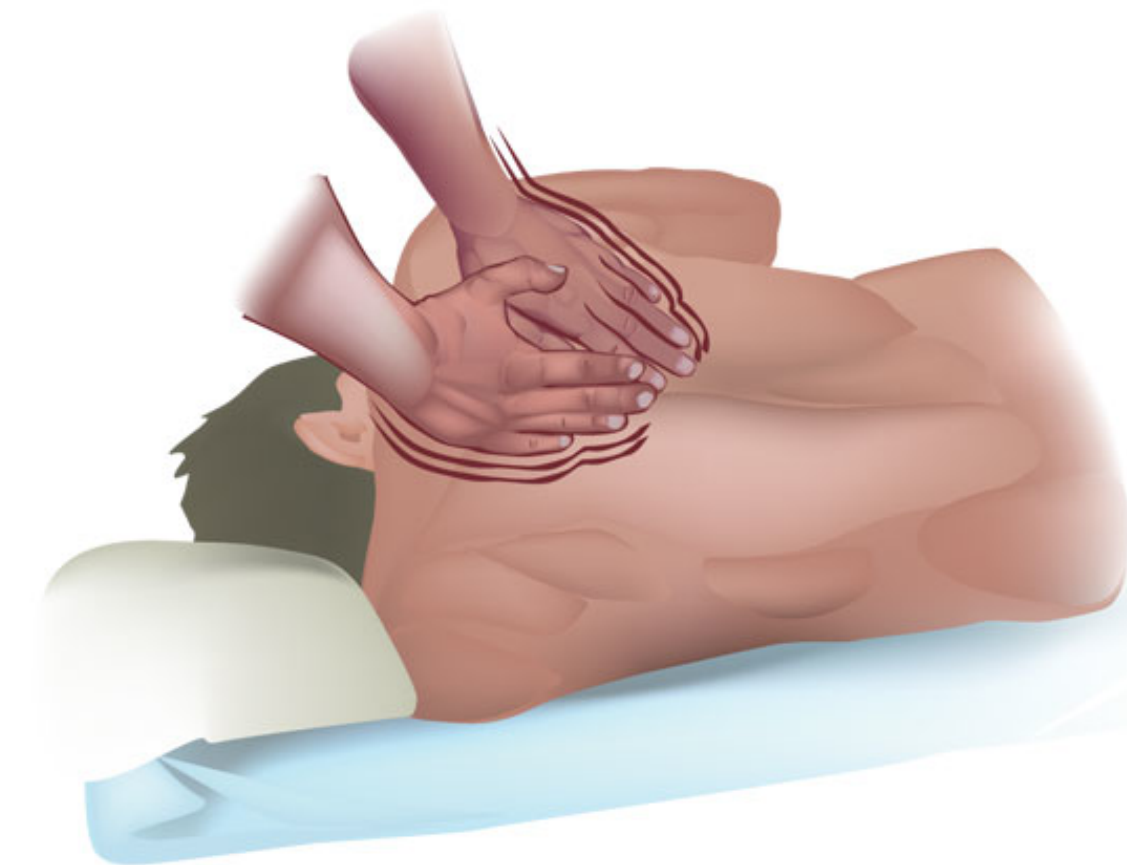
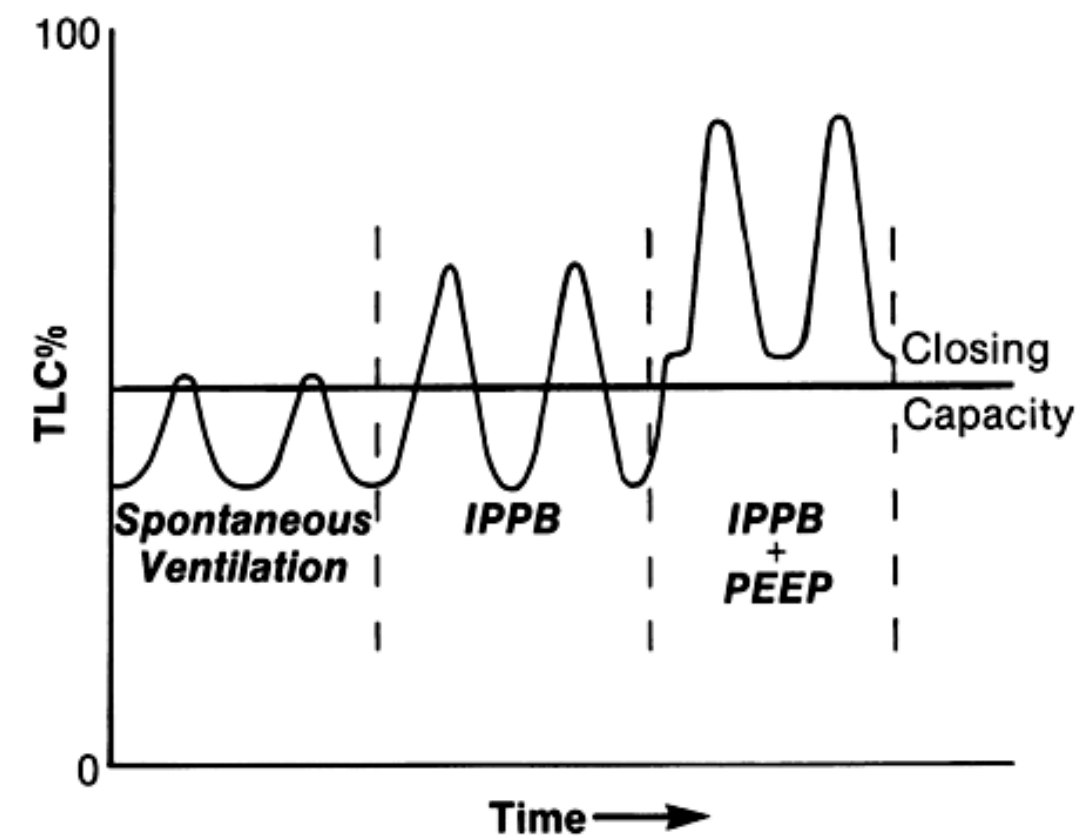
*A given breath to the maximal pressure achievable by the muscles*

*Sense of effort vs. Air hunger*



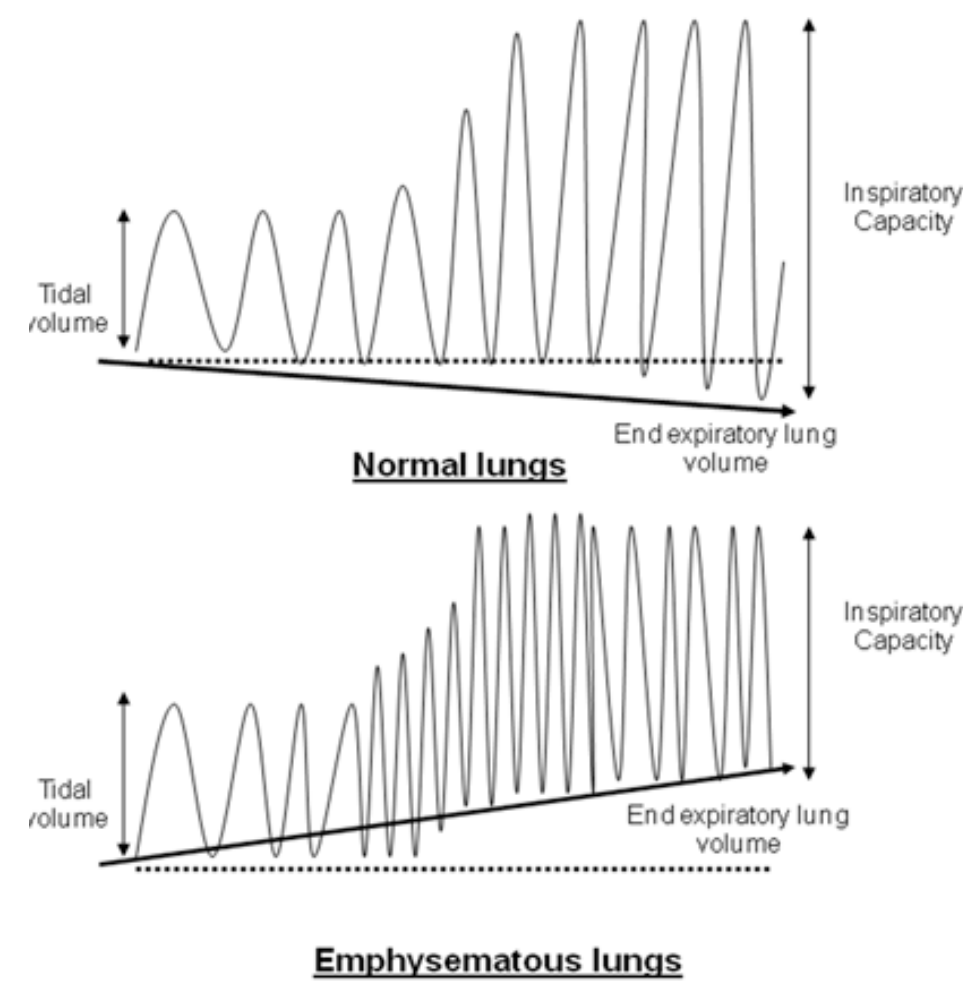
# Dyspnea

- **Neuromechanical dissociation**



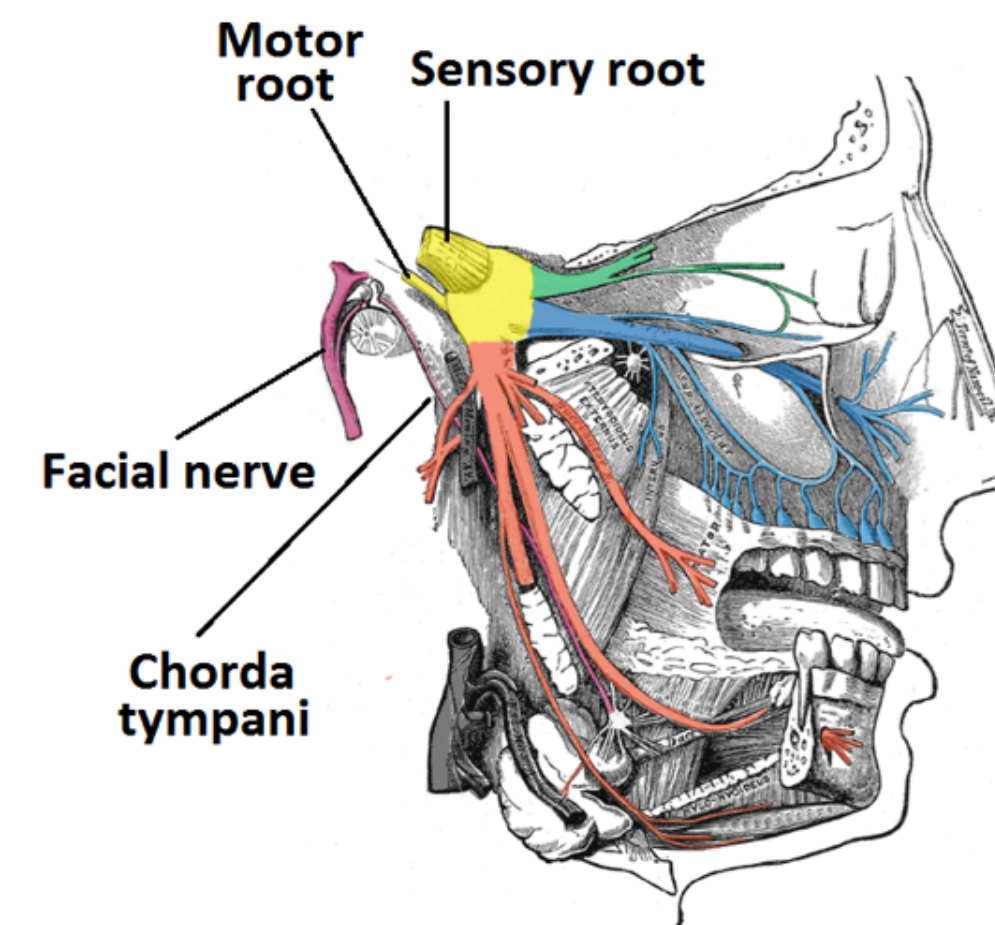
*In-phase*  
vs  
*out-of-phase*

## Mechanical Ventilation



## Dynamic hyperinflation

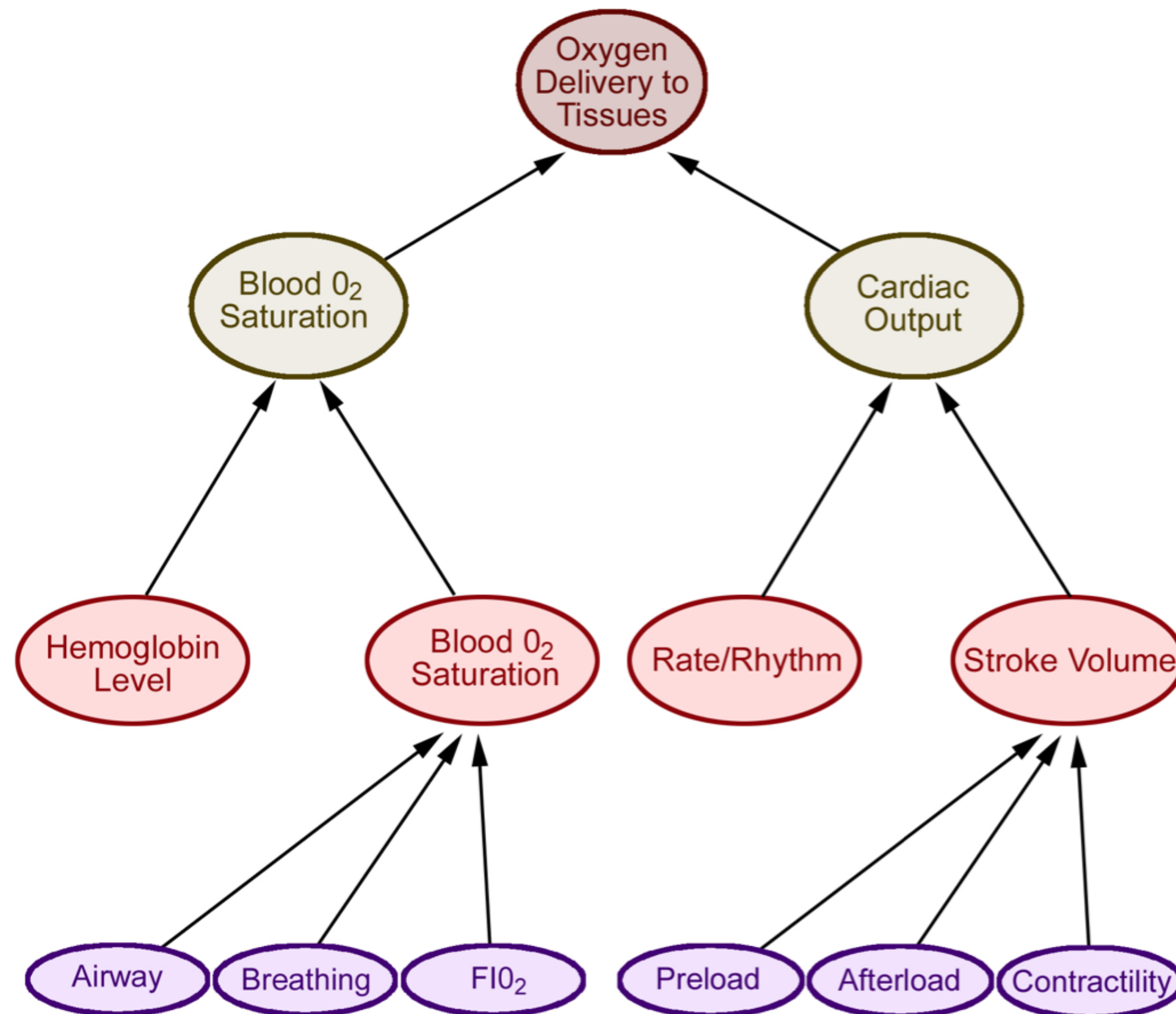
## Chest wall vibration



## A flow of air on the face

# Dyspnea

- **Impaired oxygen delivery or utilization**
  - Anemia
  - Cardiovascular deconditioning



$$O_2ER = [(CaO_2 - CvO_2)/(CaO_2)](\%)$$

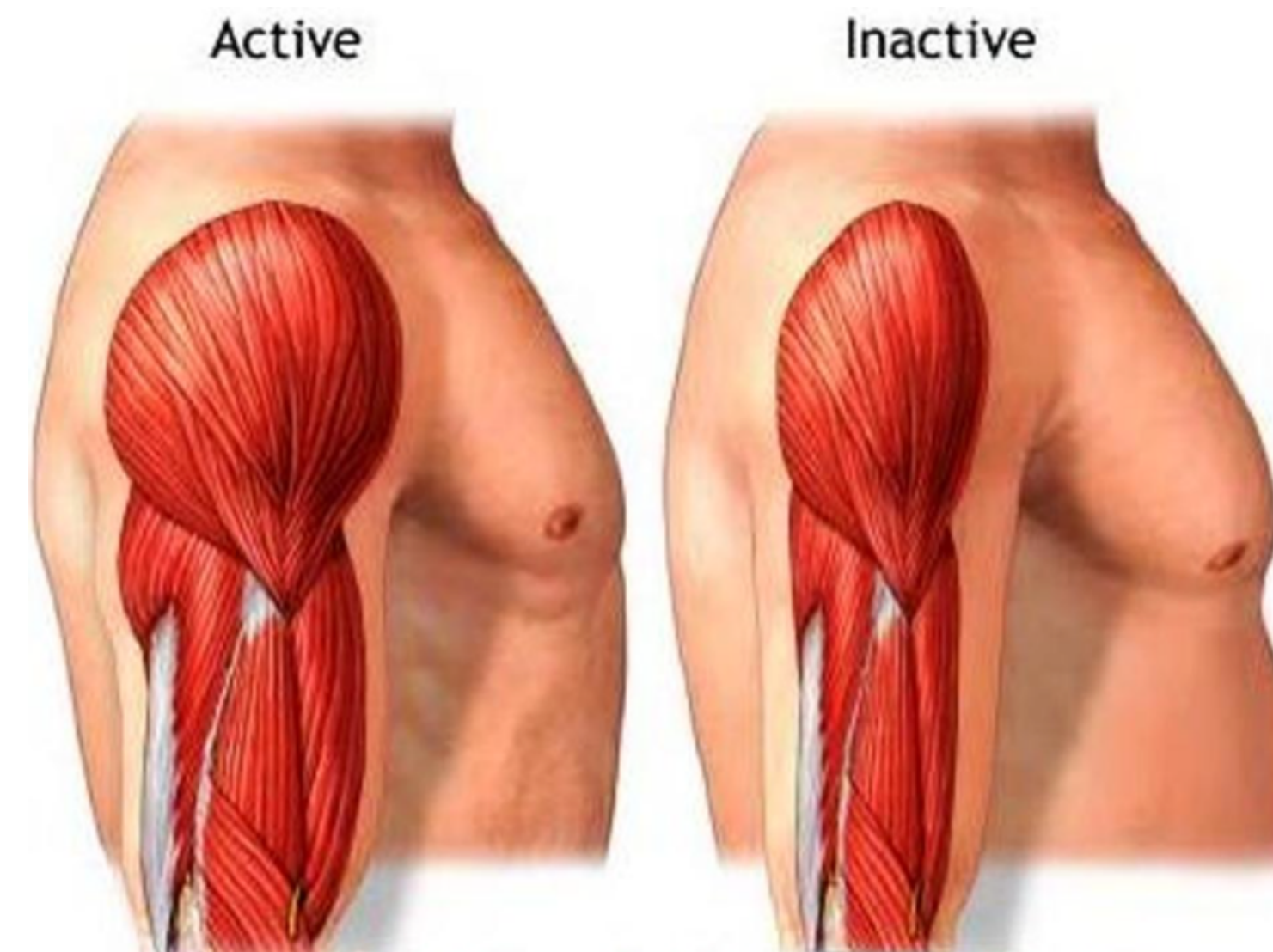
$$DO_2 = CaO_2 \cdot CO$$

$$VO_2 = CO \cdot (CaO_2 - CvO_2)$$

$$CaO_2 = [(SaO_2 \cdot 1.39 \times Hb) + (0.0031 \cdot PaO_2)]$$

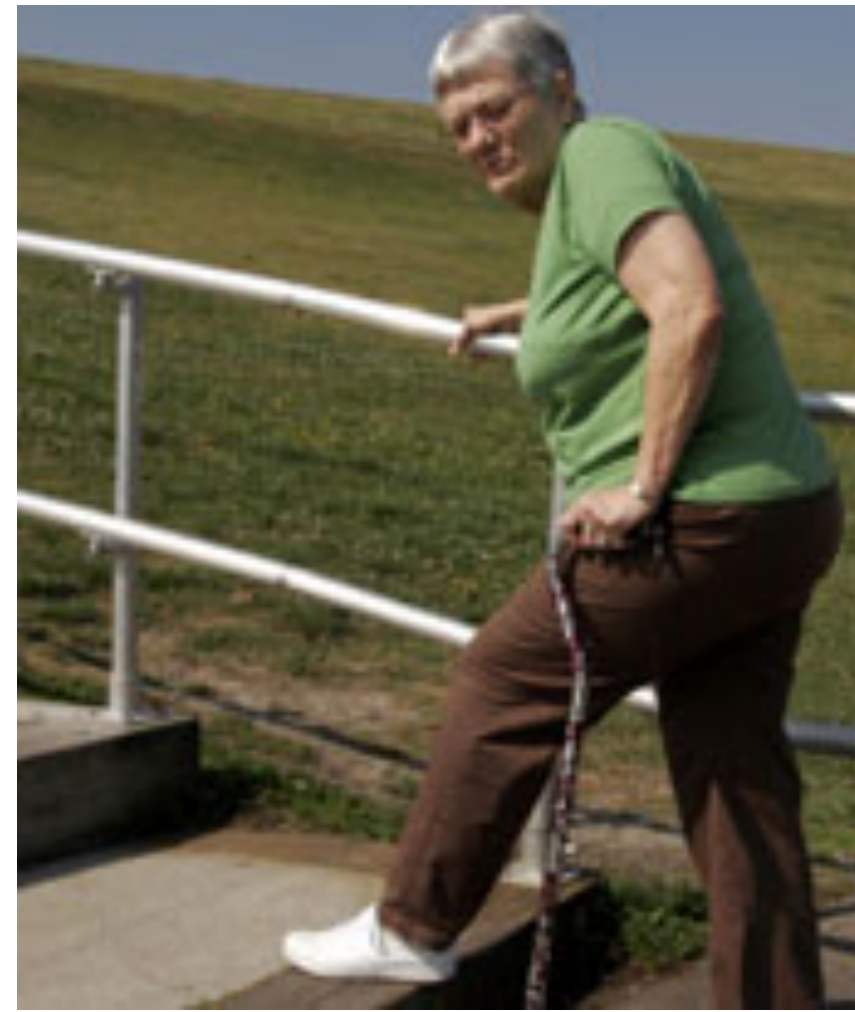


**Deconditioning** is often a major contributing factor in patients with chronic lung disease



# Dyspnea

- **Neural activation associated with breathing discomfort**
  - Sensory dimension: intensity, quality, time course
  - Affective dimension: immediate unpleasantness, evaluative and emotional response



## 呼吸困難

病徵的表現 vs. 情緒的反應？

Use this scale to rate the **intensity** or **strength** of your breathing sensations, how **much** sensation you have now.

Please focus on how your breathing feels now

0	1	2	3	4	5	6	7	8	9	10
NO SENSATION	SLIGHT SENSATION			MODERATE SENSATION						MAXIMUM SENSATION

---

Use this scale to rate the **unpleasantness** of your breathing sensations, how **good** or **bad** your breathing feels

Please focus on how your breathing feels now

←	←	0	1	2	3	4	5	6	7	8	9	10
PLEASANT	NEUTRAL	SLIGHT SENSATION			ANNOYING			DISTRESSING				UNBEARABLE

---

**SQ -- Sensory Qualities** -Rate the intensity of the breathing sensations you feel (like the loudness of sound, regardless of whether the sensation is pleasant or unpleasant; for example a sensation could be intense without being unpleasant.)

SQ1-My breathing requires muscle work or effort .

SQ2-I am not getting enough air, I feel hunger for air, or I am smothering.

SQ3-My breathing requires mental effort or concentration.

SQ4-My chest and lungs feel tight or constricted.

SQ5-I am breathing a lot. (breathing rapidly, deeply or heavily)

**E – Emotional Response**-Please tell us about how your breathing sensations made you feel – rate zero for any emotion you did not feel.

E1-Depression

E2-Anxiety

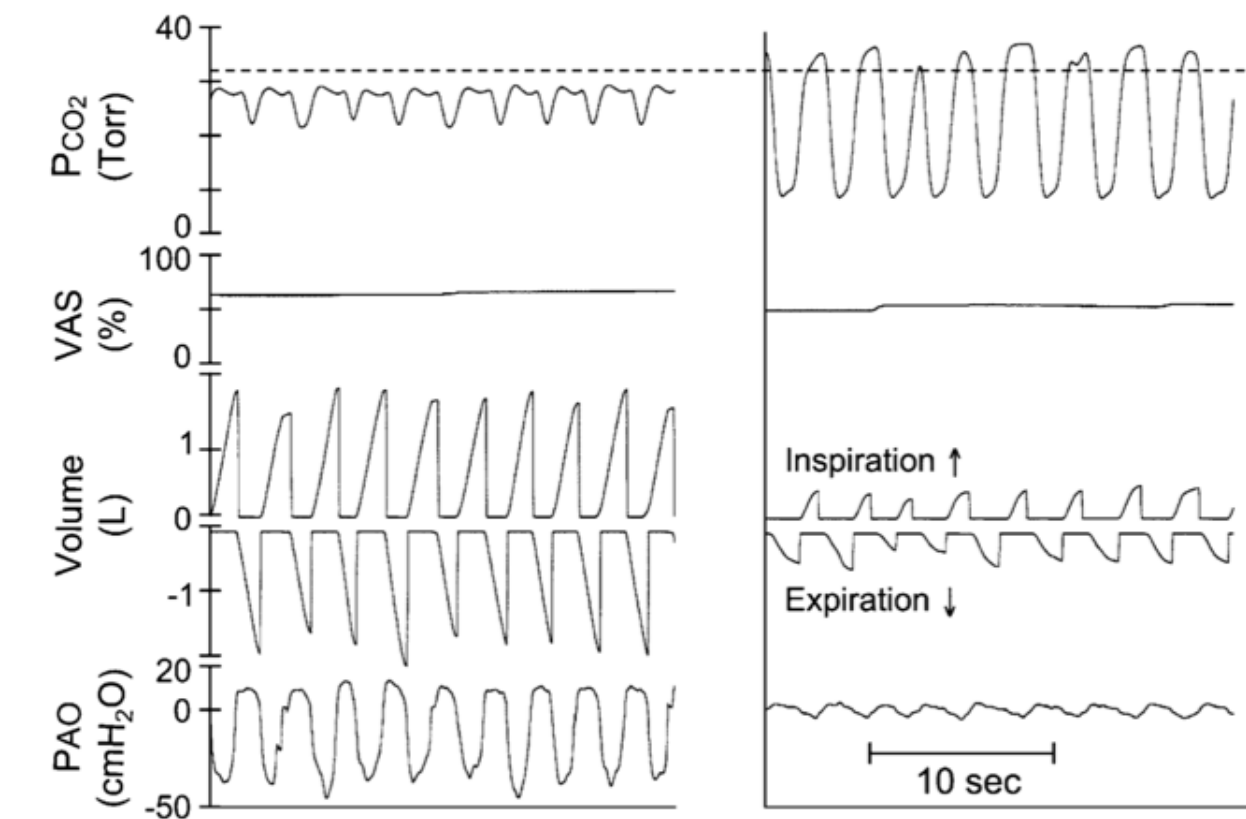
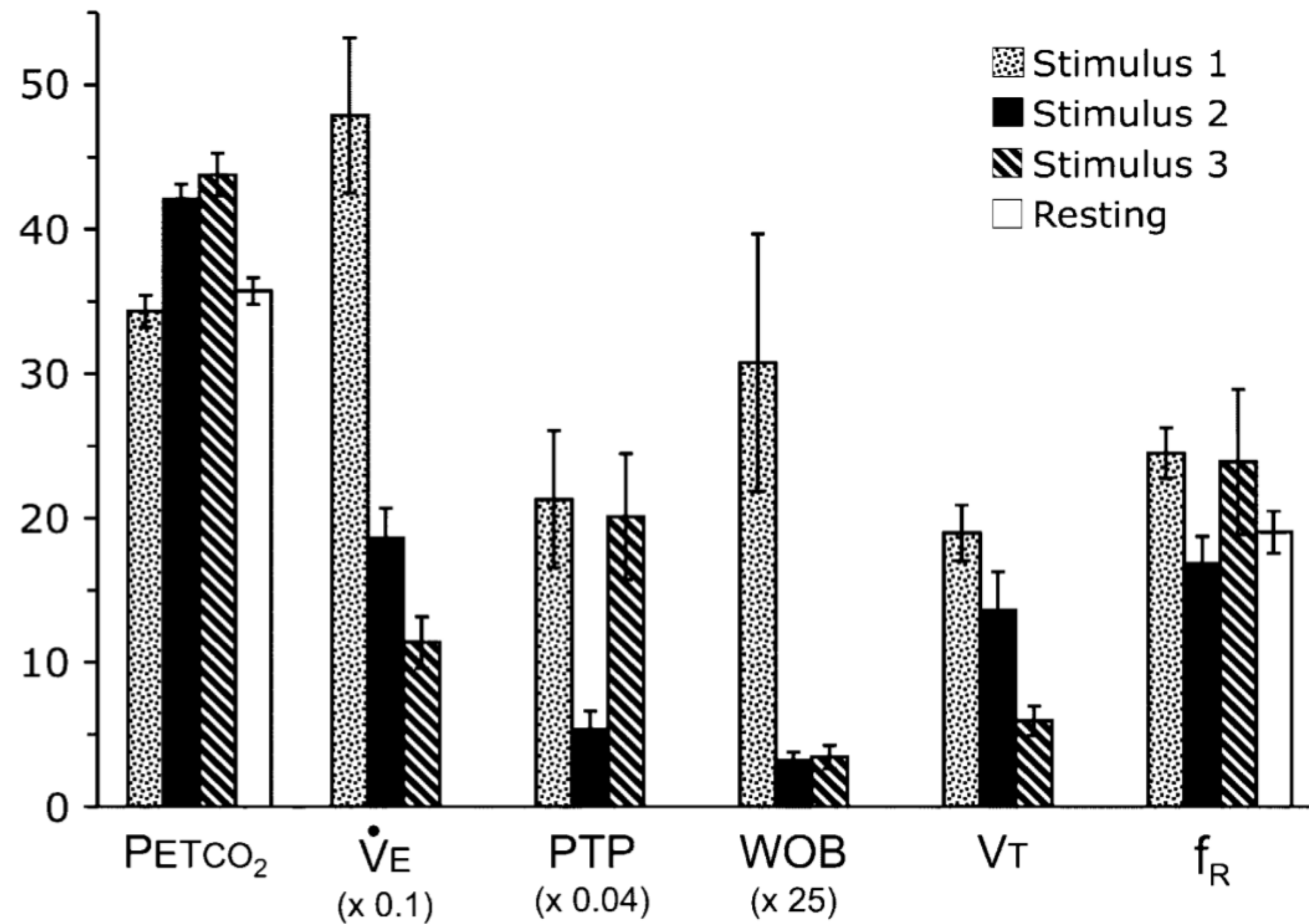
E3-Frustration

E4-Anger

E5-Fear

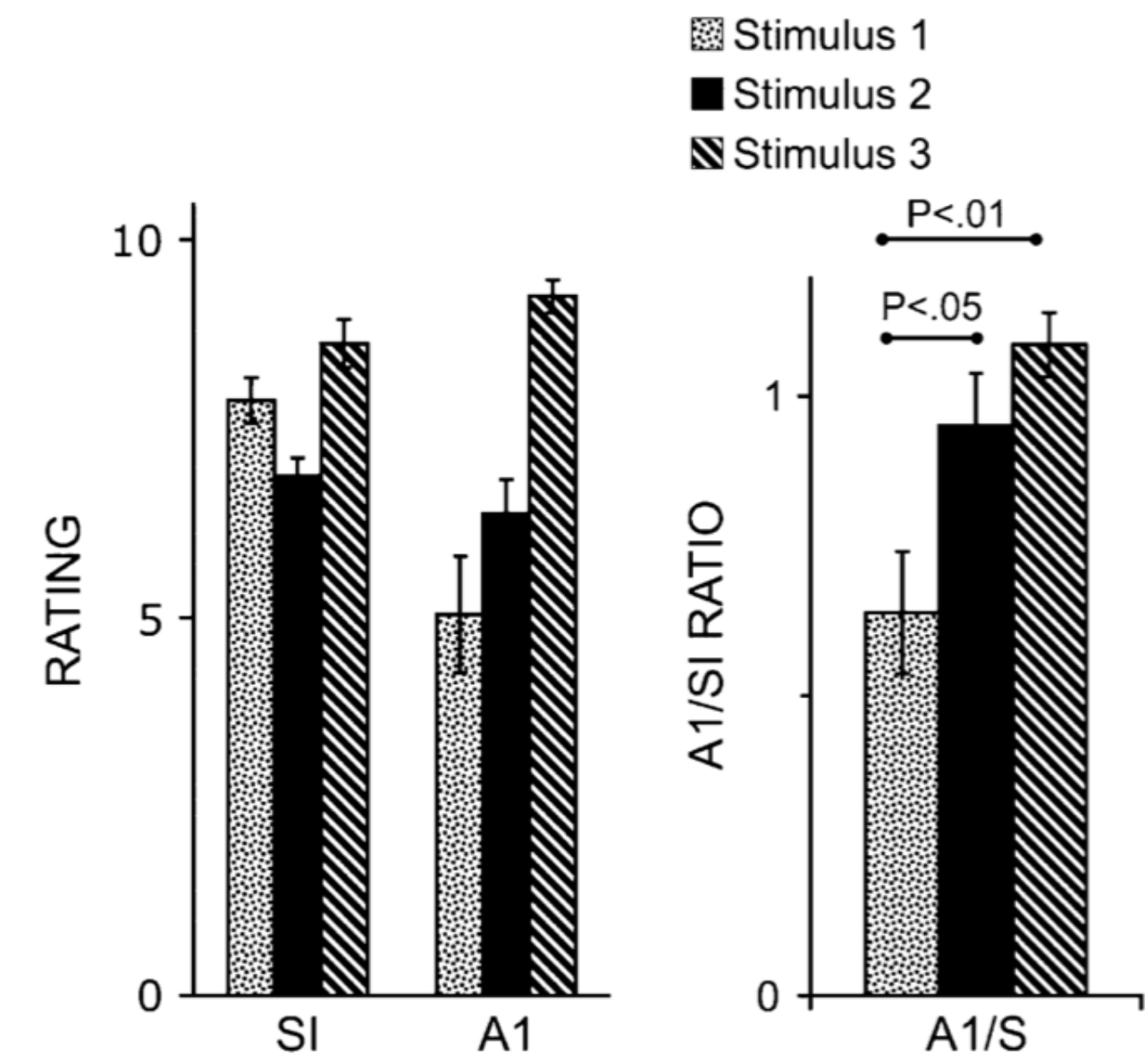
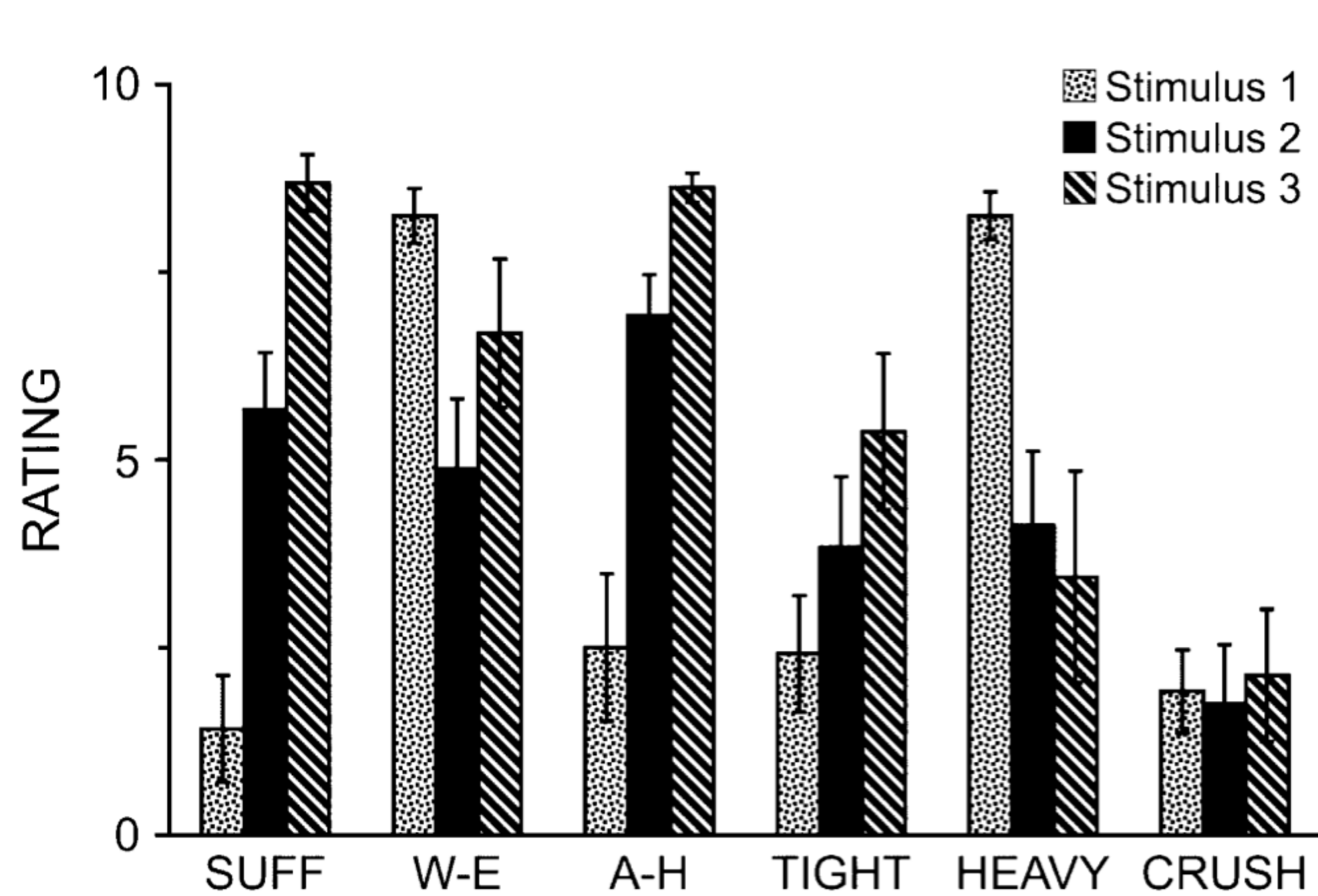
Multidimensional dyspnea profile

# Air Hunger is More Unpleasant than Work/Effort



**3 stimuli**

- 1: normocapnic hyperpnea with inspiratory resistance;*
- 2: hypercapnia with moderate restriction of ventilation;*
- 3: hypercapnia with severe restriction of ventilation.*

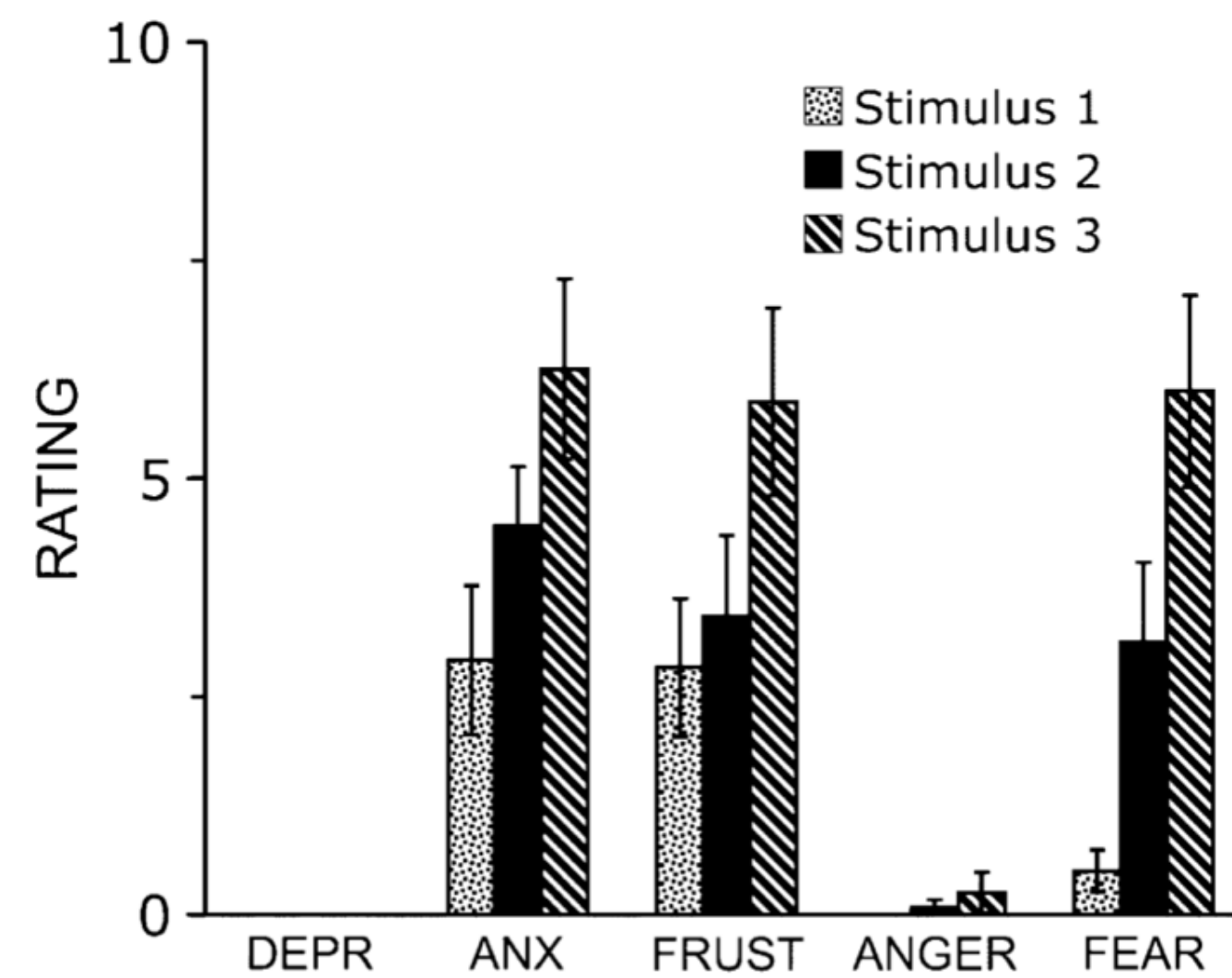


**SQ -- Sensory Qualities** -Rate the intensity of the breathing sensations you feel (like the loudness of sound, regardless of whether the sensation is pleasant or unpleasant; for example a sensation could be intense without being unpleasant.)

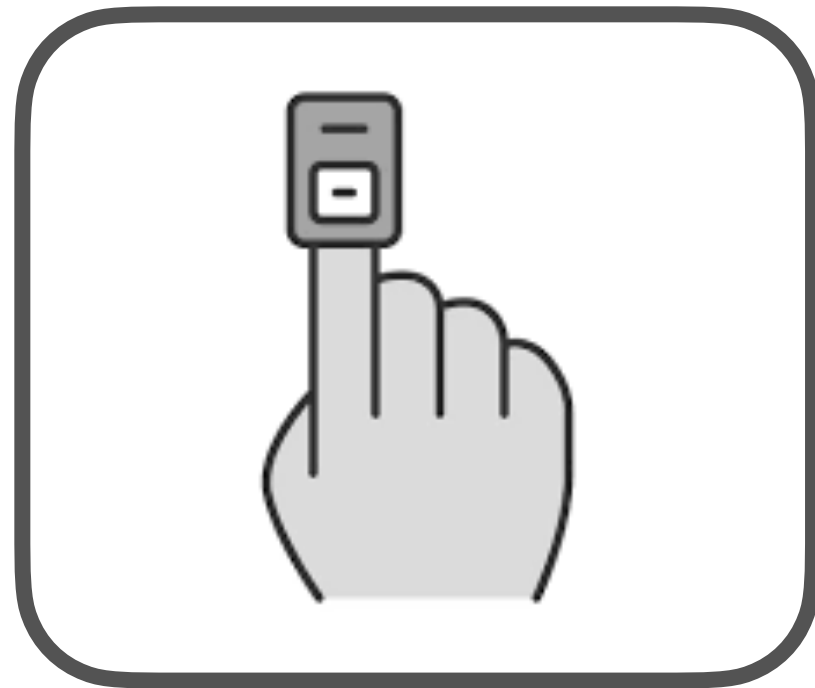
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- SQ3-My breathing requires mental effort or concentration.
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- E2-Anxiety
- E3-Frustration
- E4-Anger
- E5-Fear



# 常見呼吸疾病症狀？



缺氧



喘



咳嗽

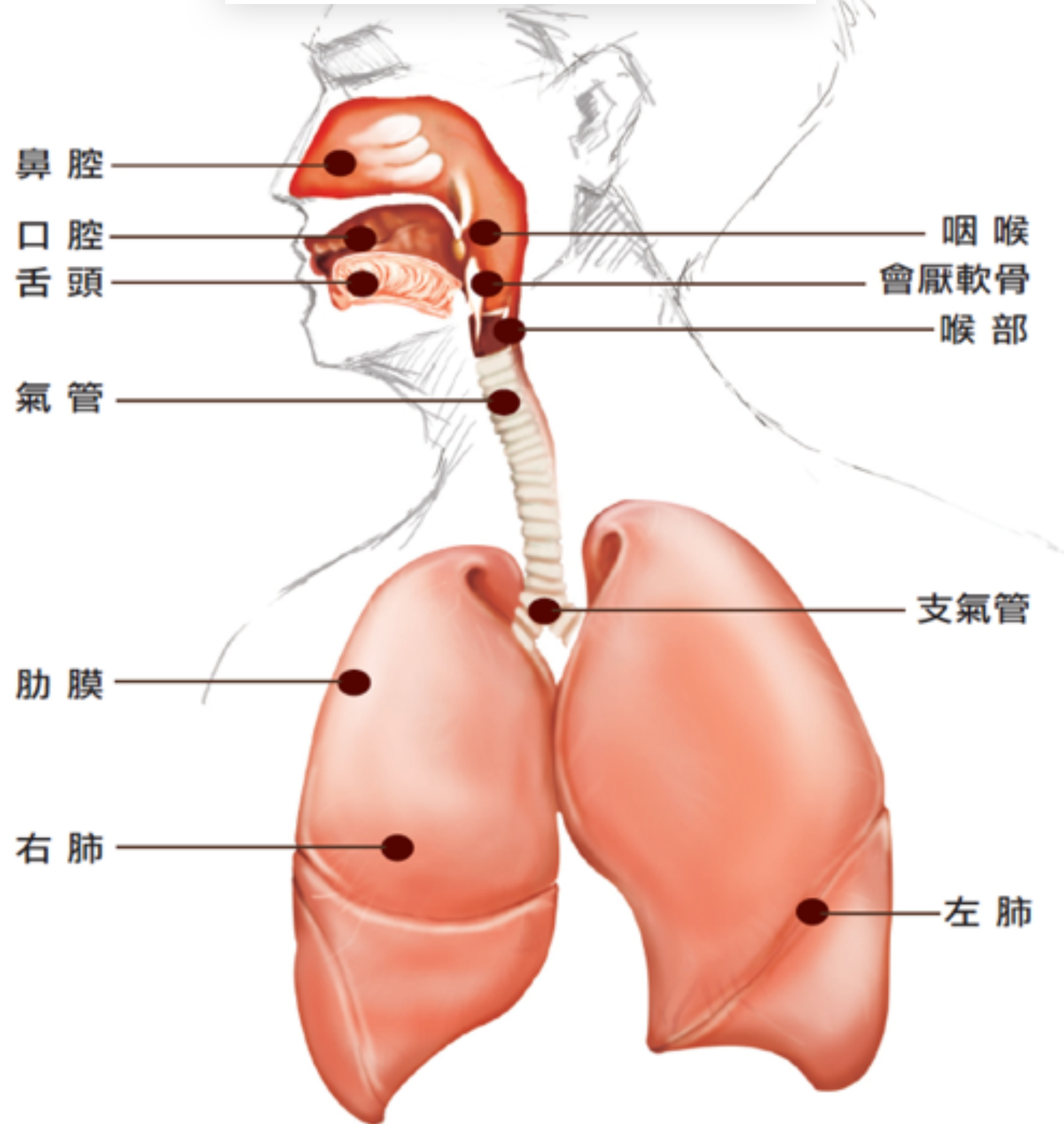


多痰

咳嗽與多痰真的是肺部的問題嗎？



# 身體的咳嗽接受器

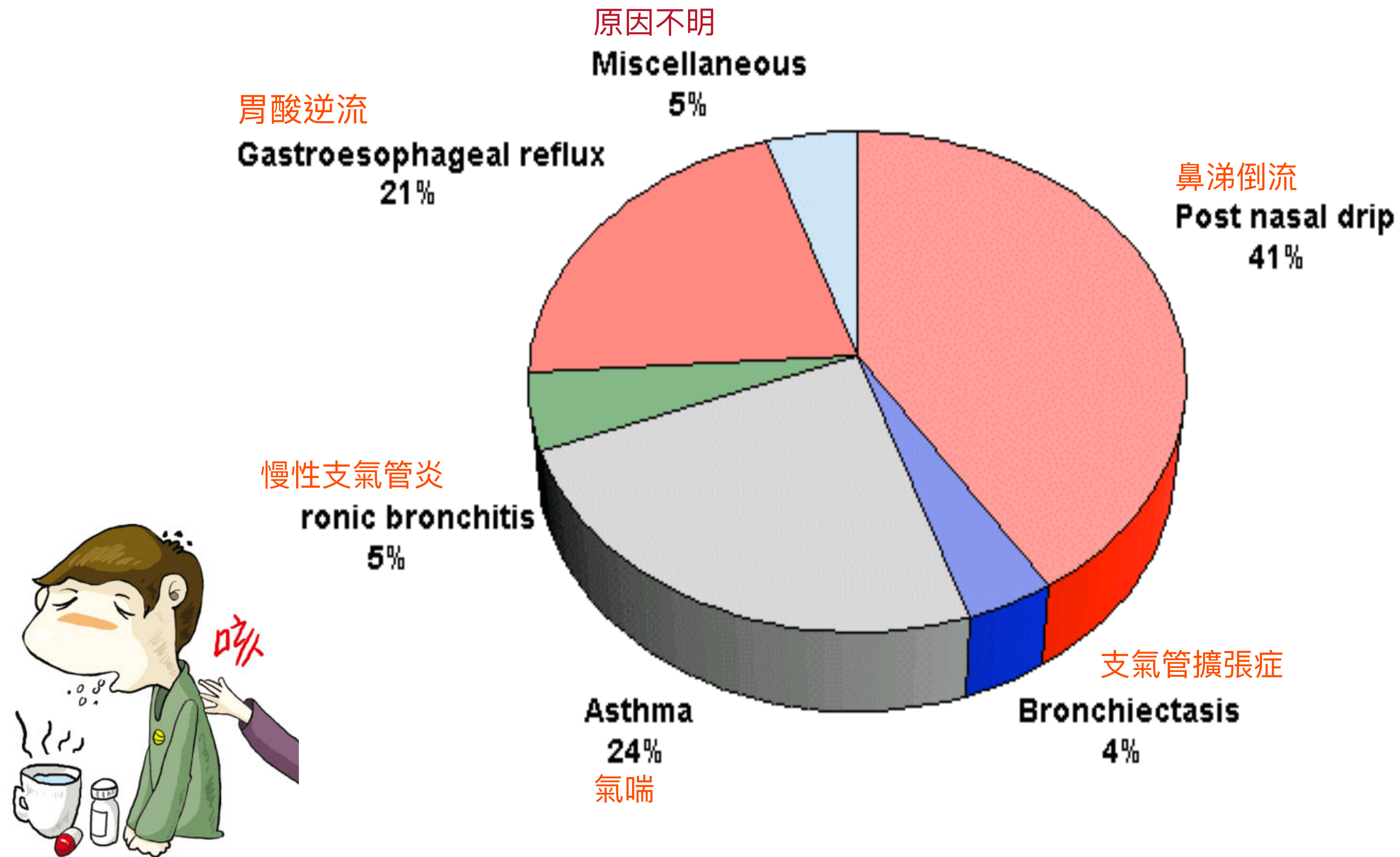


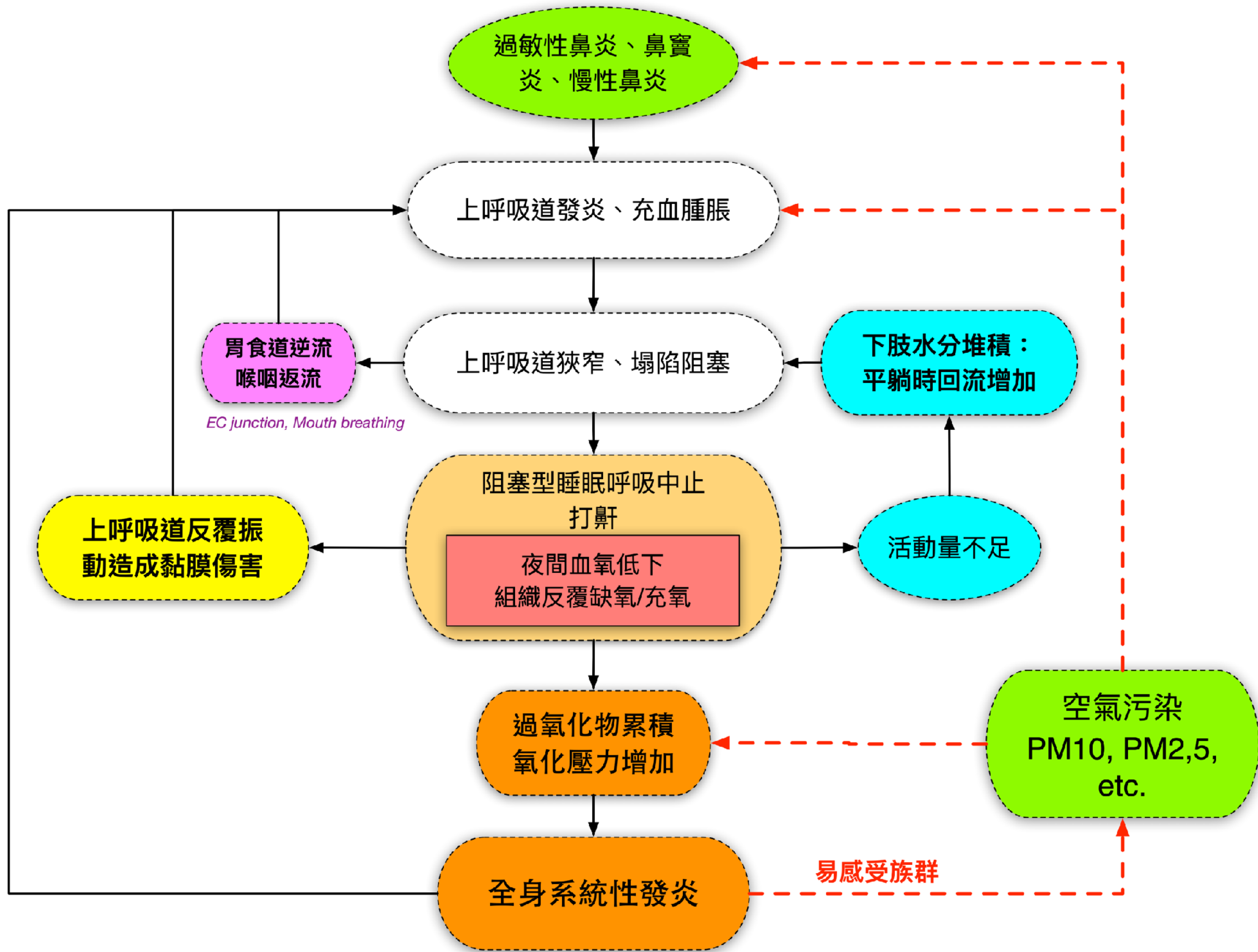
慢性咳嗽：  
>8 weeks

亞急性咳嗽：  
3~8 weeks

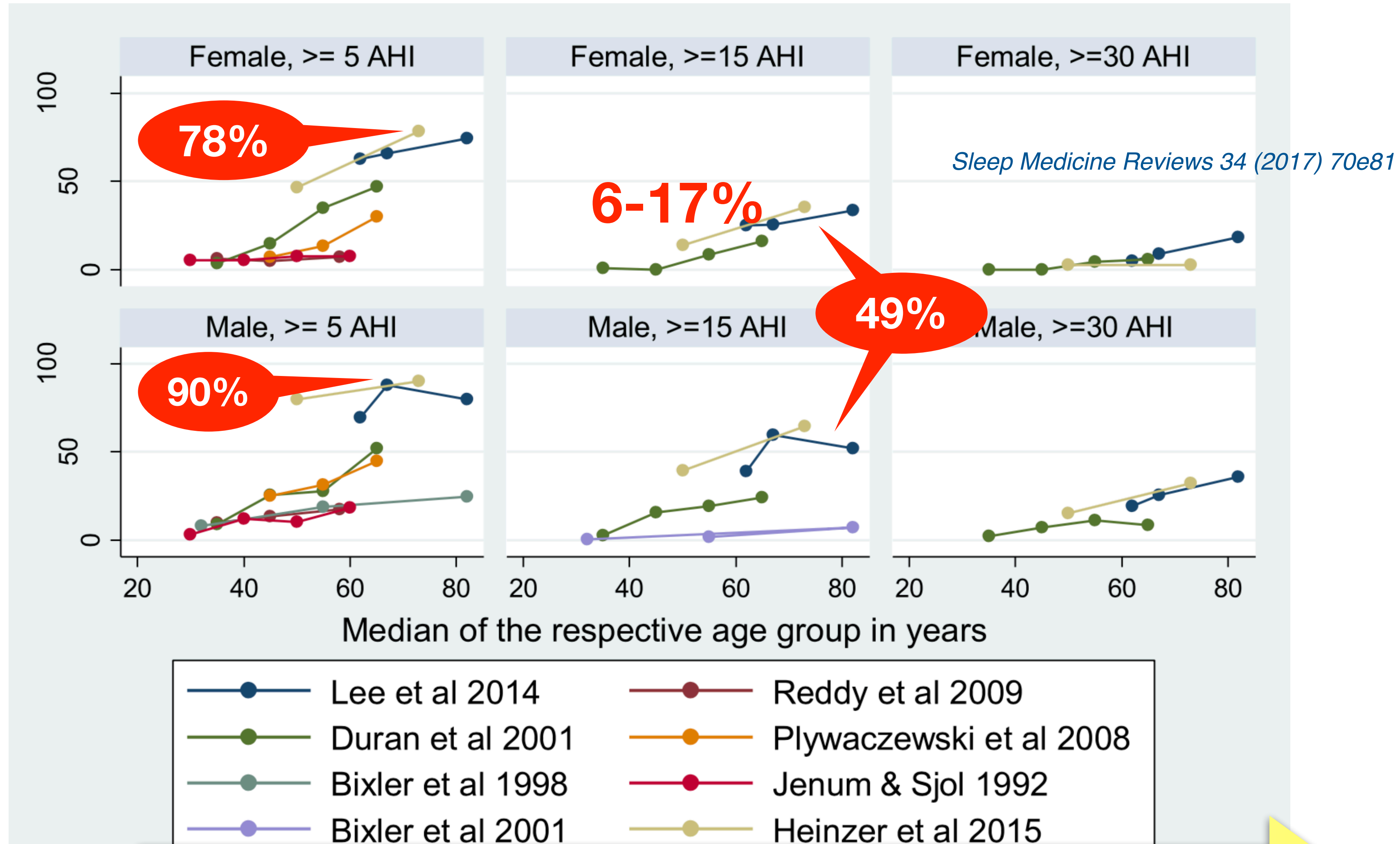
急性咳嗽：  
< 3 weeks

# 成年人常見慢性咳嗽的原因



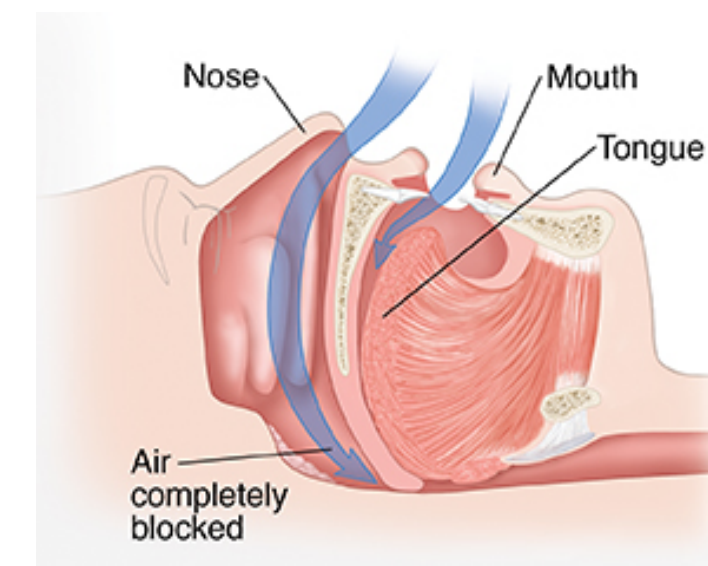


# 睡眠呼吸中止症的盛行率是多少呢？超乎我們想像！



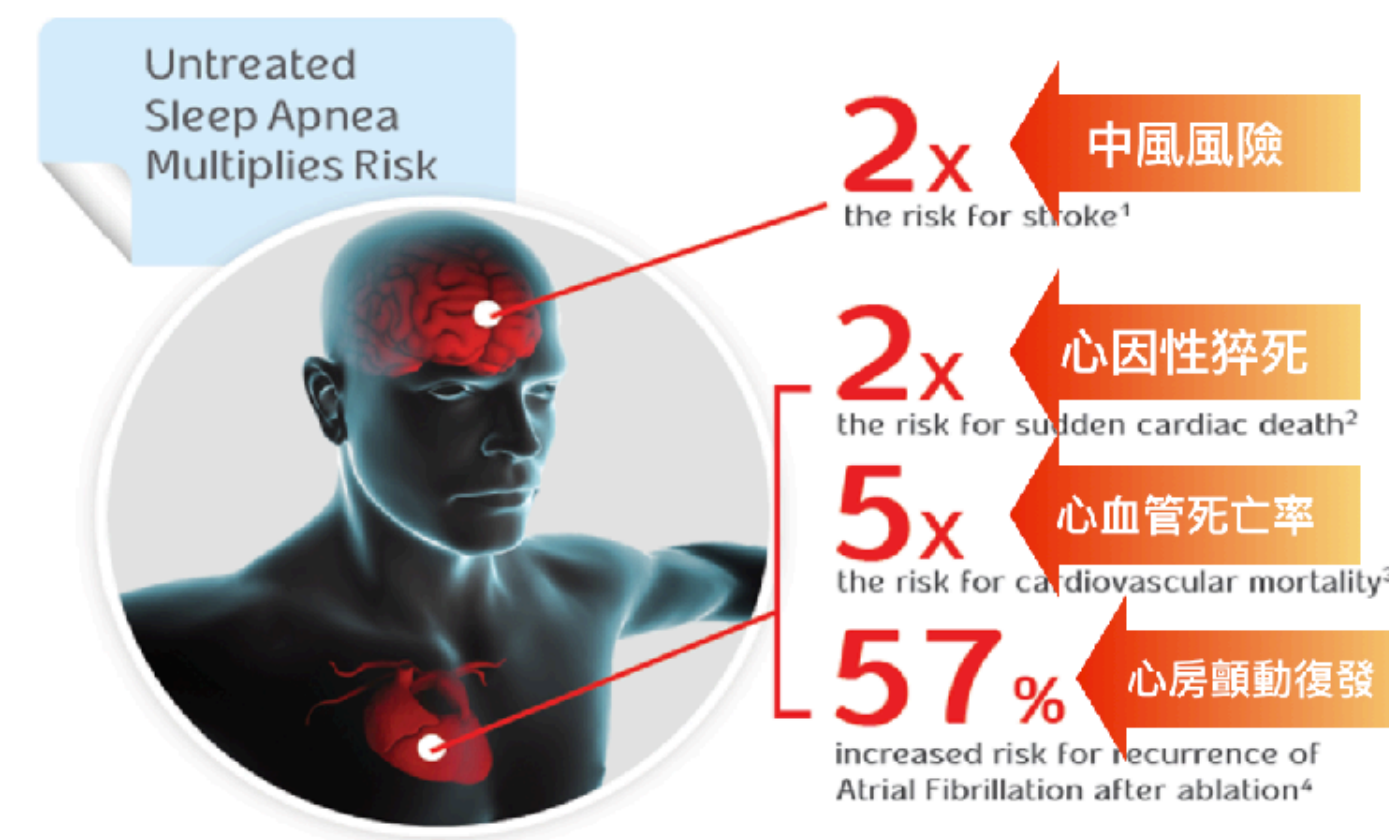
高齡60歲以上：男性超過一半，女性超過1/3 為中度以上

# 阻塞型睡眠呼吸中止症的病患到處可見！



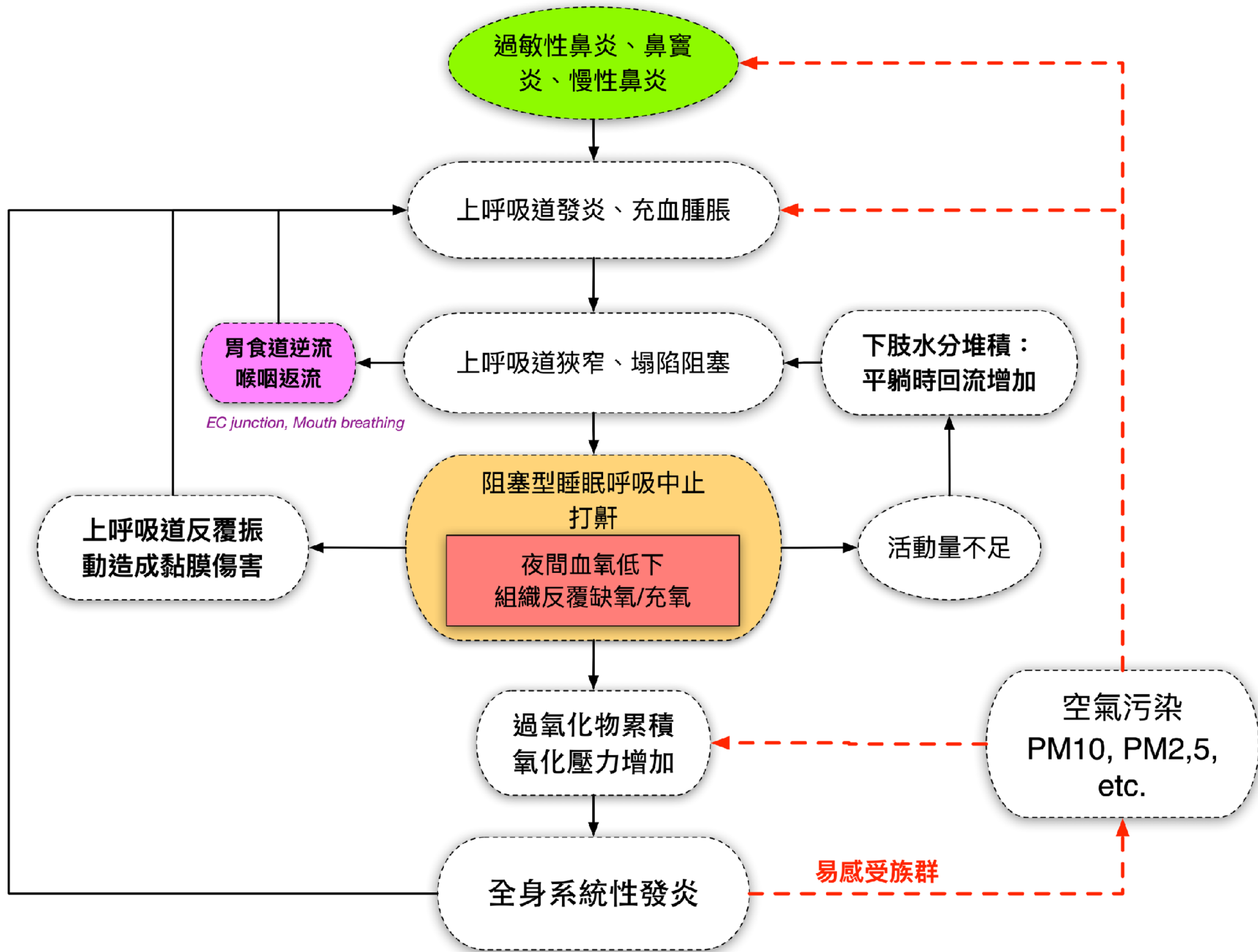
以下疾病**合併**睡眠呼吸中止症的百分比

藥物治療效果不佳的高血壓病患	80%
心臟衰竭	50-80%
心房顫動	50-70%
冠狀動脈心臟病	30-40%
中風	30-80%
慢性腎病	50%
夜尿	50%
糖尿病（第二型）	35%
病態性肥胖	50-90%
代謝症候群	50%
失眠	30-70%
長期使用安眠藥患者	50%
減肥手術	70-80%



睡眠 = 清除腦神經的廢物

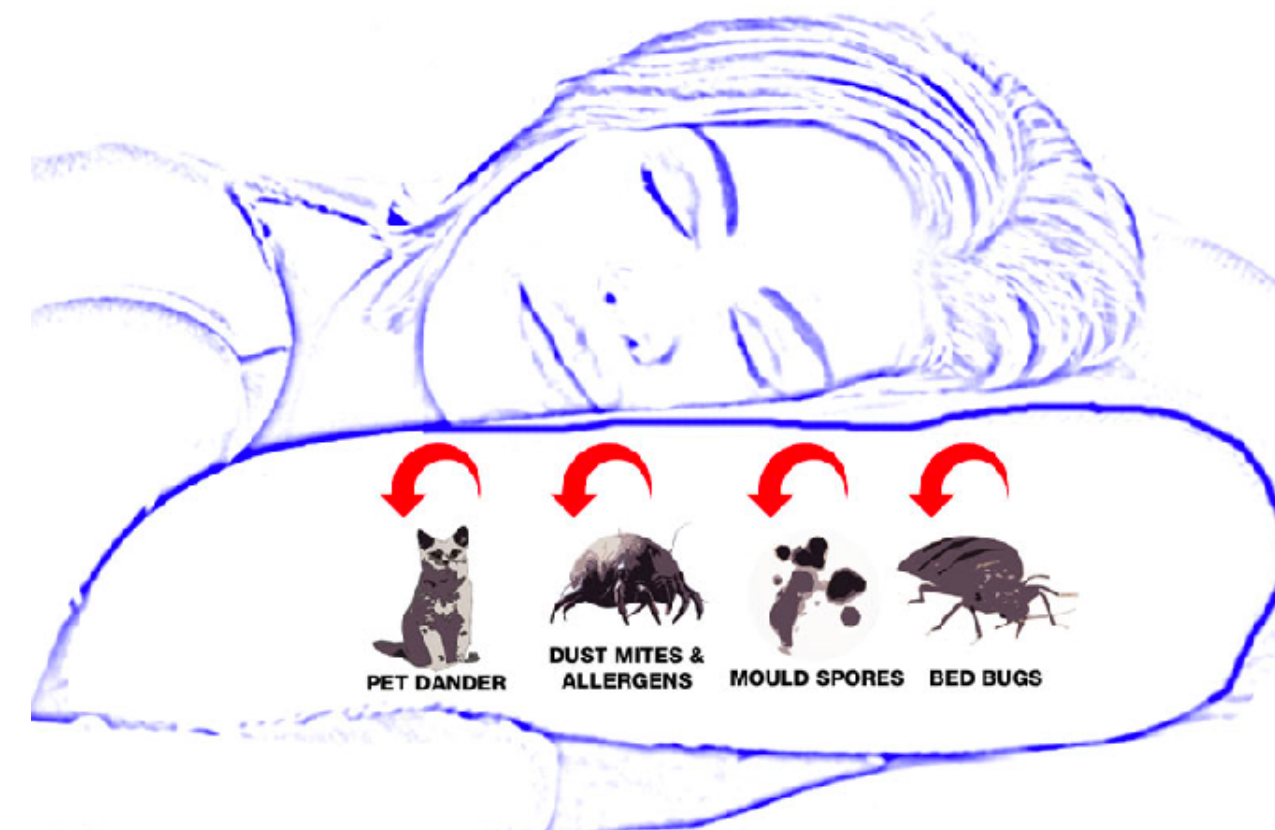




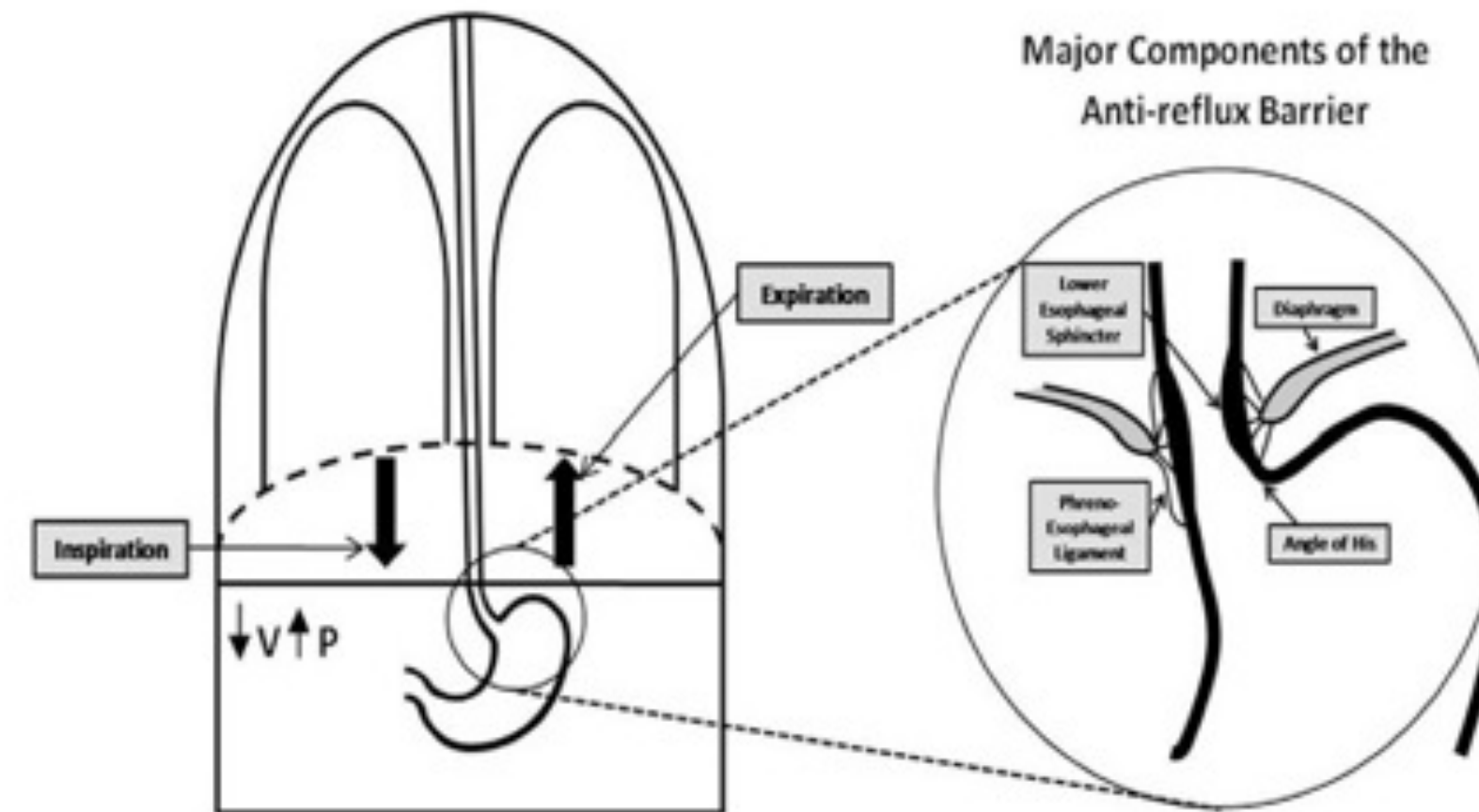
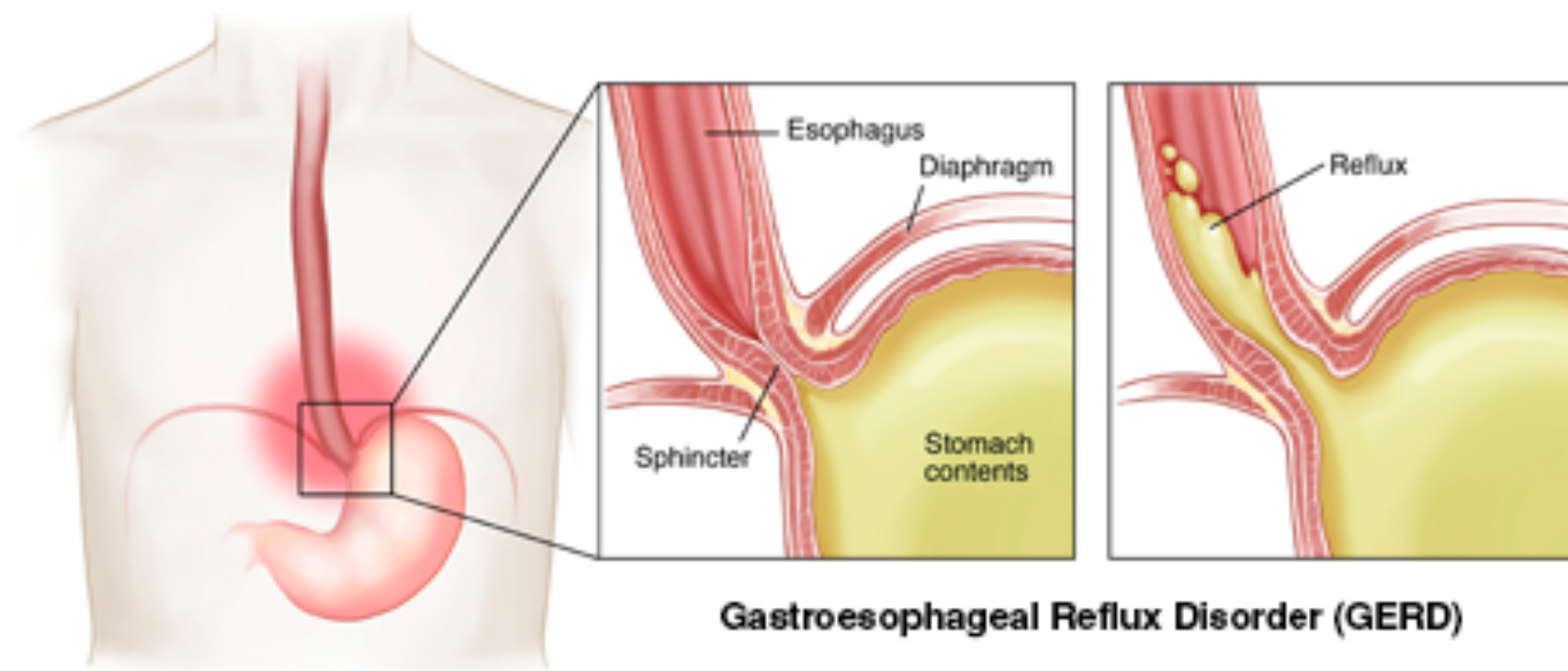
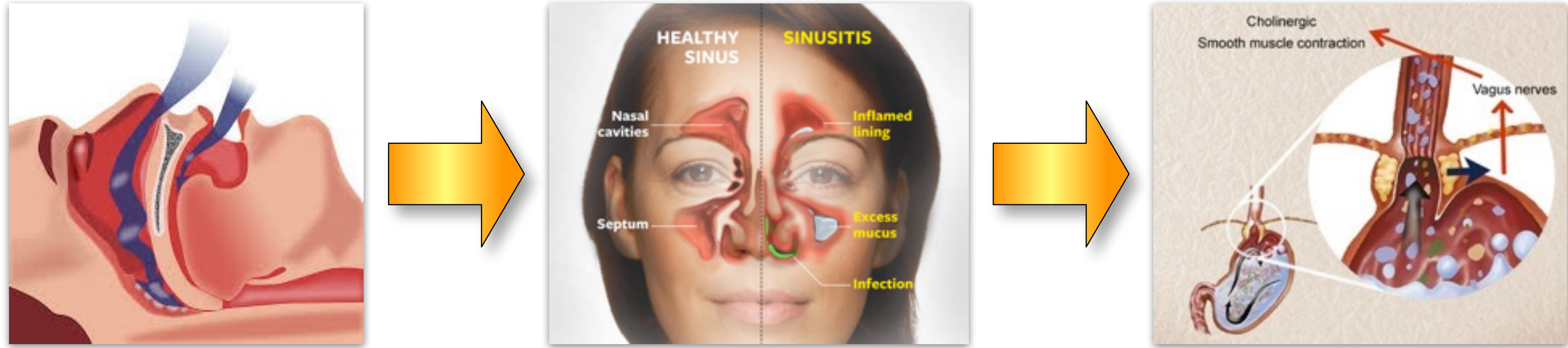
# 慢性鼻炎、鼻竇炎、張口呼吸



鼻塞的病患容易改成張口呼吸，導致口腔、咽喉乾燥，黏膜損傷，咳嗽受體及感覺神經變的異常敏感，一旦說話或一點點鼻涕倒流，便容易引起咳嗽。



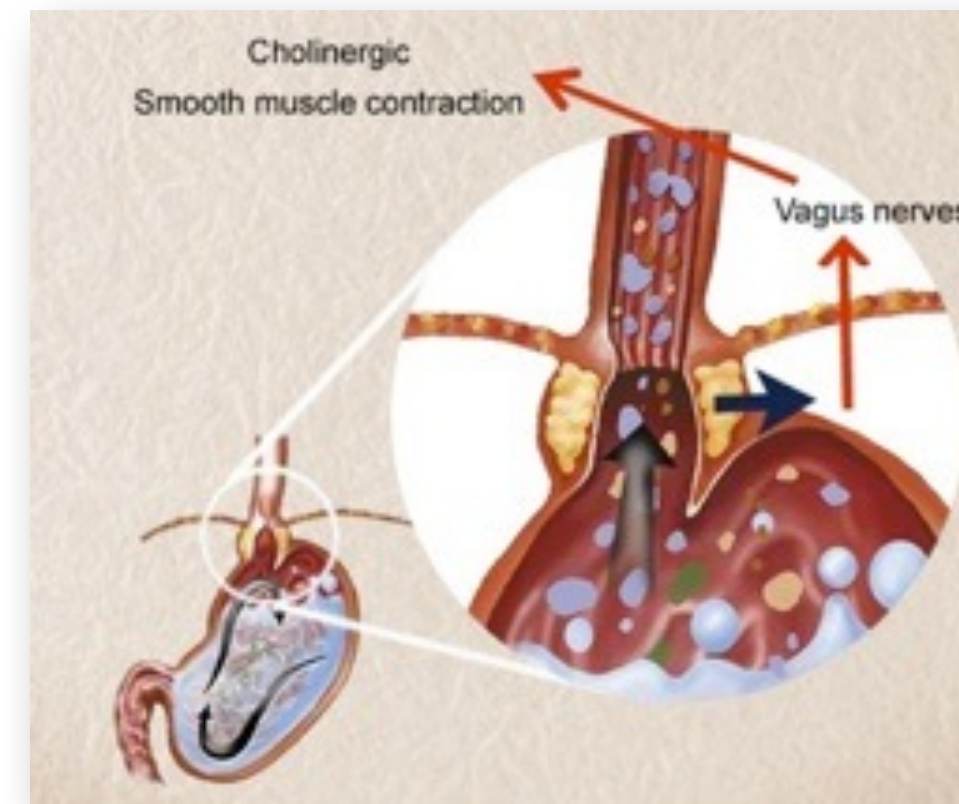
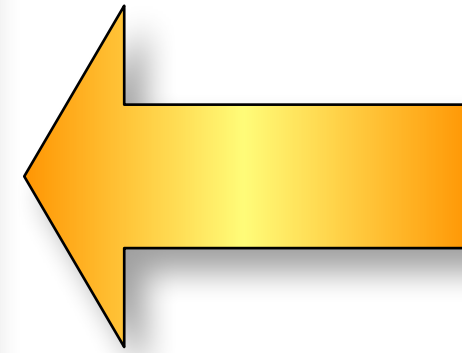
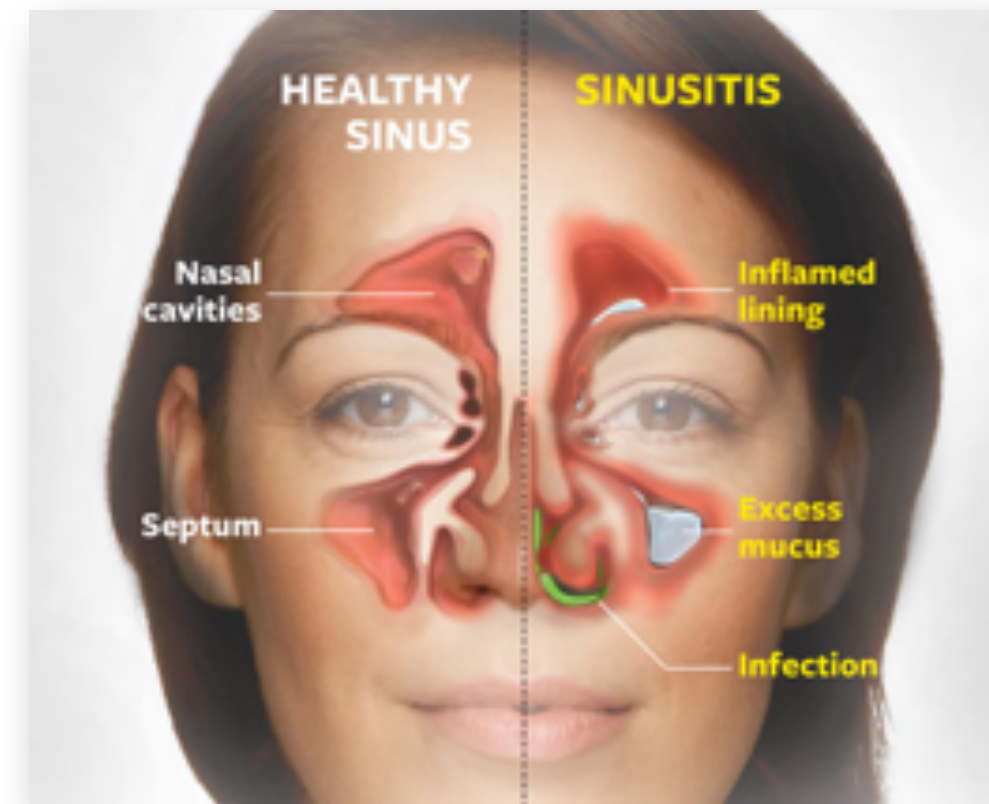
# 阻塞型睡眠呼吸中止症的合併症狀



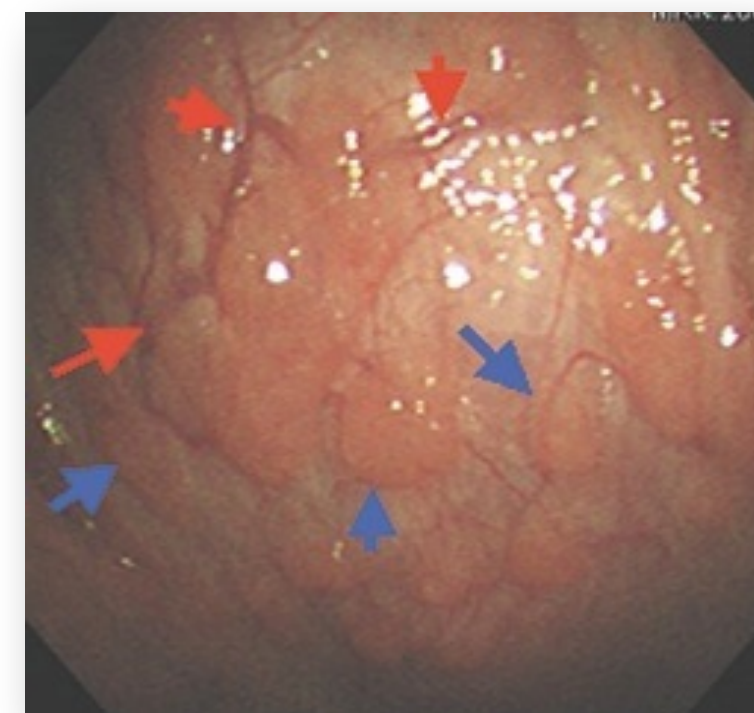
胃食道逆流



# 胃食道逆流 與 慢性鼻竇炎



- 治療**胃食道逆流**可有效改善慢性鼻炎與鼻涕倒流
- 胃內容物**並未發現直接逆流**至鼻腔的現象
- 胃食道「**反射 reflex**」可造成鼻腔內充血腫脹的現象，並增加呼吸道分泌物

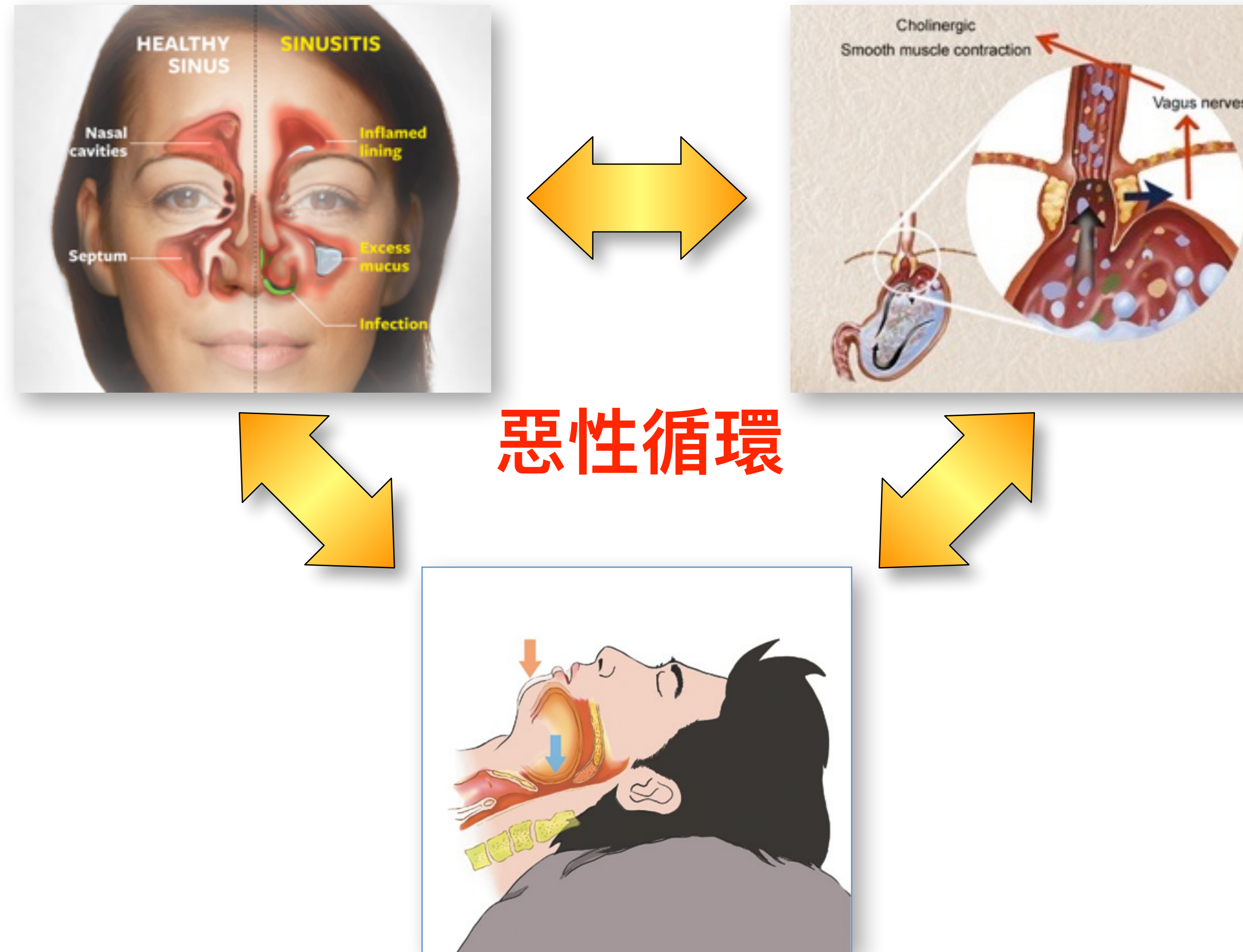


氫離子引發神經物質  
( $H^+$  induced sensory neuropeptides)

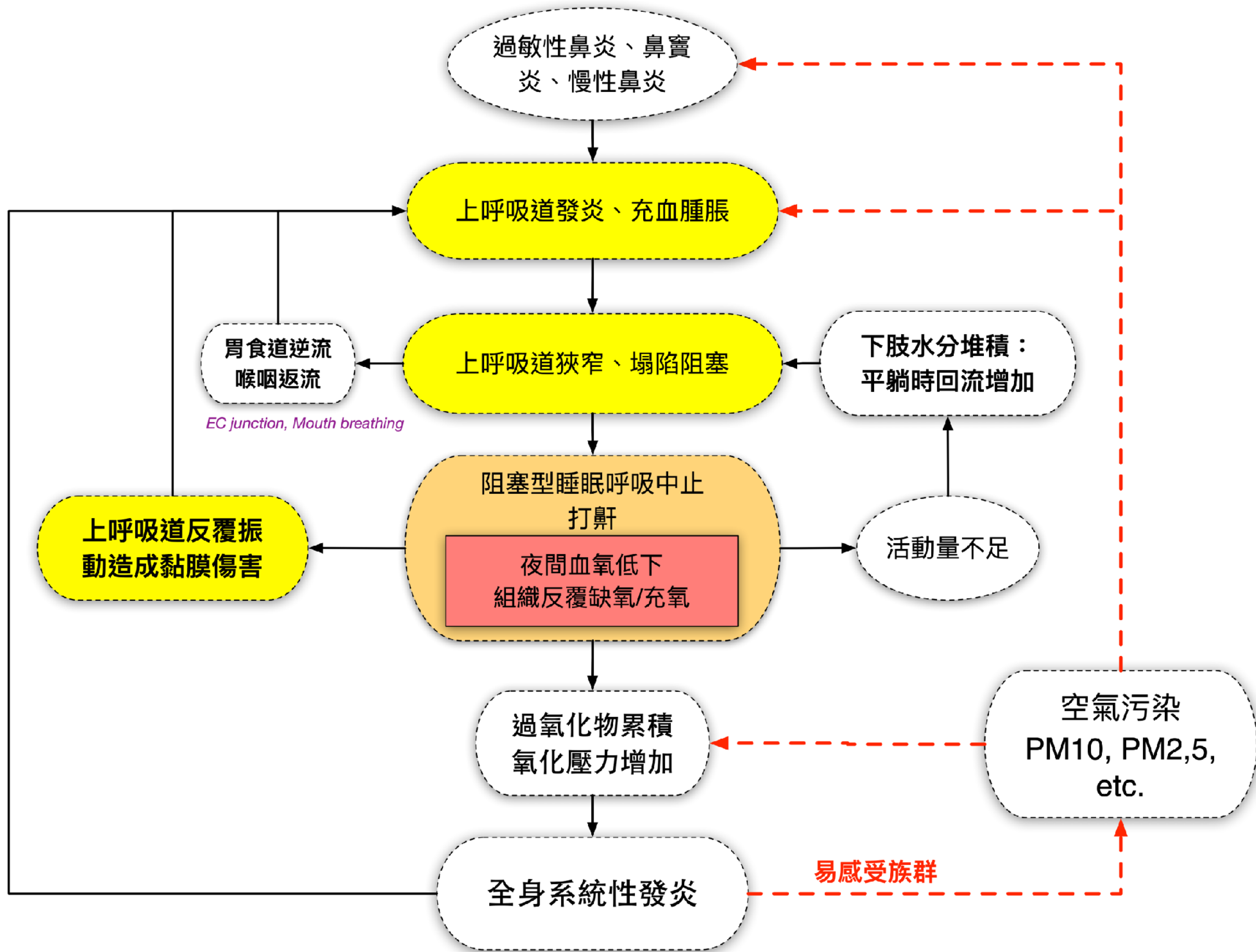
神經性發炎  
(Neurogenic inflammation)

咳嗽閾值改變  
(Cough receptor threshold)

# 胃食道逆流 與 慢性鼻竇炎



上呼吸道狹窄症候群 / **阻塞型睡眠呼吸中止**  
(氣流受限覺醒RERAs)



### OSA and Associated Manifestations

HEALTHY SINUS vs SINUSITIS

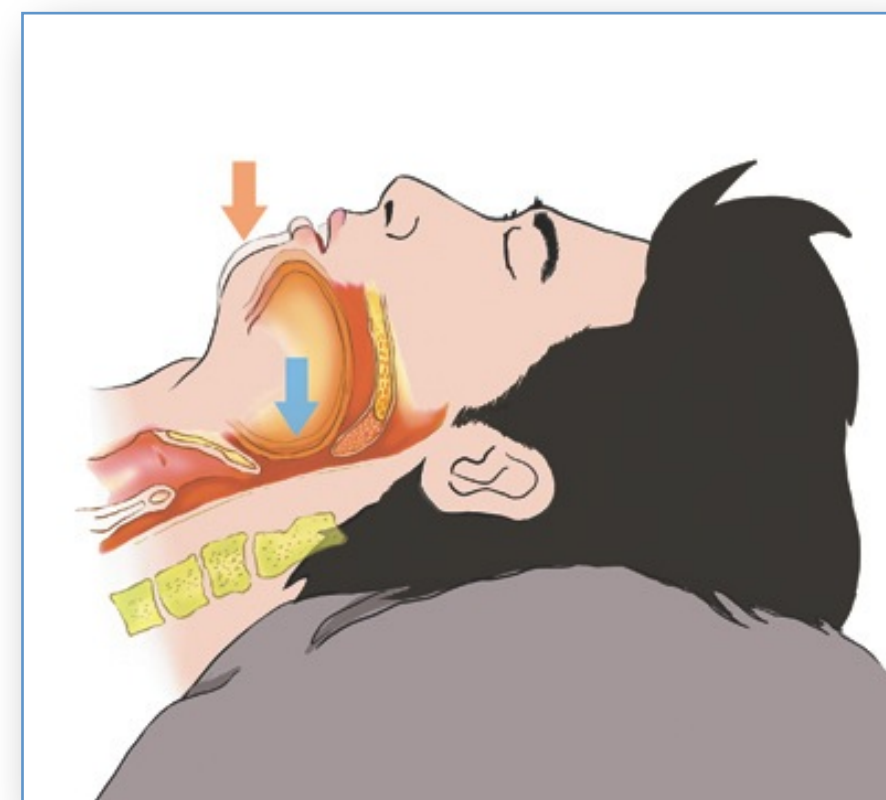
Labels: Nasal cavities, Septum, Inflamed lining, Excess mucus, Infection

Cholinergic Smooth muscle contraction, Vagus nerves

Major Components of the Anti-reflux Barrier: Lower Esophageal Sphincter, Diaphragm, Phrenic Esophageal Ligament, Angle of His

Gastroesophageal Reflux Disorder (GERD)

GERD: Gastroesophageal reflux disease



## Vibration Trauma

### GERD vs Chronic Sinusitis

HEALTHY SINUS vs SINUSITIS

Labels: Nasal cavities, Septum, Inflamed lining, Excess mucus, Infection

Cholinergic Smooth muscle contraction, Vagus nerves

- Treatment of GERD could improve Chronic Rhinitis and Post Nasal Drips
- However, no reflux contents found in Nasal Cavity
- Gastroesophageal **"REFLEX"** (instead of REFLUX): nasal congestion, irritation and increased secretion

- H<sup>+</sup> induced sensory neuropeptides
- Neurogenic inflammation
- reduced Cough receptor threshold

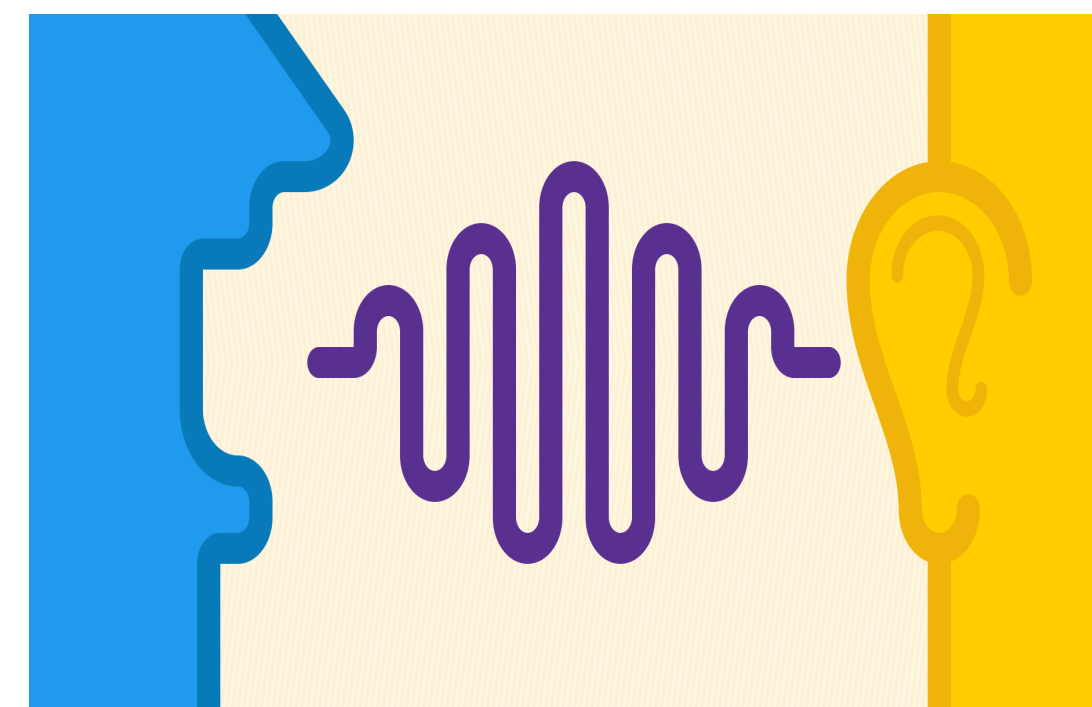
容易噎到



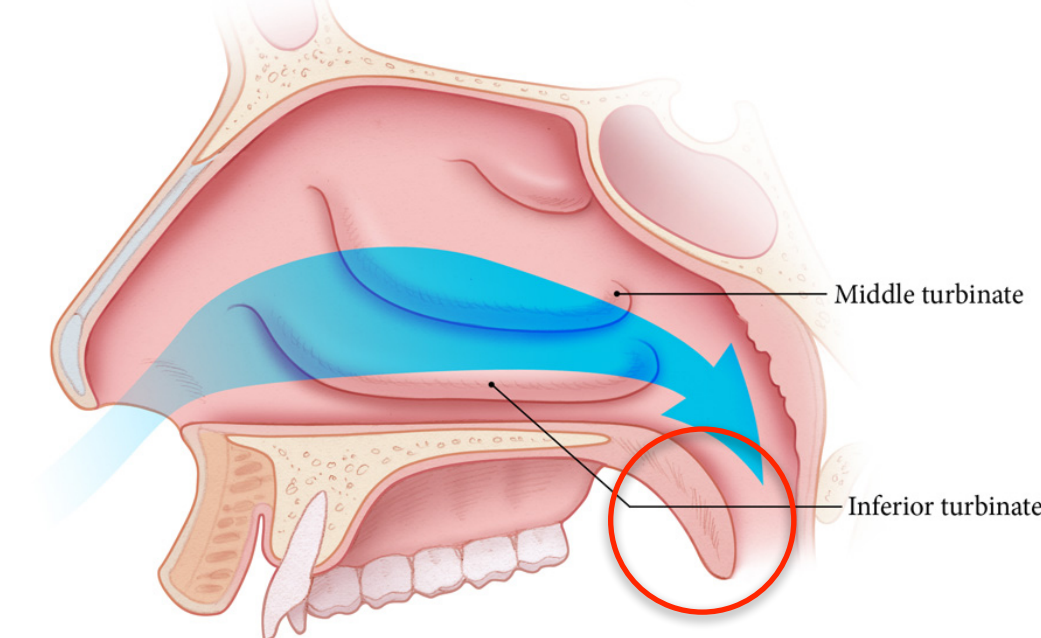
吞嚥反射受影響  
吞嚥後吸氣延遲時間縮短



黏膜振動產生的  
慢性咽喉炎

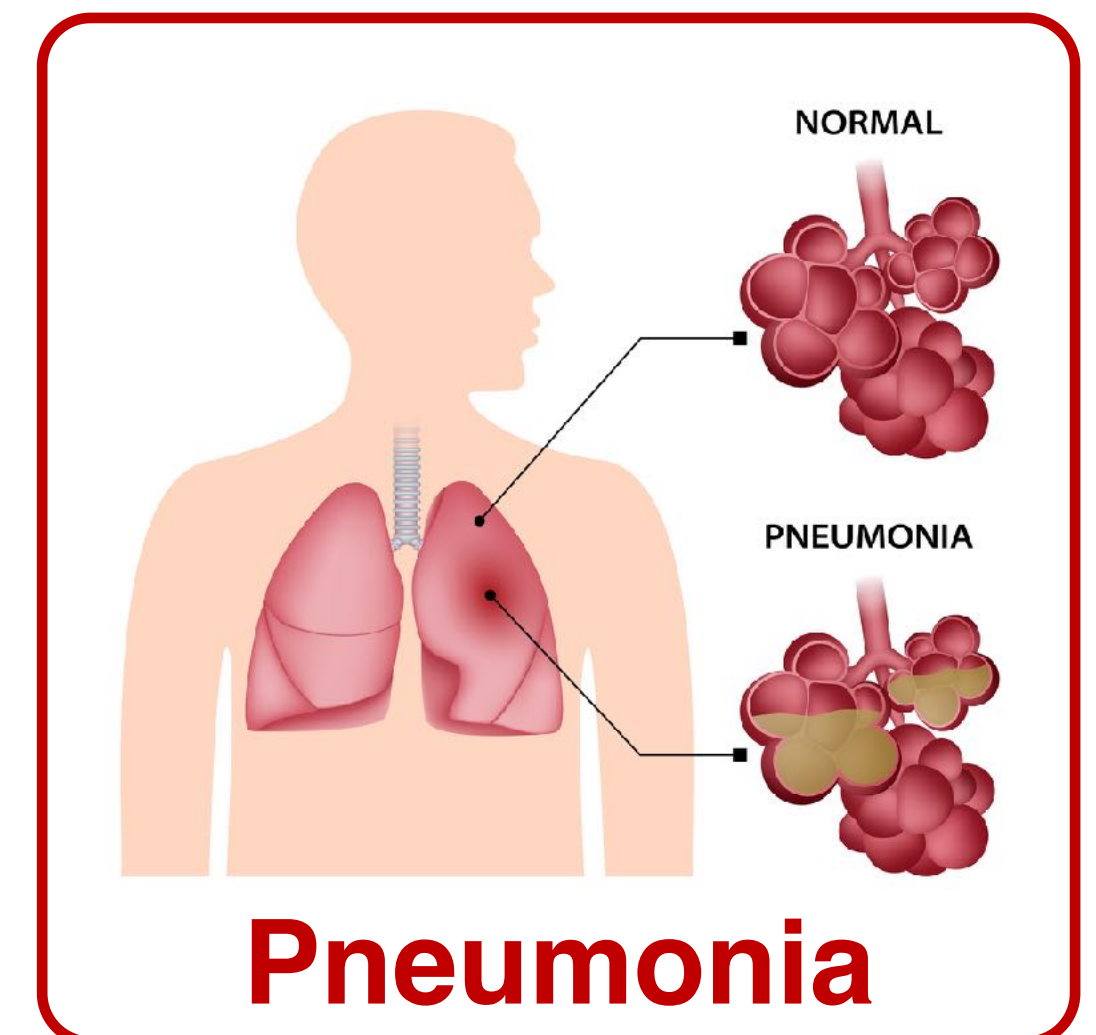
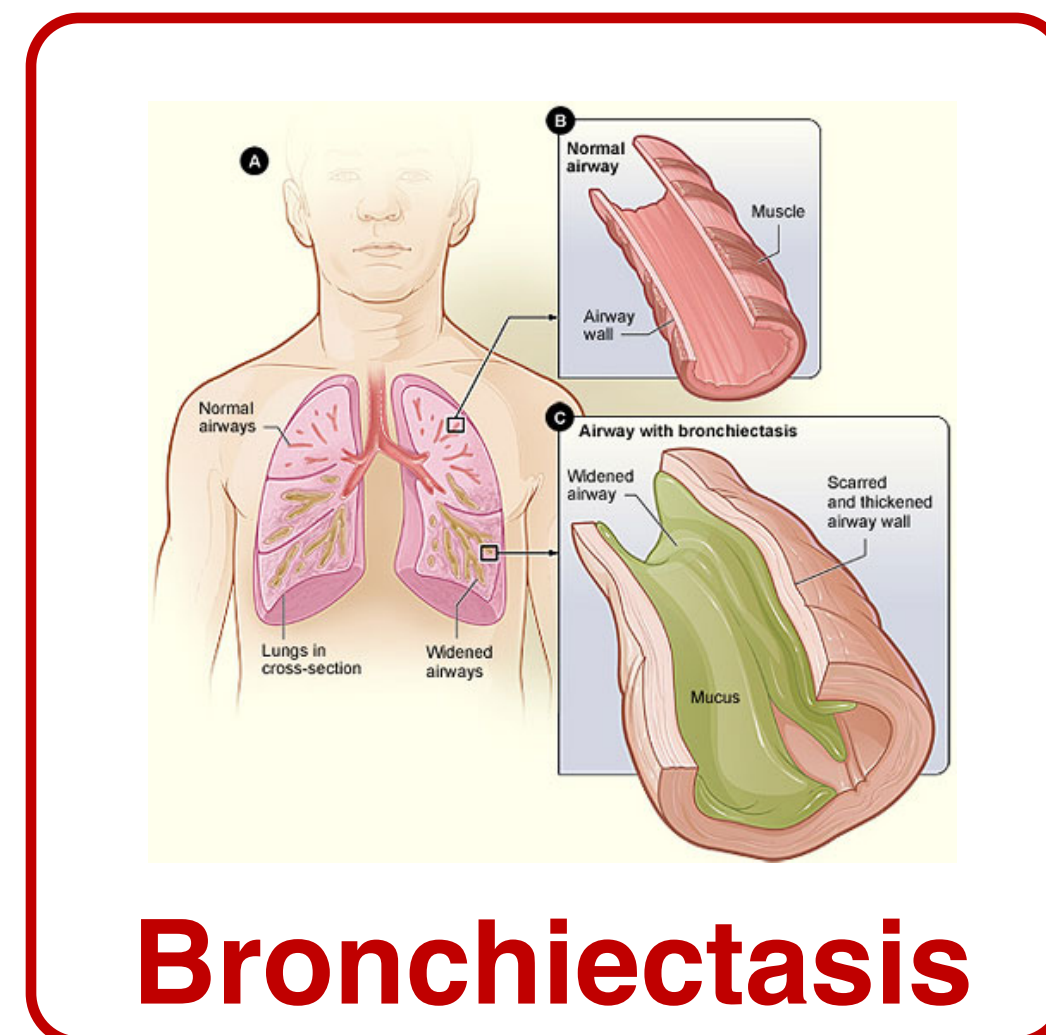
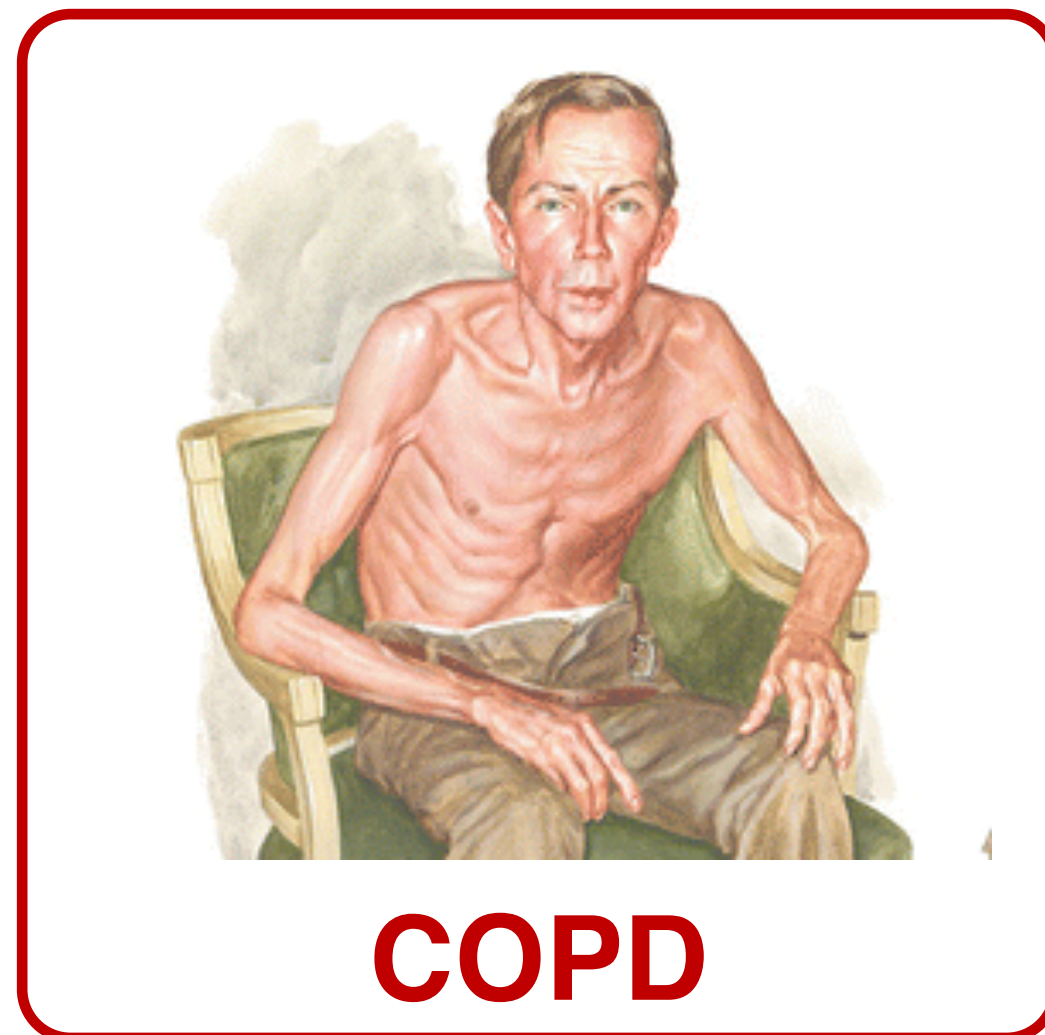


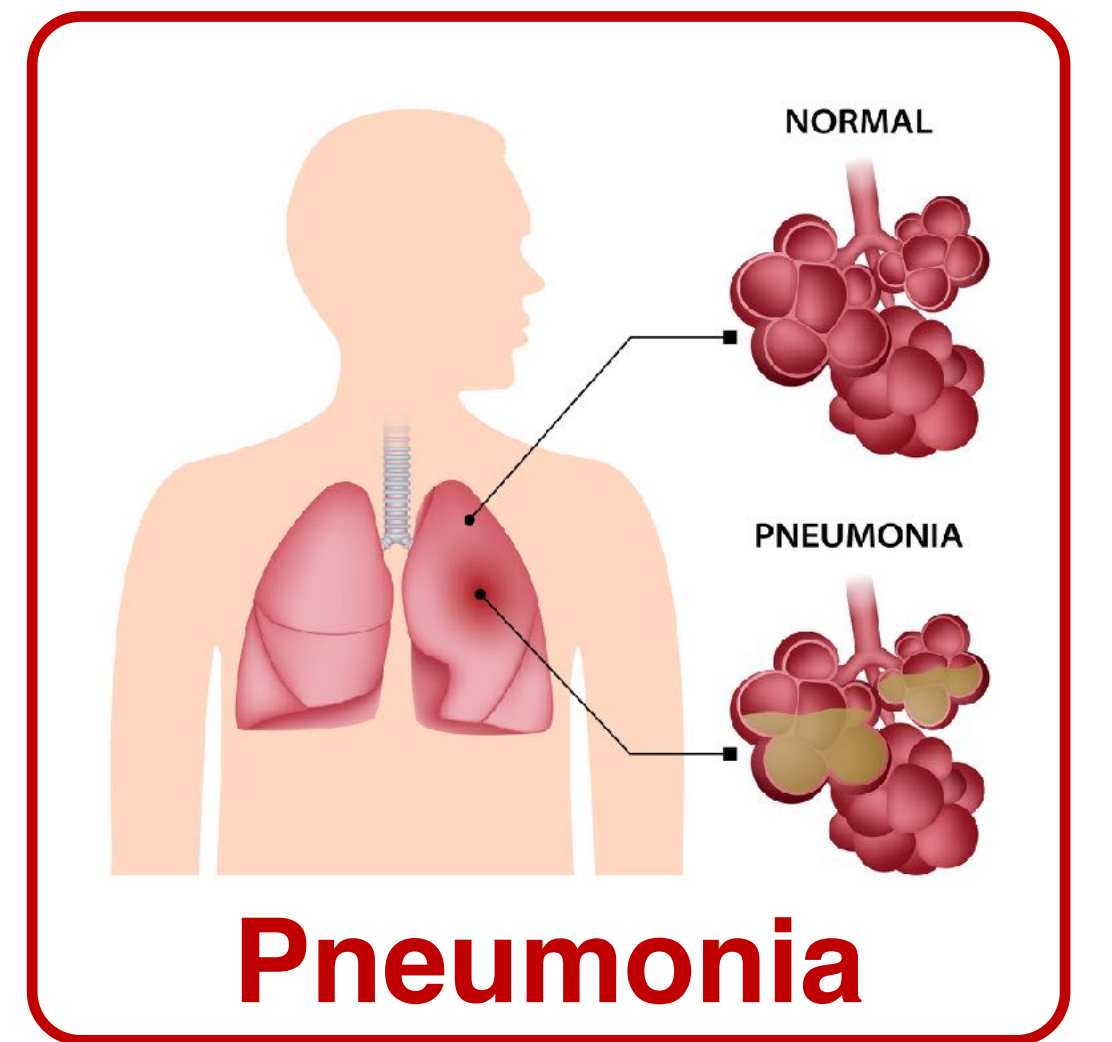
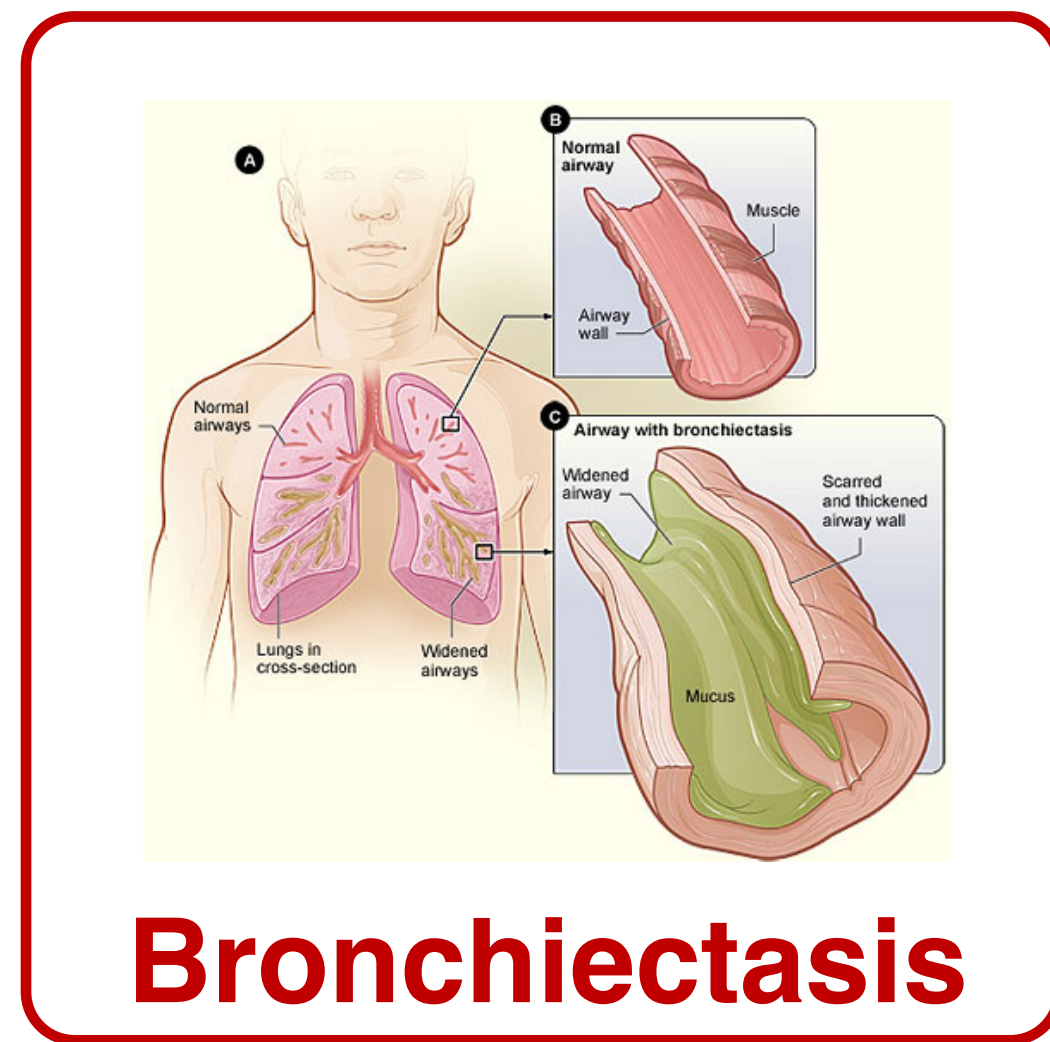
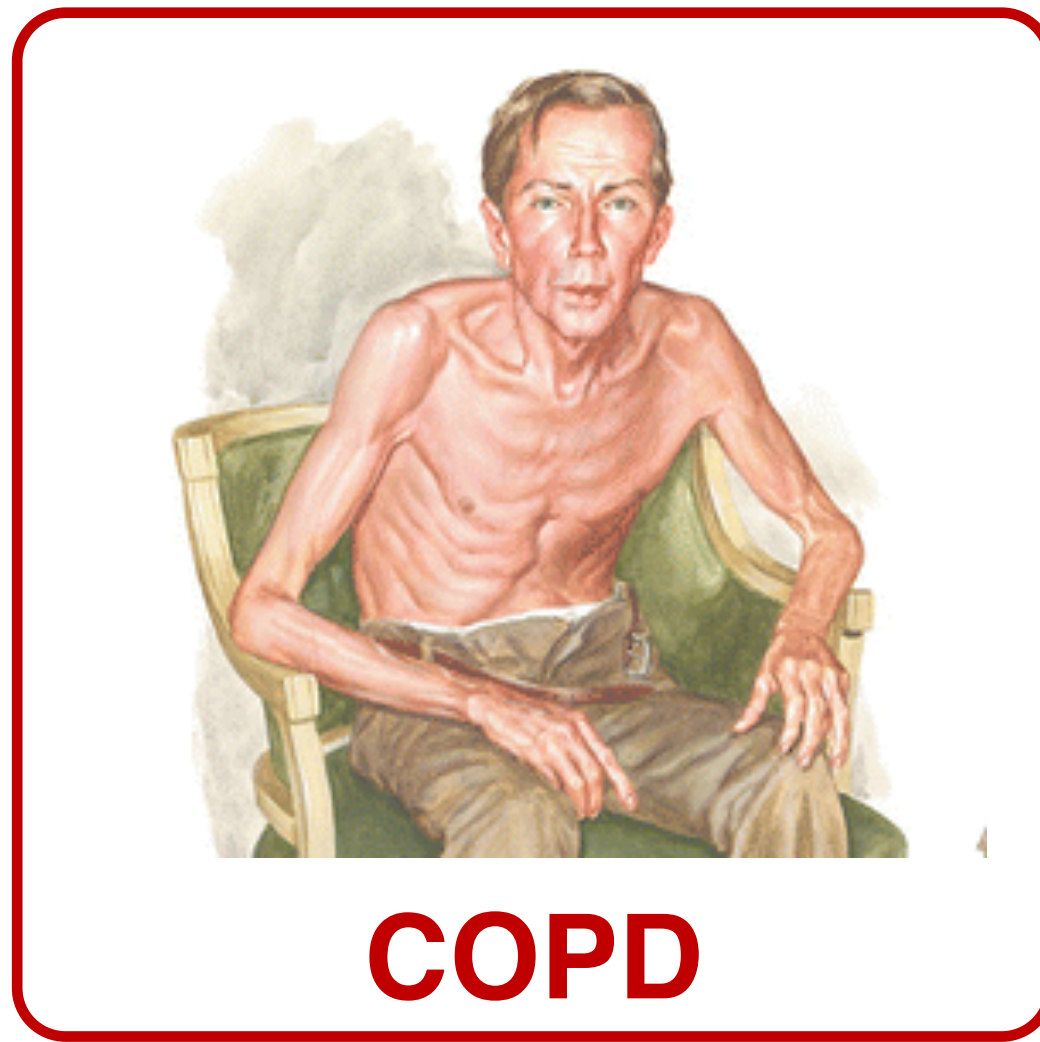
神經受損影響發聲  
與說話的清晰度



呼吸道氣流感受減弱，  
感覺氣悶

# What does the patient feel about **Airway secretions?**





*After deep breathing:  
Exercise, daytime*

*Intermittently*

*Restrictive lung,  
Hypoxia*

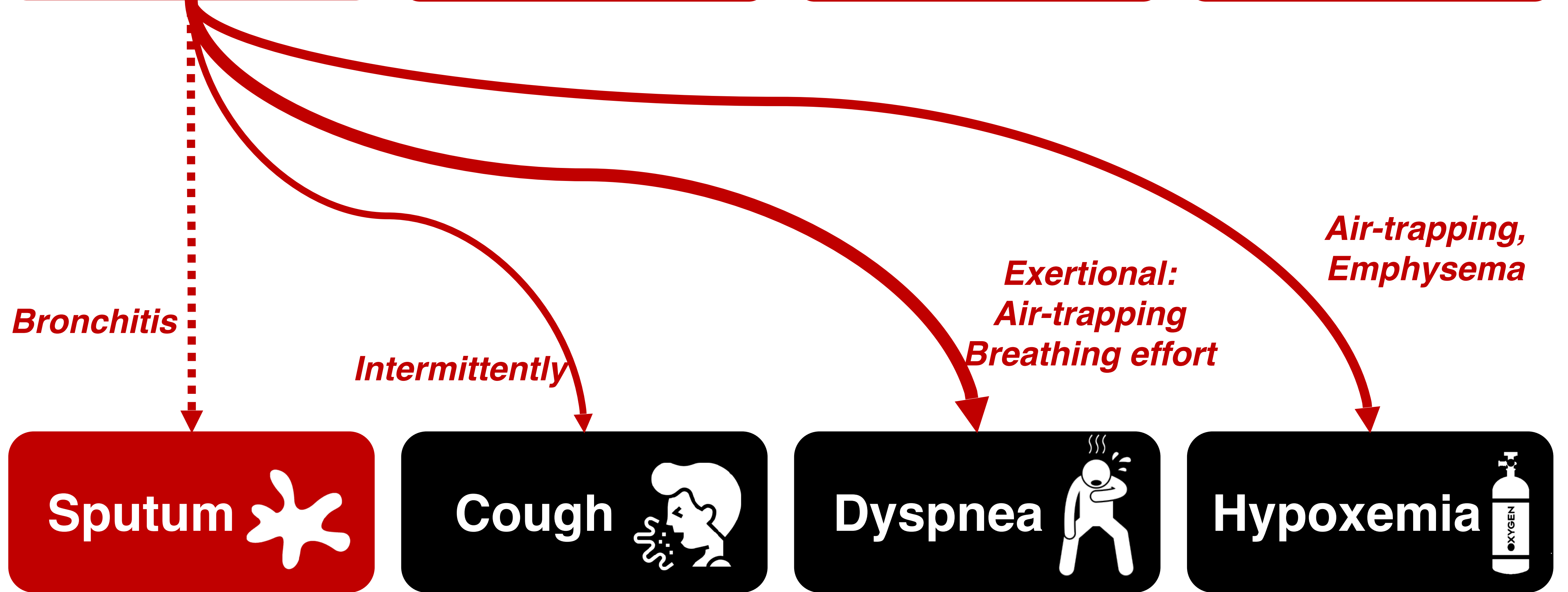
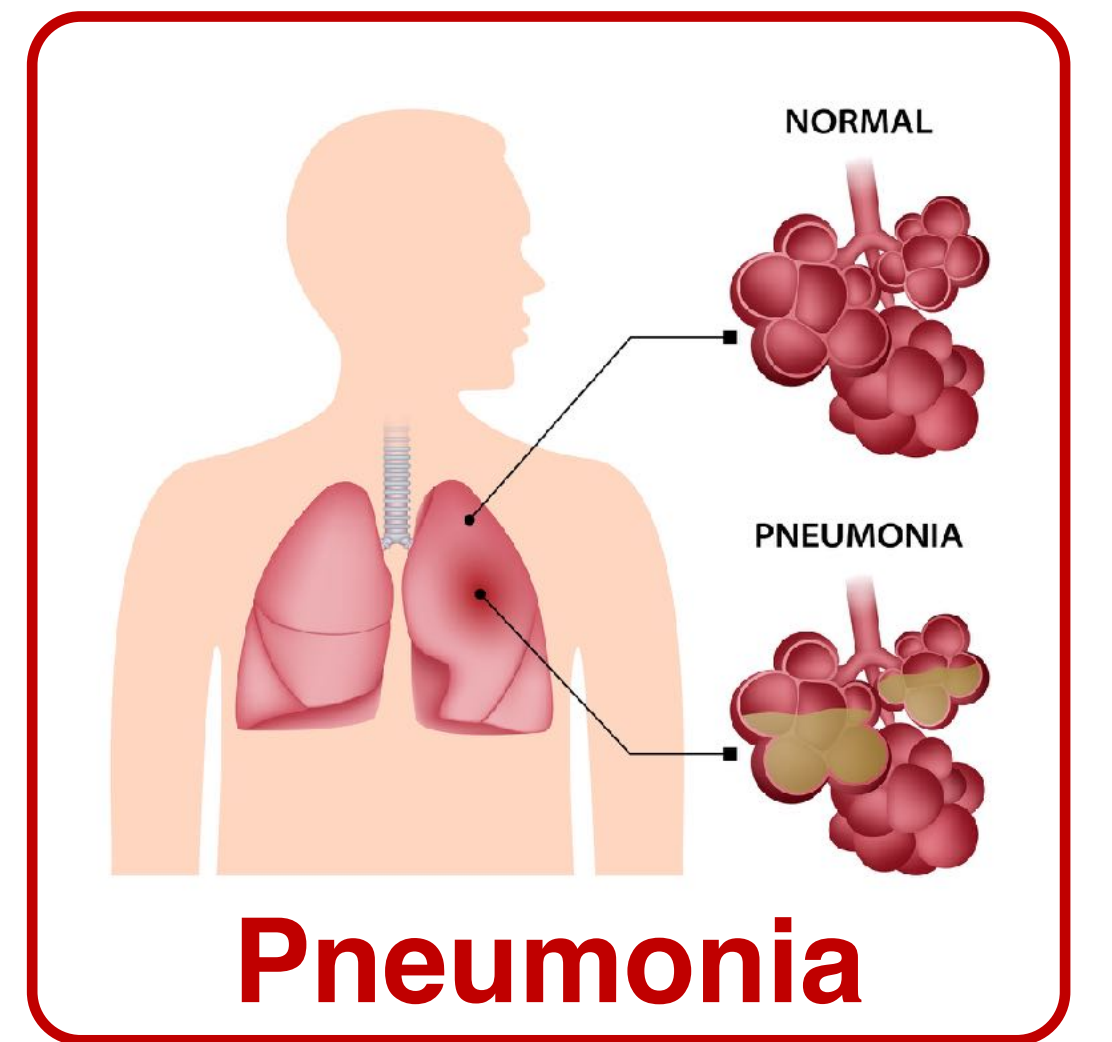
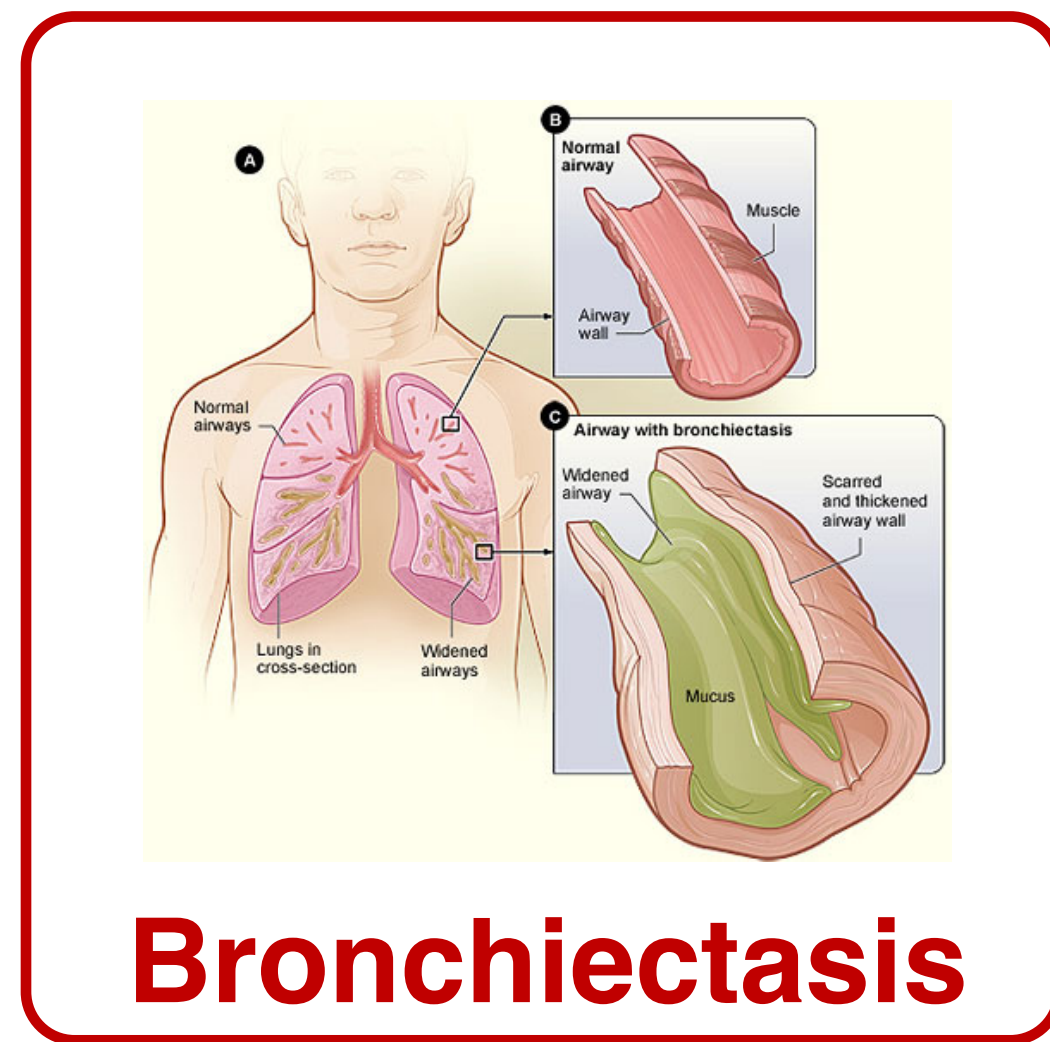
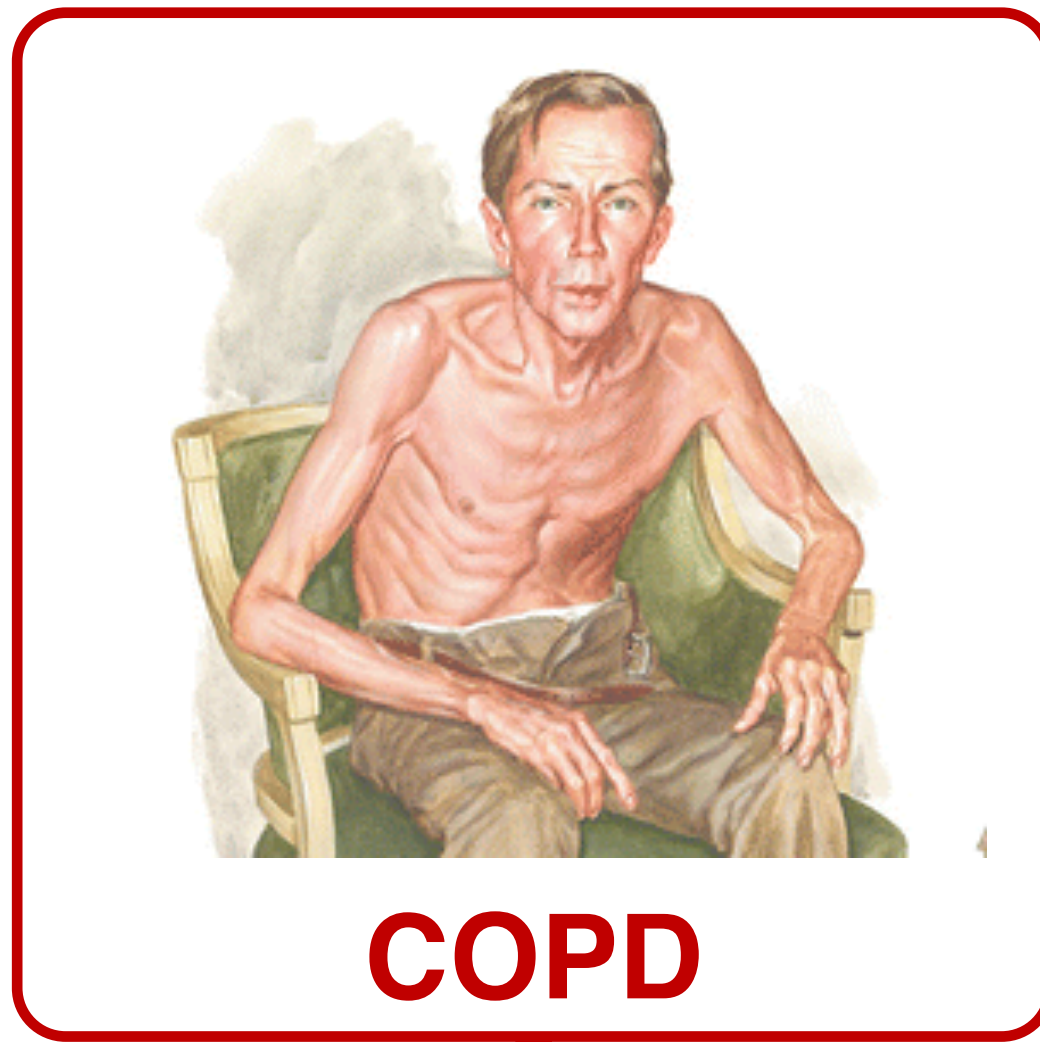
*Impaction of small airway  
V/Q mis-match*

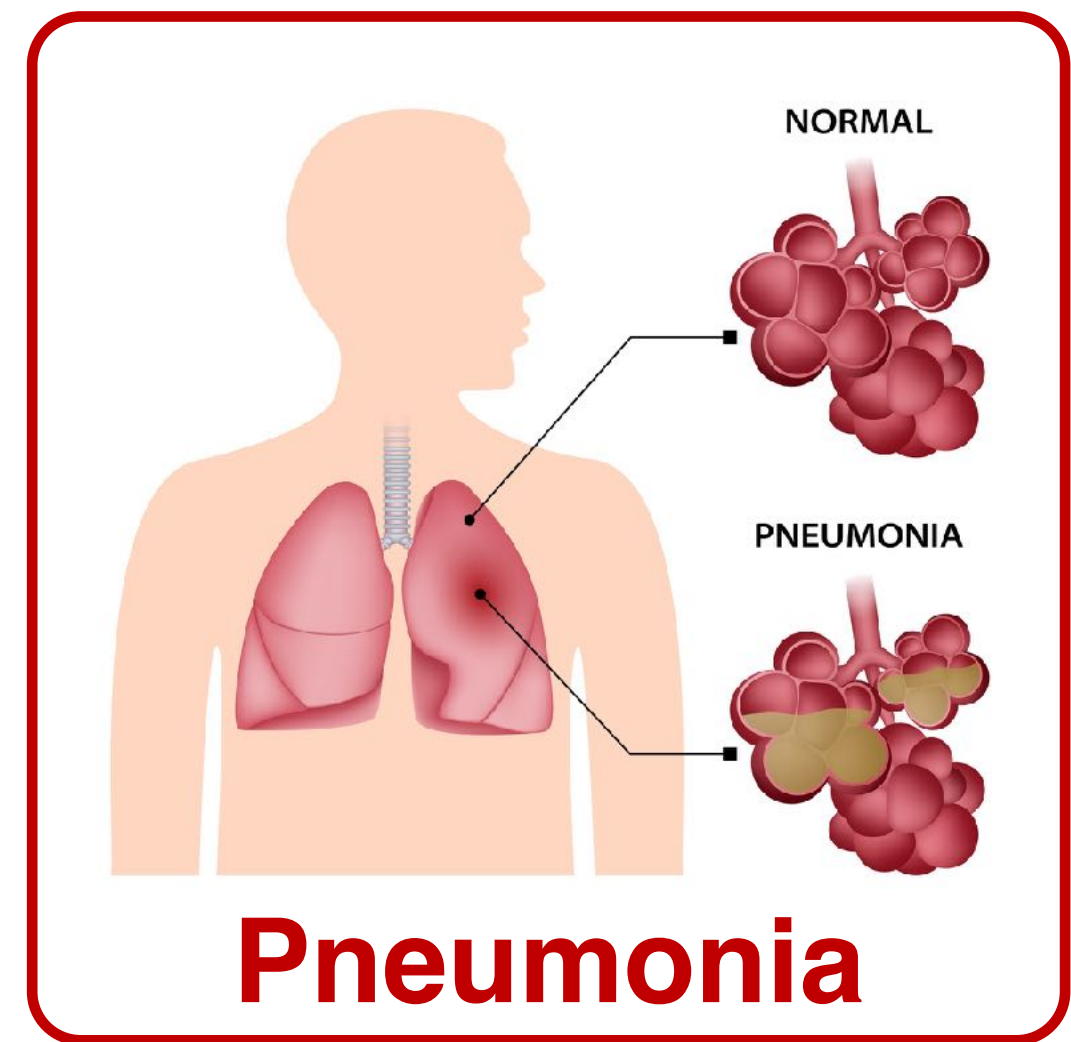
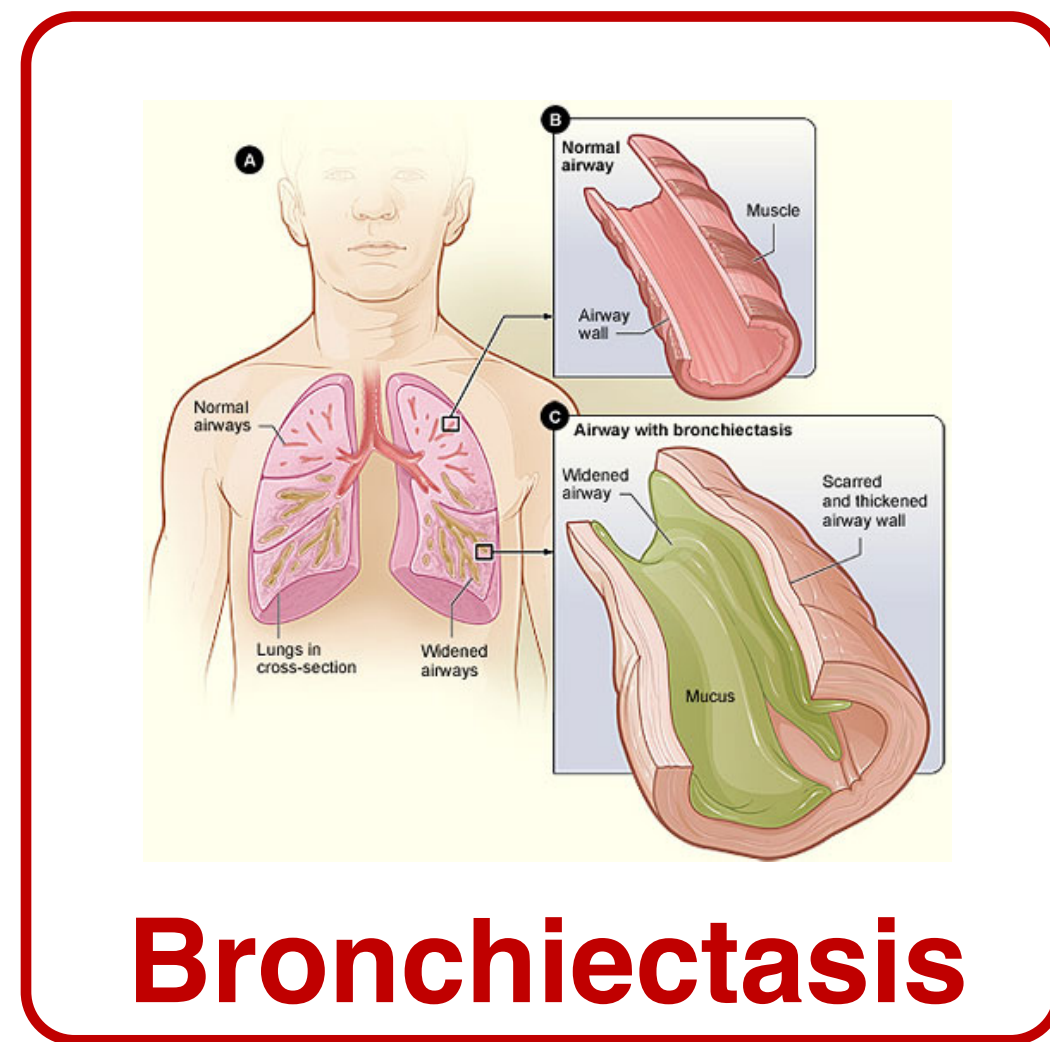
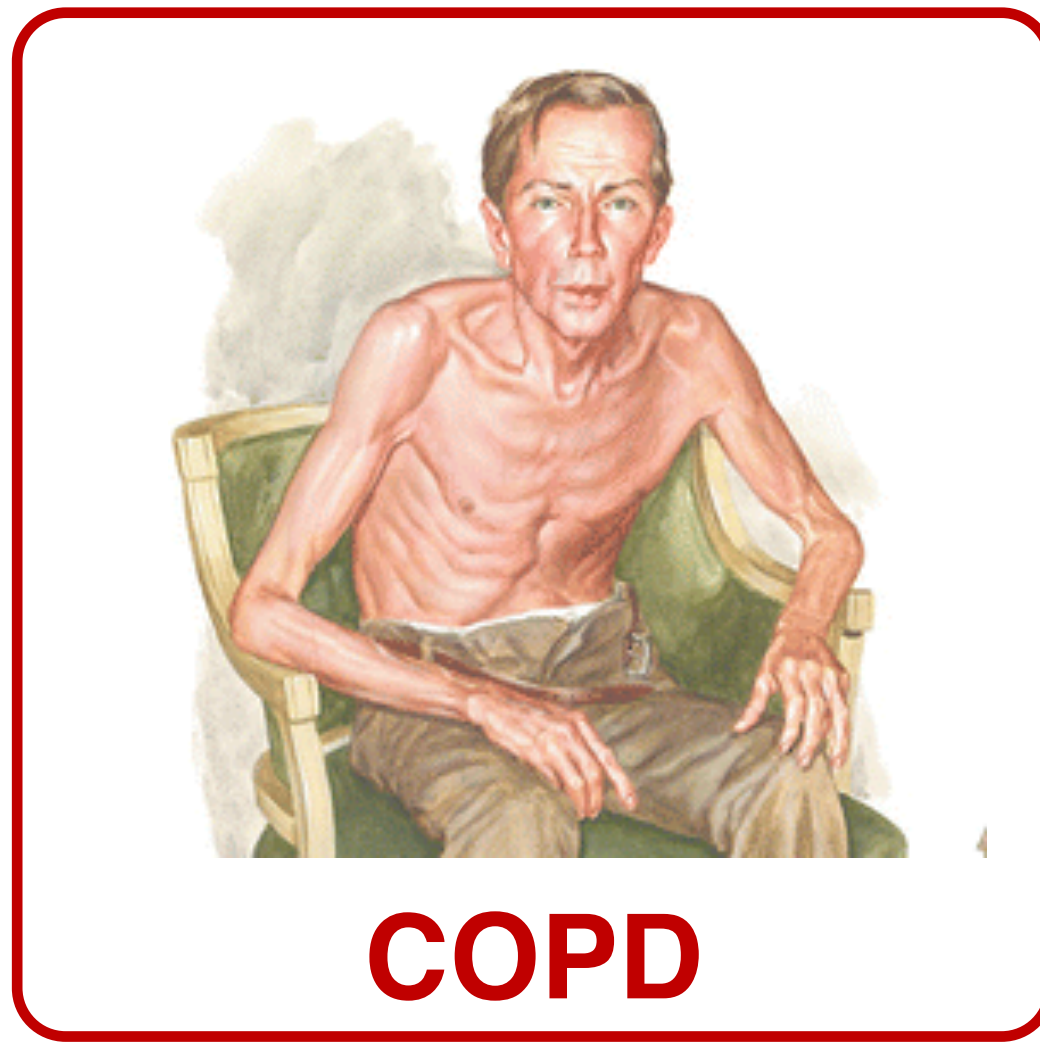
**Sputum** 

**Cough** 

**Dyspnea** 

**Hypoxemia** 





*Post nasal drips  
Lying down*

*Chronic cough,  
Pharyngitis*

*Inspiratory, Resting  
Improved after exercise*

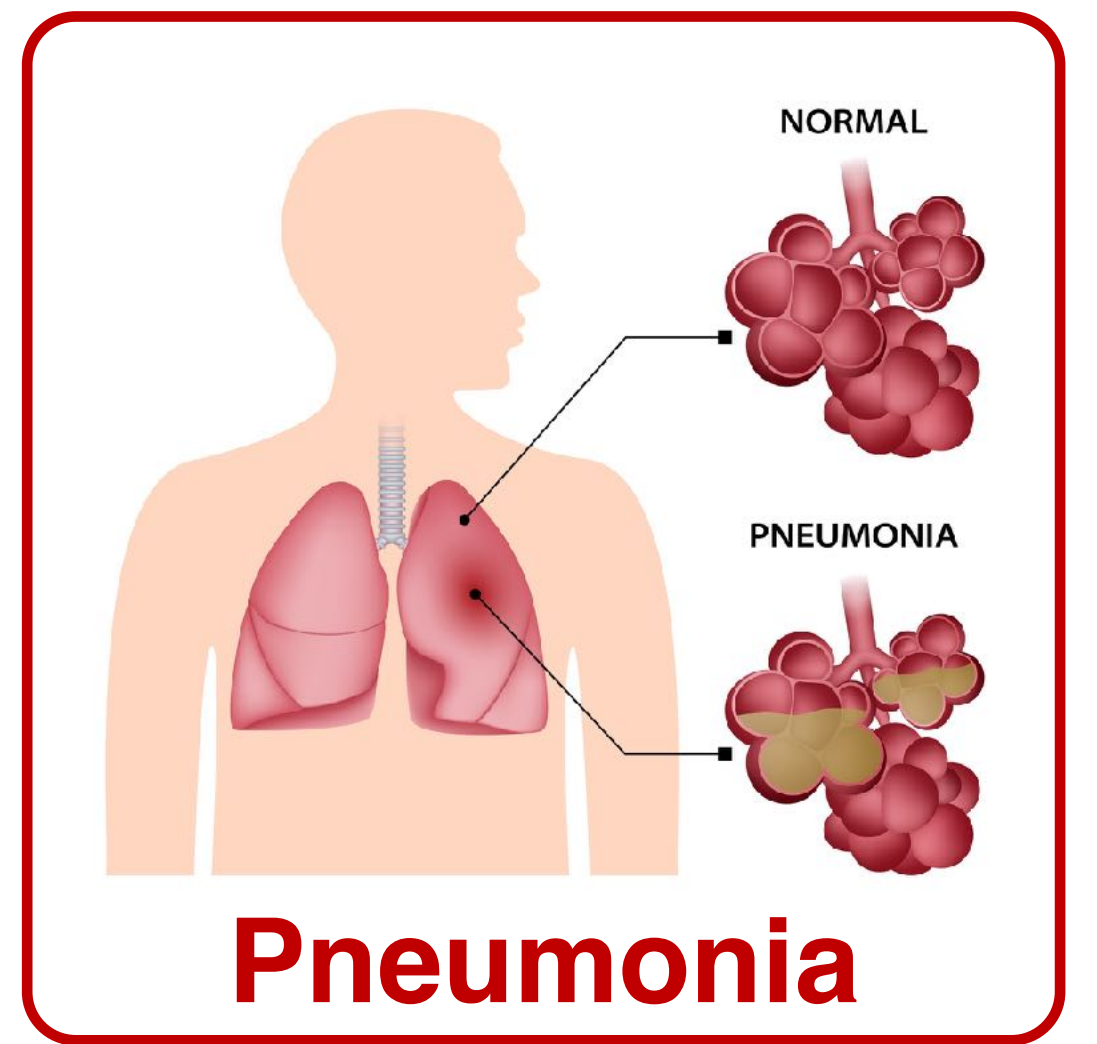
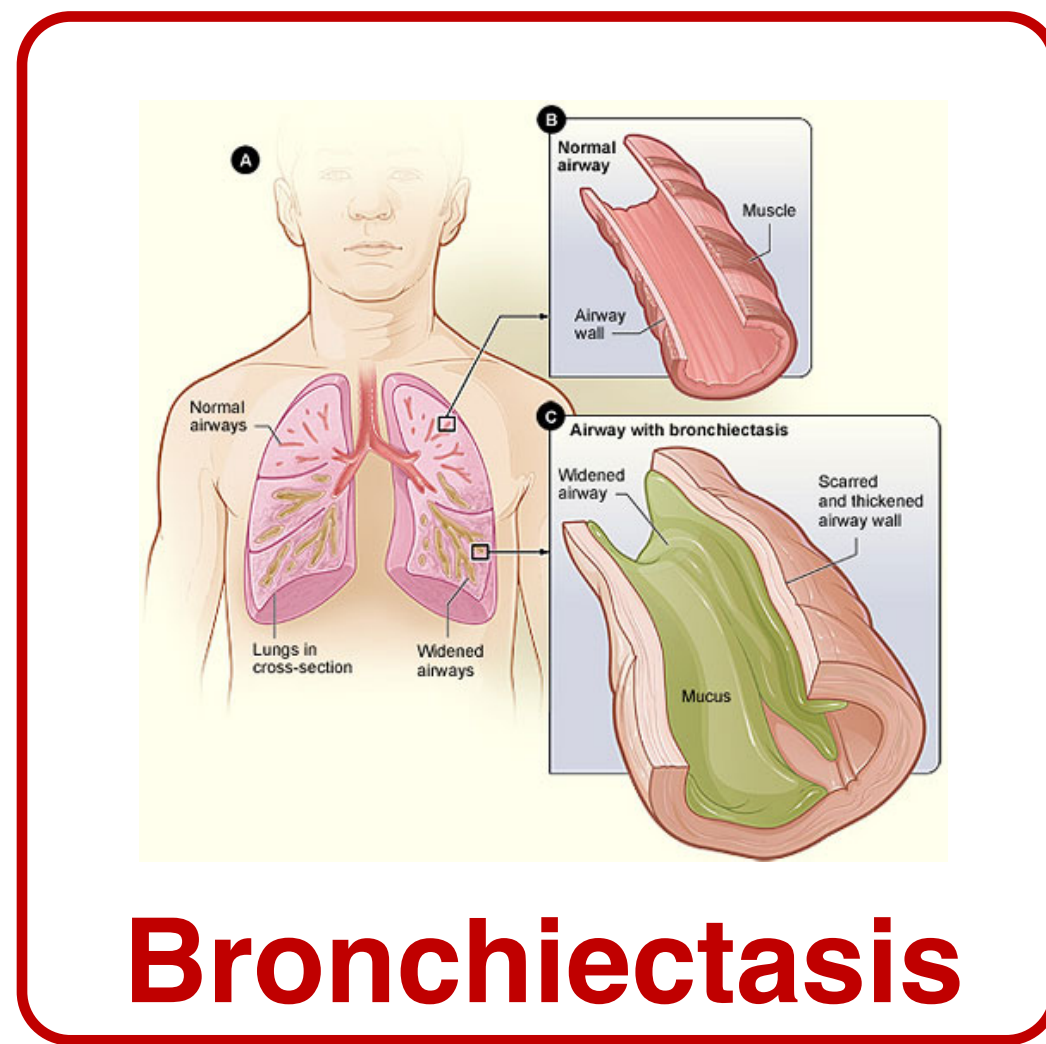
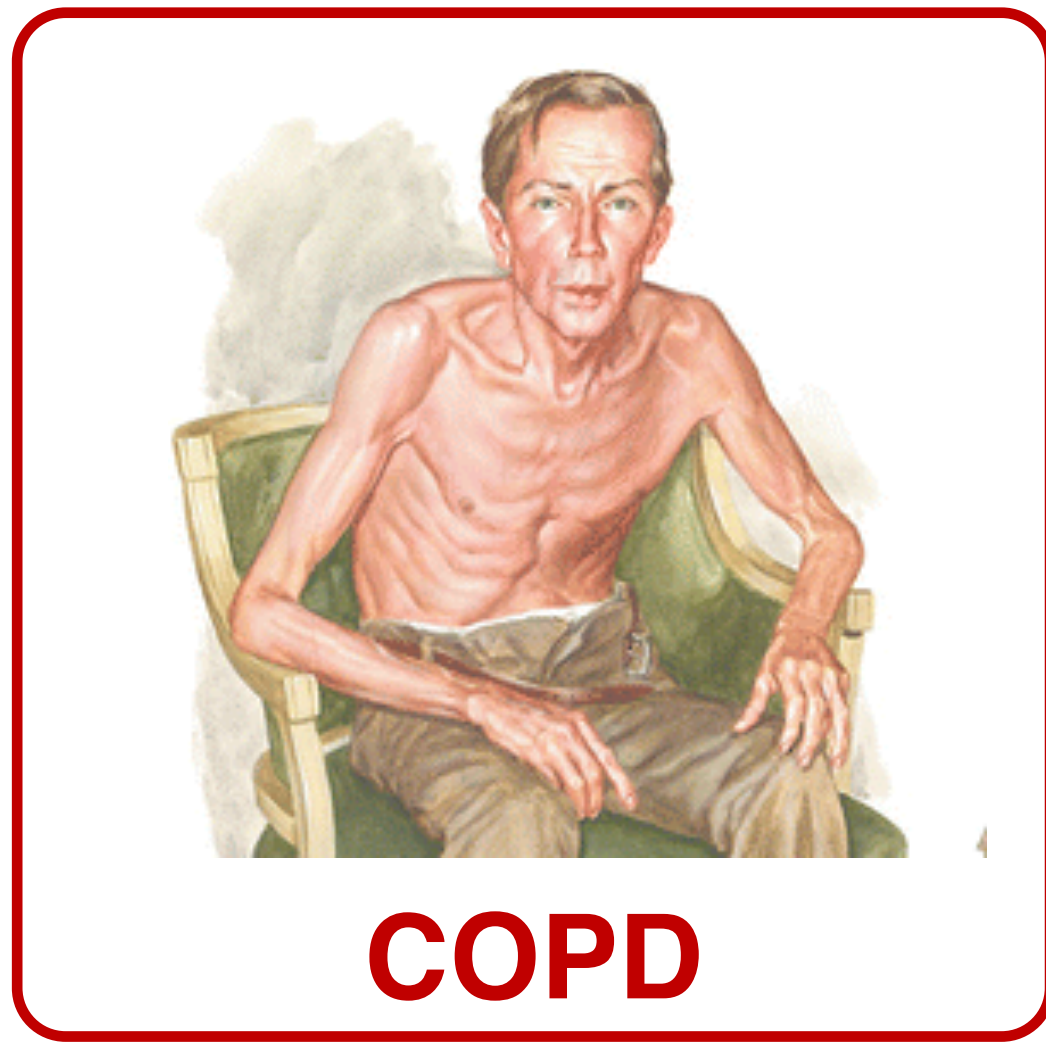
**Sputum** 

**Cough** 

**Dyspnea** 

**Hypoxemia** 





*Sporadic,  
Occasionally*


**Sputum** 

*Sporadic,  
Occasionally*

**Cough** 

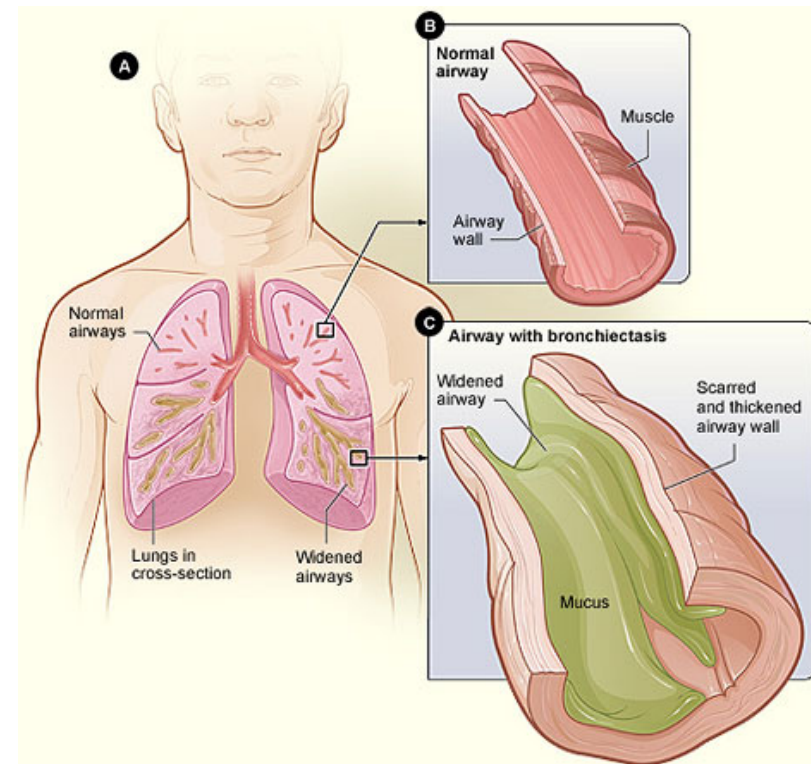
*Only when  
severe inflammation,  
V/Q mis-matching*

**Dyspnea** 

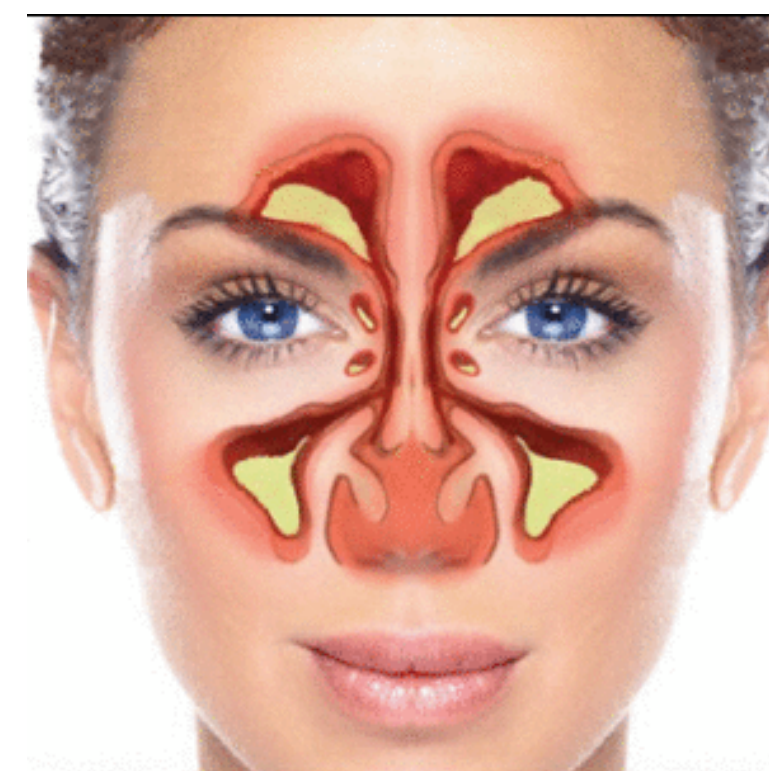
**Hypoxemia** 



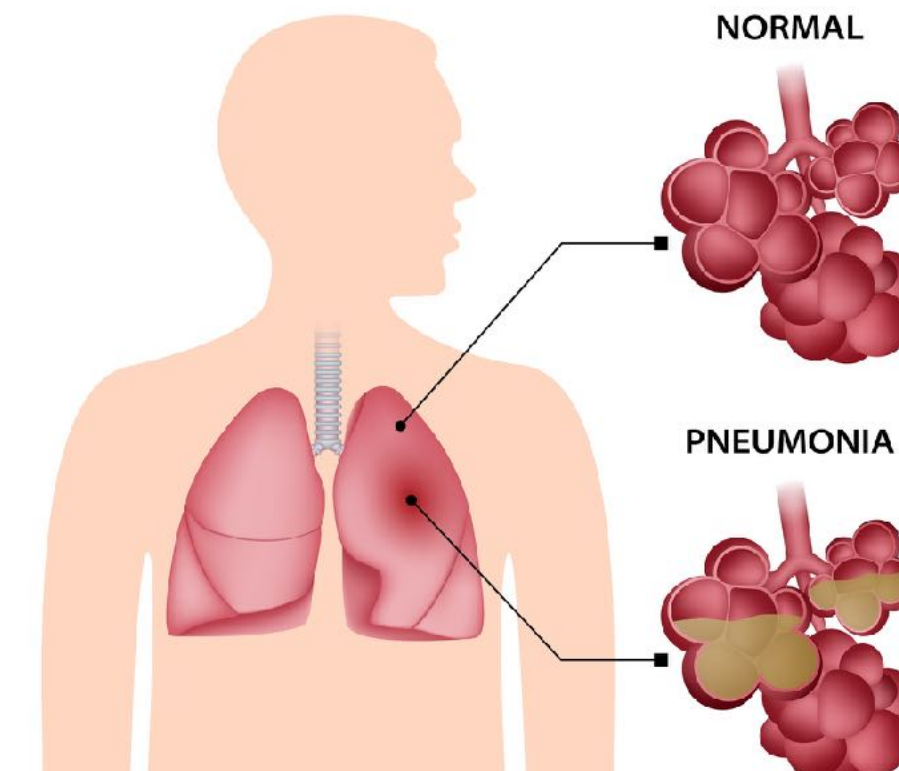
**COPD**



**Bronchiectasis**



**Sinusitis, Rhinitis**



**Pneumonia**

**Sputum** 

●  
*Bronchitis*

●●●●  
*After deep breathing: Exercise, daytime*

●●●●  
*Post nasal drips Lying down*

●●  
*Sporadic, Occasionally*

**Cough** 

●●  
*Intermittently*

●●  
*Intermittently*

●●●●●  
*Chronic cough Pharyngitis*

●●  
*Sporadic, Occasionally*

**Dyspnea** 

●●●●●  
*Exertional: Air-trapping*

●●  
*Restrictive lung, Hypoxia*

●●  
*Inspiratory, Resting Improved after exercise*

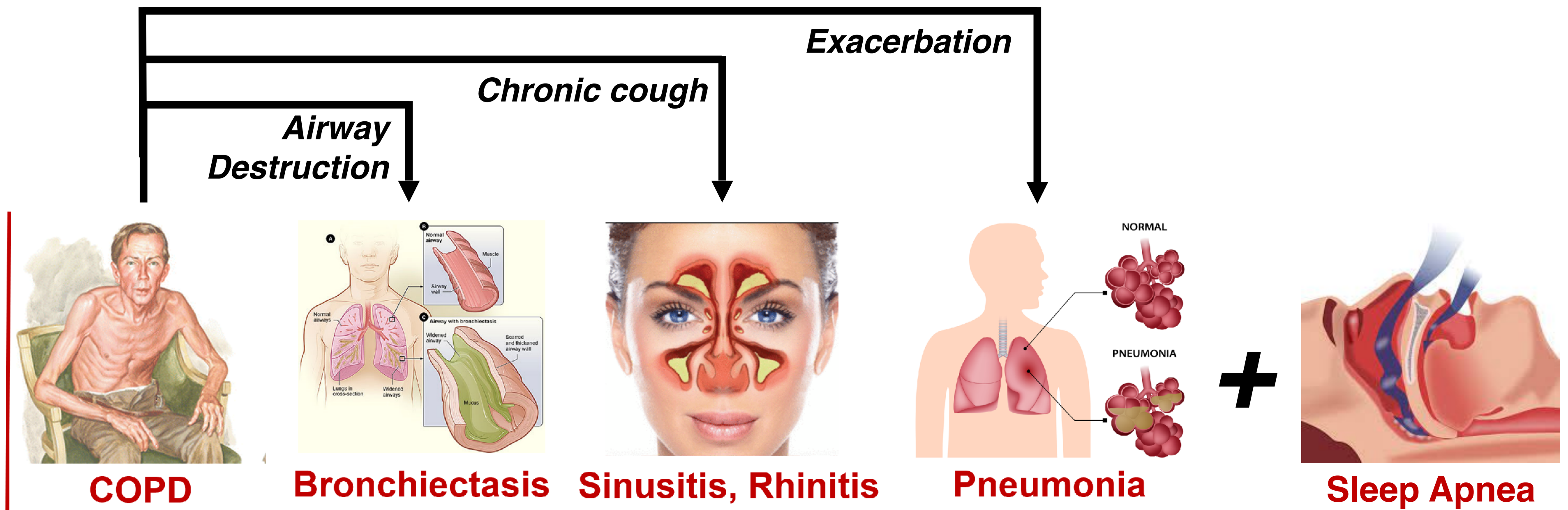
● *Only when severe inflammation, V/Q mis-matching*

**Hypoxemia** 

●●●  
*Air-trapping Emphysema*

●●●●  
*Mucus impaction V/Q mis-match*

● *Only when severe inflammation, V/Q mis-matching*



	<b>COPD</b>	<b>Bronchiectasis</b>	<b>Sinusitis, Rhinitis</b>	<b>Pneumonia</b>
<b>Sputum</b>	● <i>Bronchitis</i>	●●●●● <i>After deep breathing: Exercise, daytime</i>	●●● <i>Post nasal drips Lying down</i>	●● <i>Sporadic, Occasionally</i>
<b>Cough</b>	●● <i>Intermittently</i>	●● <i>Intermittently</i>	●●●●● <i>Chronic cough Pharyngitis</i>	●● <i>Sporadic, Occasionally</i>
<b>Dyspnea</b>	●●●●● <i>Exertional: Air-trapping</i>	●● <i>Restrictive lung, Hypoxia</i>	●● <i>Inspiratory, Resting Improved after exercise</i>	● <i>Only when severe inflammation, V/Q mis-matching</i>
<b>Hypoxemia</b>	●●● <i>Air-trapping Emphysema</i>	●●● <i>Mucus impaction V/Q mis-match</i>		● <i>Only when severe inflammation, V/Q mis-matching</i>