



비엔동물전문의료센터
BIEN ANIMAL MEDICAL CENTER

비엔 마취 세미나 : 호흡 및 EtCO₂ 조절

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Previous seminar

- Hypotension
 - Definition
 - Criteria
- Causes of hypotension
- Detection of Hypotension
 - Physical examinations
 - Measurement of blood pressure
- Treatments of Hypotension
 - Fluid therapy
 - Vasoactive drugs
- Critical patients
 - Massive hemorrhage
 - Septic shock
 - Hypoalbuminemia
 - Hypersensitivity

EtCO₂

Respiration monitoring

- Carbon dioxide
- End-tidal carbon dioxide (EtCO₂)
- Measurement of EtCO₂
- Respiration monitoring during general anesthesia
- Voluntary respiration trigger
- Hypocapnia and hypercapnia
- Voluntary respiration vs. Artificial ventilation

Various situation

- Hypo/Hyperthermia
- Acute cardiovascular depression★
- Unilateral intubation
- Tidal volume decreased
- BC and EDAC

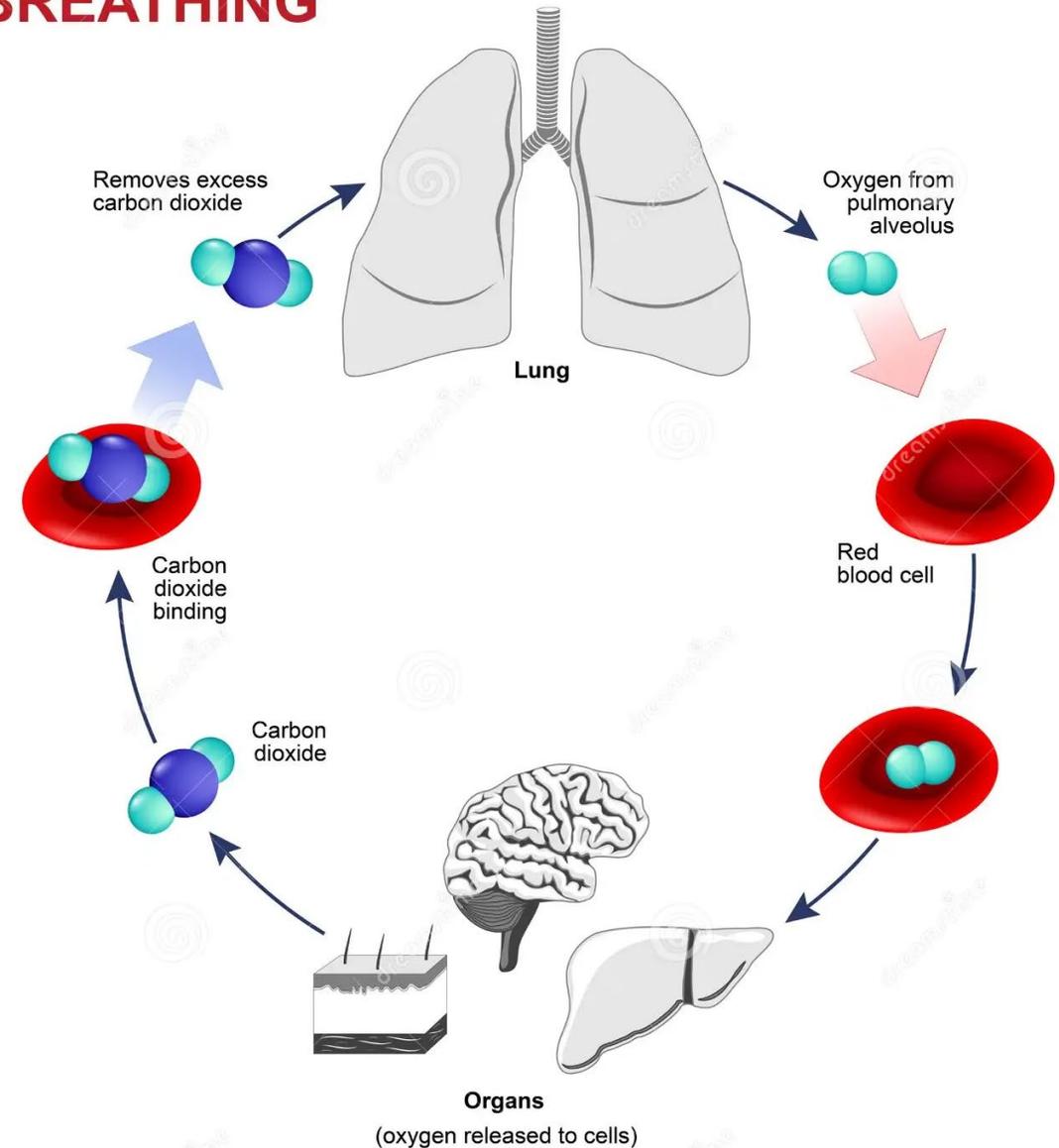
Respiration Monitoring

- Why we do respiration?
 - Oxygen supply, Carbon dioxide emission
- Pulse oximetry, Capnography



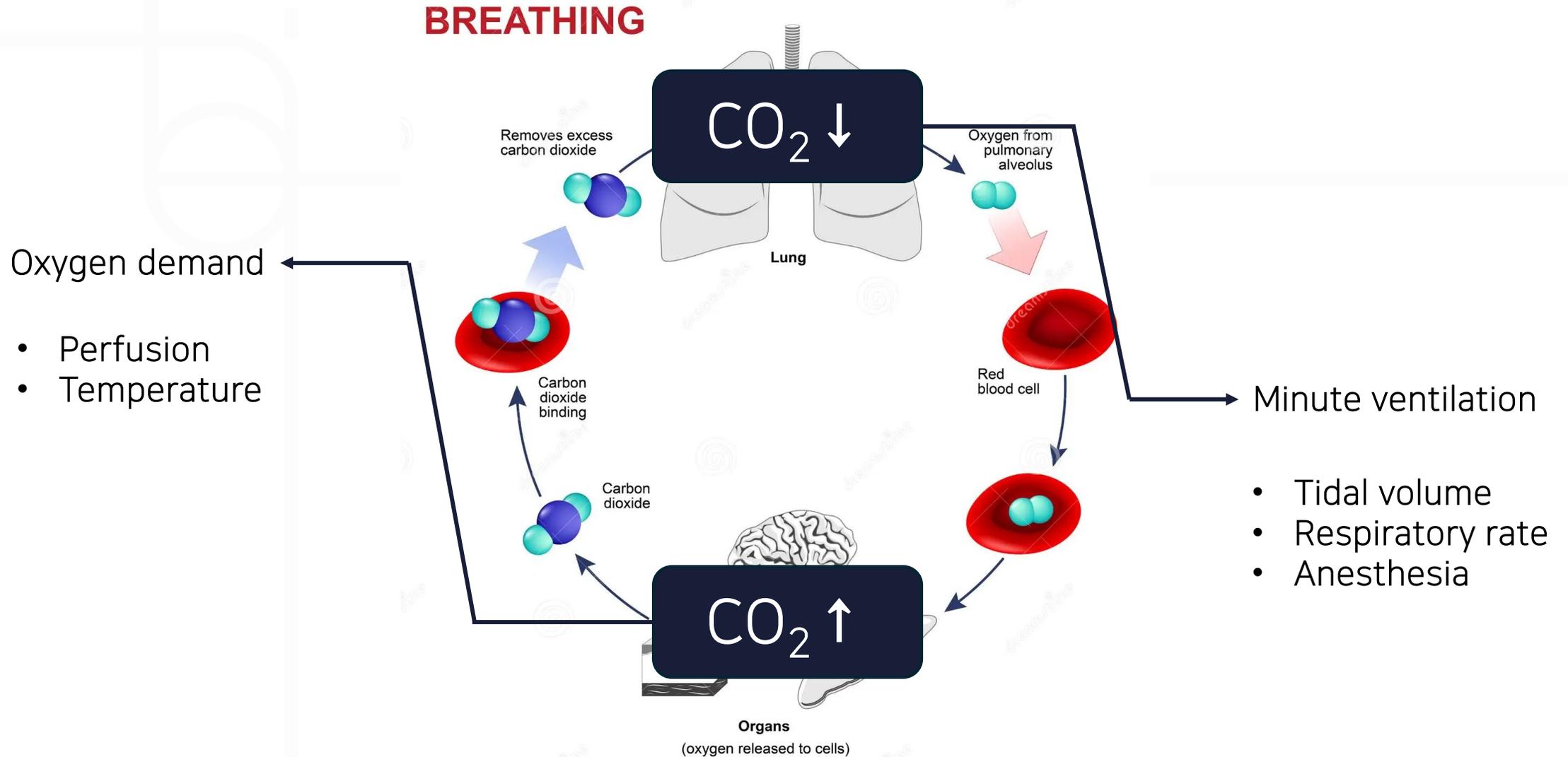
- During anesthesia,
Why we do respiration monitoring?

BREATHING



Respiration Monitoring

Carbon dioxide

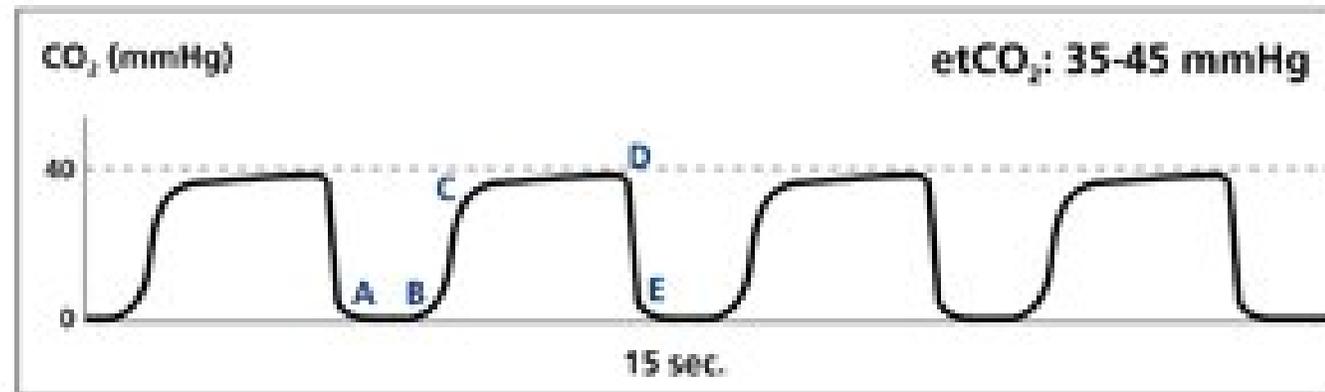
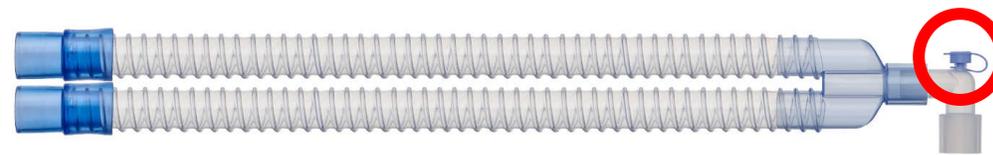
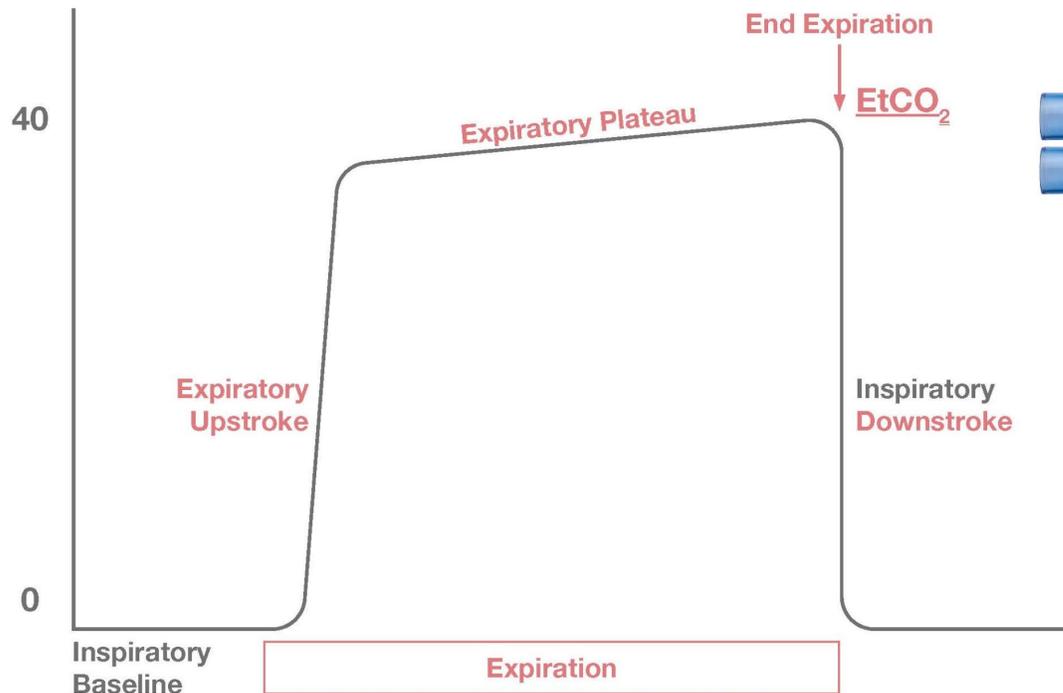


Respiration Monitoring

End-tidal carbon dioxide (EtCO₂)

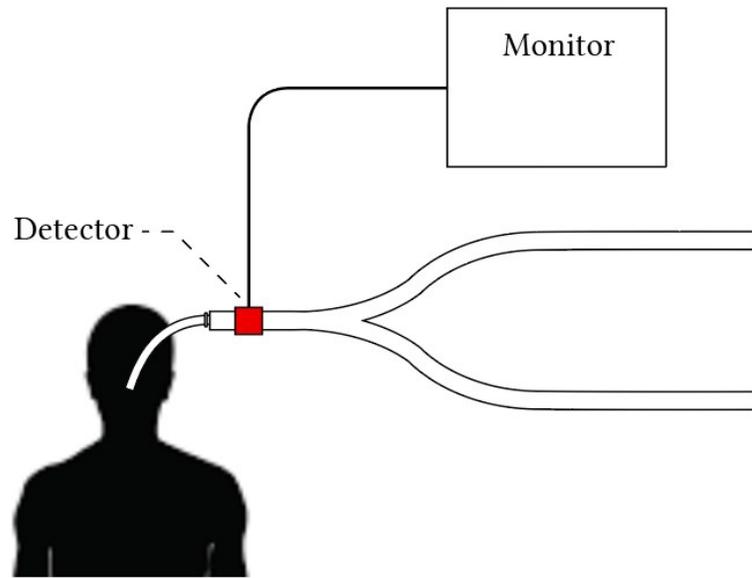
* "Tidal" volume

: amount of air that moves in or out of the lungs with "each respiratory cycle"

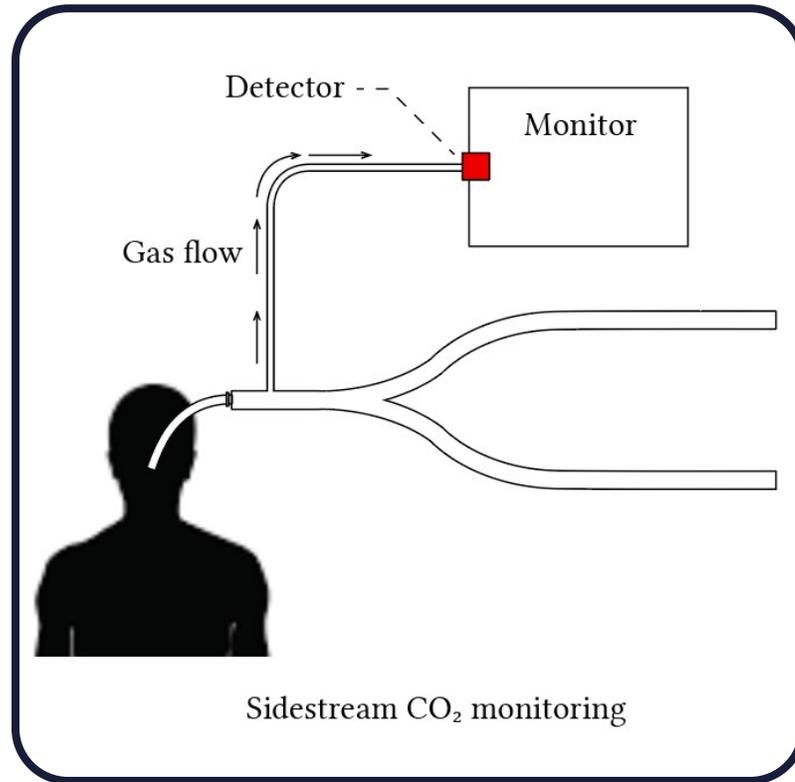


Respiration Monitoring

Measurement of EtCO₂



Mainstream CO₂ monitoring



Sidestream CO₂ monitoring

	Main	Side
Delay	X	0
Water vapor	X	0
Dead space	0	X

Respiration Monitoring

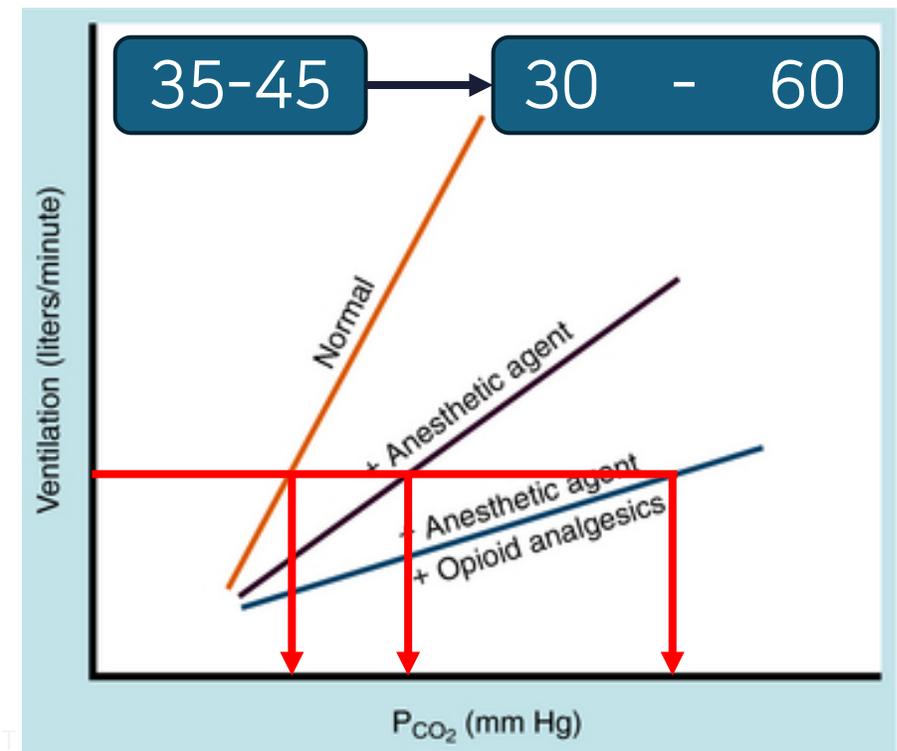
Respiration monitoring during general anesthesia

- During anesthesia, why we do respiration monitoring?

Respiratory muscles

	Respiration		Ocular movements	Pupils no pre-med	Eye reflexes	Pharynx larynx reflexes	Lacrimation	Muscle tone	Resp. response incision
	Intercostal	Diaphragm							
Stage I			Voluntary control				Normal	Normal	
Stage II						Swallow Retch Vomit		Tense struggle	
Stage III Plane 1									
Plane 2					Corneal Pupillary light reflex	Glottis			
Plane 3									
Plane 4						Carinal			
Stage IV									

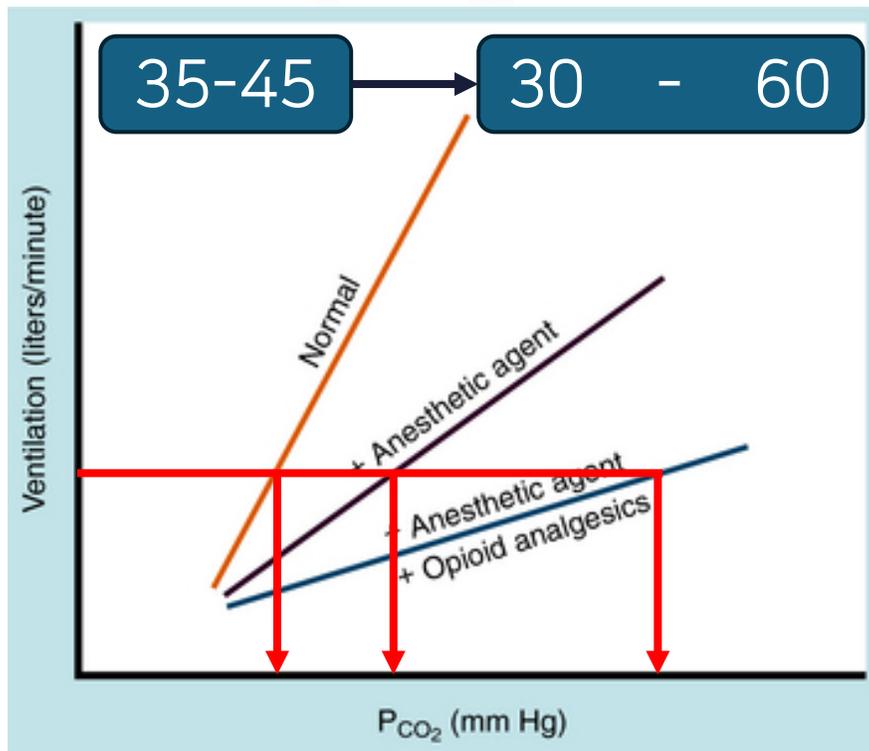
Respiratory chemoreceptors



Respiration Monitoring

Voluntary respiration trigger

Respiratory chemoreceptors



- Anesthesia depth
- Hypercapnia
 - P_aCO₂ (EtCO₂) > 60 mmHg,
Indication of artificial ventilation support

Respiration Monitoring

Hypocapnia and hypercapnia

	Dogs	Cats
EtCO ₂	35-45 mmHg	27-41 mmHg

Hypocapnia

- Electrolyte imbalance
 - Respiratory alkalosis
- Arrhythmia
- Cardiac ischemia
 - Blood vessel constriction

Hypercapnia

- Electrolyte imbalance
 - Respiratory acidosis
- Arrhythmia
- Cardiovascular depression
- Intracranial pressure elevation
 - Blood vessel dilation

Respiration Monitoring

Voluntary respiration vs. Artificial ventilation

Voluntary

Pros

- Cardiovascular depression X

Cons

- Support respiration X
- Possibility of tachypnea

Artificial

Pros

- Support respiration O
- Indication of pneumothorax

Cons

- Cardiovascular depression O
- Possibility of volo/baro trauma

Respiration Monitoring

Artificial ventilation control

Pinsp (inspiration pressure): 8-12 cmH₂O, < 20 cmH₂O

Tidal volume: 8-20 mL/kg, < 20 mL/kg

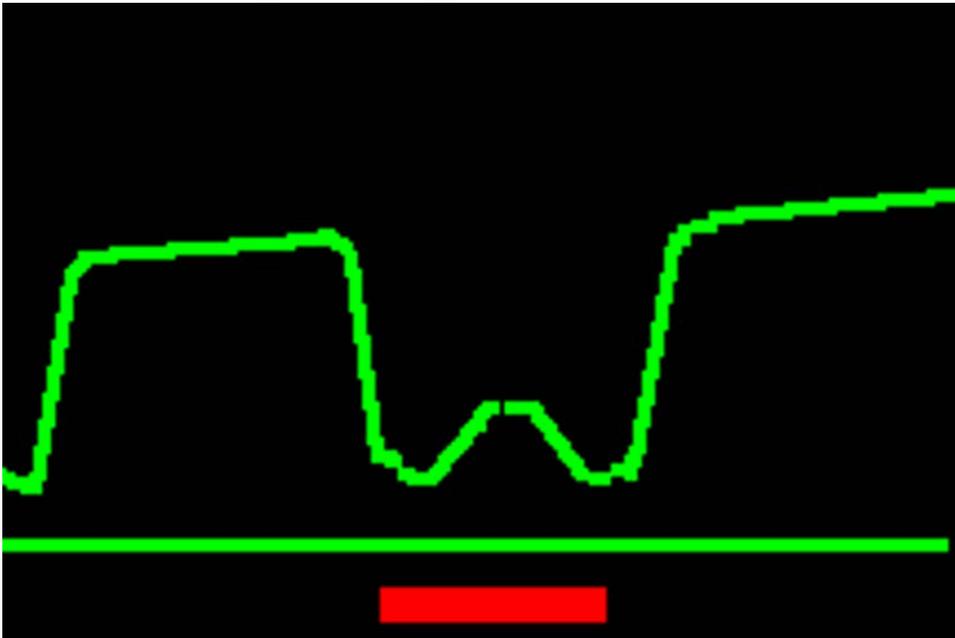
Respiratory rate: 4-30 RPM

Minute ventilation: 1-3 L/kg/min

Various Situations

Hypo/Hyperthermia

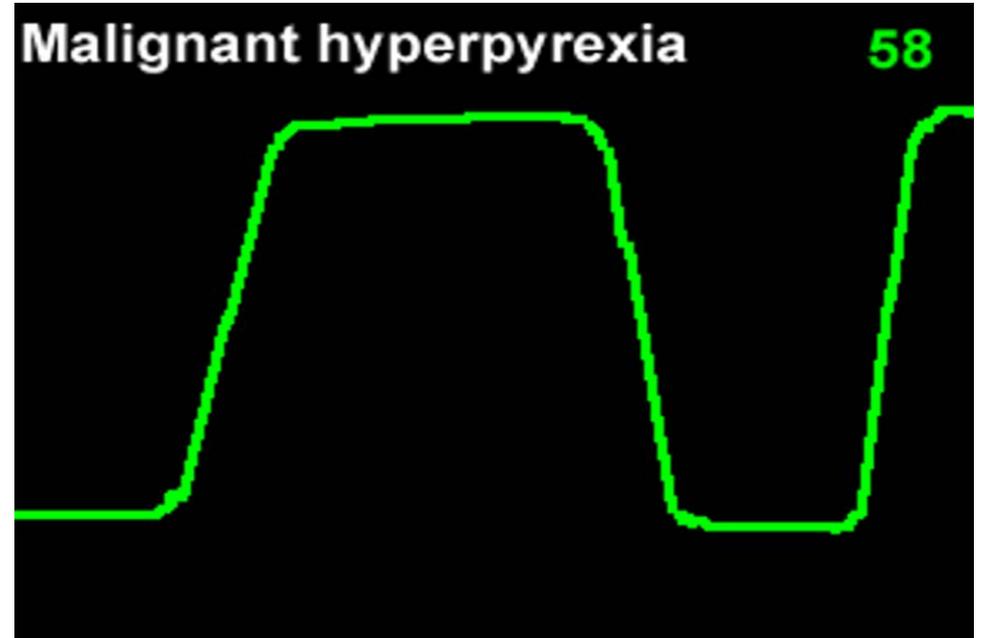
Hypothermia



Hyperthermia

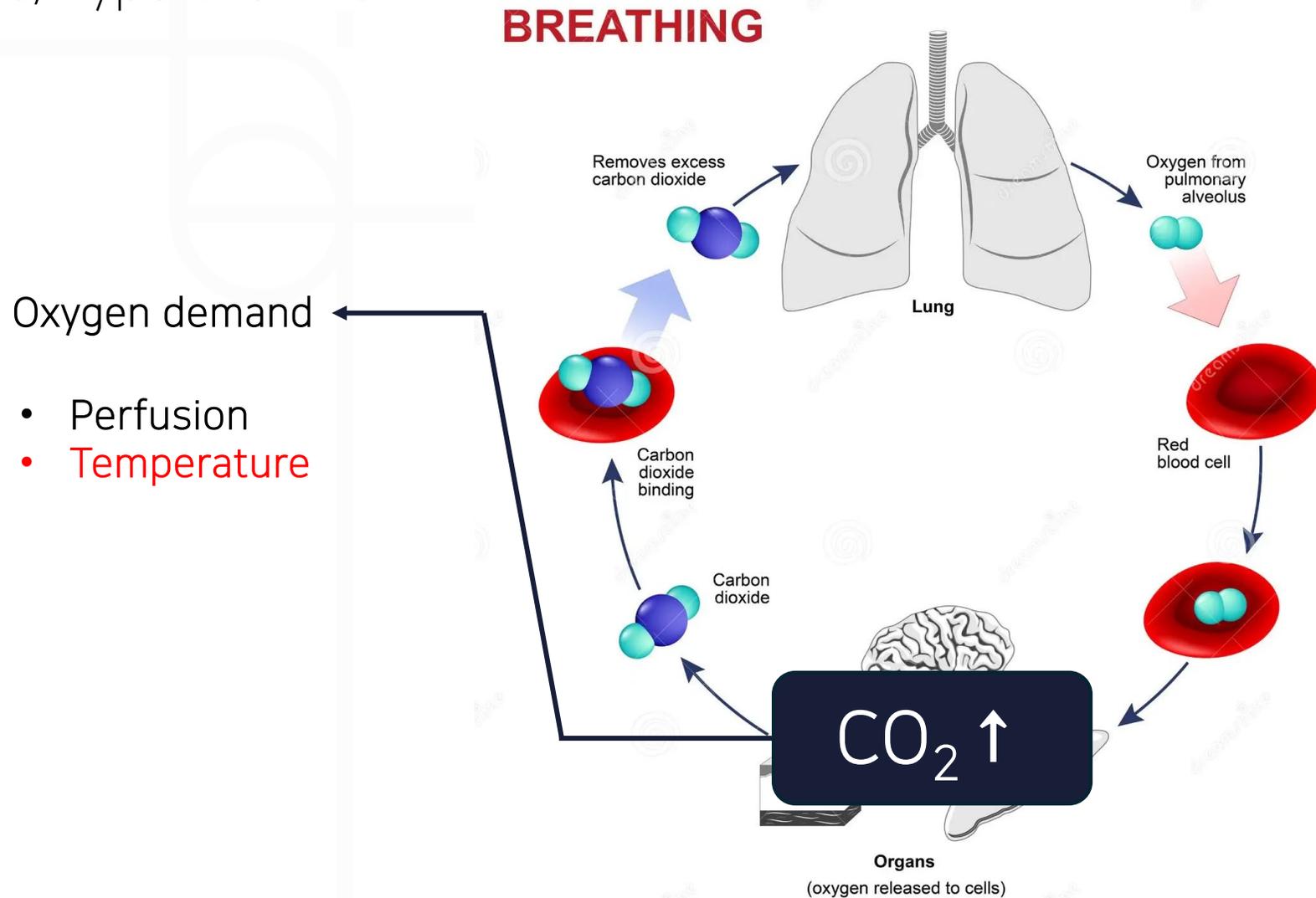
Malignant hyperpyrexia

58



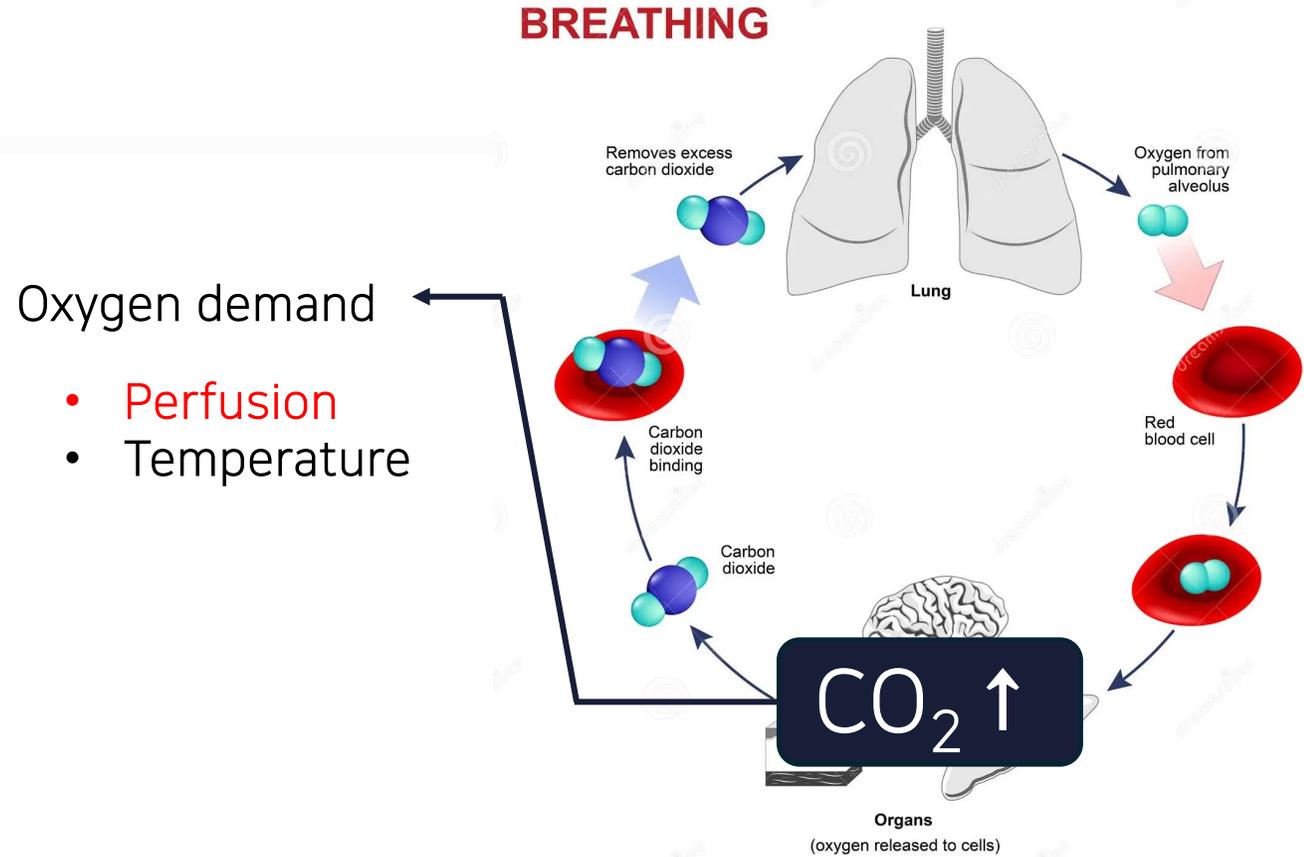
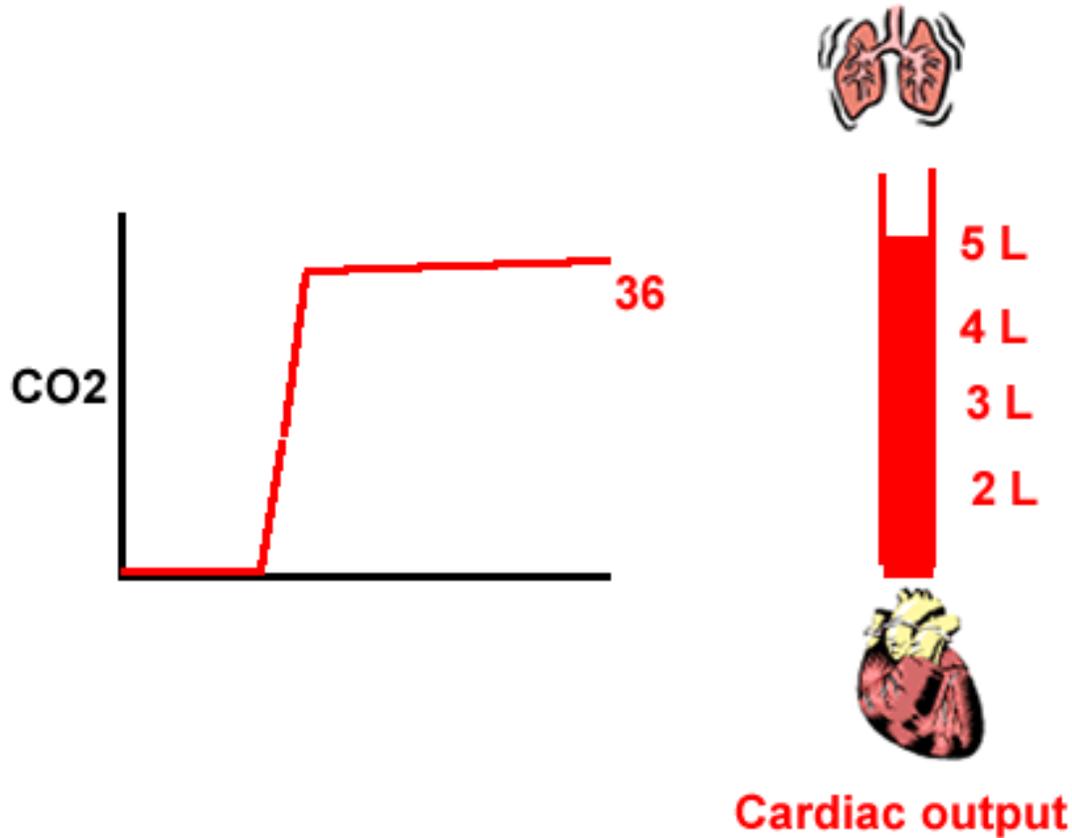
Various Situations

Hypo/Hyperthermia



Various Situations

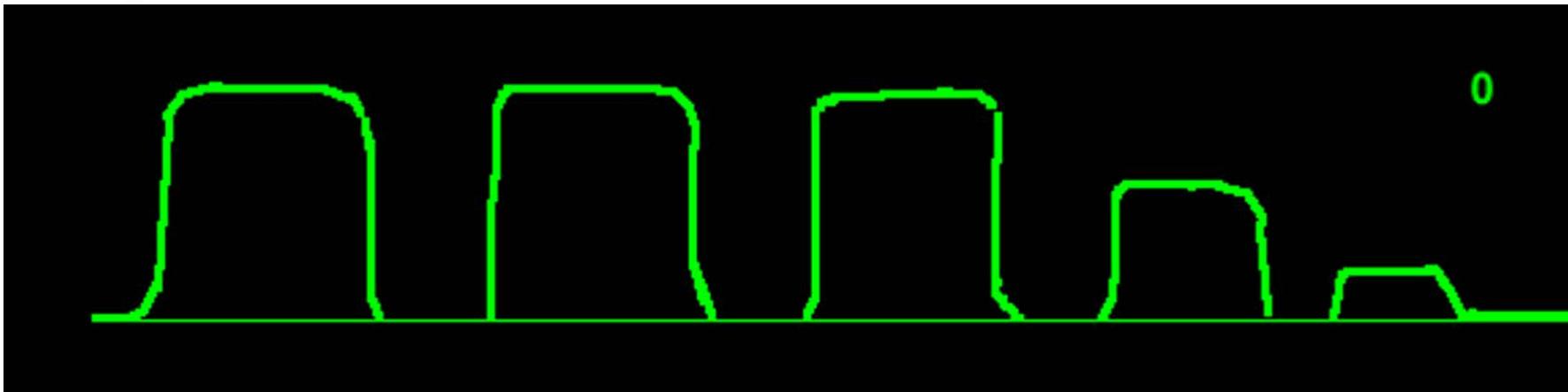
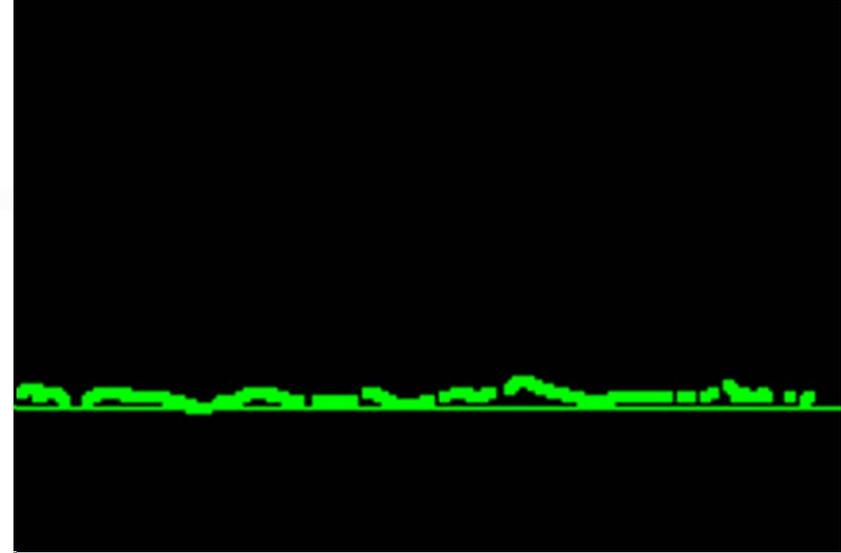
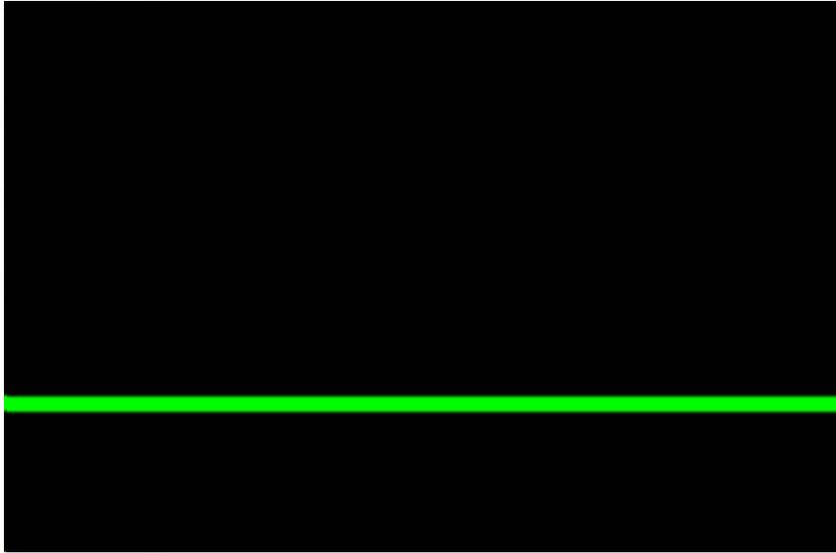
Acute cardiovascular depression★



- Perfusion
- Temperature

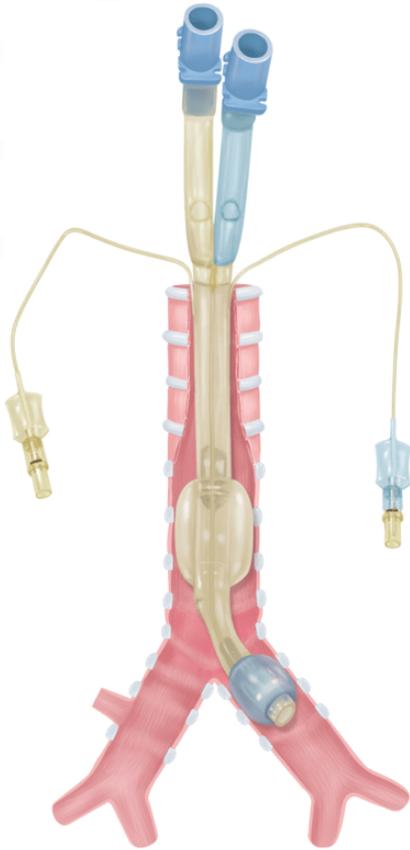
Various Situations

Esophagus intubation



Various Situations

Unilateral intubation



Source: Tobin MJ: *Principles and Practice of Mechanical Ventilation*, 3rd Edition: www.accessanesthesiology.com
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Pinsp (inspiration pressure): 8-12

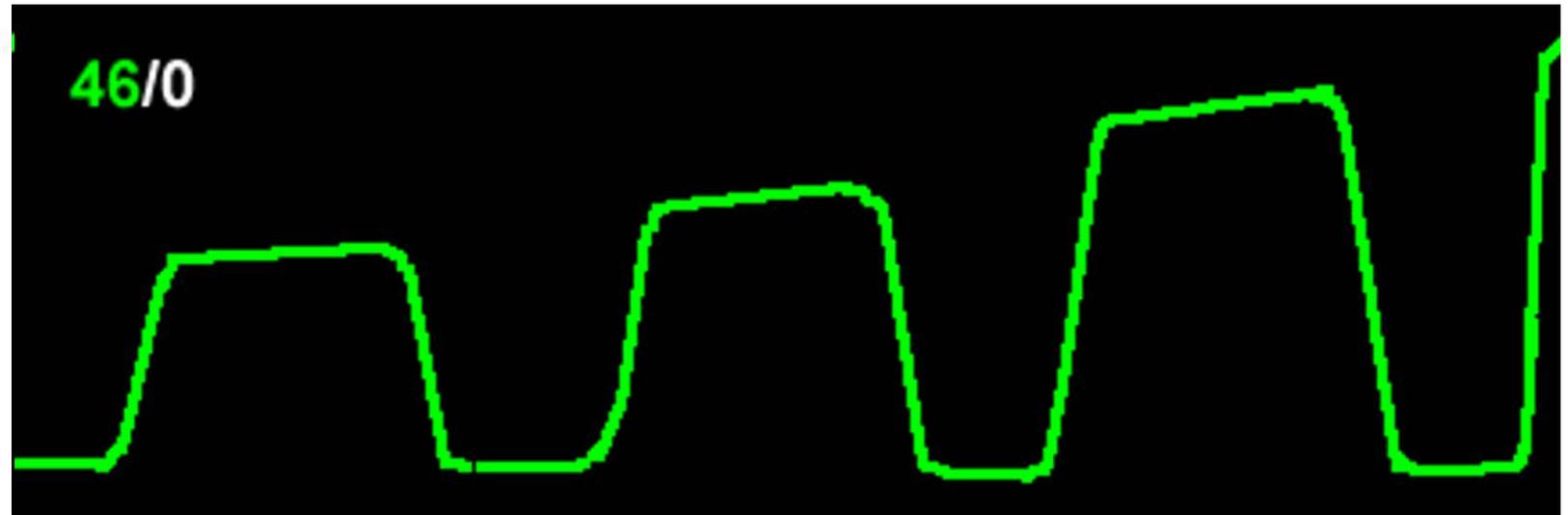
Tidal volume: 1/2

Respiratory rate: up to EtCO₂

Various Situations

Tidal volume decreased

- PInsp not enough
- Obesity
- After mastectomy



MRI coil

Various Situations

Bronchoconstriction

: Propofol

Excessive dynamic airway collapse

: Et tube movement



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