

V_E - minute ventilation

V_A - alveolar ventilation

PO_2 - partial pressure

PCO_2

VO_2 - oxygen consumption

VCO_2

C_L - lung compliance

R_L - lung resistance

W_B - work of breathing

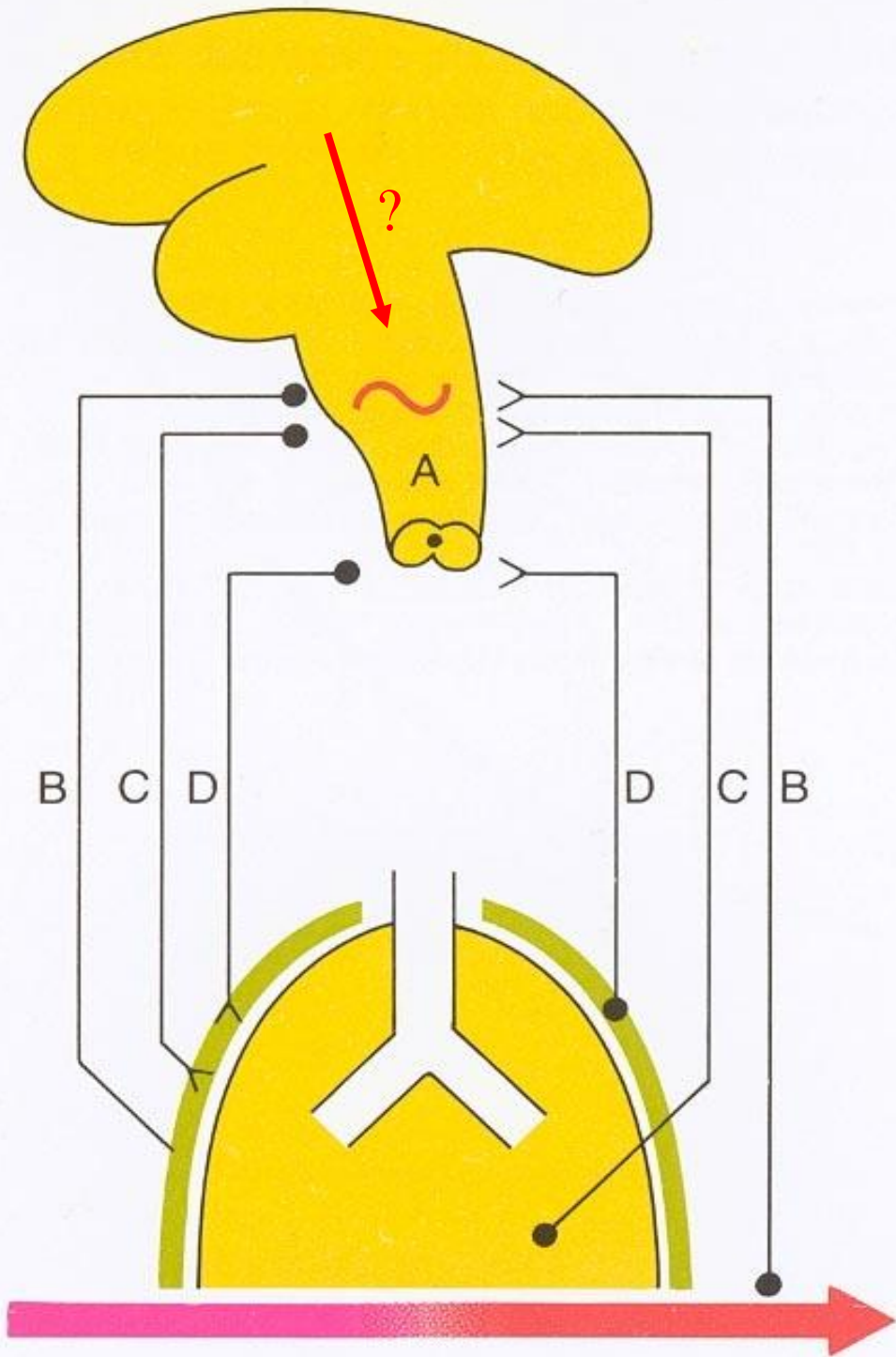
W_{el} - elastic

W_R - resistive

Control of breathing

Metabolic demands = $\dot{V}O_2$, $\dot{V}CO_2$

	PO_2	PCO_2	
• air	150	~ 0	P_B
• alveoli	100	40	V_A
• arteries	~ 97	40	diffusion, V/Q
• capillary			CO, Hb
• mitochondria	>1		$\dot{V}O_2$, distance
• venous	~ 50	46	



A rhythm generator

B metabolic control (chemoreceptors)

C pattern of breathing (mechanoreceptors)

D respiratory muscles (proprioceptors)

The Respiratory Rhythm Generator

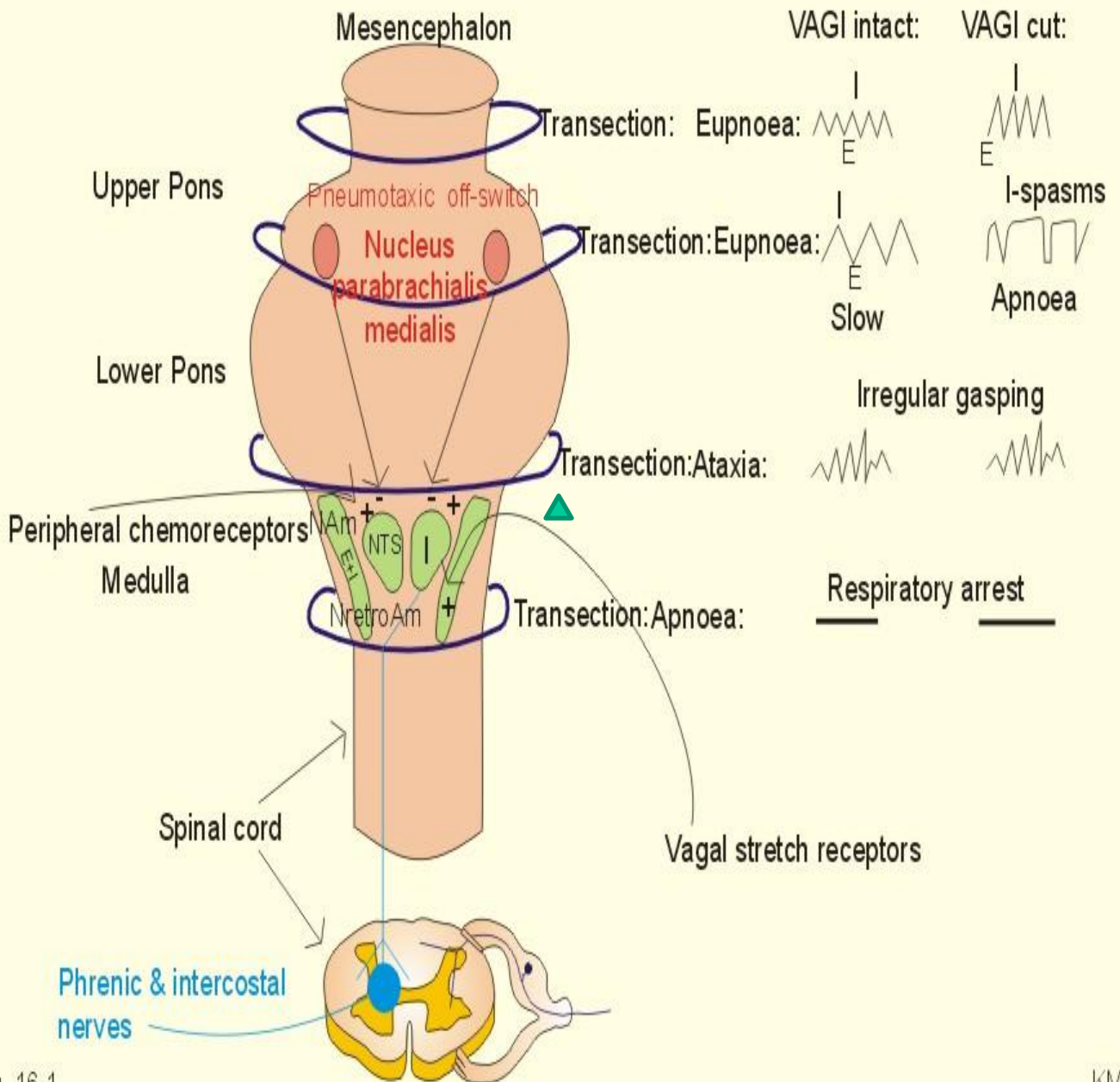
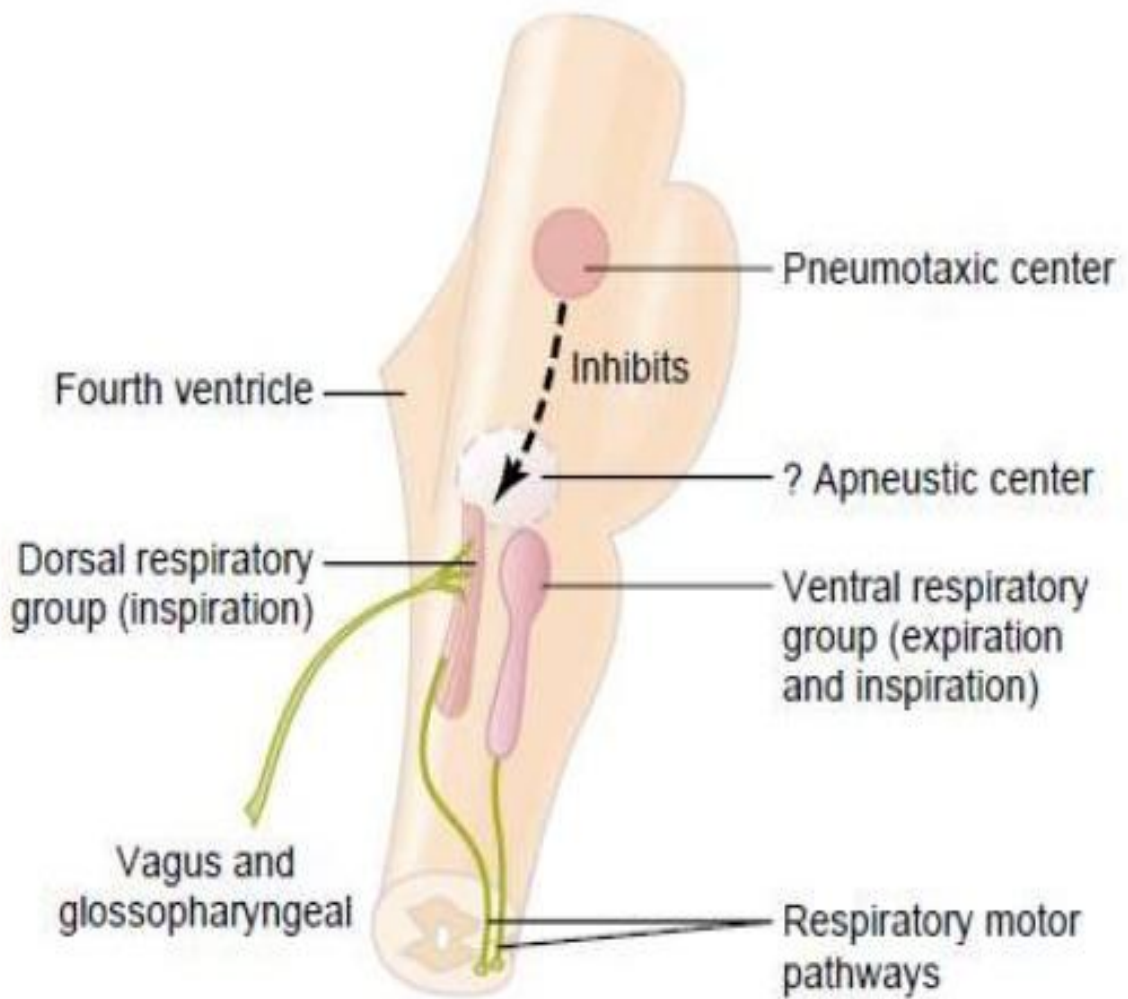
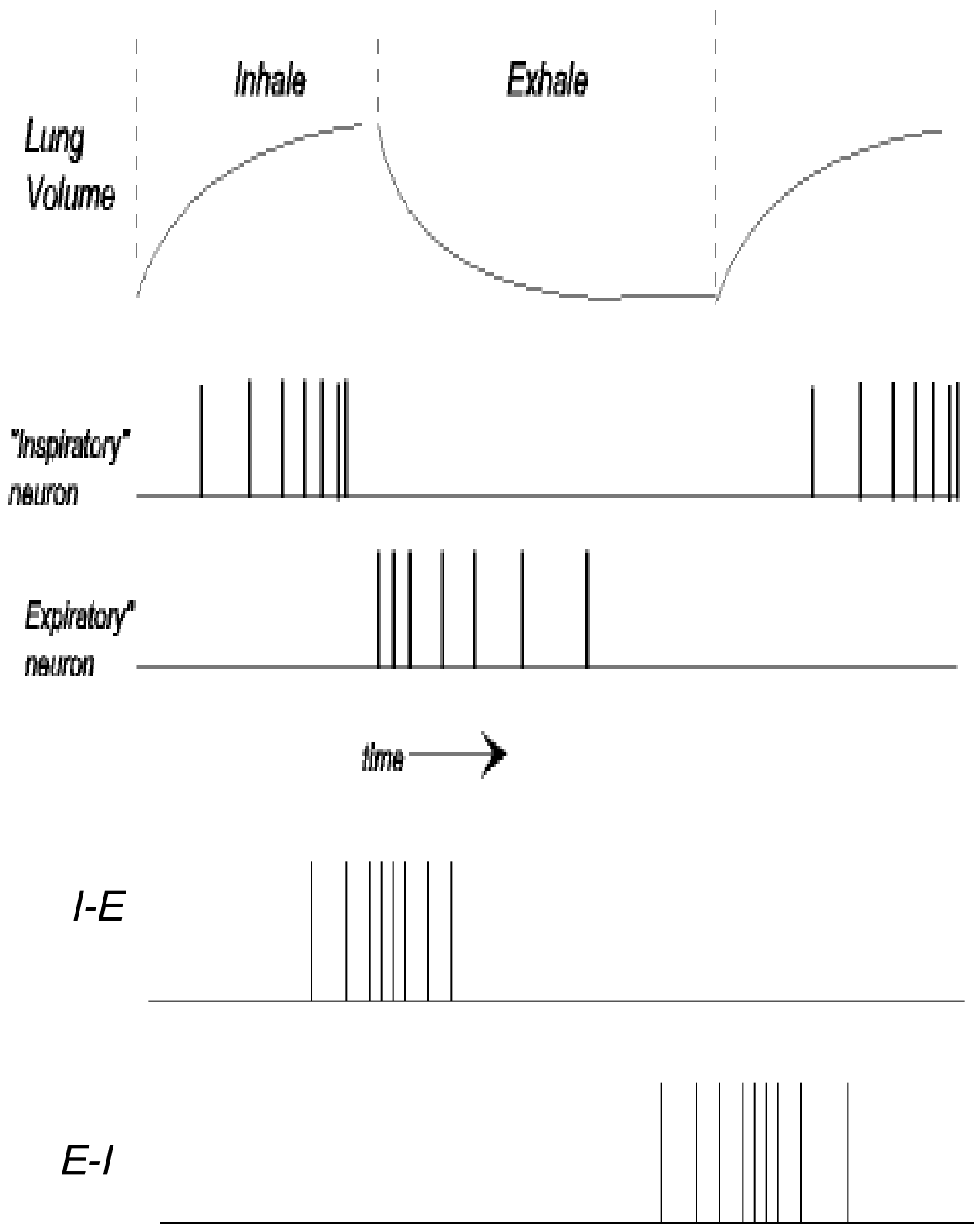
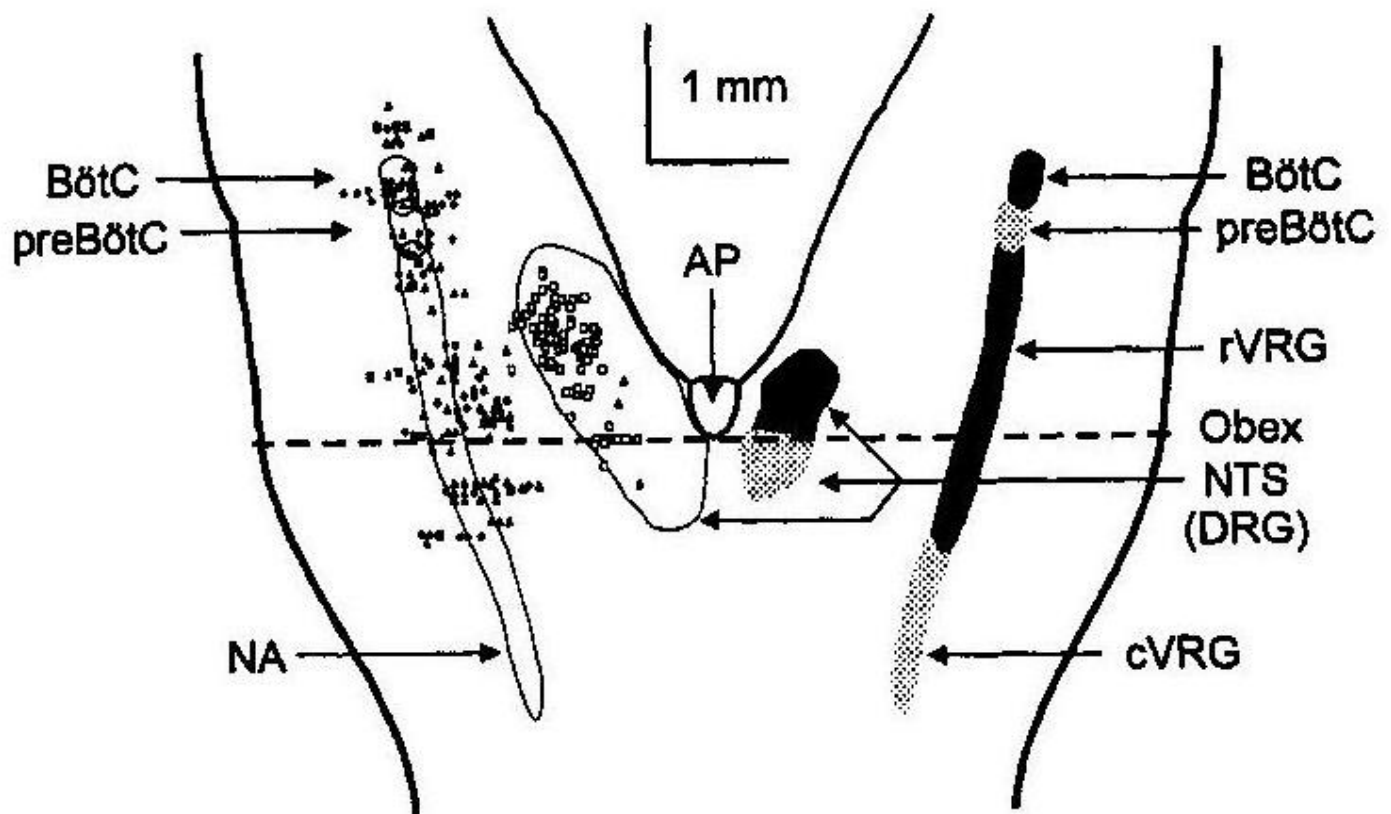


Fig. 16-1



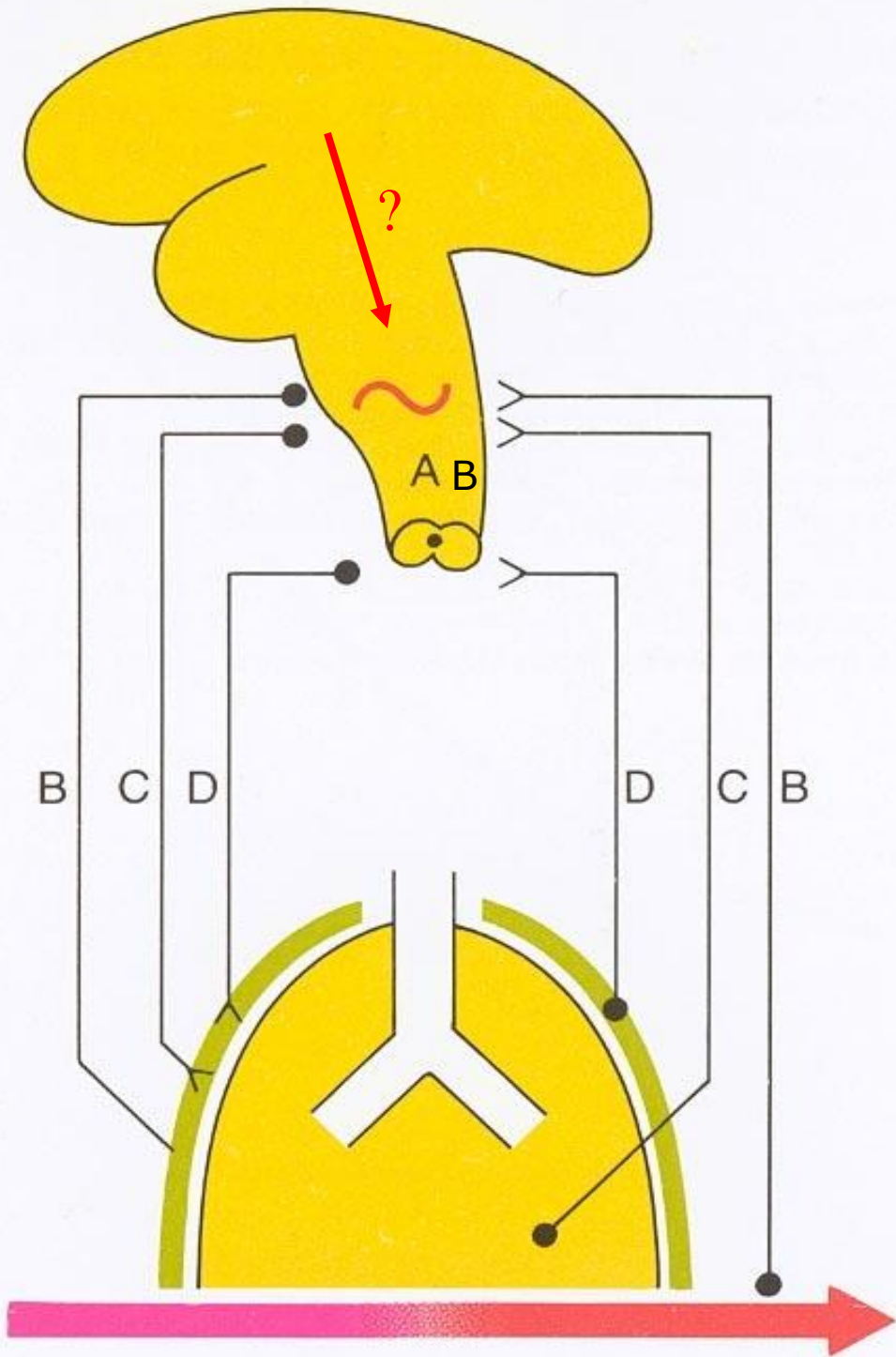
Organization of the respiratory center.





AP area postrema
 BotC Botzinger complex
 cVRG caudal ventral respiratory group
 DRG dorsal respiratory group
 NTS nucleus tractus solitarius

- Inspiratory
- Expiratory
- △ Early inspiratory
- ▲ Postinspiratory

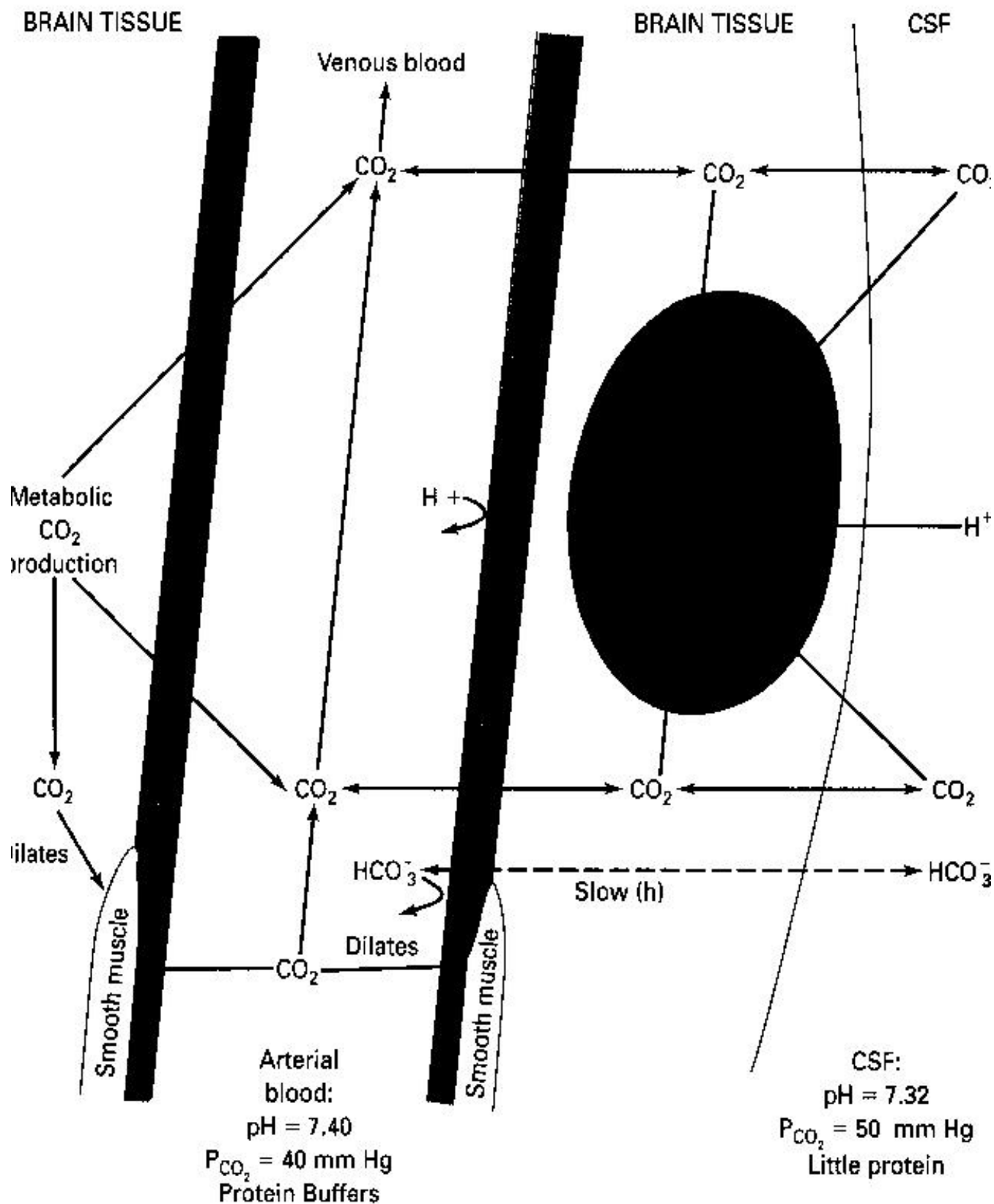


A rhythm generator

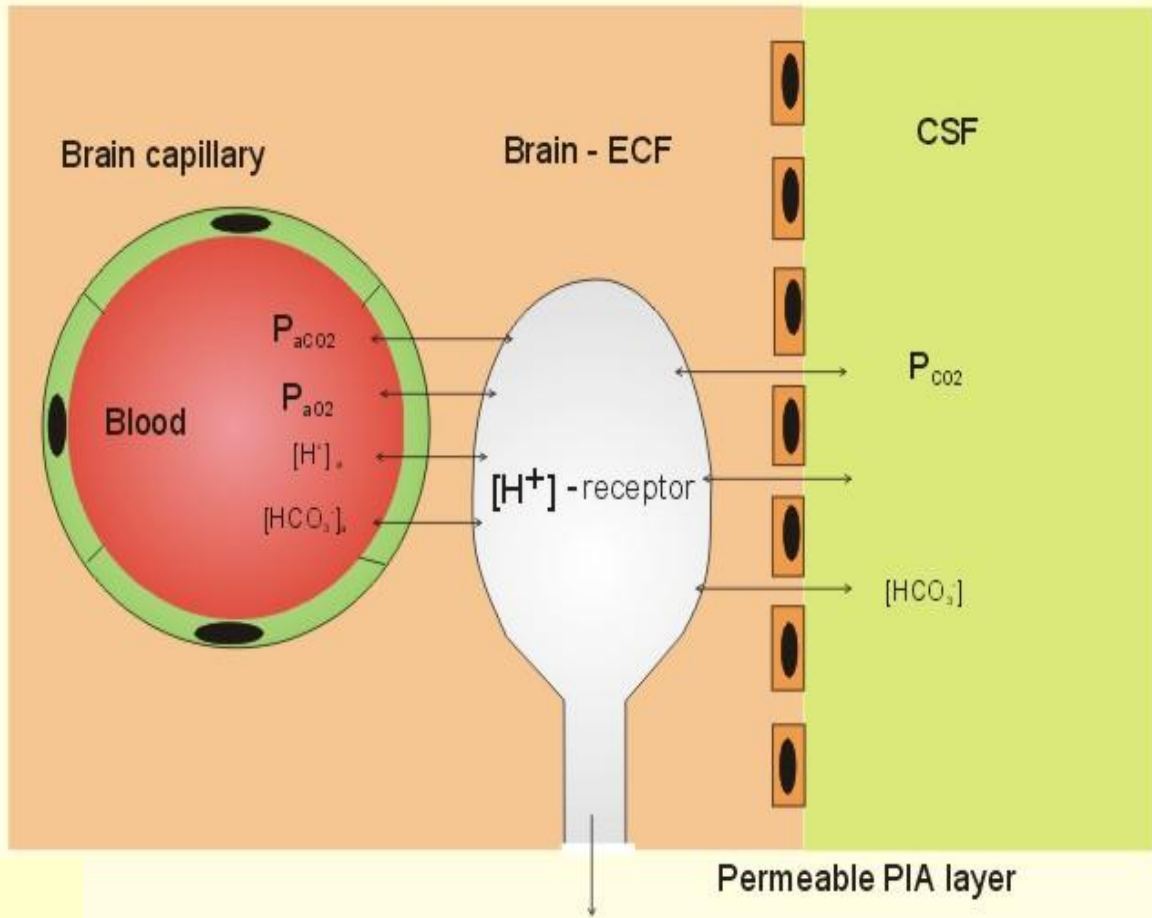
B **metabolic control (chemoreceptors)**

C pattern of breathing (mechanoreceptors)

D respiratory muscles (proprioceptors)

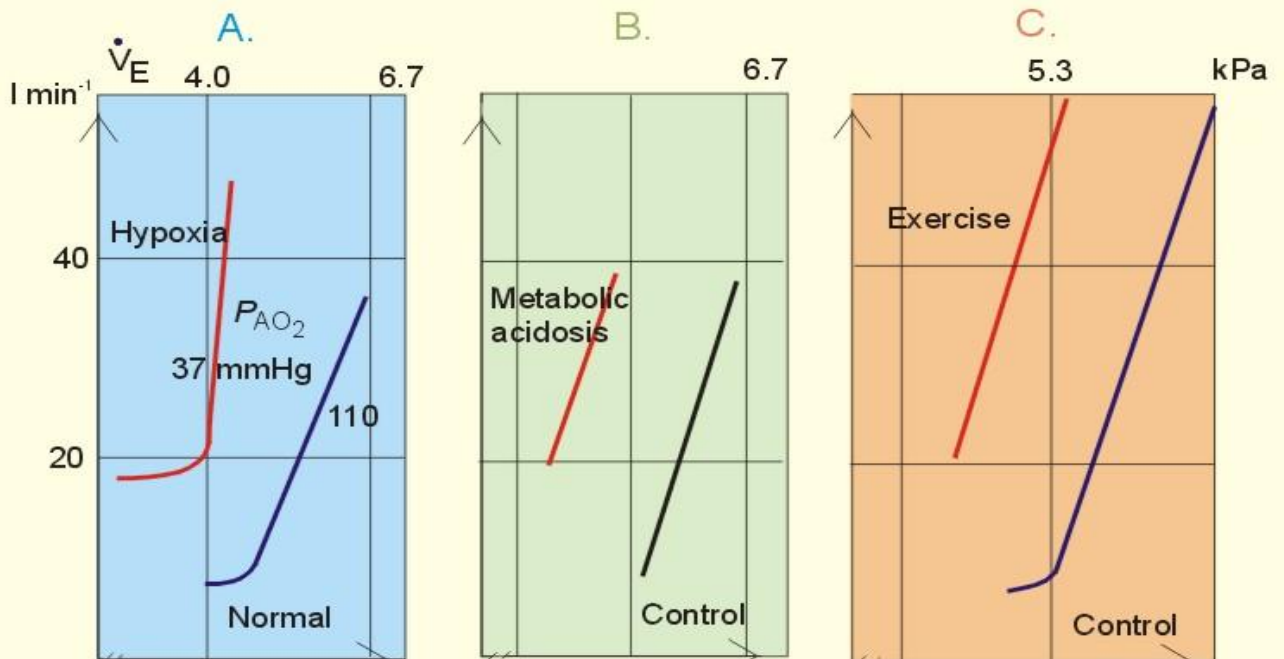


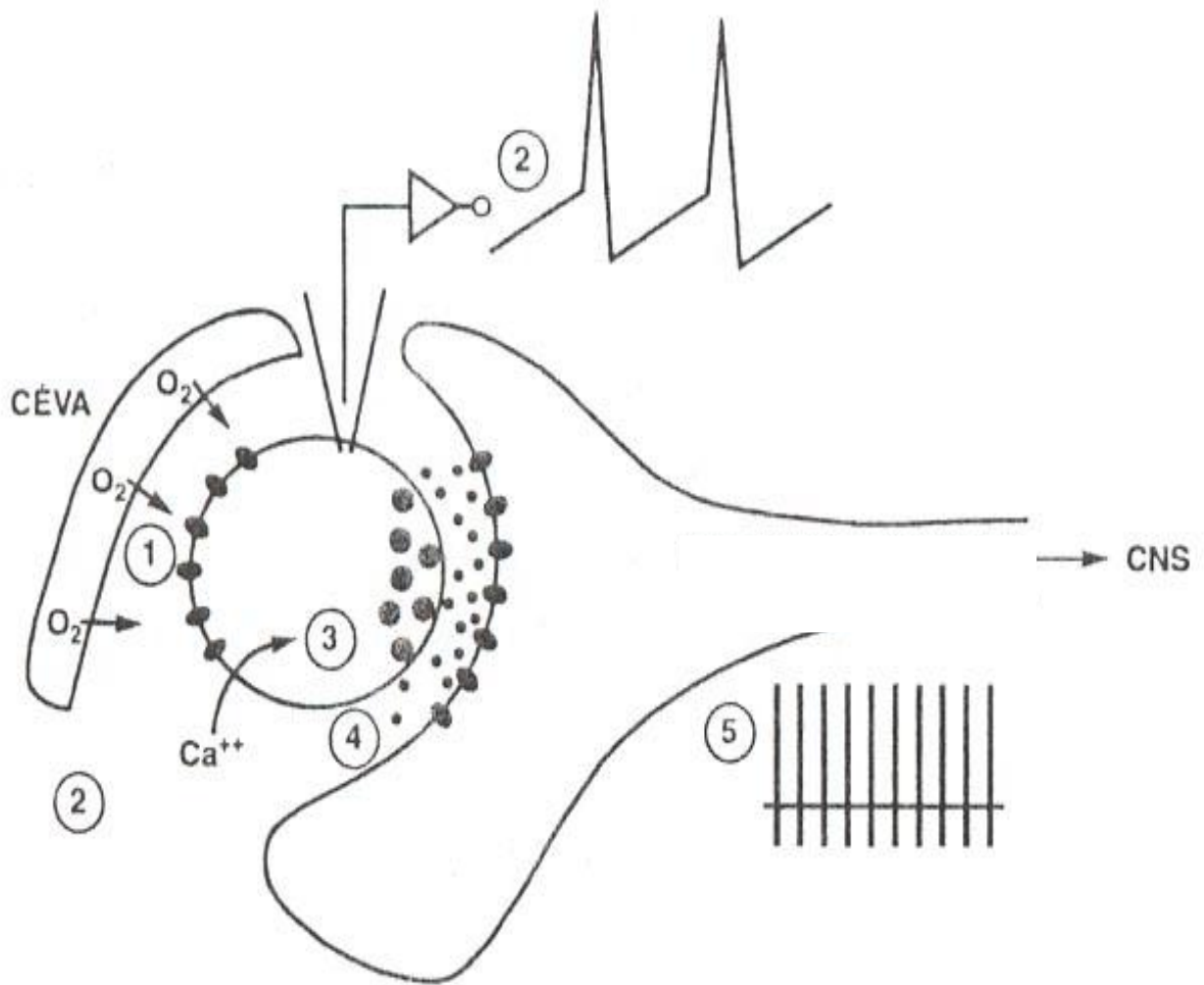
Blood-brain Barrier and Medullary Chemoreceptors



KMc

Carbon Dioxide Response Curves





Peripheral chemoreceptors: 1) O₂ sensing, 2,3) Ca²⁺ influx, 4) mediator release, 5) neural activity

Arterialised Blood Passing Glomus Cell

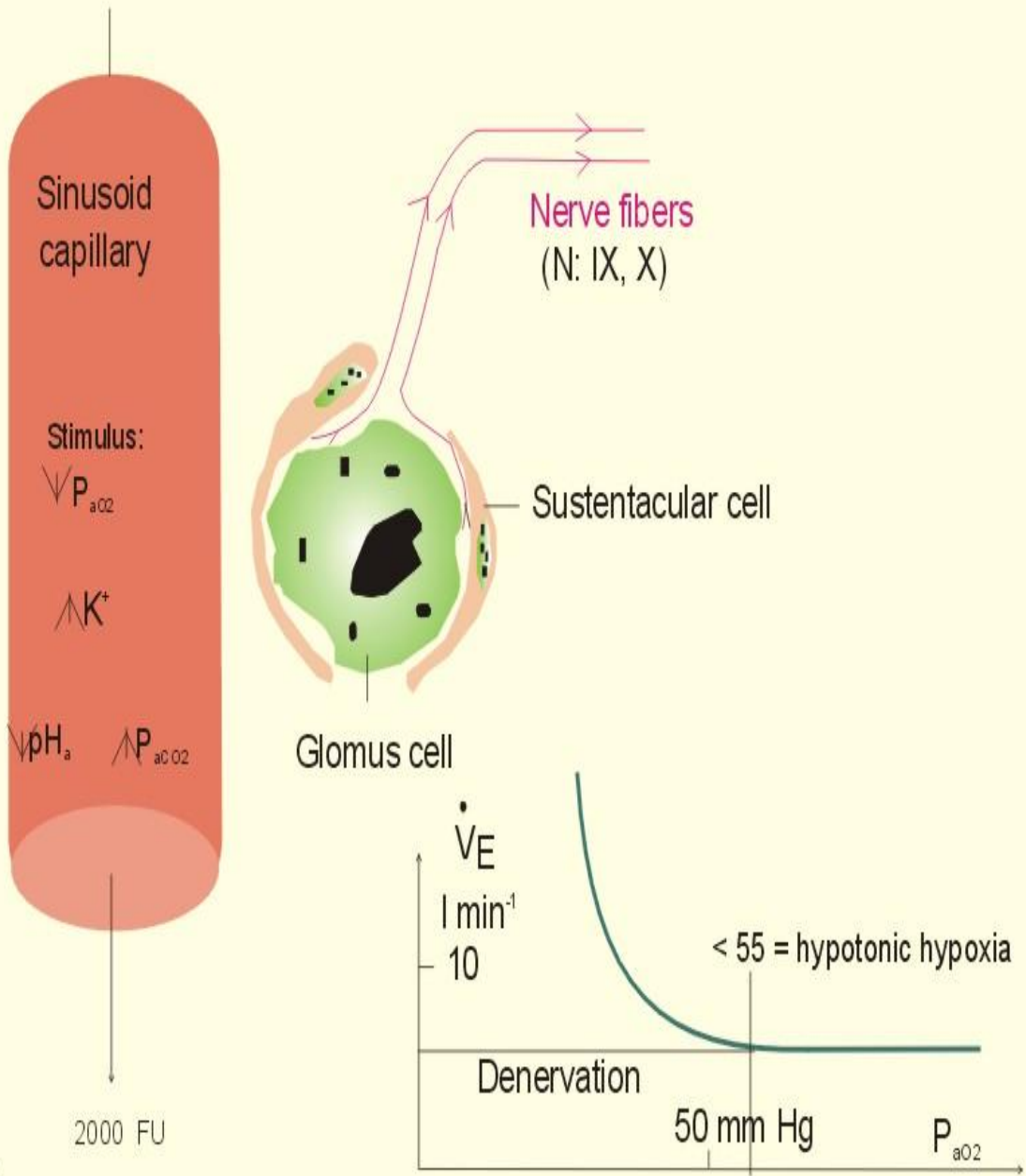
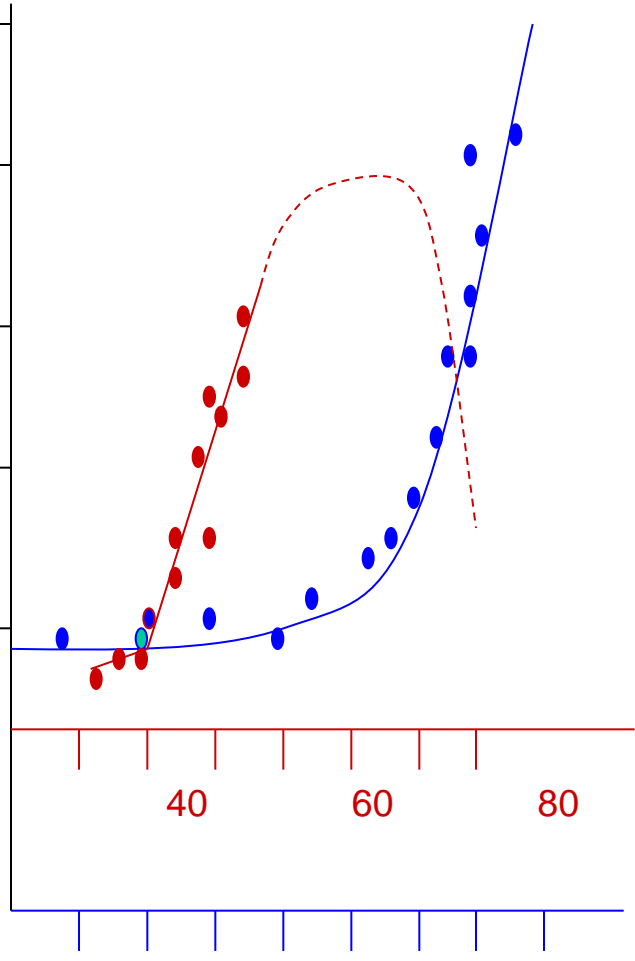


Fig. 16-2

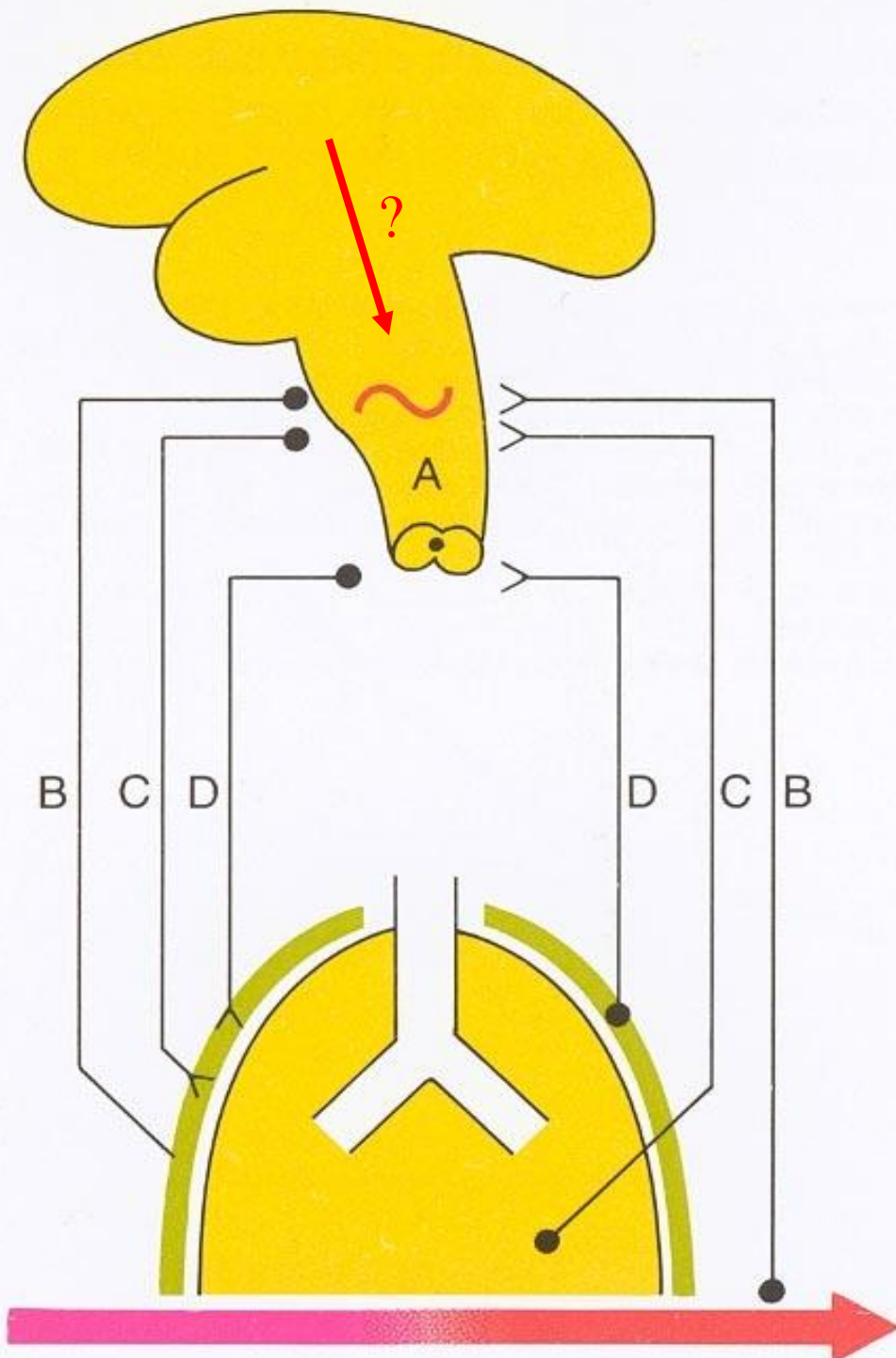
V_E
(l/min)



PCO_2 (mmHg)

PO_2 (mmHg)

40

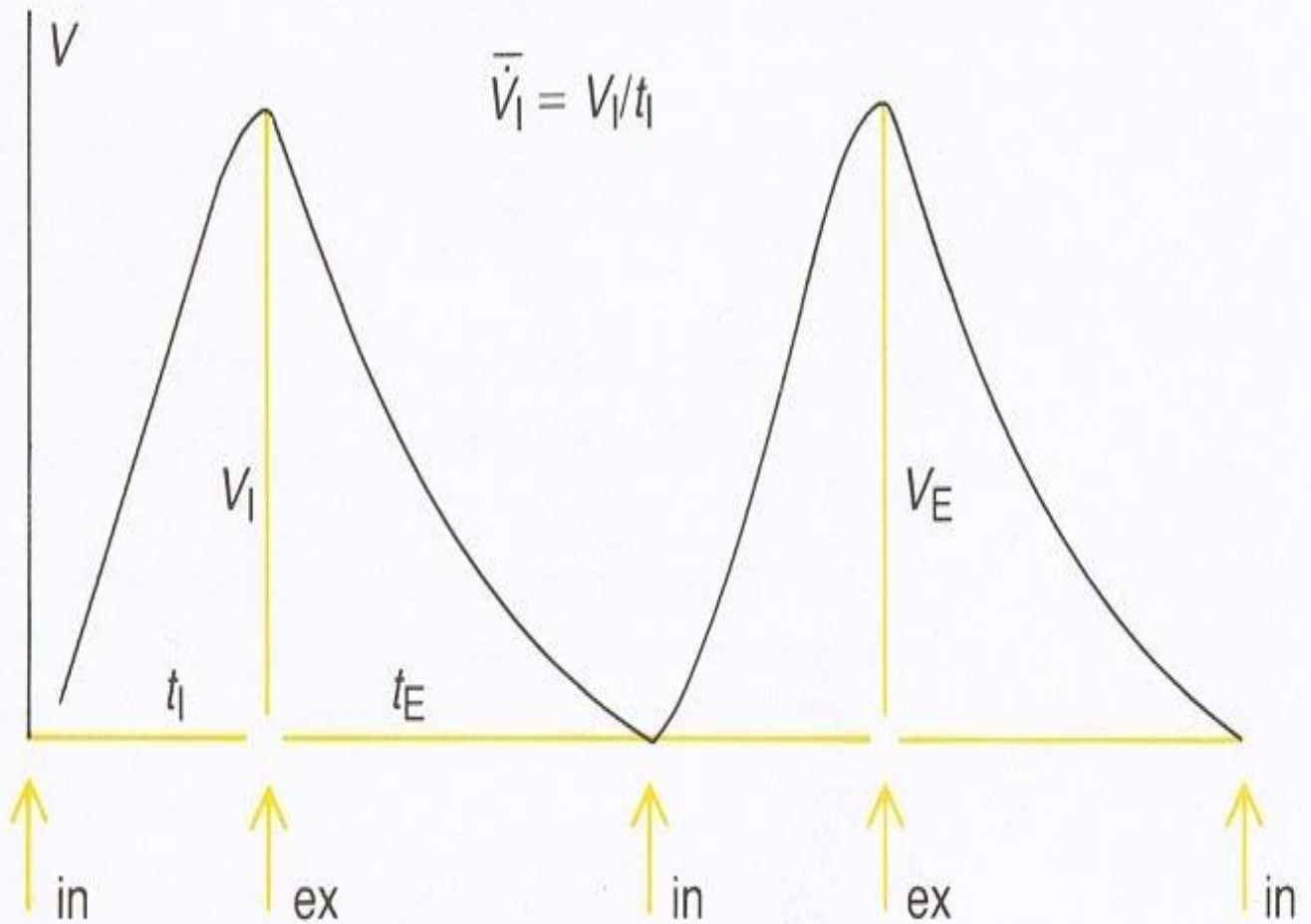


A rhythm generator

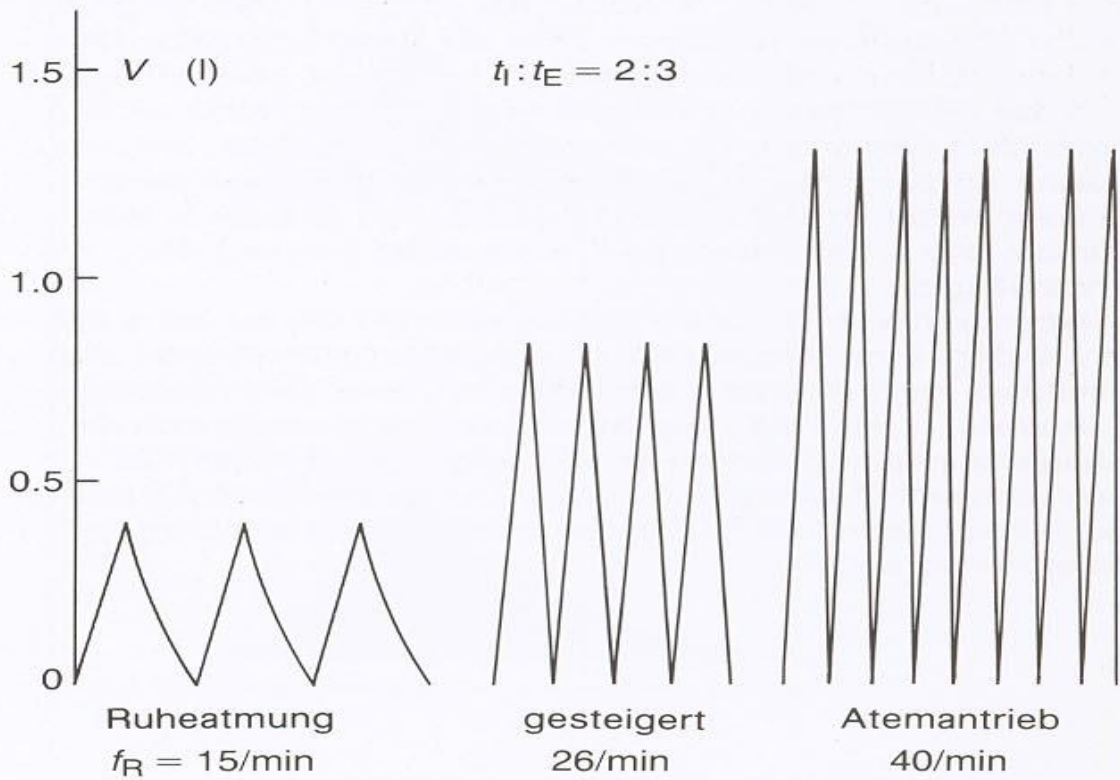
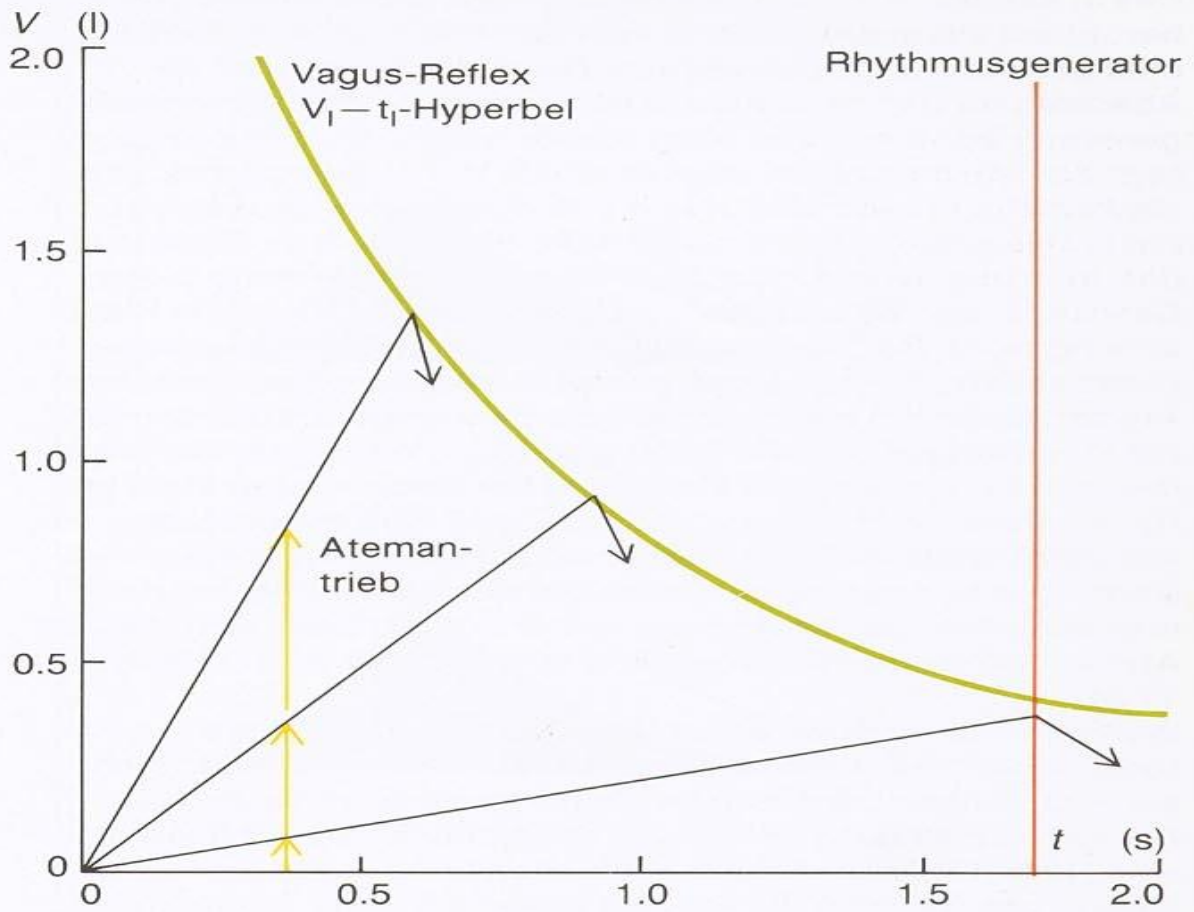
B metabolic control (chemoreceptors)

C pattern of breathing (mechanoreceptors)

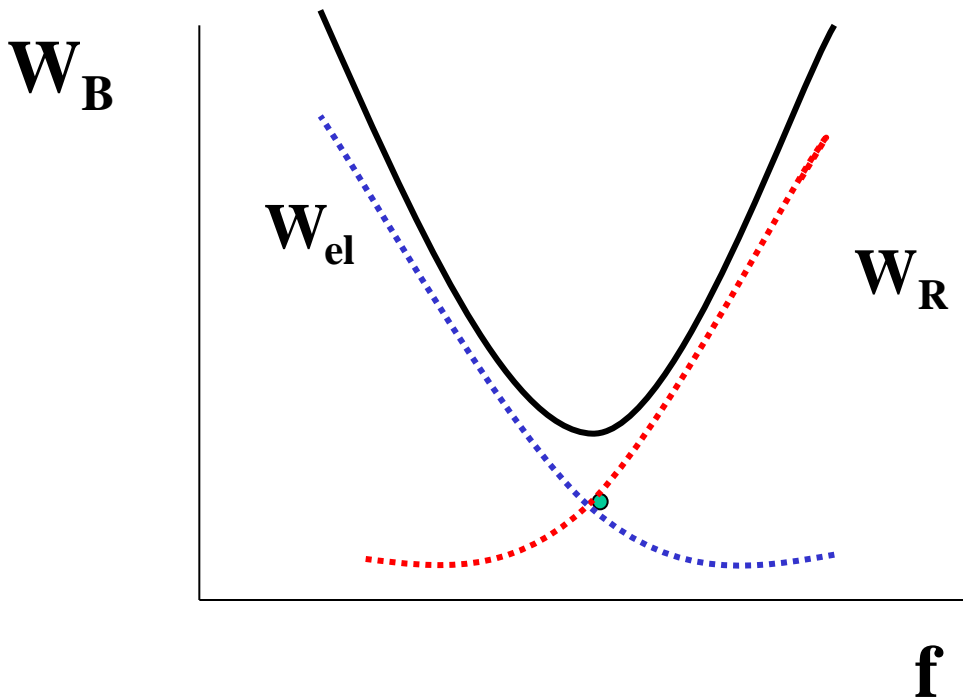
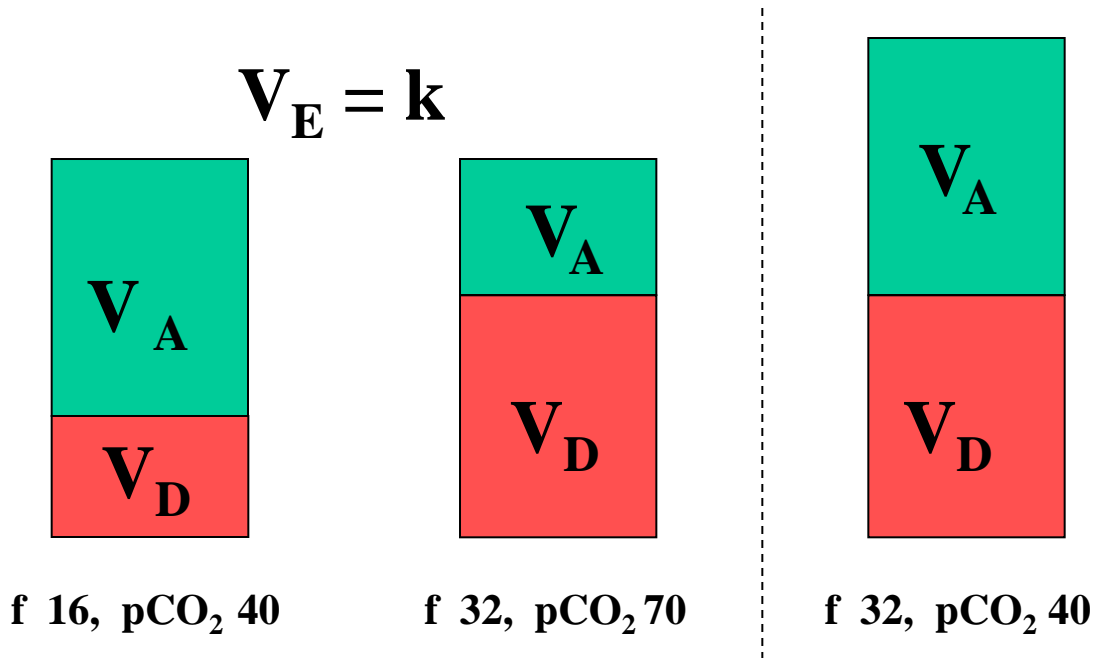
D respiratory muscles (proprioceptors)

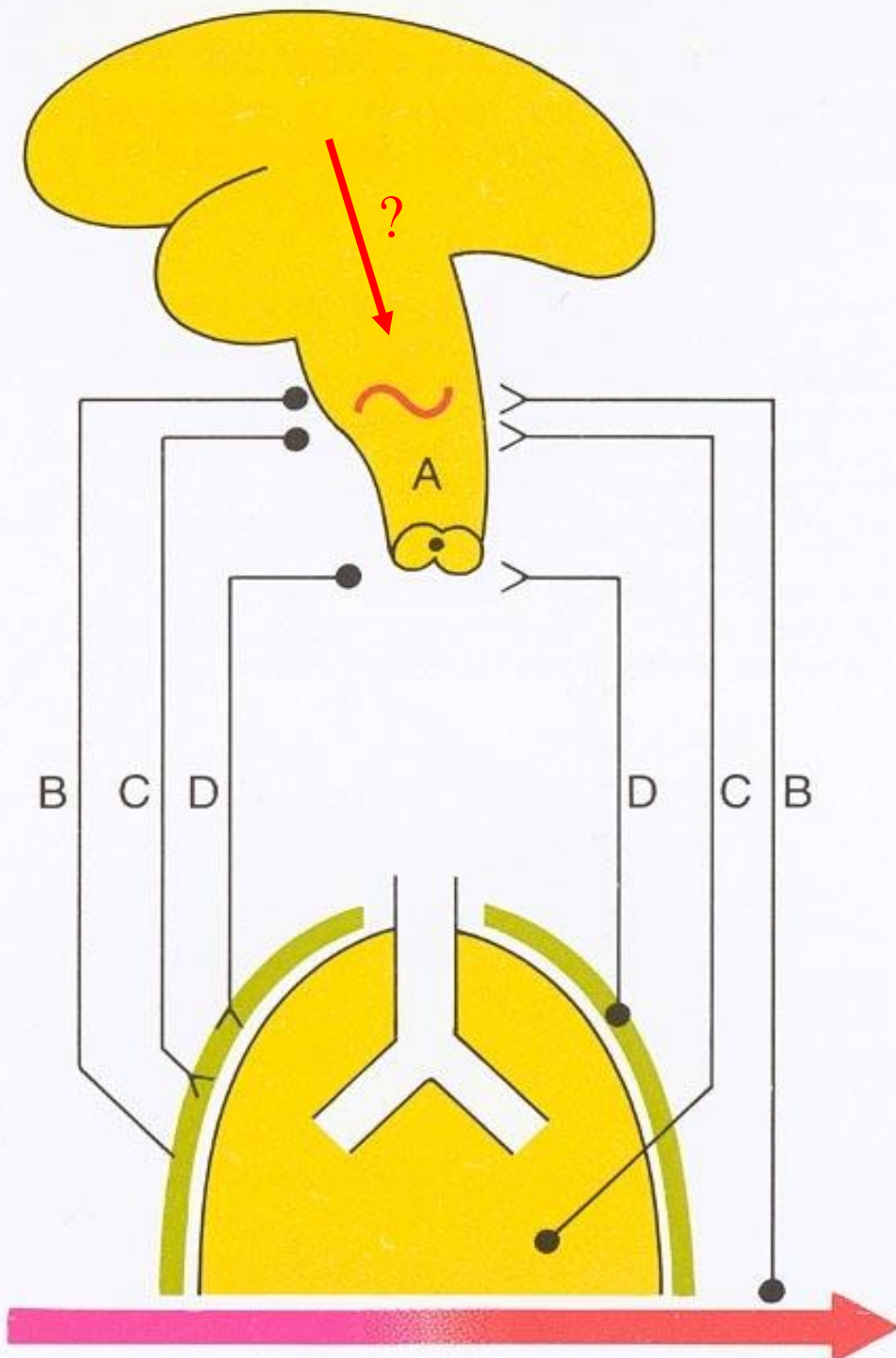


Pattern of breathing



Work of breathing





A rhythm generator

B metabolic control (chemoreceptors)

C pattern of breathing (mechanoreceptors)

D respiratory muscles (proprioceptors)

Respiratory muscles:

Diaphragm - C₃- C₅

Intercostal – Th₁ – Th₁₂

Transversus thoracis, levatores costarum

Abdominal: T₇ – T₁₁

T₇ – T₁₁, T₁₂, L₁

Pomocné: skaleni C₄ – C₈

sternocleidomastoideus C₁-C₂

Ostatní: trapezoid

Pectoralis major and minor

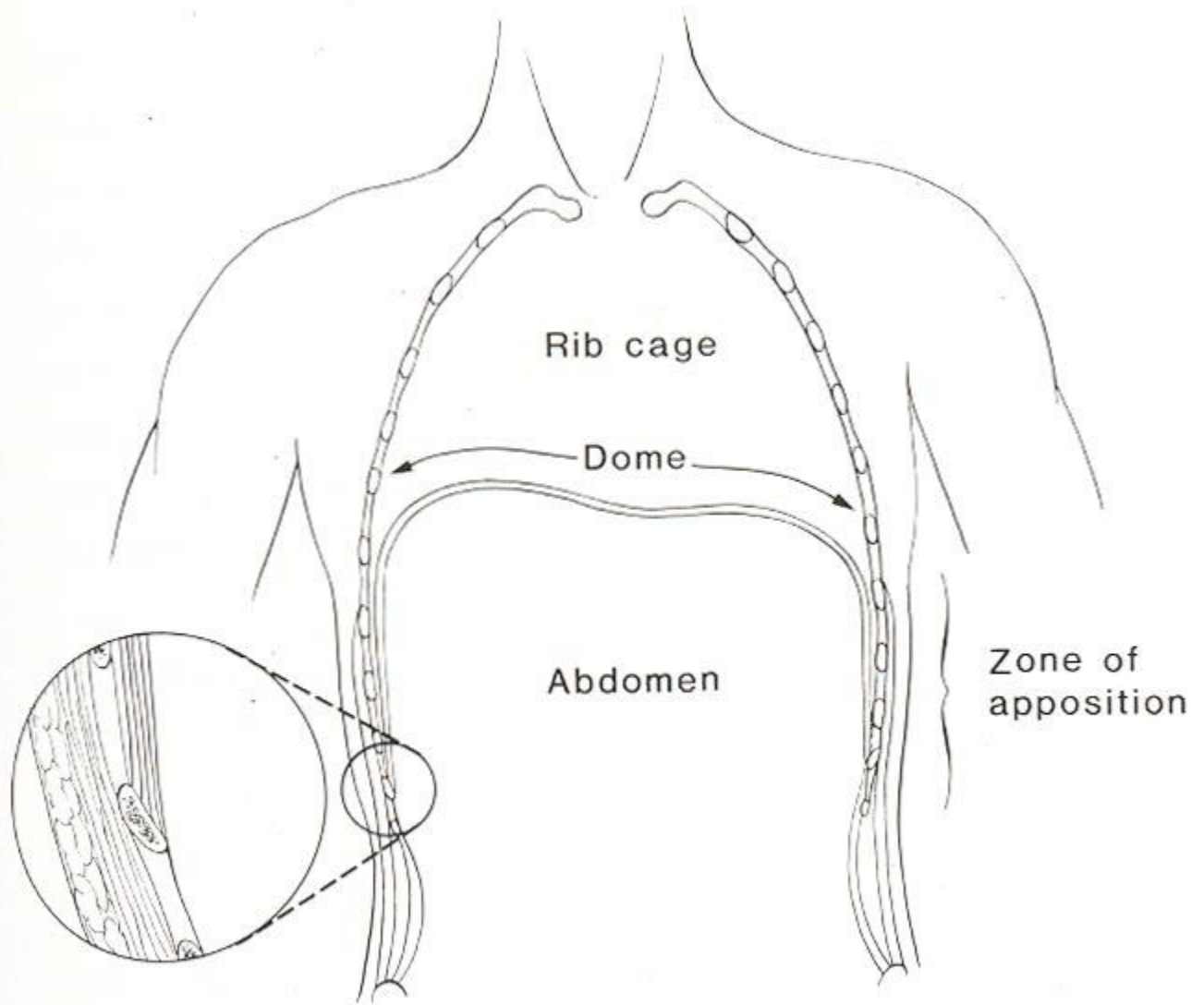
Latissimus dorsi

Serratus anterior, posterior superior,

posterior inferior

Quadratus lumborum

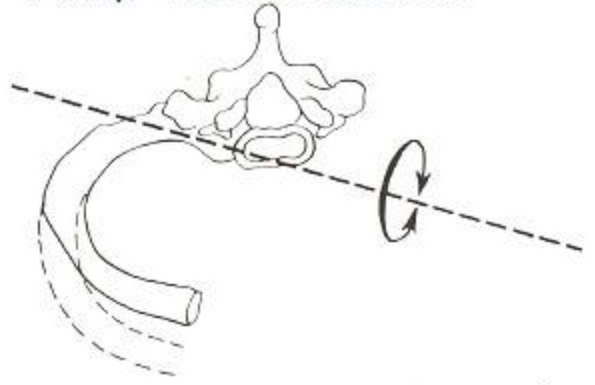
sakrospinal



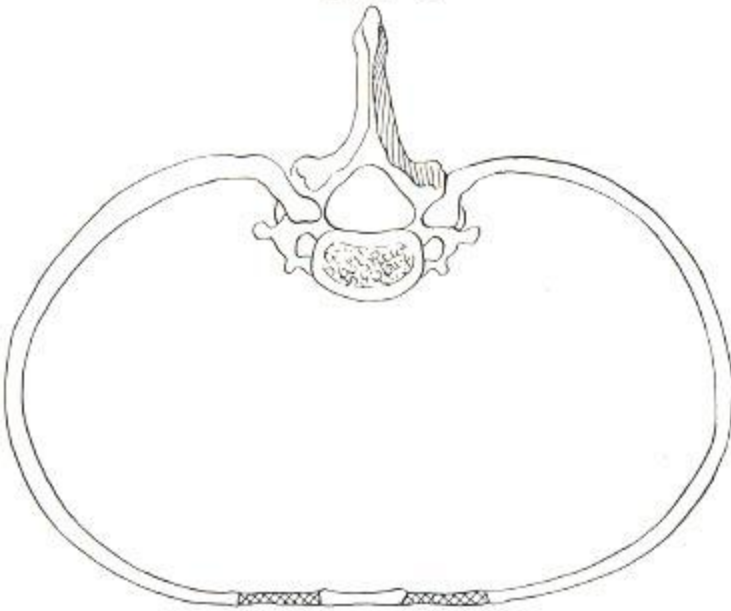
Rib 1



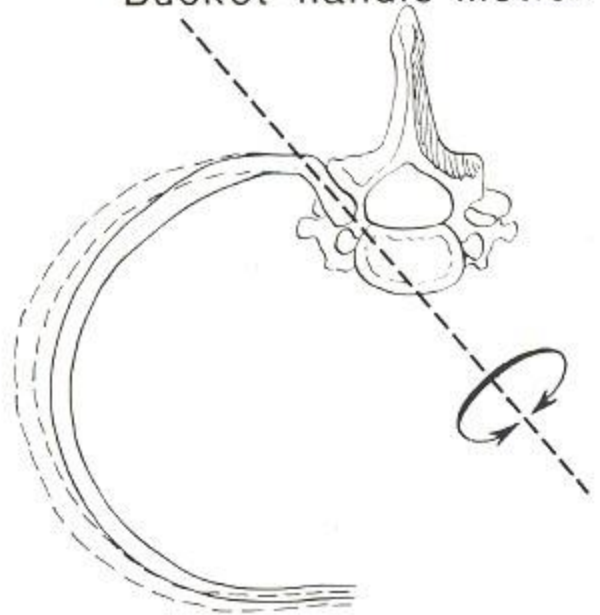
Pump-handle motion

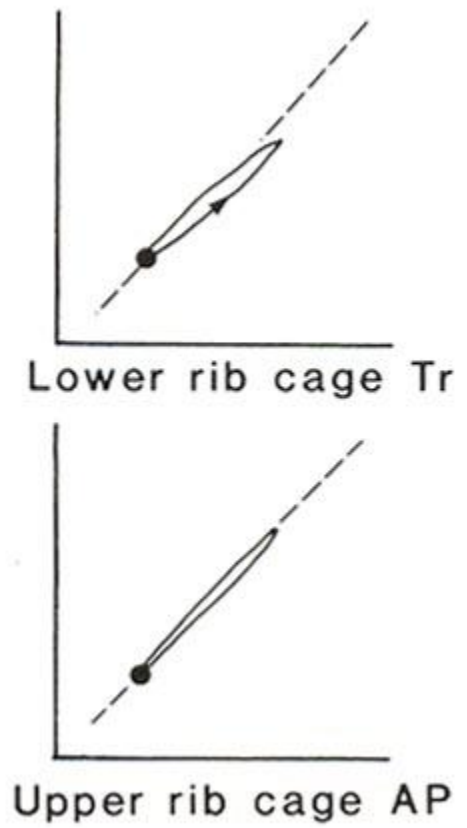
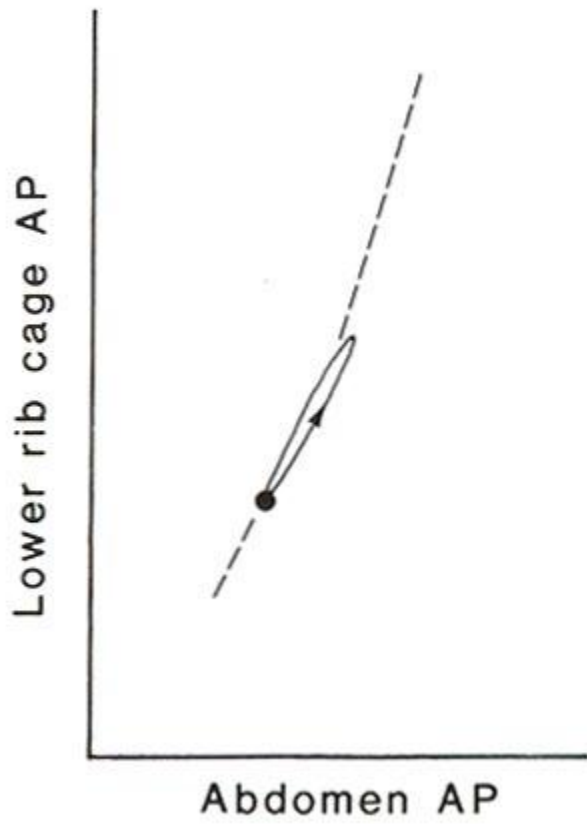


Rib 6

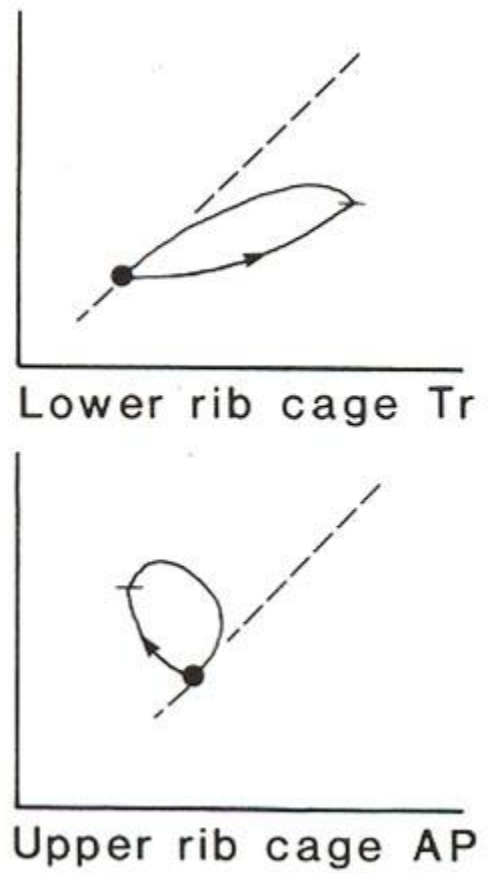
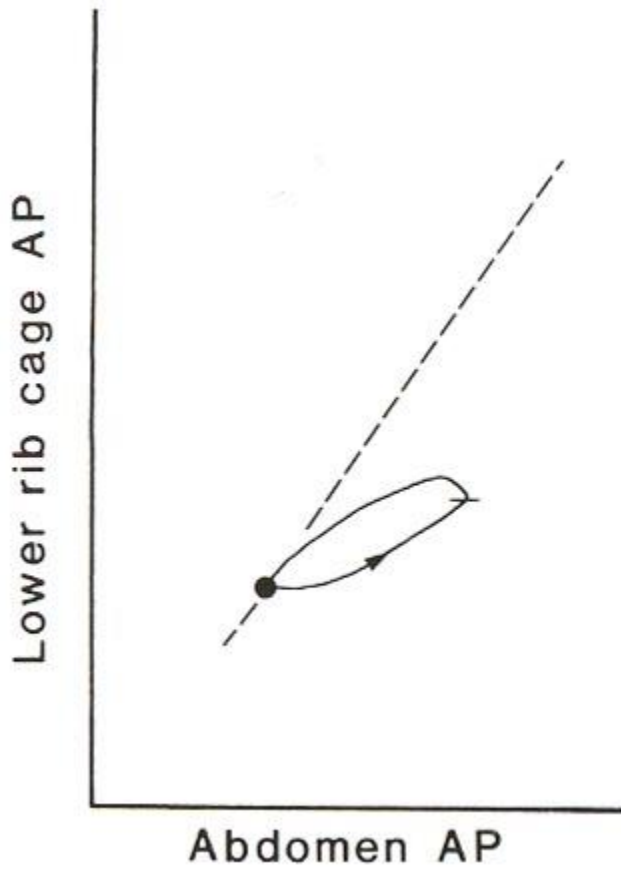


Bucket-handle motion





normal



C₅

Lower rib cage AP



Abdomen AP



Lower rib cage Tr

Lower rib cage AP



Upper rib cage AP



Xiphi-pubic distance

C_2