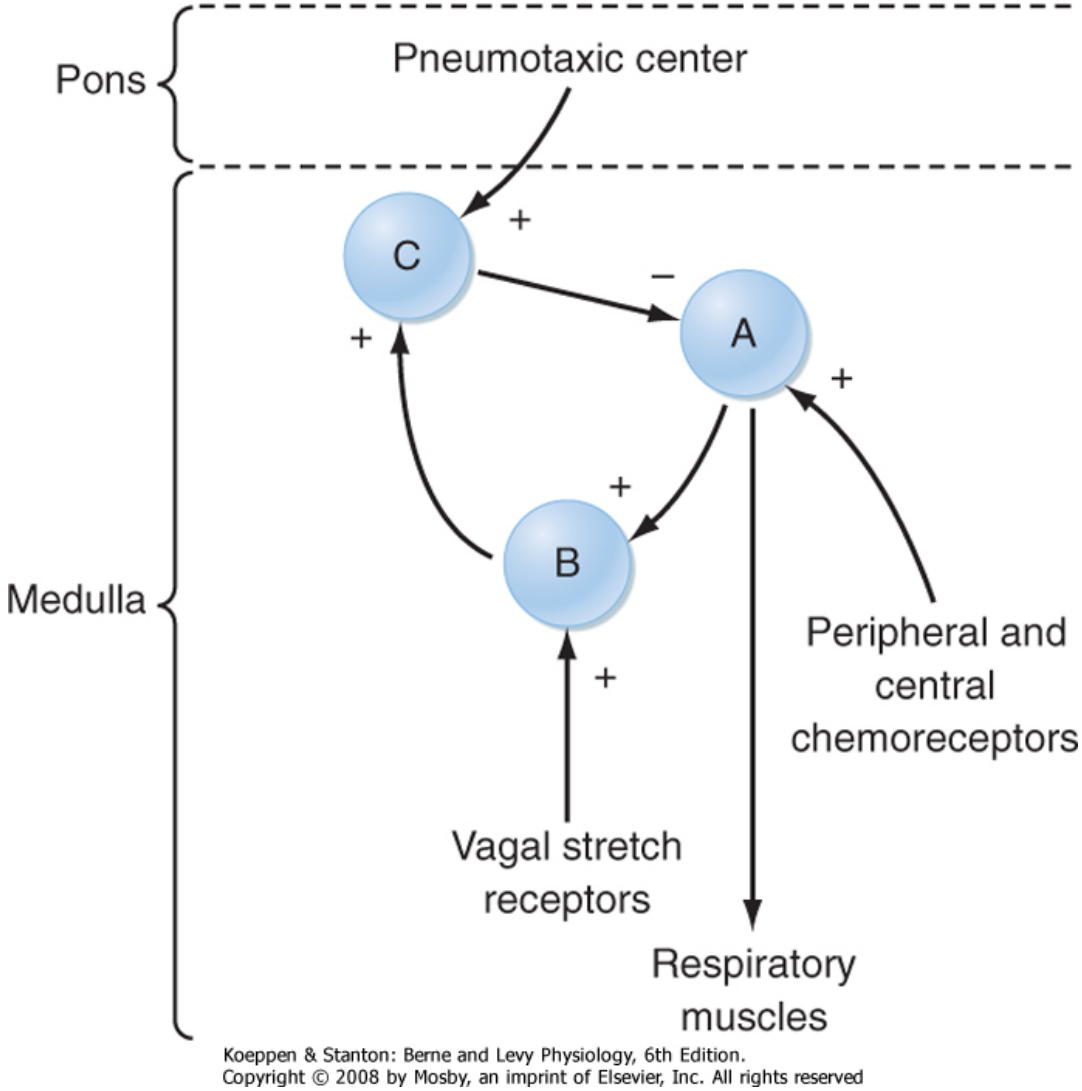
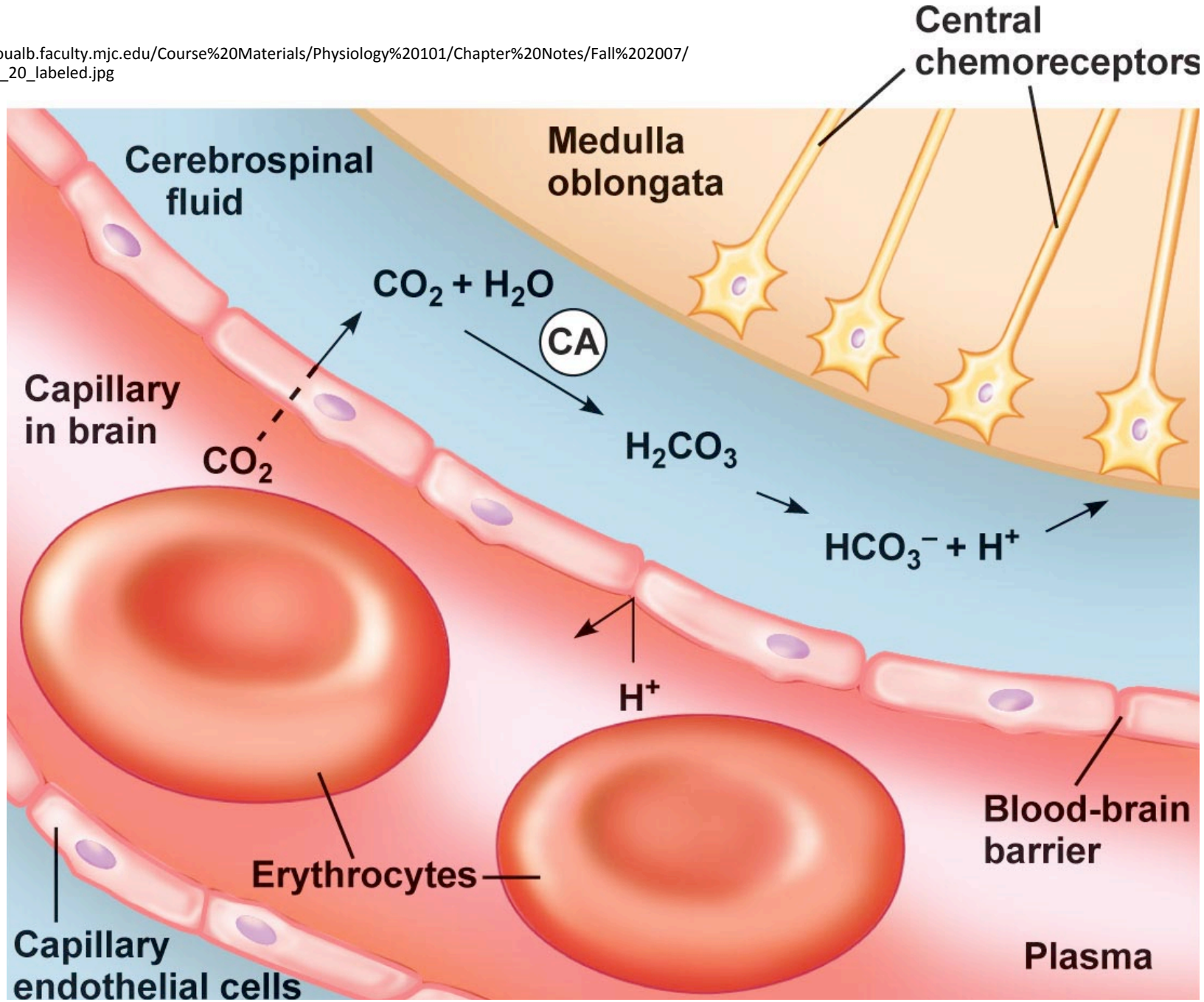
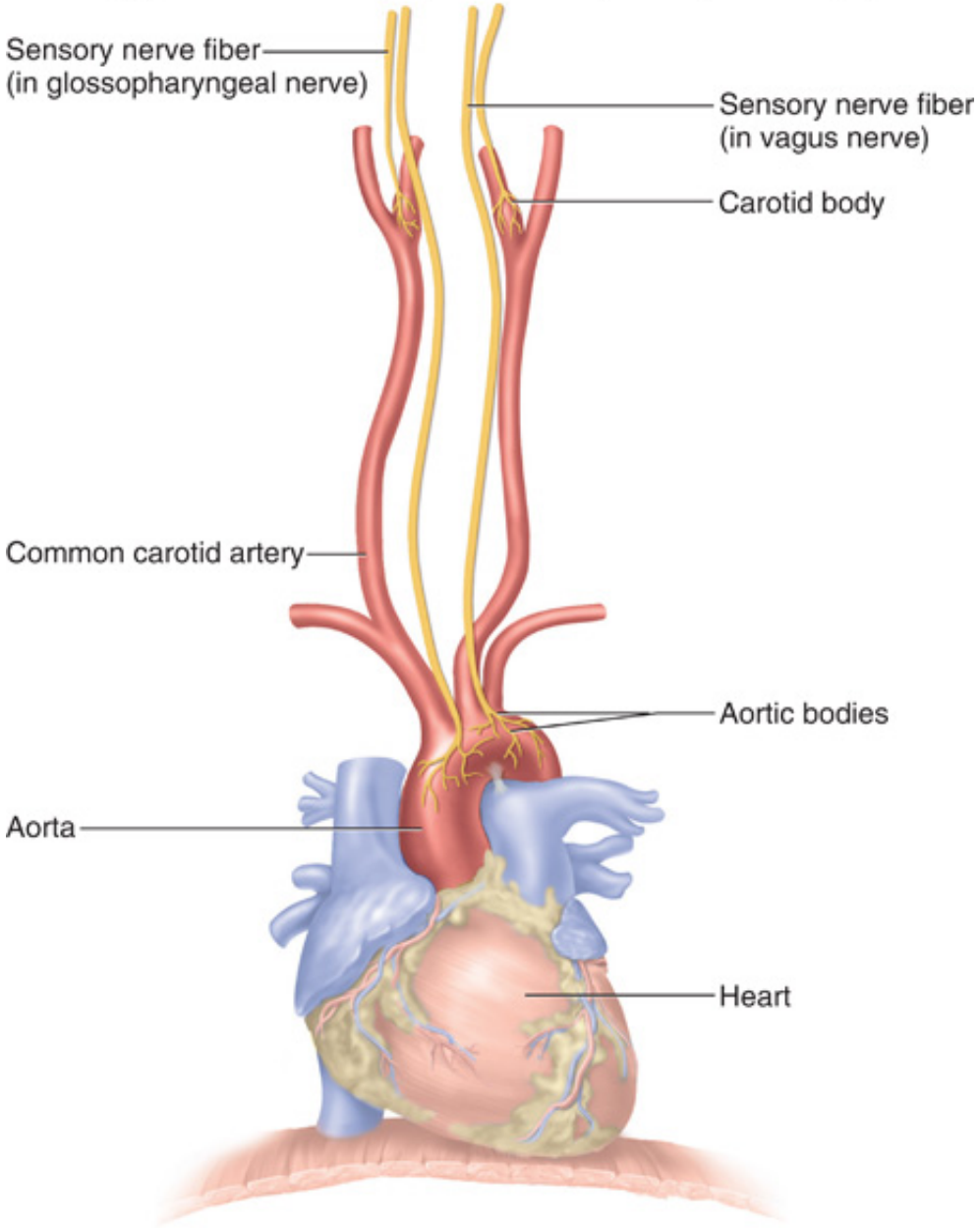


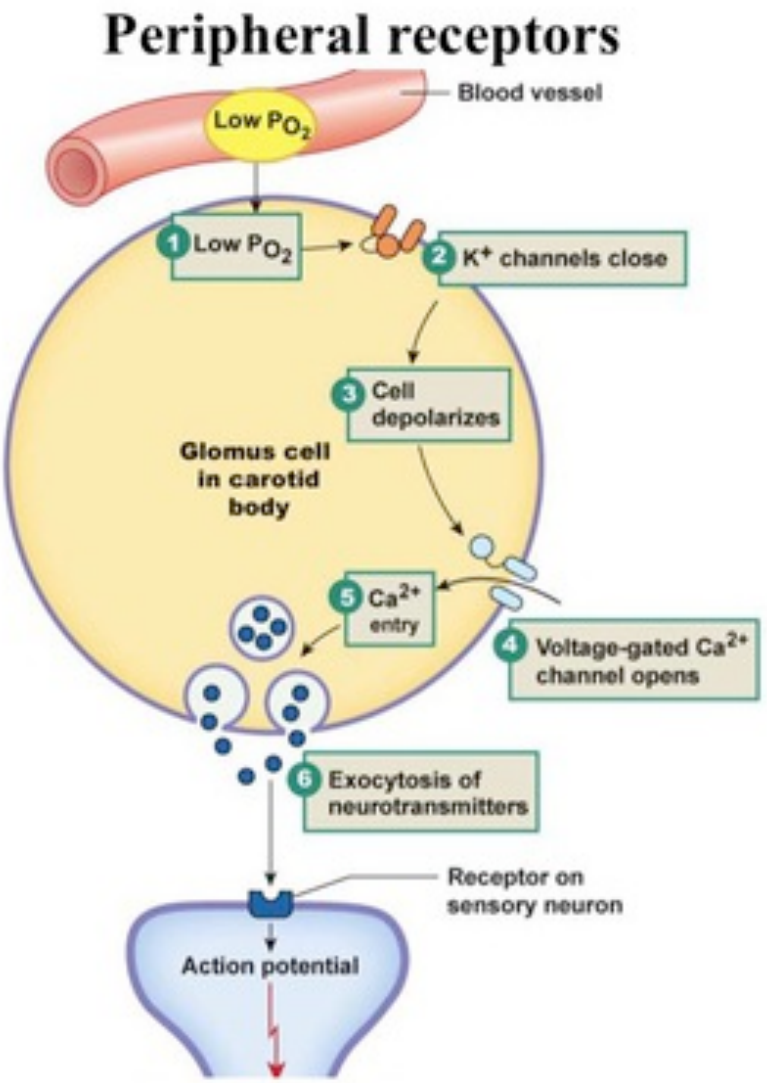
Figure 24-4 The basic wiring diagram of the brainstem ventilatory controller. The signs of the main output (arrows) of the neuron pools indicate whether the output is excitatory (+) or inhibitory (-). Pool A provides tonic inspiratory stimuli to the muscles of breathing. Pool B is stimulated by pool A and provides additional stimulation to the muscles of breathing, and pool B stimulates pool C. Other brain centers feed into pool C (inspiratory cutoff switch), which sends inhibitory impulses to pool A. Afferent information (feedback) from various sensors acts at different locations: chemoreceptors act on pool A and intrapulmonary sensory fibers act via the vagus nerves on pool B. A pneumotaxic center in the anterior pons receives input from the cerebral cortex, and it modulates the pool C group.

http://droualb.faculty.mjc.edu/Course%20Materials/Physiology%20101/Chapter%20Notes/Fall%202007/figure_17_20_labeled.jpg





VSL[10] 13-33



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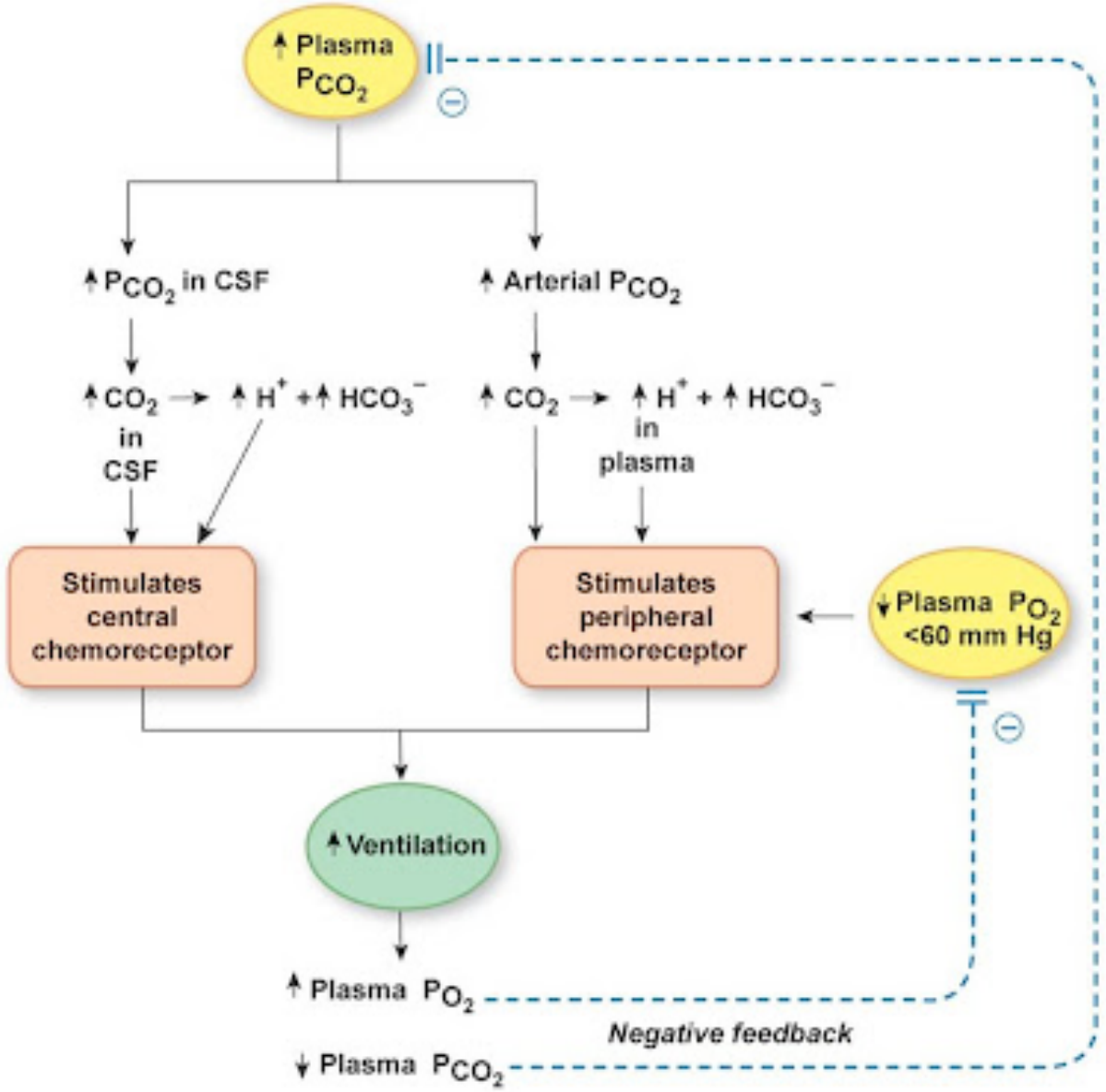
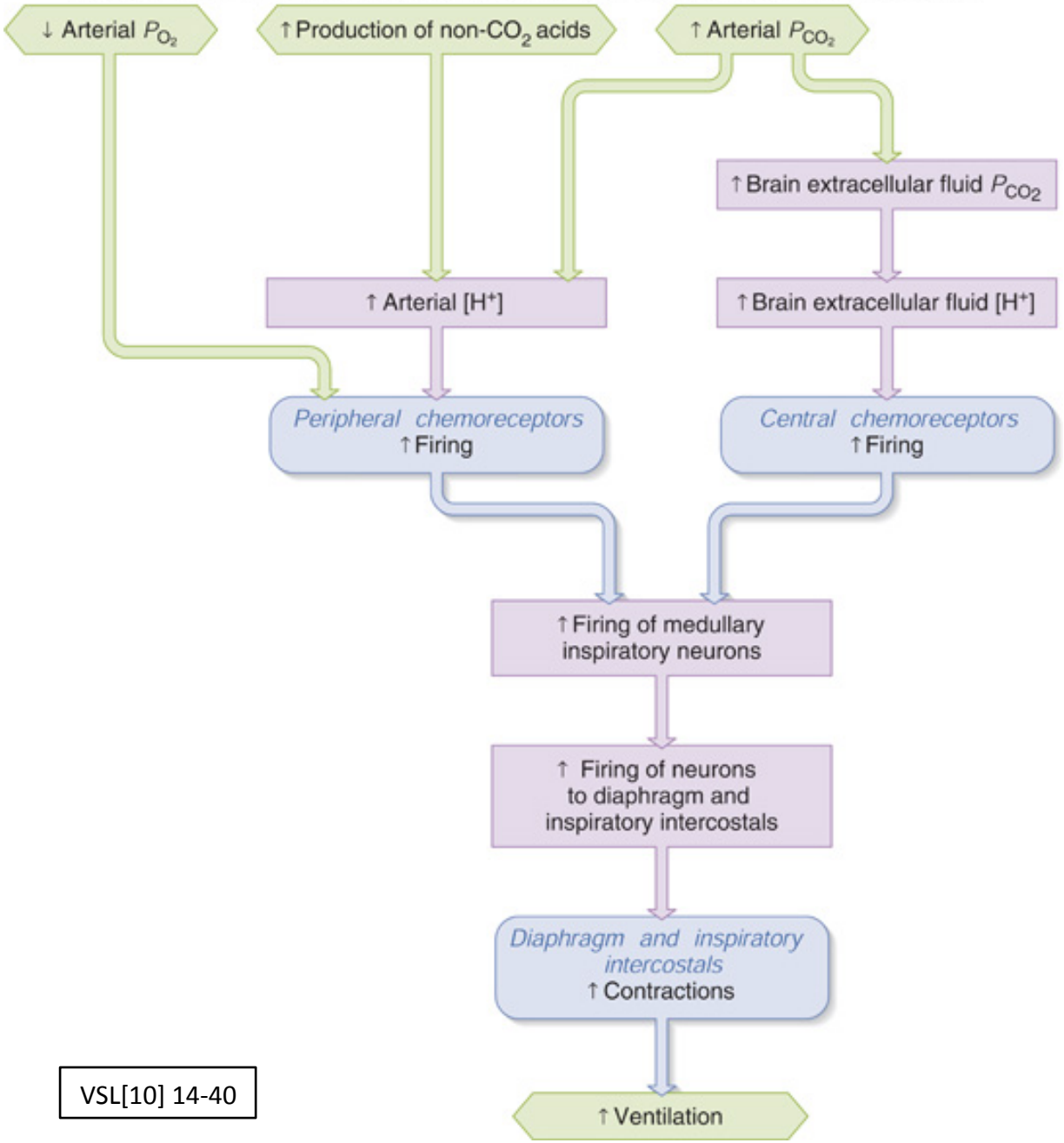


http://tsbiomed.blogspot.com/2012/12/notes-in-respiratory-physiology.html

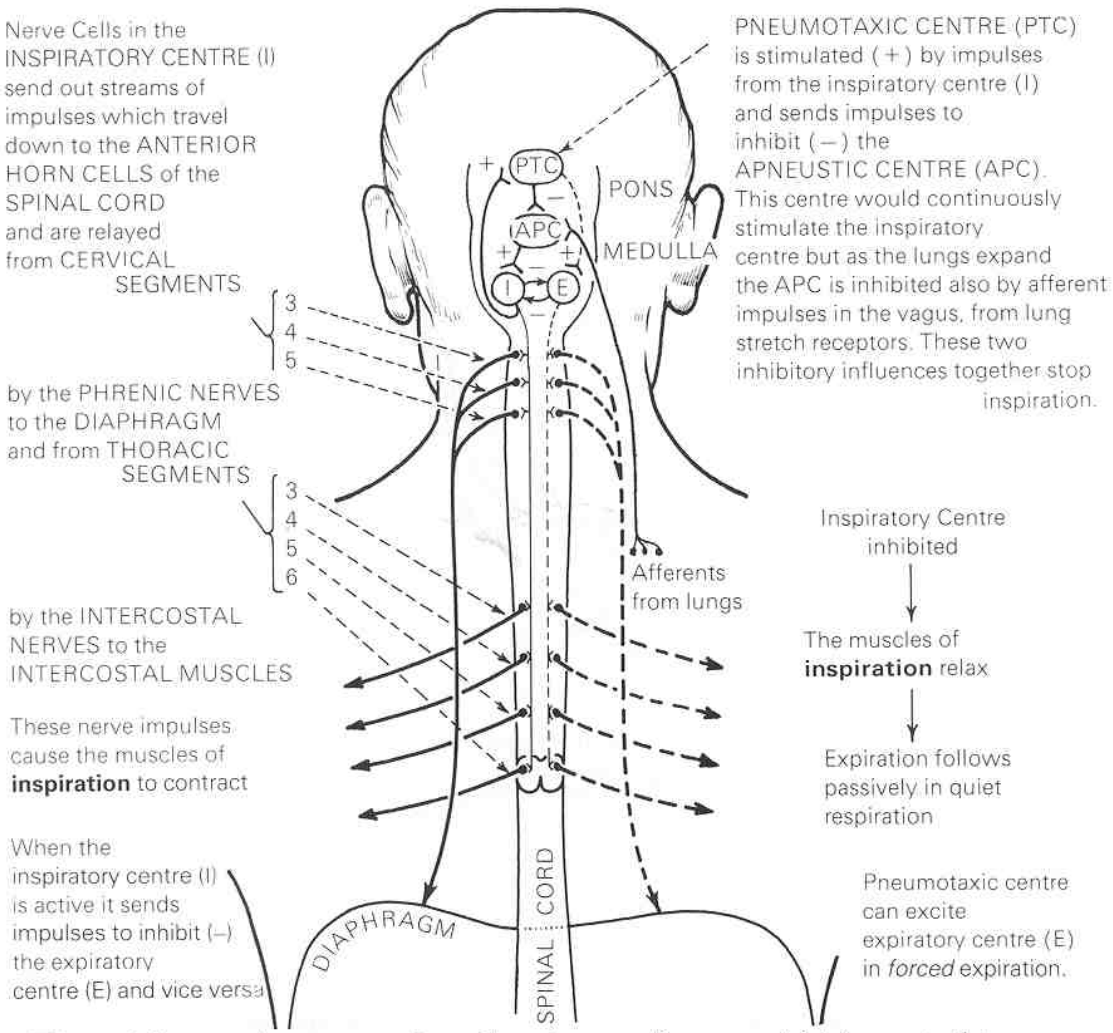


VSL[10] 14-40

Additional Slides

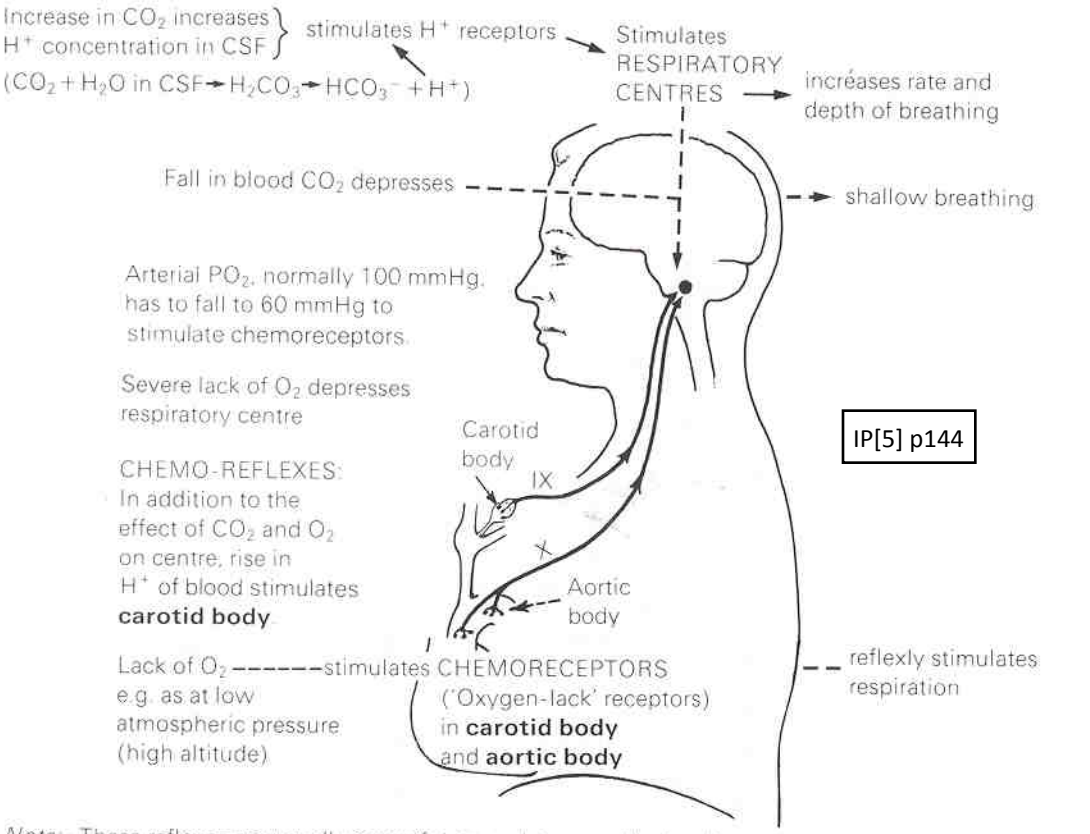
Normal respiratory movements are involuntary. They are carried out automatically (i.e. without conscious control) through the rhythmical discharge of nerve impulses from **controlling centres** in the **brain**.

IP[5] p143



The medullary respiratory centre has a **dorsal** group of neurons which innervate the diaphragm and a **ventral** group which innervate the accessory respiratory muscles and the intercostals. The dorsal group may drive the ventral group and may be switched on and off by the apneustic centre.

The activity of the respiratory centres is affected by the O_2, CO_2 and H^+ content of the blood. **Carbon dioxide** and **H^+** are the most important. CO_2 dissolves in cerebrospinal fluid (CSF) which bathes receptors sensitive to H^+ on the ventral aspect of the medulla. Stimulation of these receptors leads to an increase in the rate and depth of respiration. Carotid bodies are stimulated if H^+ in blood rises; this also increases ventilation.



IP[5] p144

Note:- These reflexes are usually powerful enough to override the direct depressant action of lack of O_2 on respiratory centres themselves.

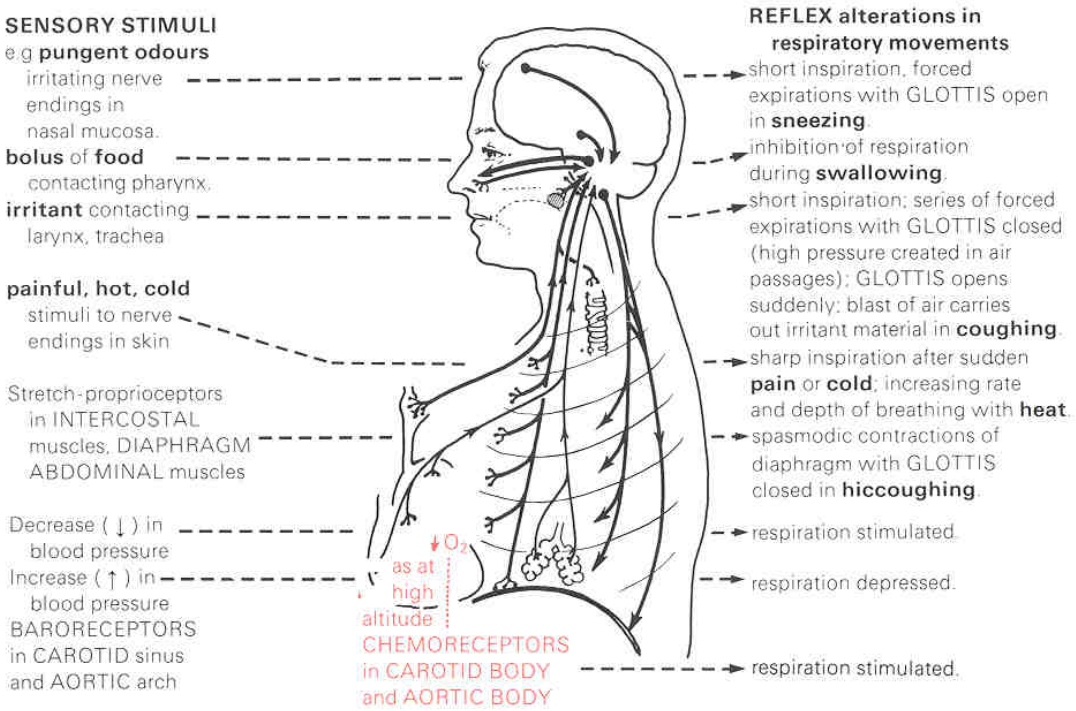
The **chemical** and **nervous** means of regulating the activity of **respiratory centres** act together to adjust rate and depth of breathing to the needs of the body. E.g. **exercise** causes increased requirement for O_2 and production of more CO_2. Ventilation is increased to match this need for extra O_2 and get rid of the extra CO_2. However, the **alveolar** PO_2 and PCO_2 remain constant.

Although fundamentally automatic and regulated by chemical factors in the blood, ingoing impulses from many parts of the body also modify the activity of the **respiratory centres** and consequently alter the outgoing impulses to the respiratory muscles to coordinate **rhythm, rate** or **depth** of breathing with other activities of the body.

IP[5] p145

Impulses from HIGHER CENTRES – PSYCHIC and EMOTIONAL INFLUENCES

- Voluntary alterations in breathing.
- Interruptions of expiration in **speech** and **singing**.
- Deep inspiration then short spasmodic expirations in **laughter** and **weeping**.
- Prolonged expiration in **sighing**.
- Deep inspiration with mouth open in **yawning**.
- Slow shallow breathing in **suspense** and **concentration**.
- Rapid breathing in **fear** and **excitement**.



Proprioceptors stimulated during muscle movements send impulses to respiratory centre → ↑ rate and depth of breathing. (NB: This occurs with active or passive movements of limbs.)

In normal breathing respiratory rate and rhythm are thought to be influenced rhythmically by the Hering-Breuer reflex.

Distension of alveoli at end of inspiration → stimulates stretch receptors in bronchioles → Stream of ingoing impulses passes along vagus nerves to inhibit inspiratory centres → Withdrawal of outgoing impulses to respiratory muscles → expiration

145

END

Video 2, Module 14