Sodium-potassium pump cycle

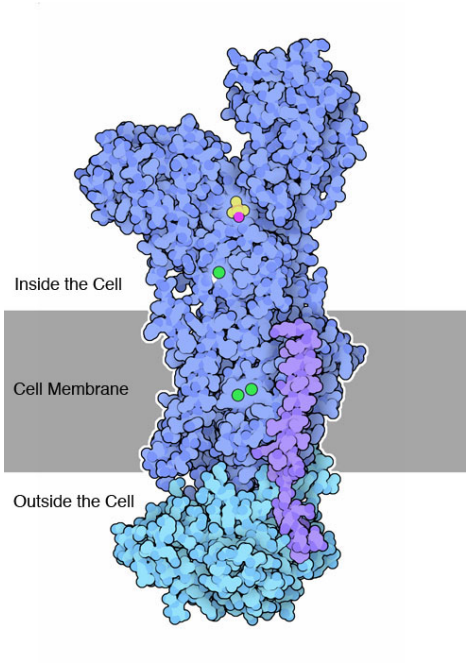
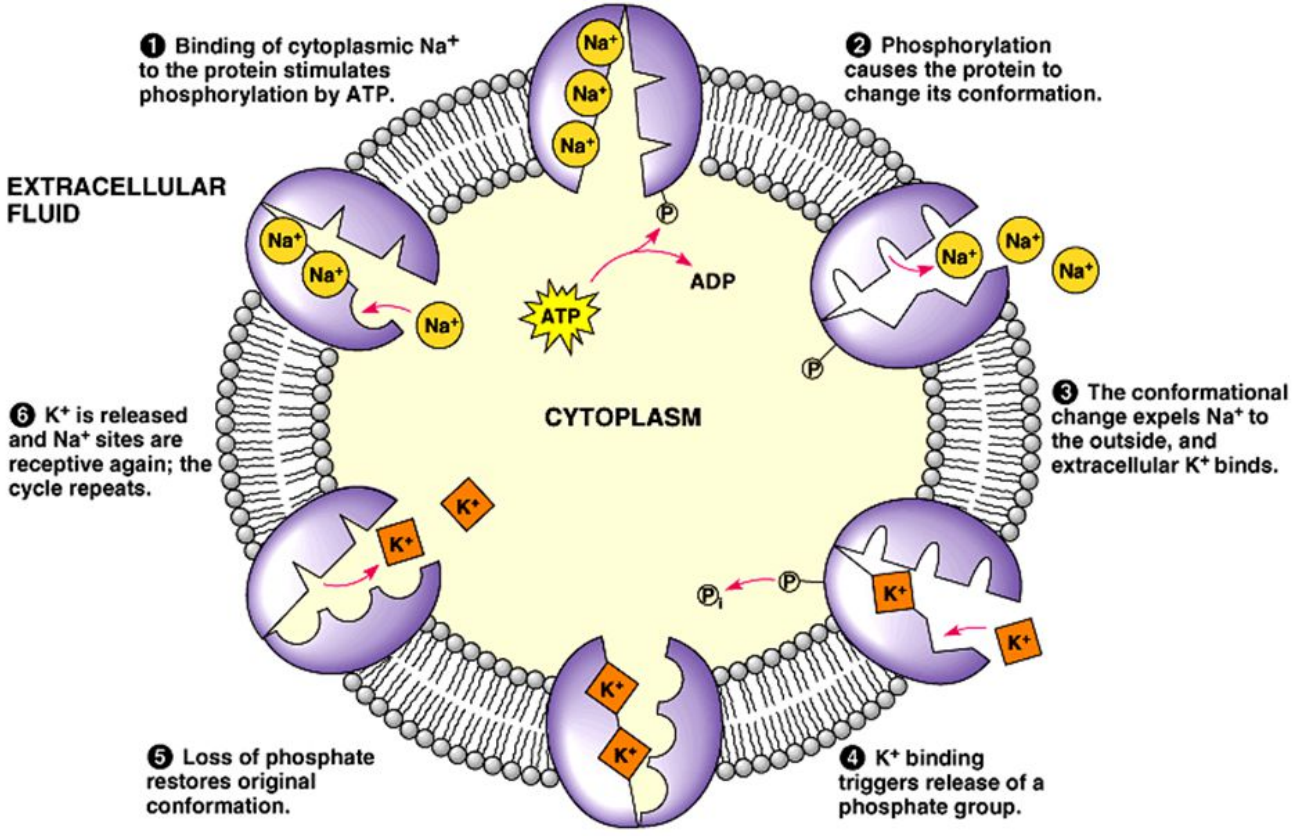


Figure 8.15 The sodium-potassium pump: a specific case of active transport



Recurrent laryngeal nerve (RLN)

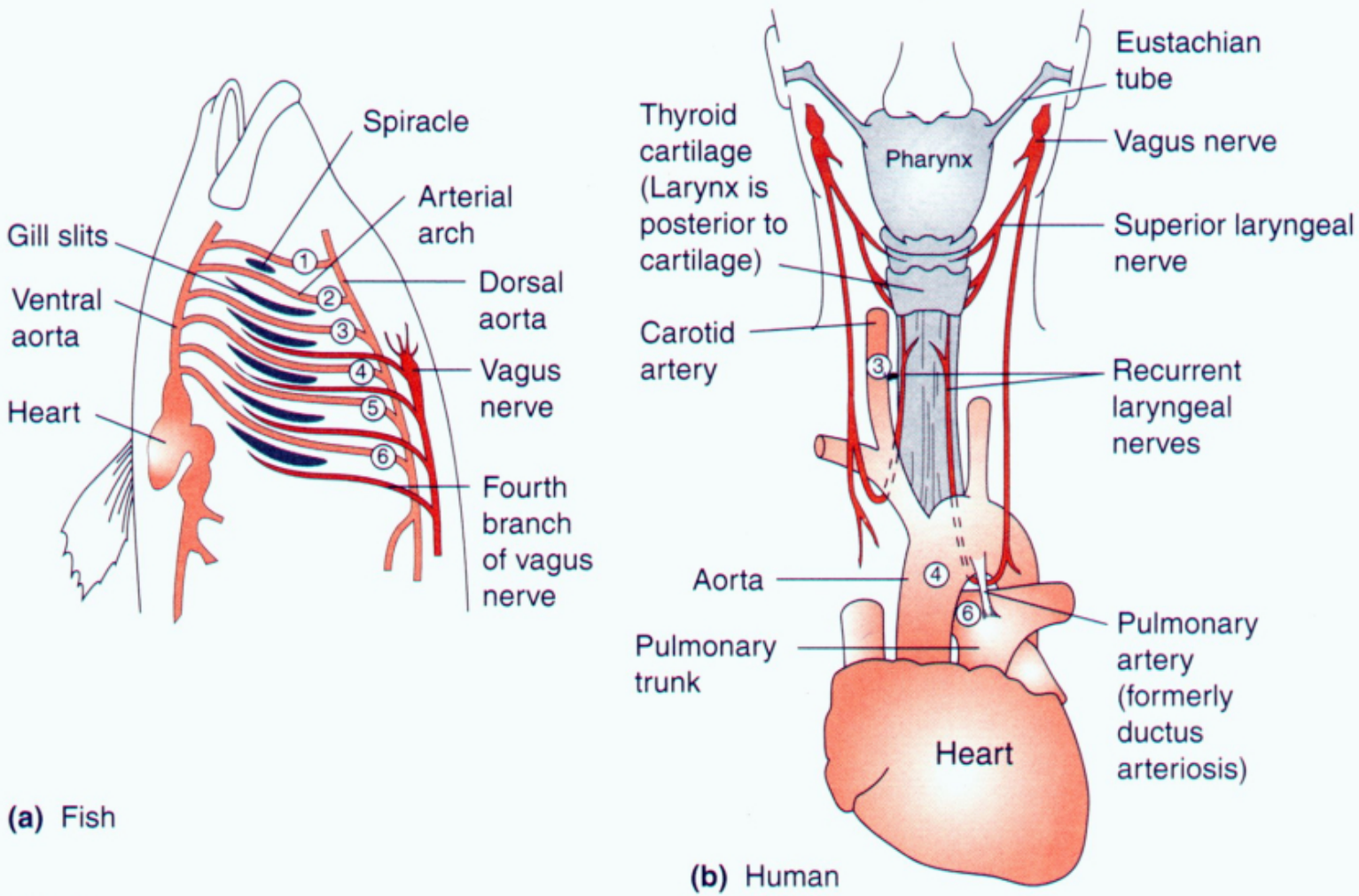
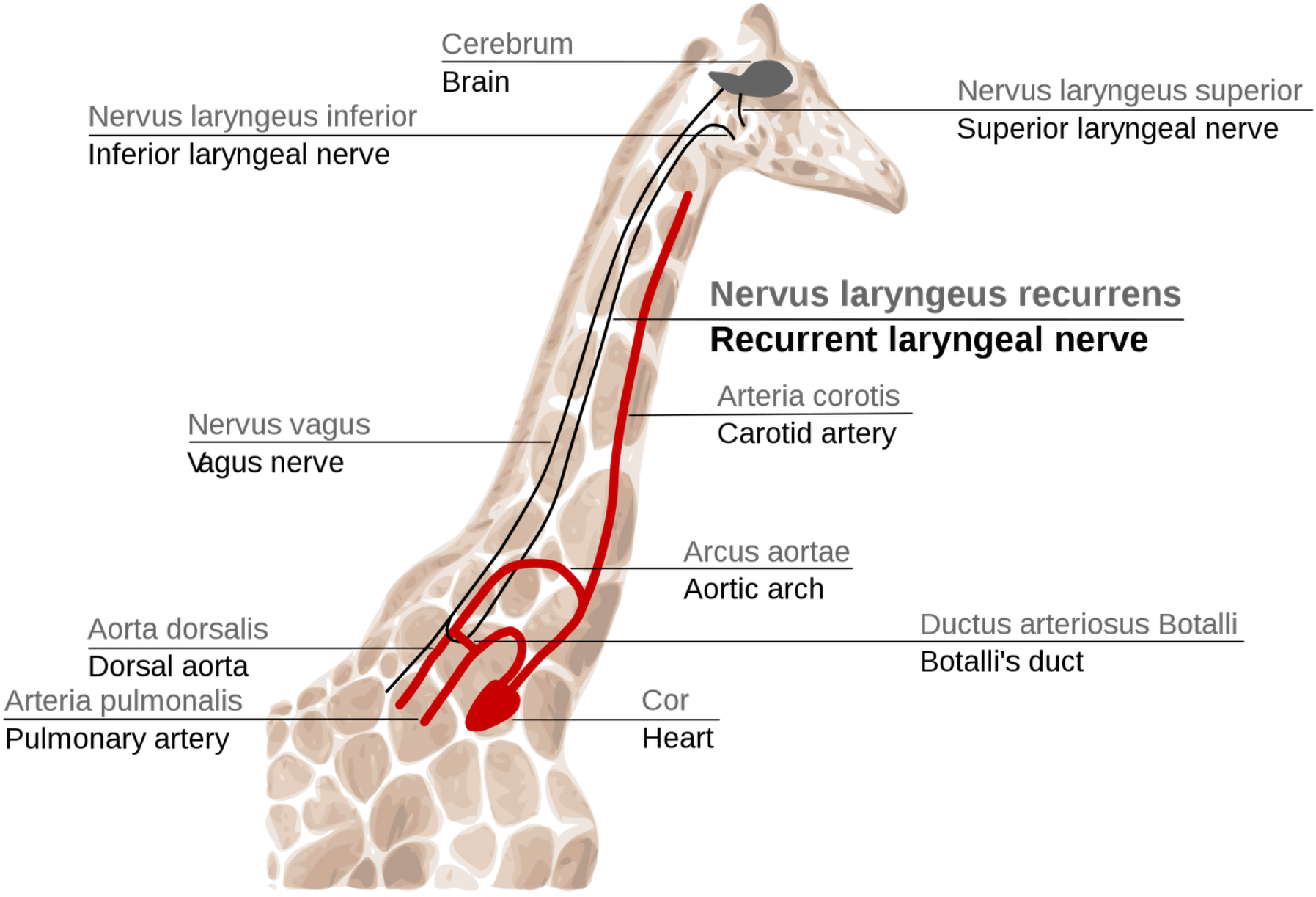
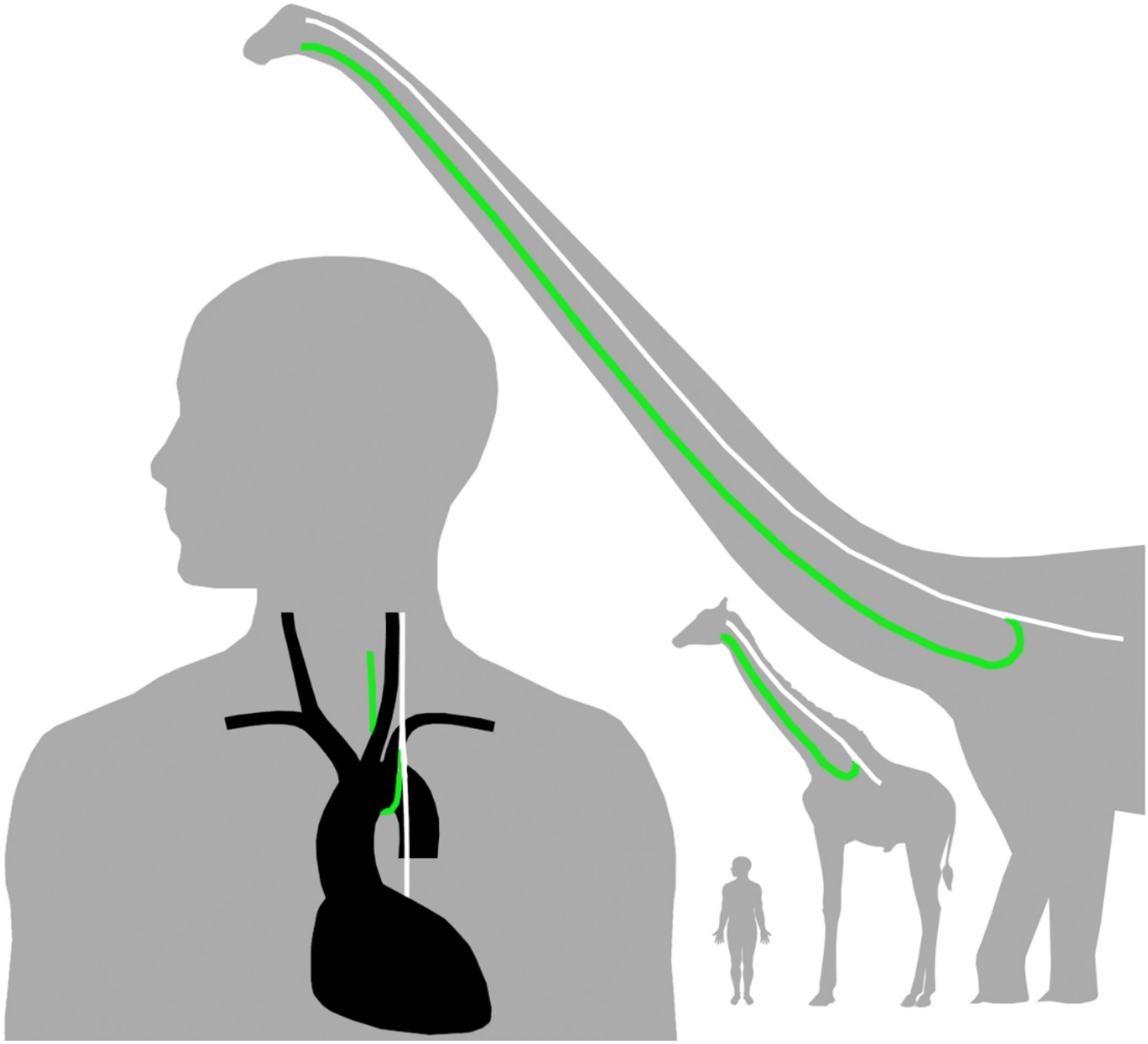


FIGURE 3-11 Schematic diagram showing the relationship between the vagus cranial nerve and the arterial arches in fish (*a*) and human (*b*). Only the third, fourth, and part of the sixth arterial arches remain in placental mammals, the sixth acting only during fetal development to carry blood to the placenta. The fourth vagal nerve in mammals (the recurrent laryngeal nerve) loops around the sixth arterial arch just as it did in the original fishlike ancestor, but must now travel a greater distance since the remnant of the sixth arch is in the thorax.

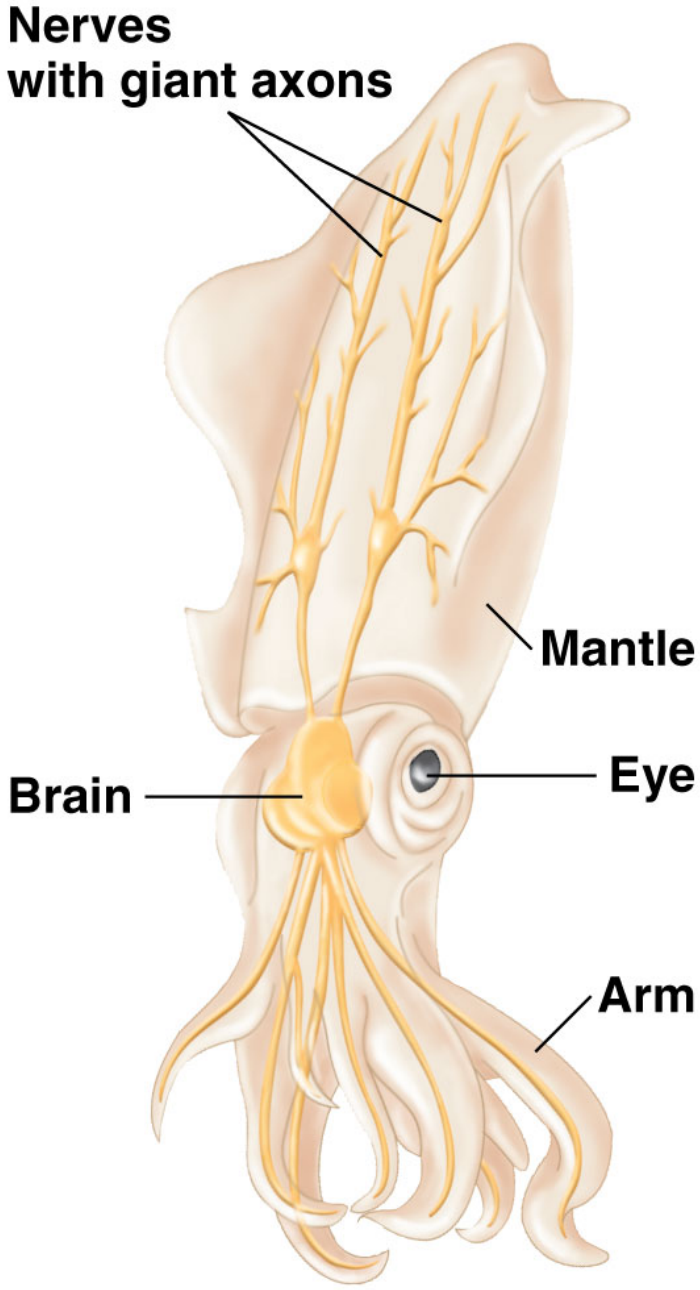
Giraffe RLN $\sim$ 4.6 m



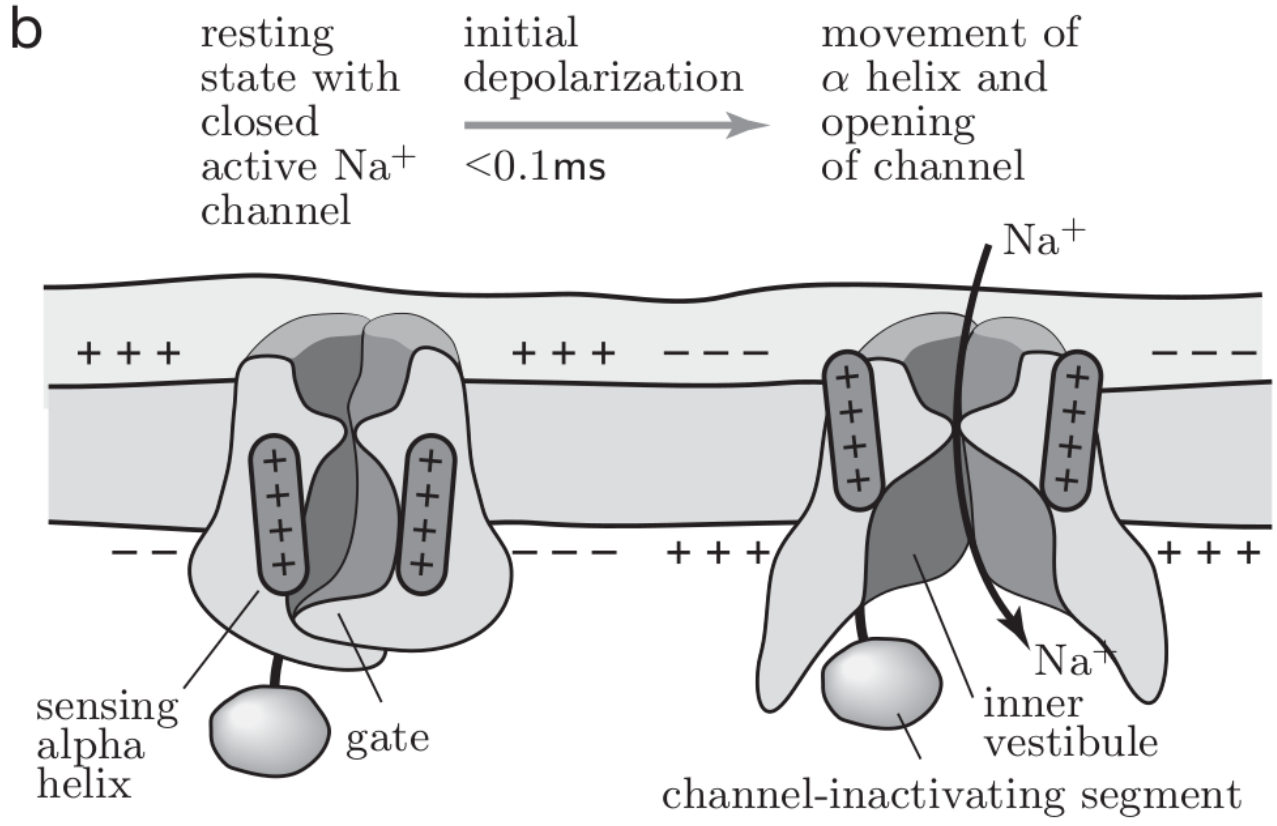
Sauropod RLN $\sim$ 38 m



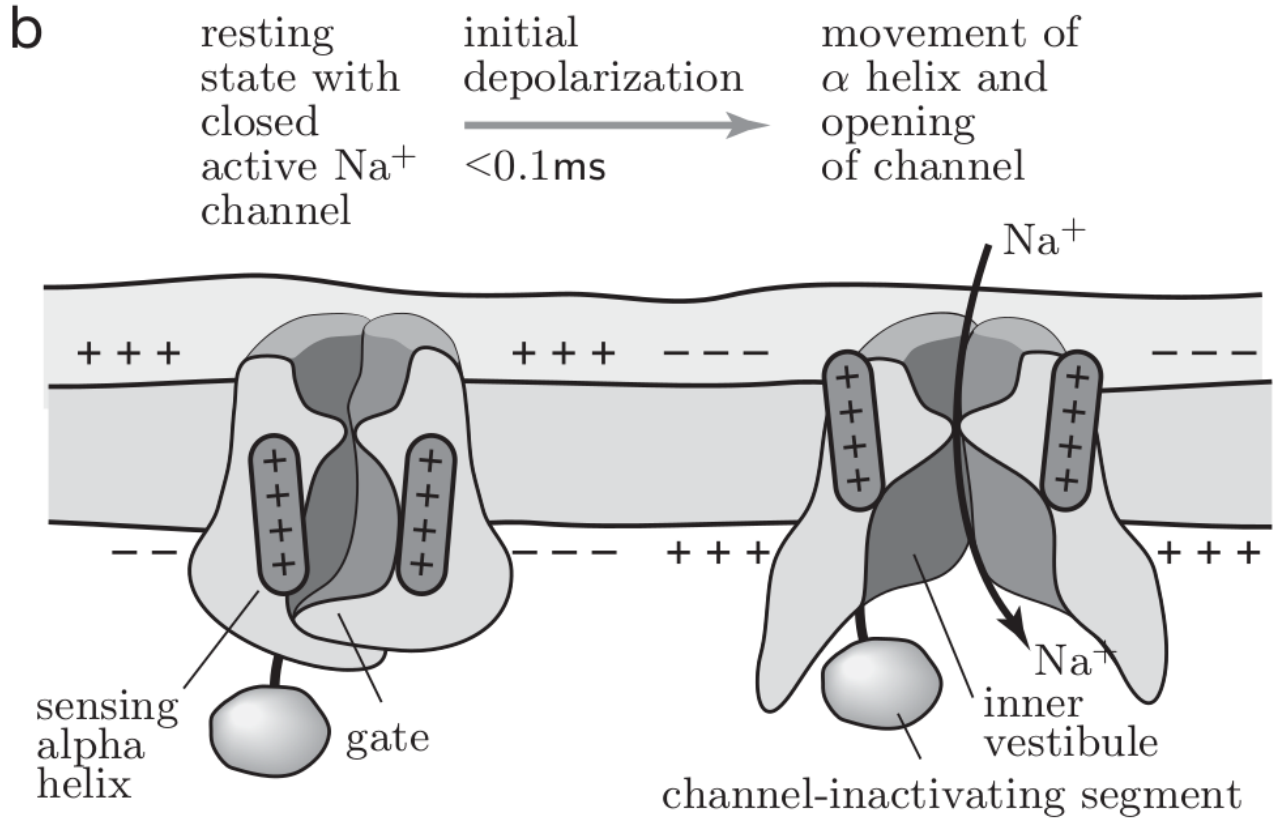
Squid giant axon (not giant squid axon)



Voltage-gated Na^+ channel



Voltage-gated Na^+ channel



Simple thermodynamic model: state 1 = **closed**, state 2 = **open**

$$\frac{k_{21}}{k_{12}} = e^{-\beta(G_2 - G_1 - Q\ell V/d)}$$

where Q is the "gating charge", ℓ is the distance it moves, and V/d is the electric field ($d = 4$ nm is membrane thickness).

Voltage-gated Na^+ channel

Probability for channel to be open in stationary state at given V:

$$p_{Na}(V) = p_2^s = \frac{k_{21}}{k_{21} + k_{12}} = \frac{1}{1 + e^{\beta(G_2 - G_1 - Q\ell V/d)}}$$