

(a)

**Soma:**

Skin

Muscle

Bone

**Viscera:**

Lungs

Heart

Liver

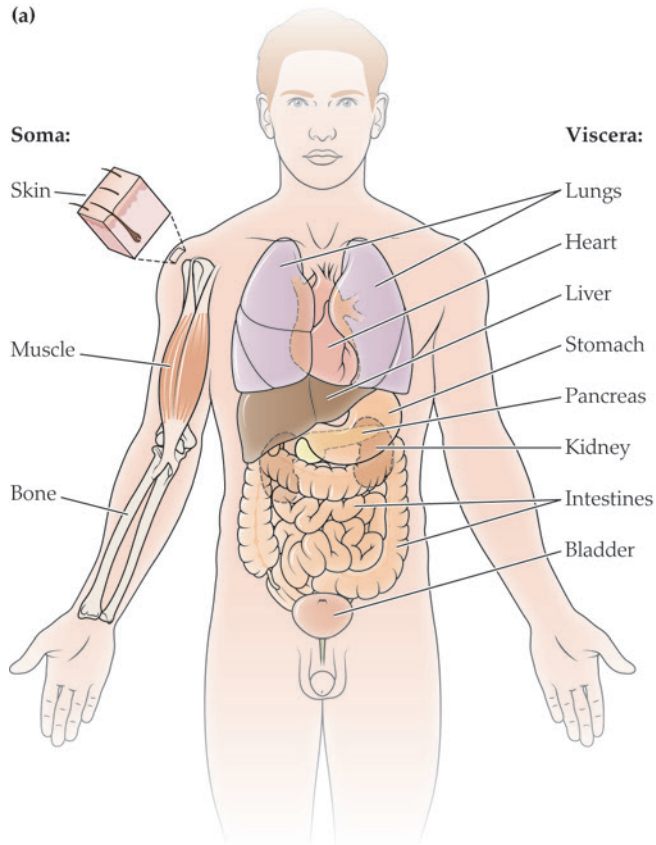
Stomach

Pancreas

Kidney

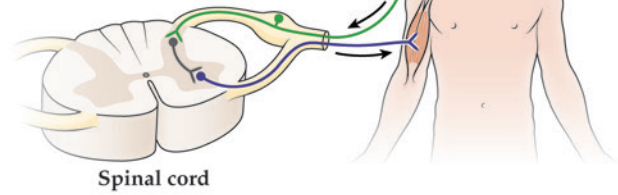
Intestines

Bladder

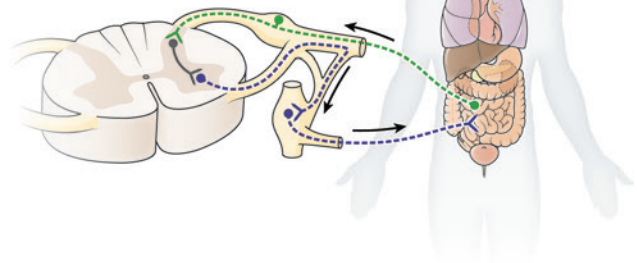


(b)

— Somatosensory neurons (input)  
— Motor neurons (output)

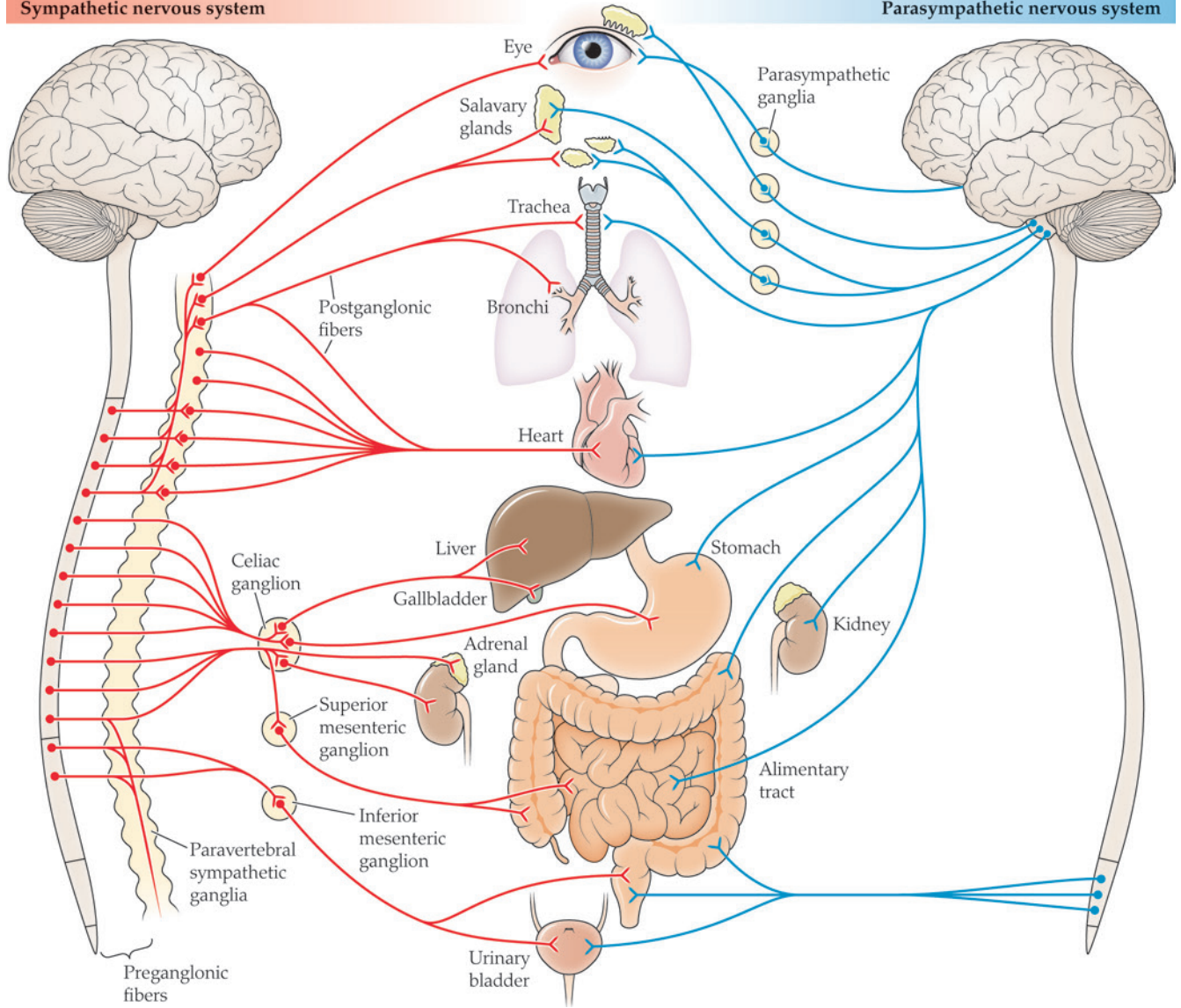


--- Visceral sensory neurons (input)  
--- Visceral (autonomic) motor neurons (output)

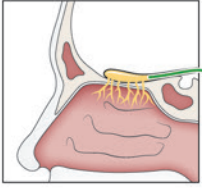


Sympathetic nervous system

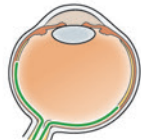
Parasympathetic nervous system



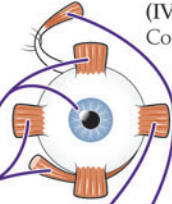
**(I) Olfactory**  
Carries signals for the sense of smell from the nasal passage to the brain



**(II) Optic**  
Carries visual signals from the retina to the thalamus



**(III) Oculomotor**  
Controls eye movement and pupillary constriction



**(IV) Trochlear**  
Controls eye movement

**(VI) Abducens**  
Controls eye movement

Motor fibers  
Sensory fibers

**(V) Trigeminal**  
Controls the muscles of mastication (chewing); involved in the sensation of touch and pain by the face and mouth

**(VII) Facial and intermediate**  
Carries signals for the sense of taste (anterior 2/3 of tongue); controls the muscles of facial expression; involved in the secretion of tears and saliva

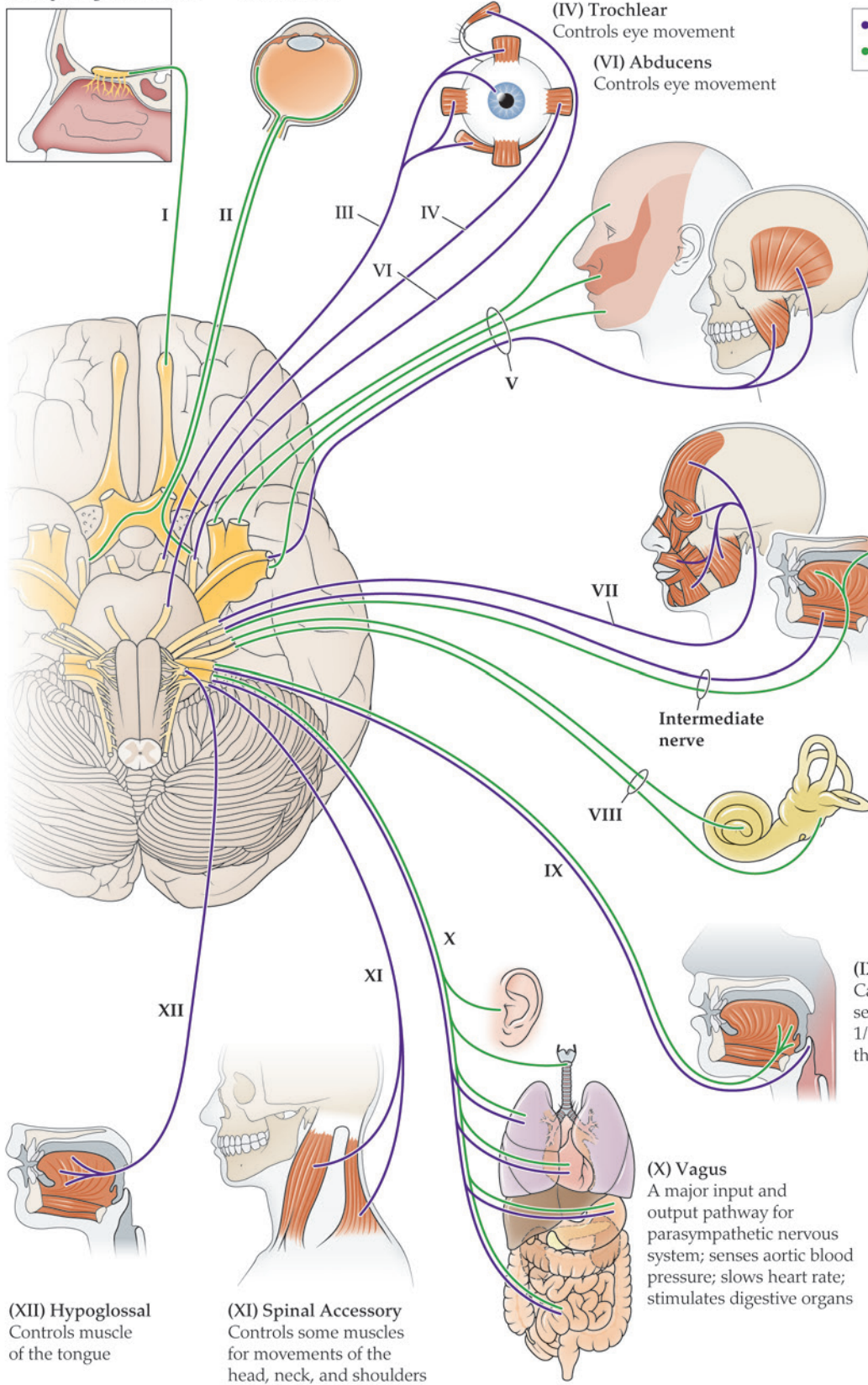
**(VIII) Vestibulocochlear**  
Carries signals for the senses of hearing and balance

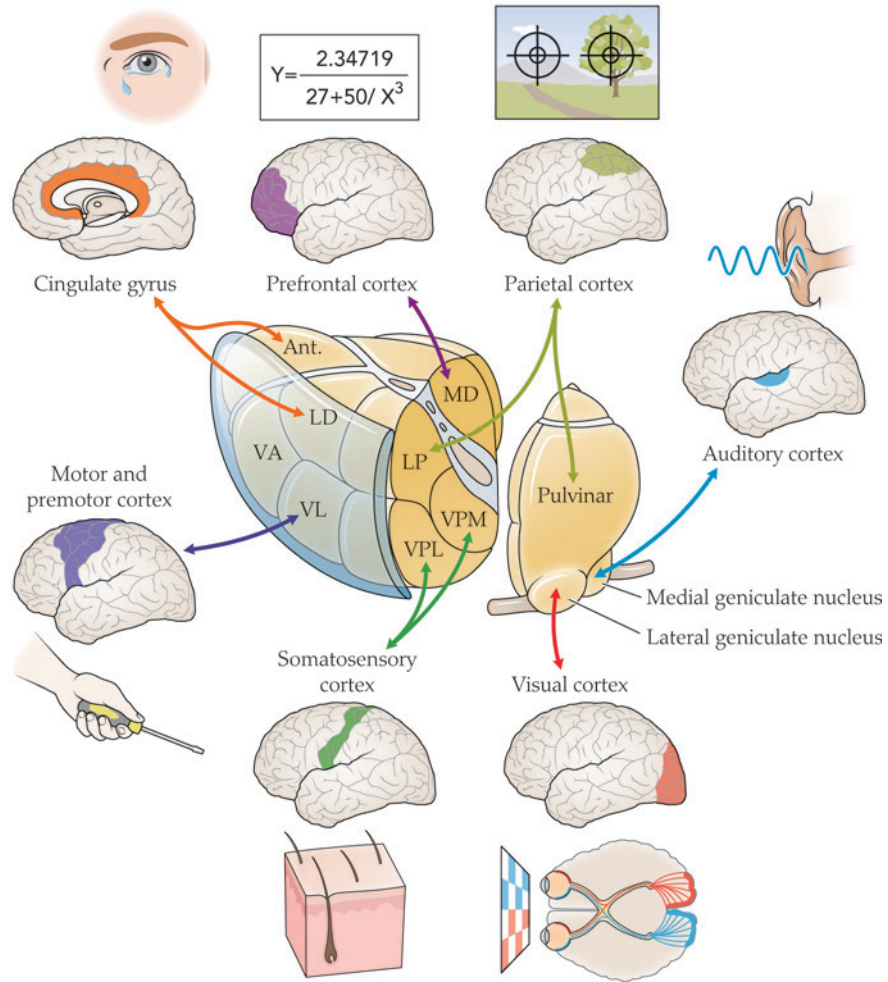
**(IX) Glossopharyngeal**  
Carries signals for the sense of taste (posterior 1/3 of tongue); mediates the swallowing reflex

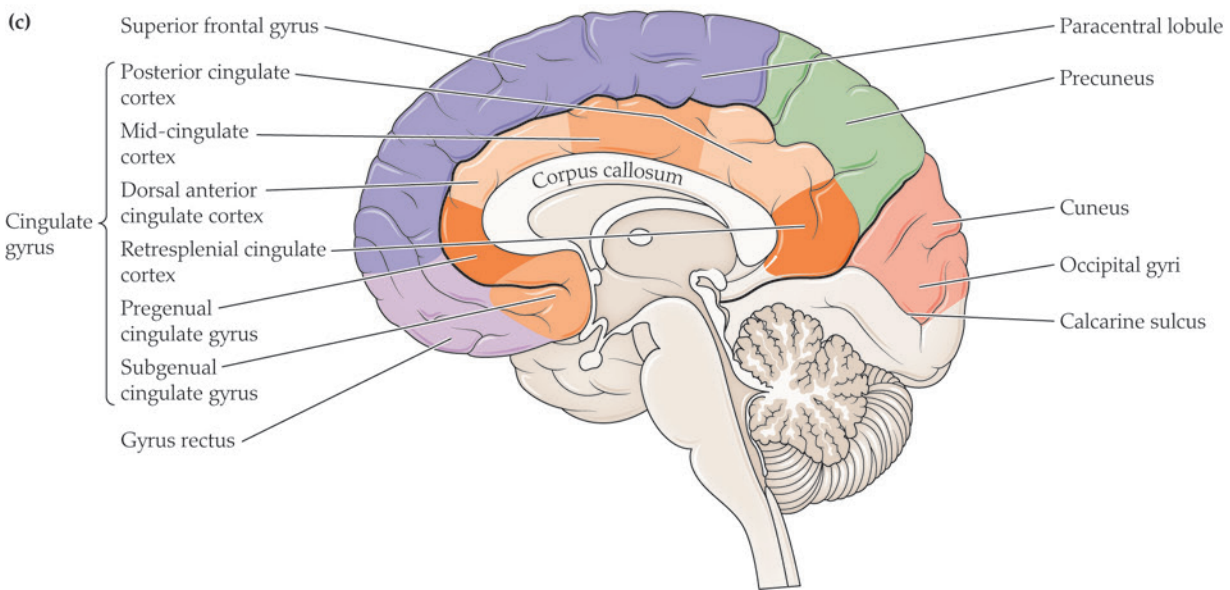
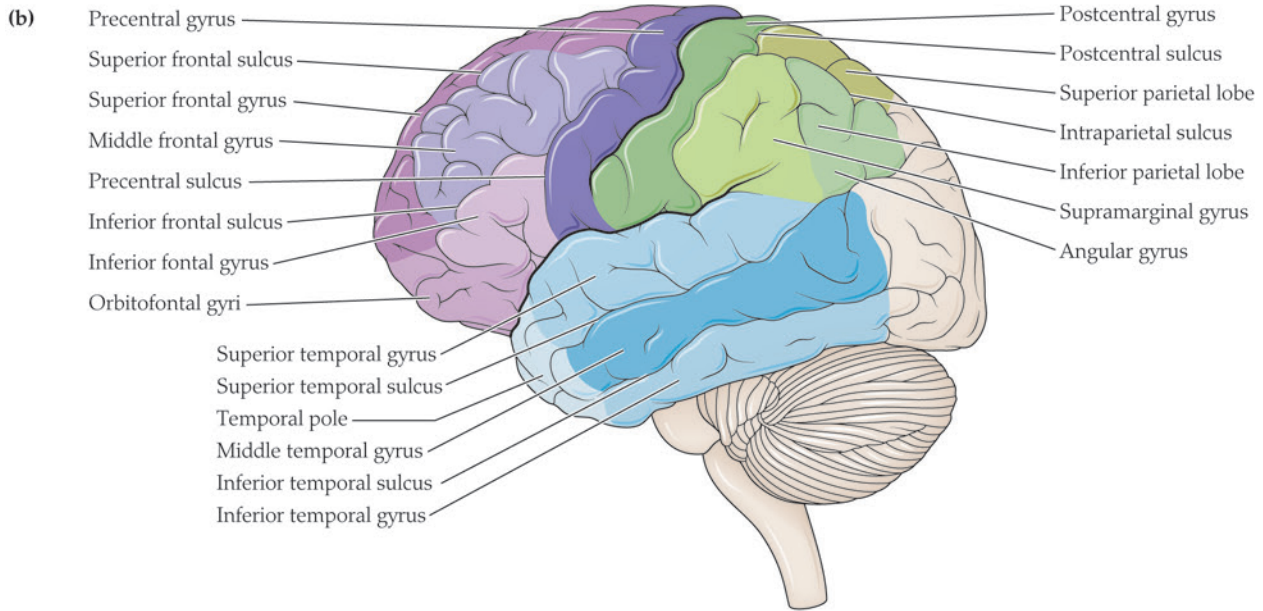
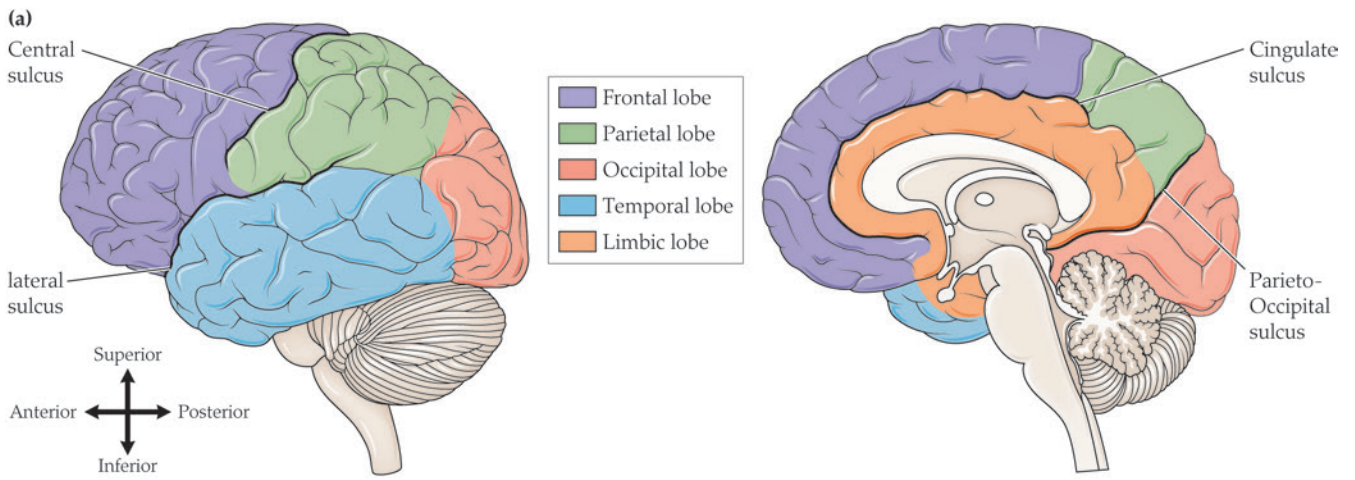
**(X) Vagus**  
A major input and output pathway for parasympathetic nervous system; senses aortic blood pressure; slows heart rate; stimulates digestive organs

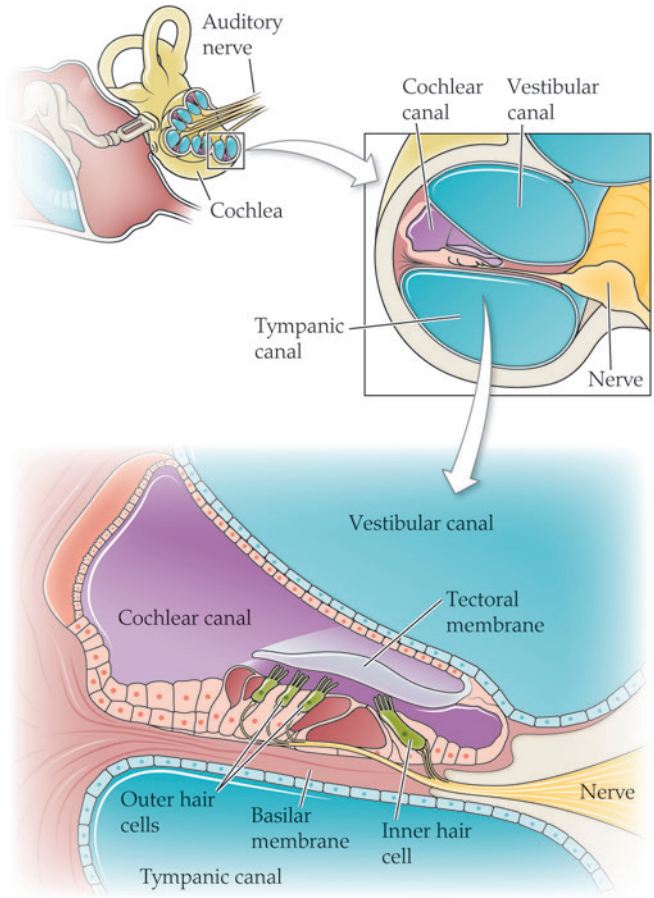
**(XII) Hypoglossal**  
Controls muscle of the tongue

**(XI) Spinal Accessory**  
Controls some muscles for movements of the head, neck, and shoulders

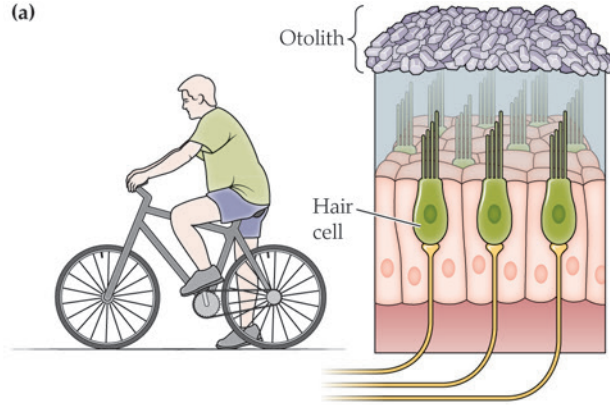




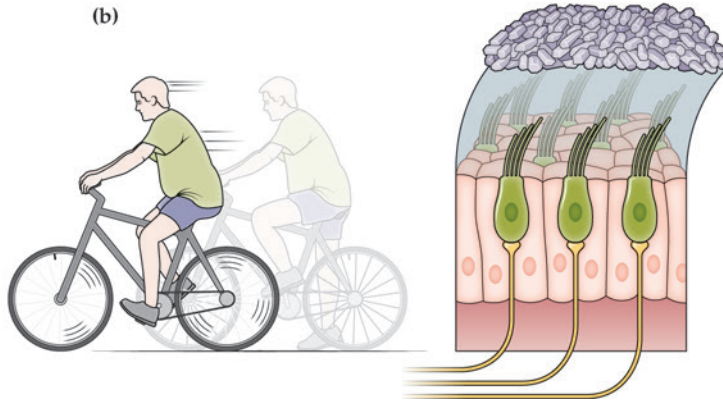


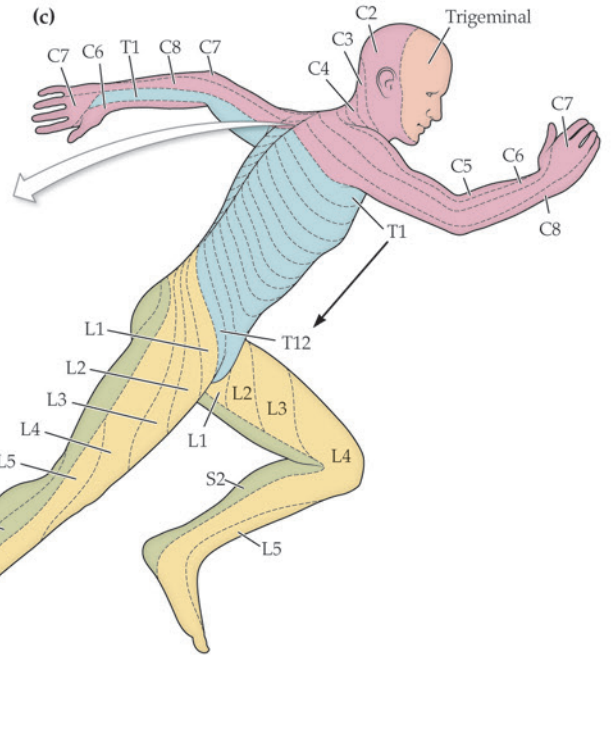
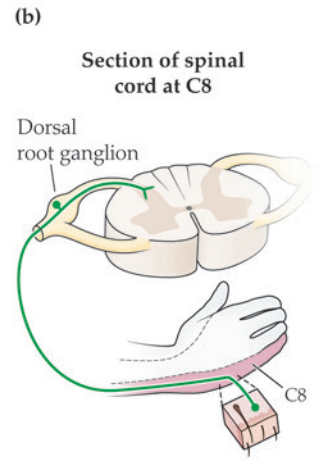
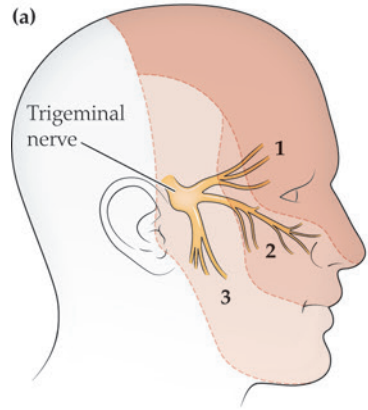


(a)

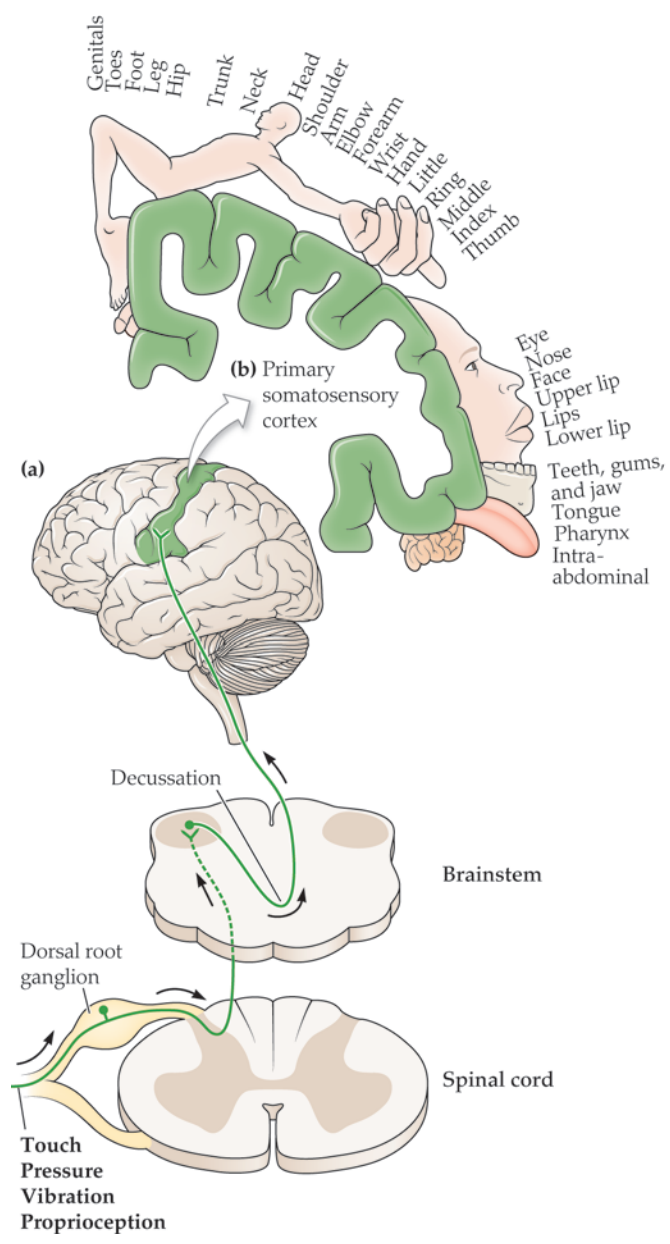


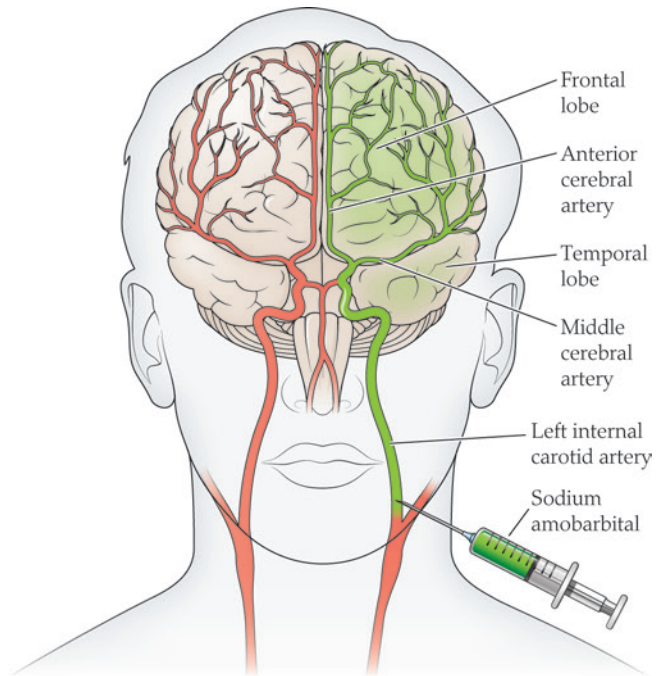
(b)











Cognition

$$Y = \frac{2.34719}{27 + 50/X^3}$$

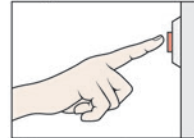
Dorsolateral prefrontal cortex

Complex movements

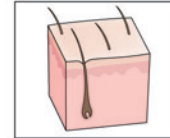


Premotor area

Simple movements



Primary motor cortex



Somatosensory cortex

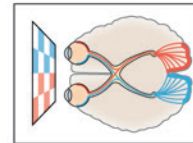
Ventrolateral prefrontal cortex

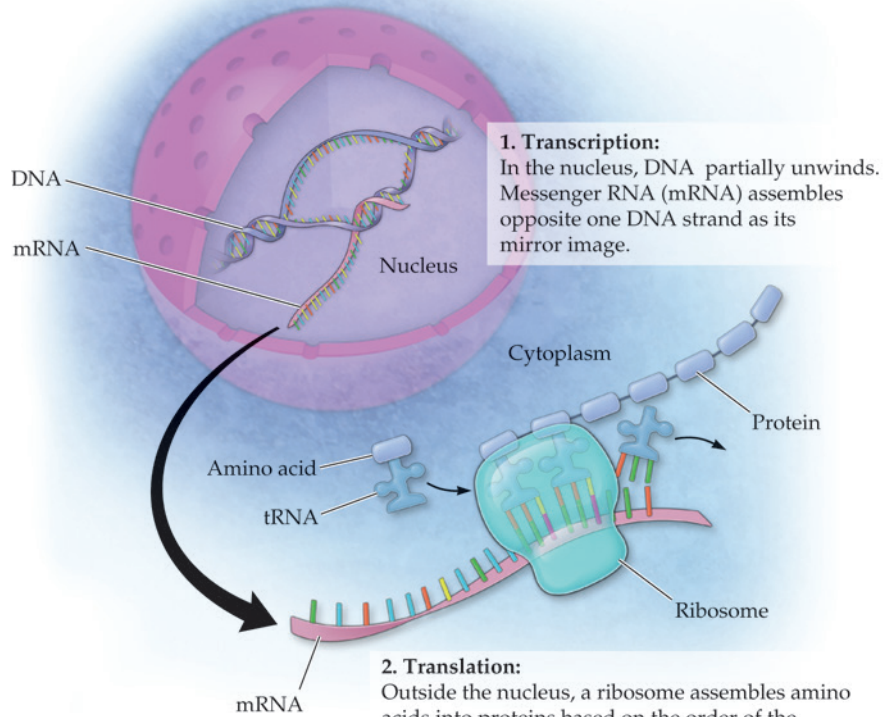
Auditory cortex



Parietal cortex

Visual cortex





**1. Transcription:**  
In the nucleus, DNA partially unwinds. Messenger RNA (mRNA) assembles opposite one DNA strand as its mirror image.

**2. Translation:**  
Outside the nucleus, a ribosome assembles amino acids into proteins based on the order of the nucleotide bases in the mRNA. Transfer RNA (tRNA) brings amino acids to the ribosome and organizes them based on the order of mRNA base pairs.

**Cell membrane:**  
Separates internal and external cellular environment

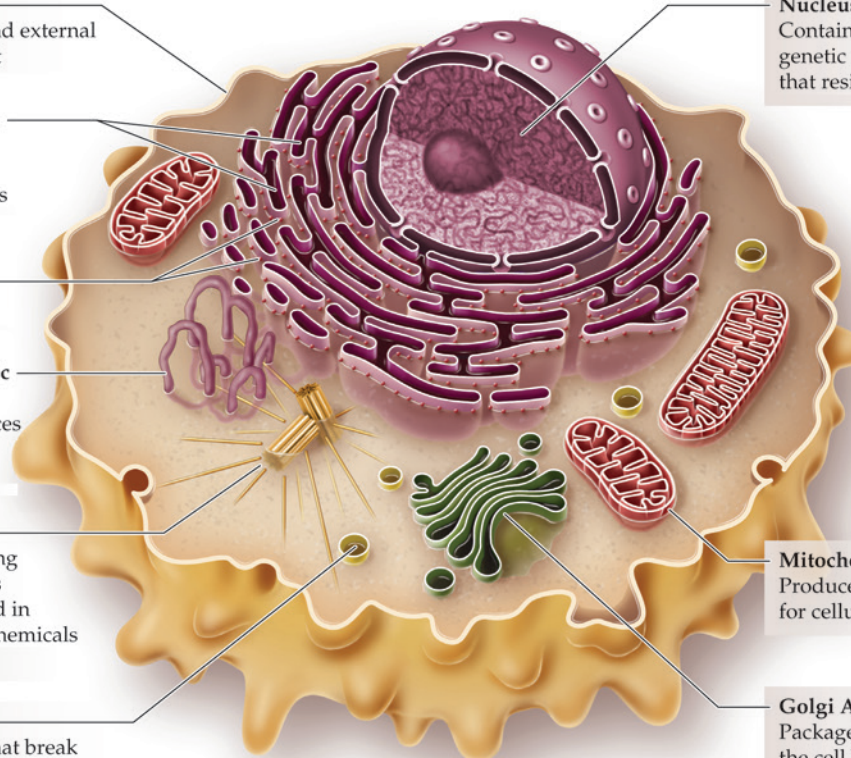
**Rough endoplasmic reticulum:**  
Has ribosomes that manufacture proteins

**Ribosome:**  
Primary site of protein synthesis

**Smooth endoplasmic reticulum:**  
Synthesizes substances such as lipids and steroids

**Cytoskeleton:**  
Consists of scaffolding by structures such as microtubules that aid in the transport of biochemicals within the cell

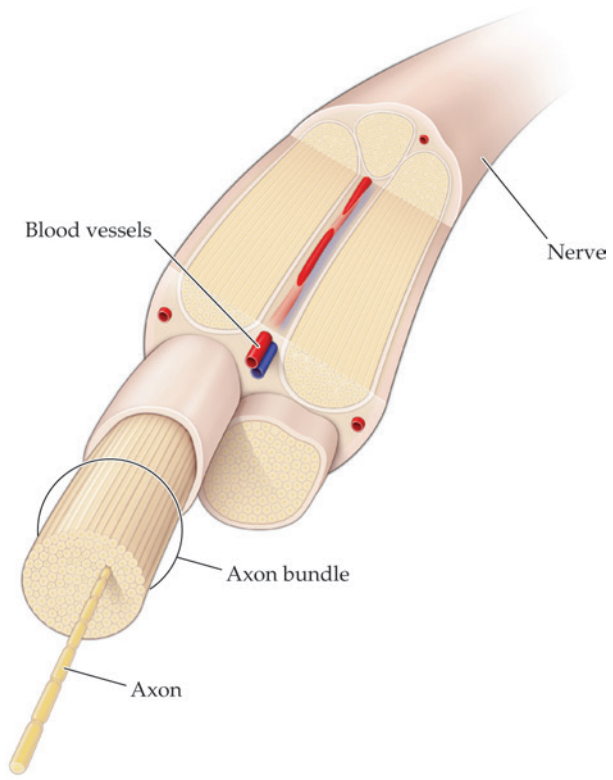
**Lysosome:**  
Contains enzymes that break down molecules such as proteins and lipids

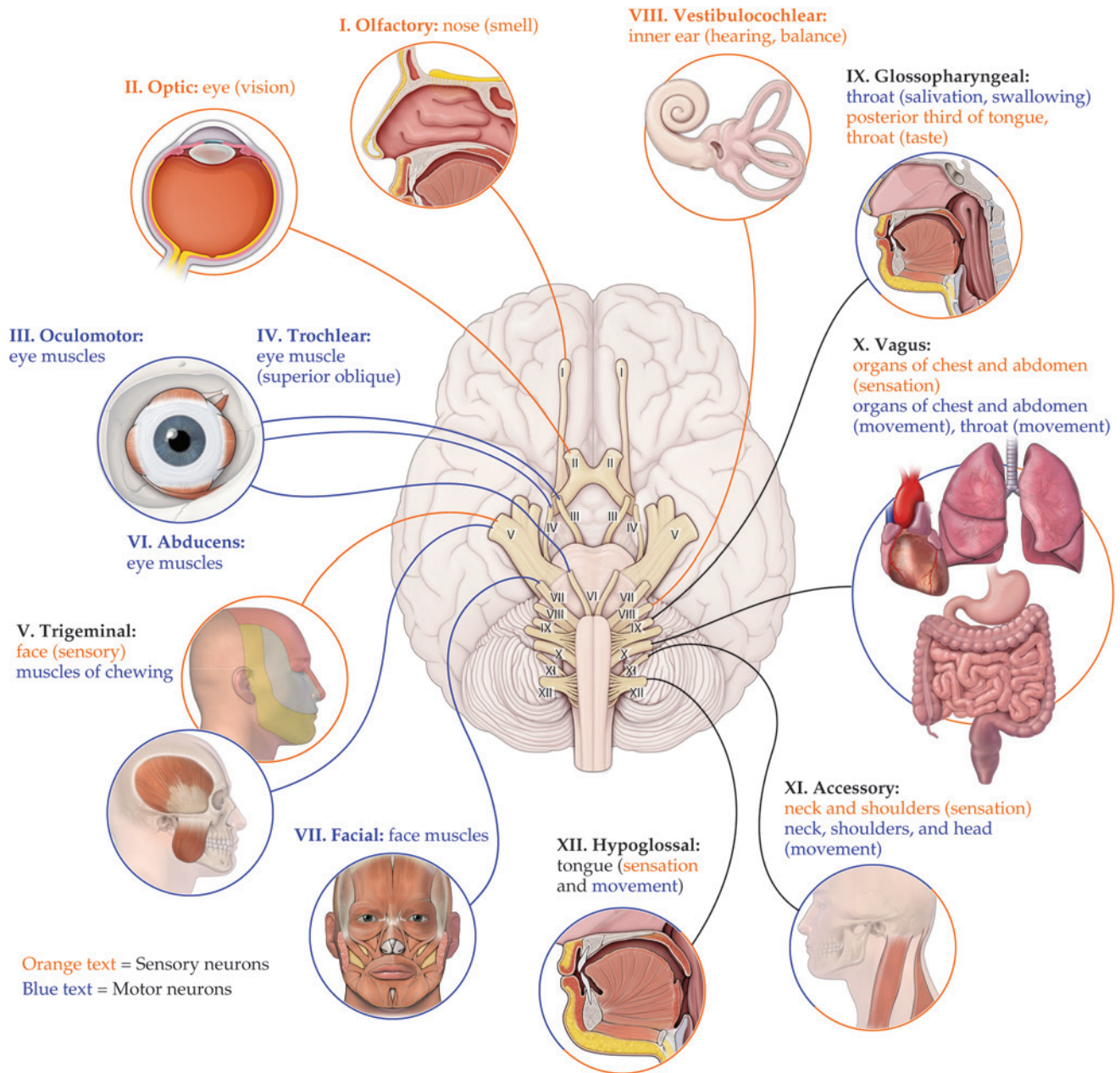


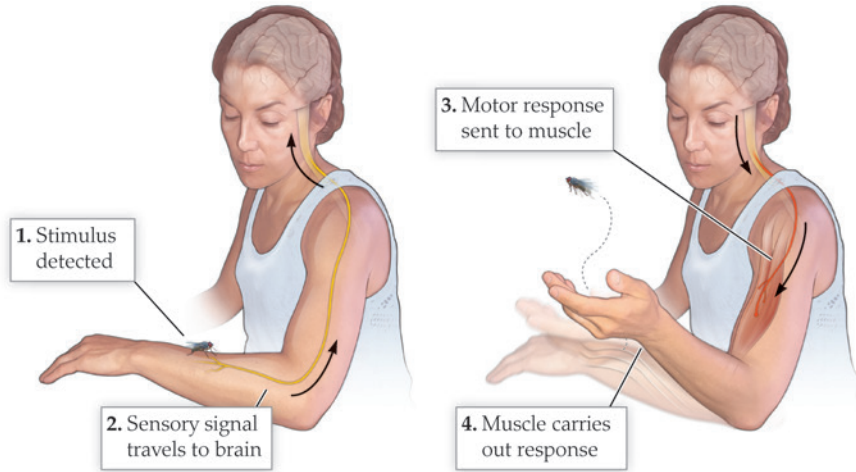
**Nucleus:**  
Contains most of the cell's genetic material such as the genes that reside on the chromosomes

**Mitochondria:**  
Produces energy necessary for cellular functions

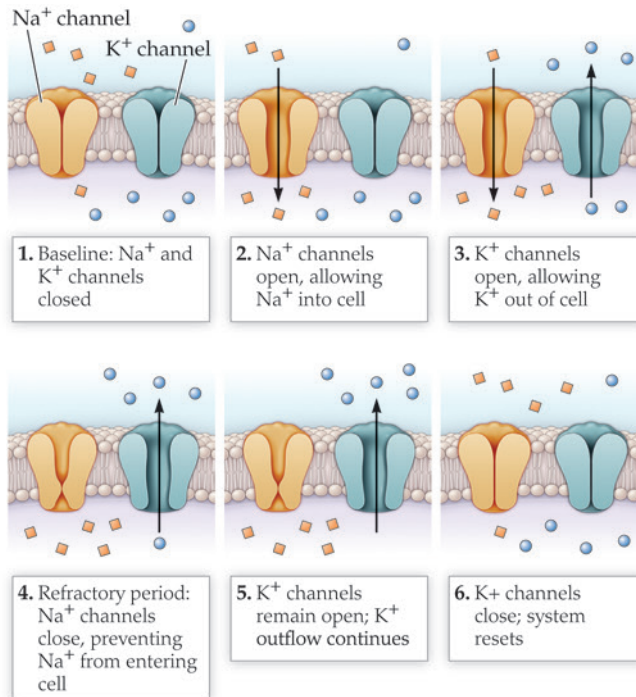
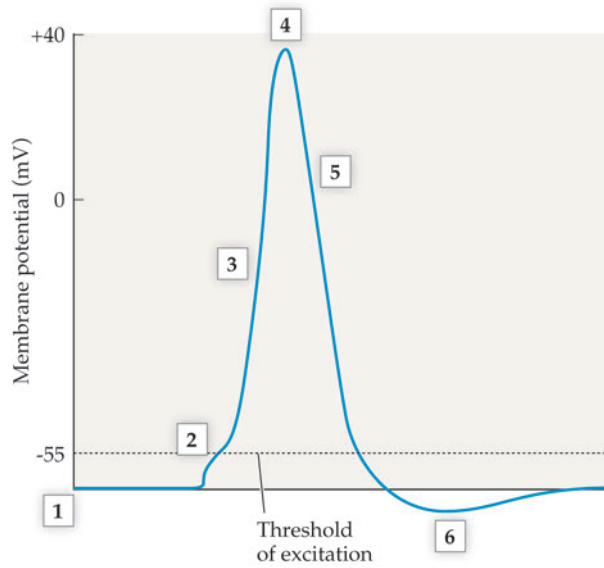
**Golgi Apparatus:**  
Packages proteins within the cell before they are sent to their destination

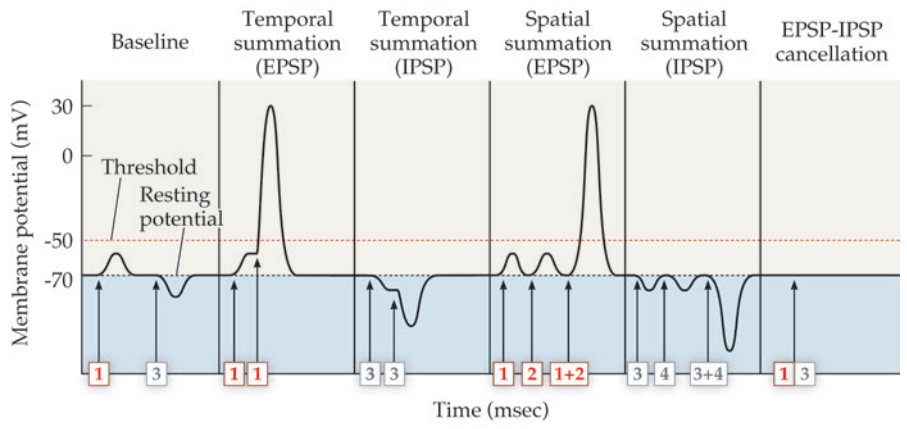
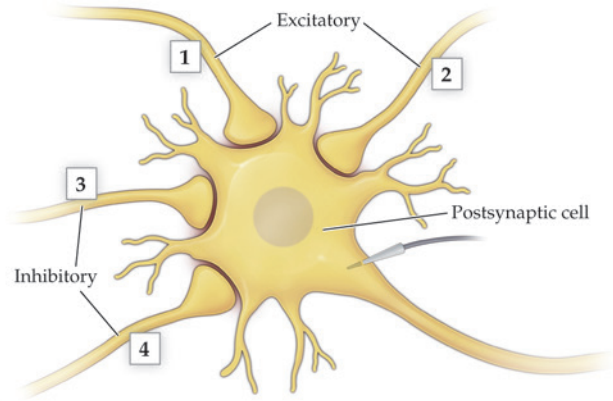


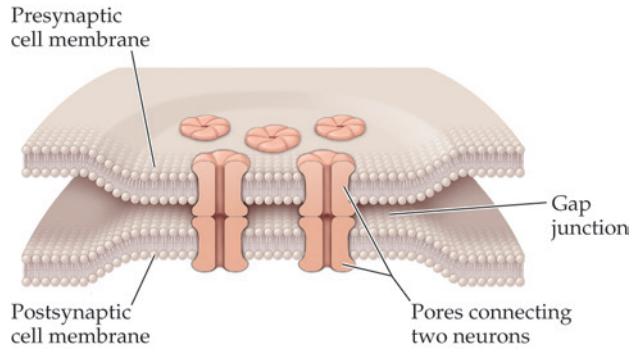


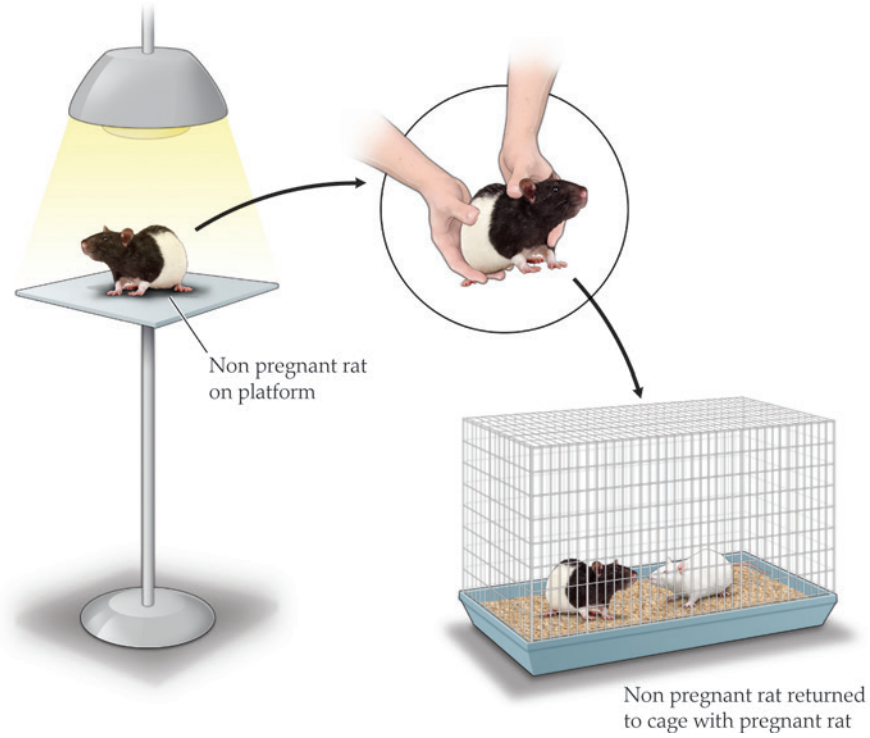


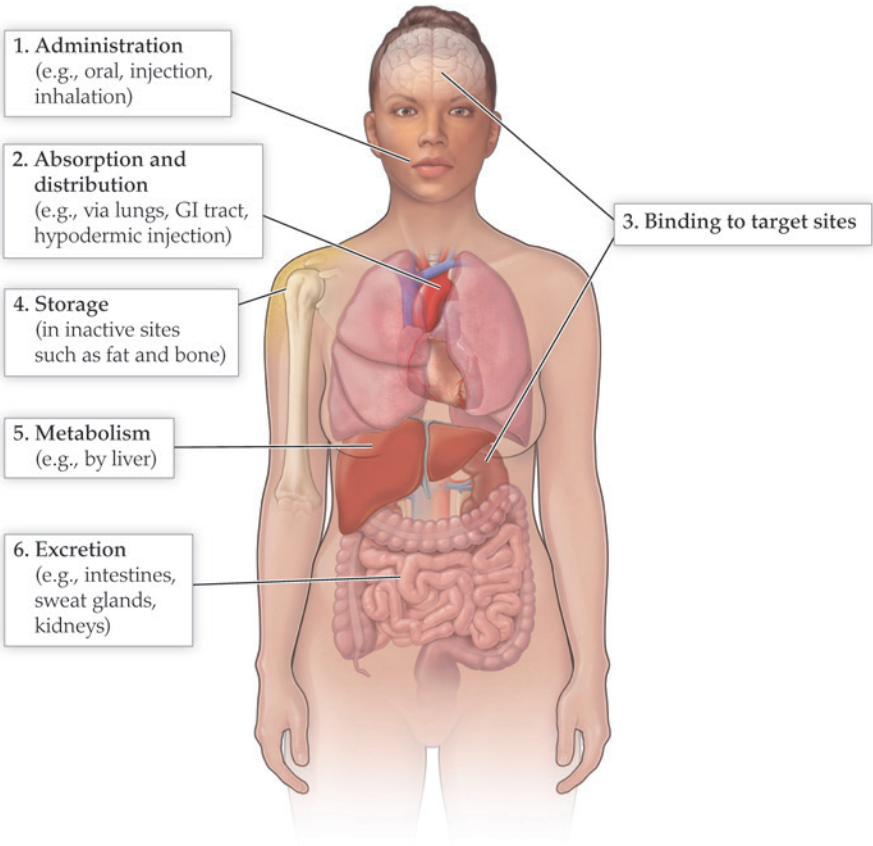




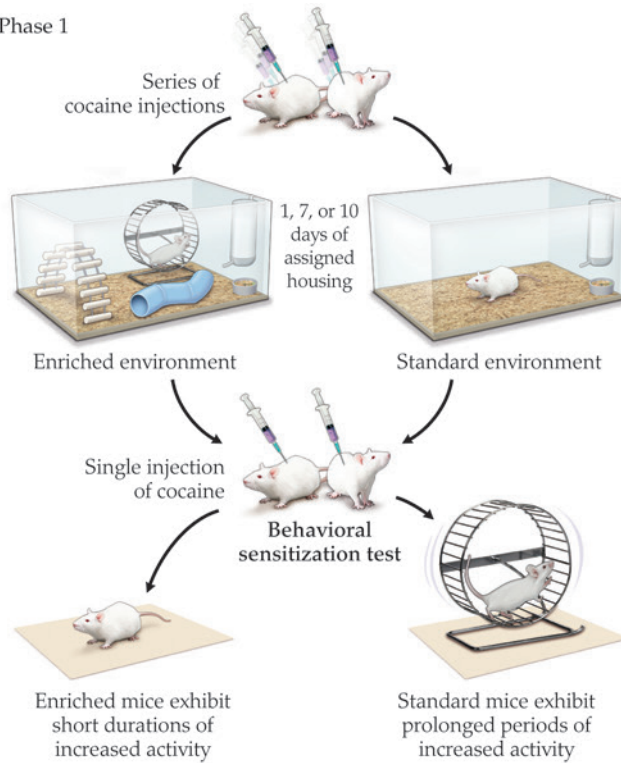




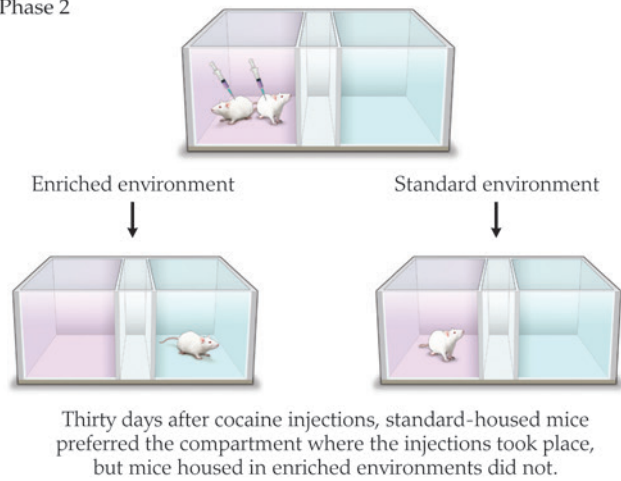




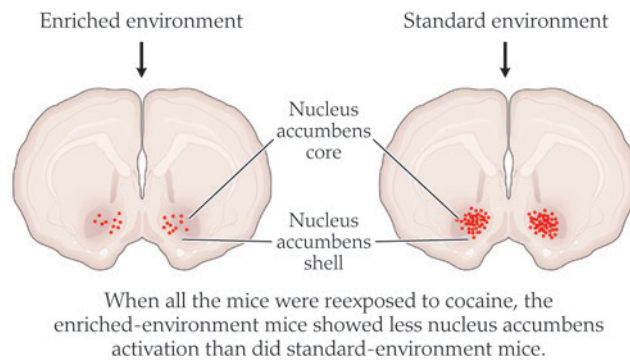
Phase 1

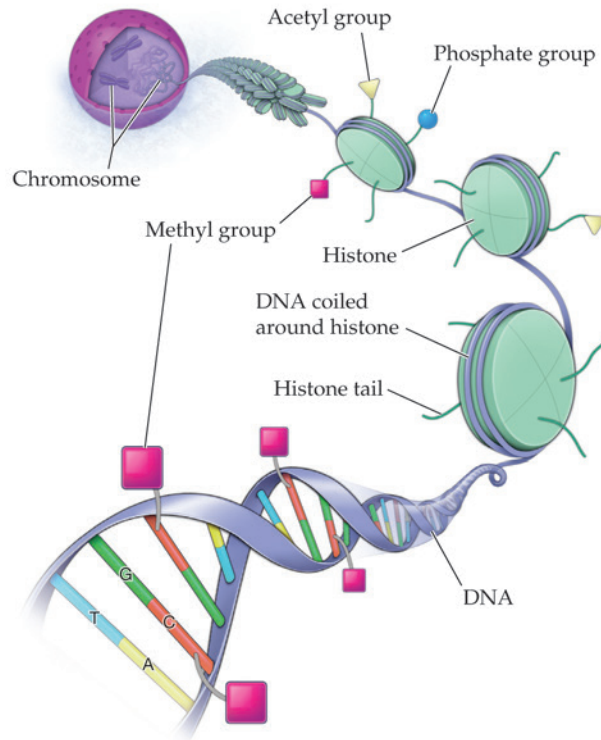


Phase 2

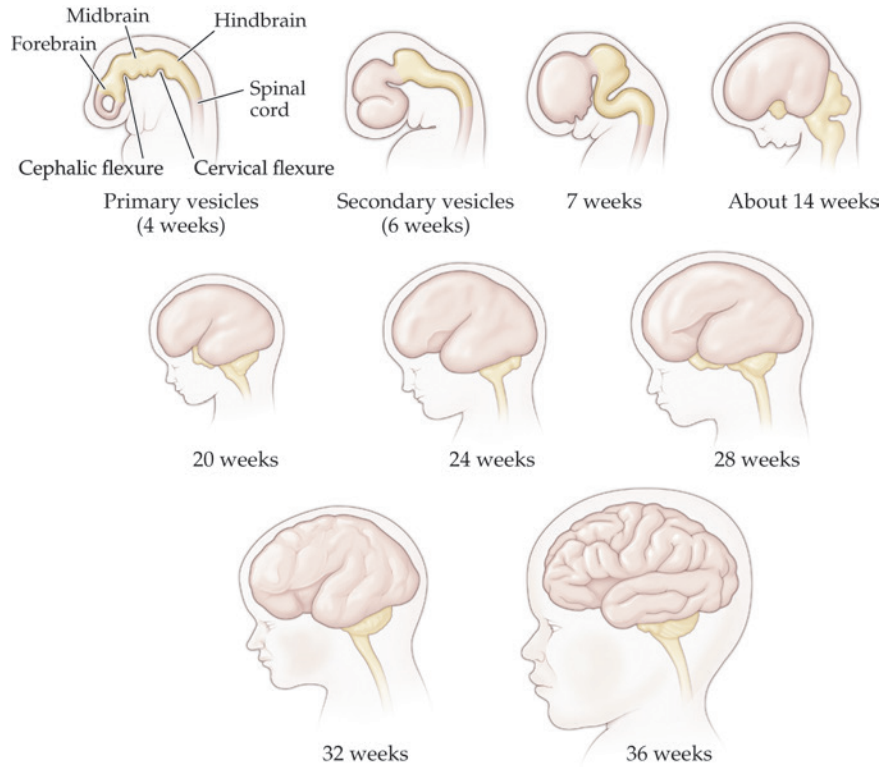


Phase 3

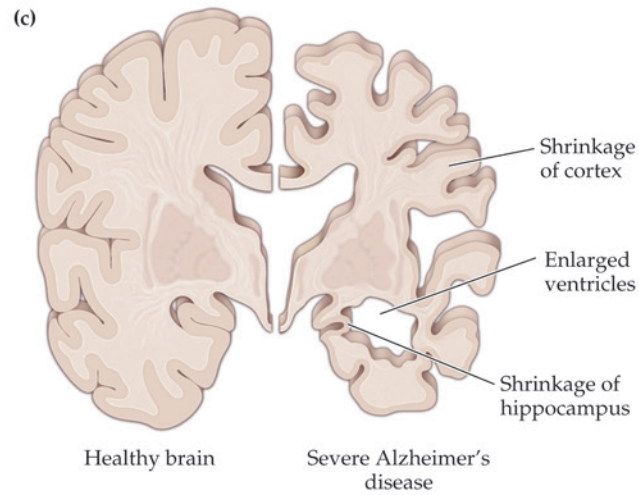
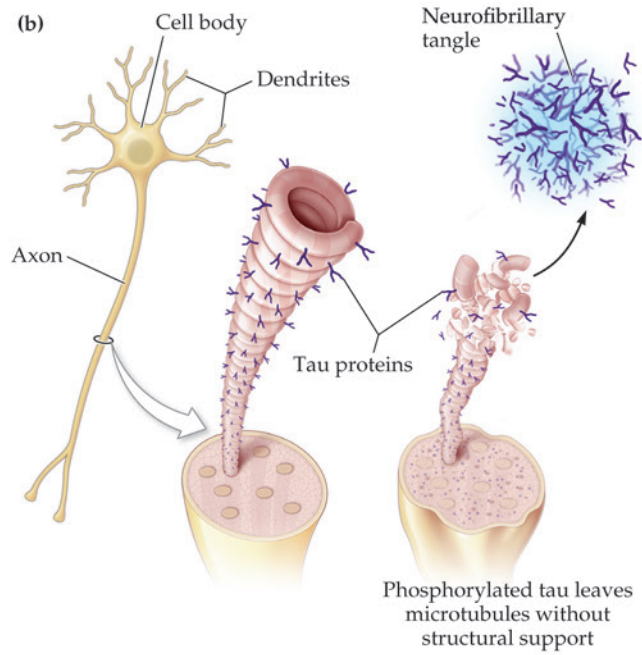
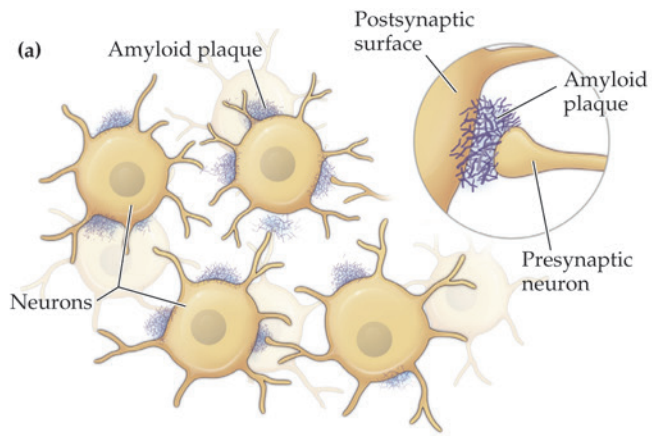


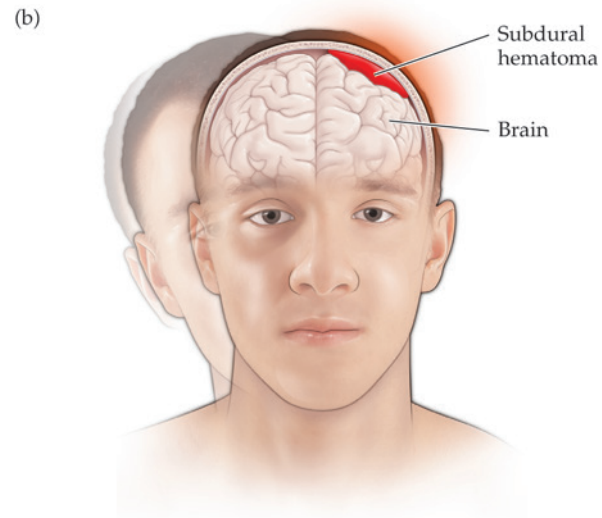
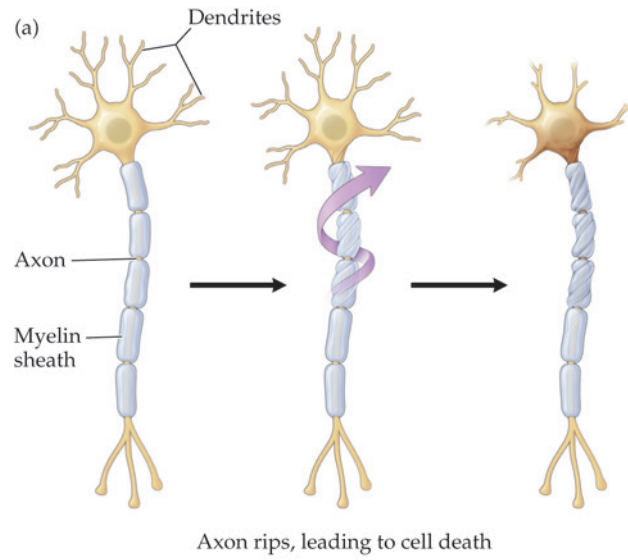


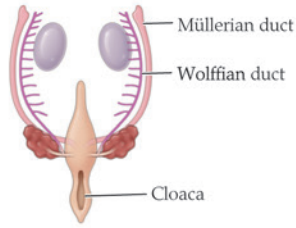
Chemical markers on DNA can affect gene expression. Histone modification occurs throughout an organism's life. Removal of methyl groups occurs at fertilization, during fetal development, and immediately after birth.



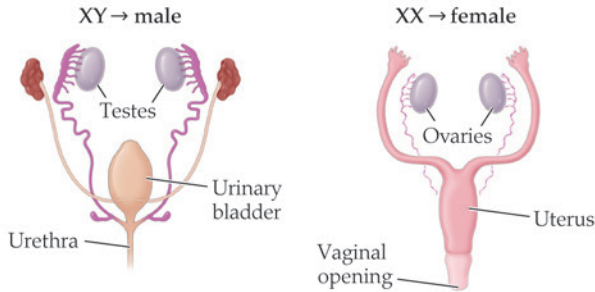




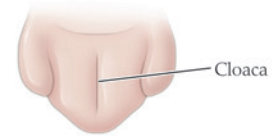
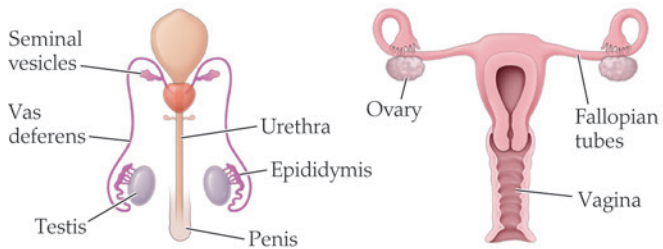




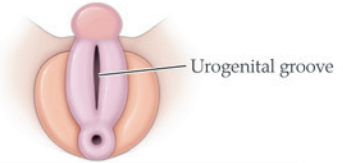
Six weeks following conception, males and females have the same internal anatomy.



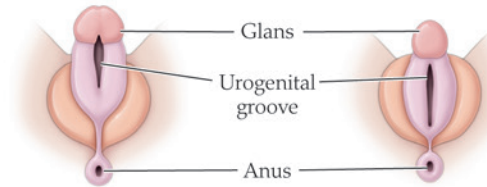
Fourteen weeks following conception, in males the Wolffian ducts have begun to develop into the male internal reproductive organs. In females, the Müllerian ducts have begun to develop into the female internal reproductive organs.



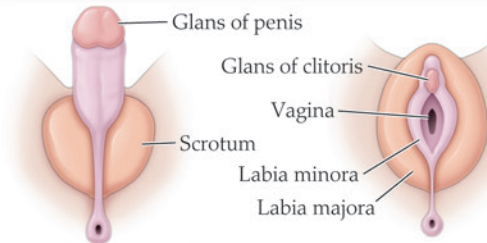
4 weeks



Six weeks following conception, males and females have the same external anatomy.

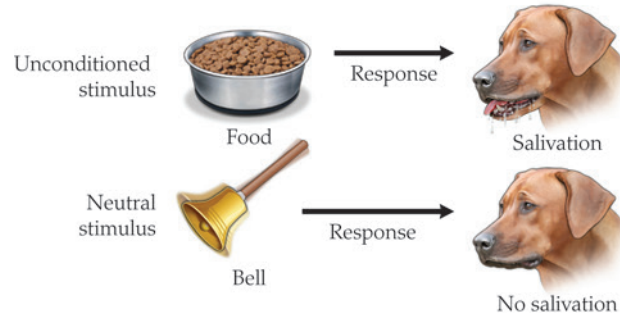


Nine weeks following conception, the male and female external genitalia have begun to differentiate.

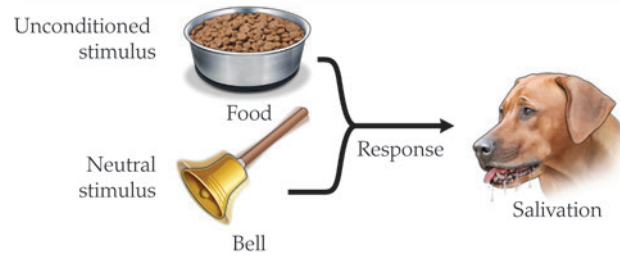


Fourteen weeks following conception, male and female external genitalia have fully differentiated.

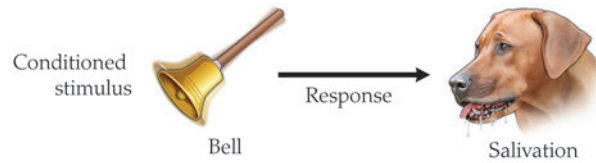
### Stage 1

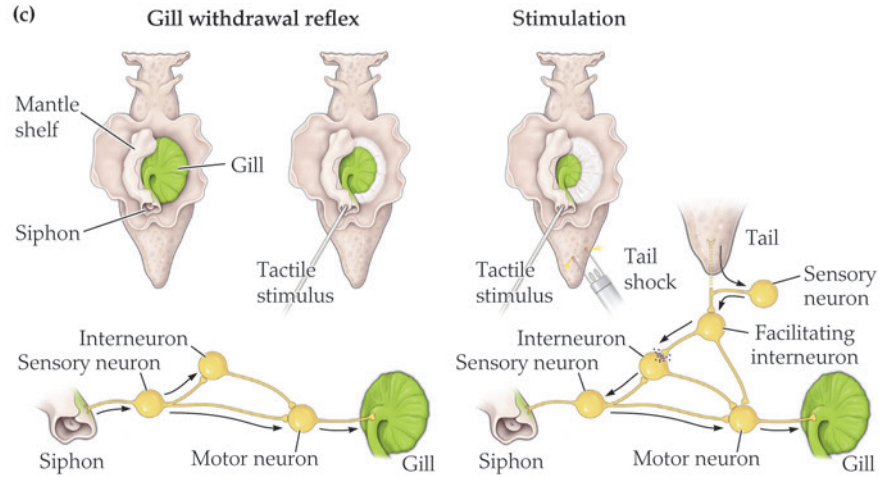


### Stage 2



### Stage 3

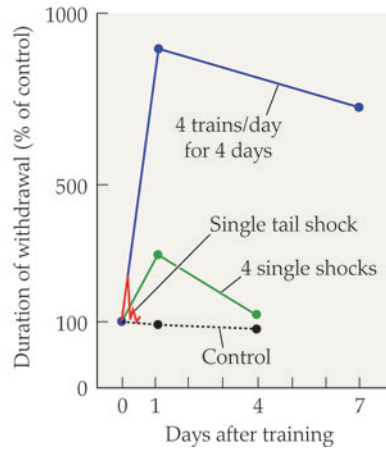


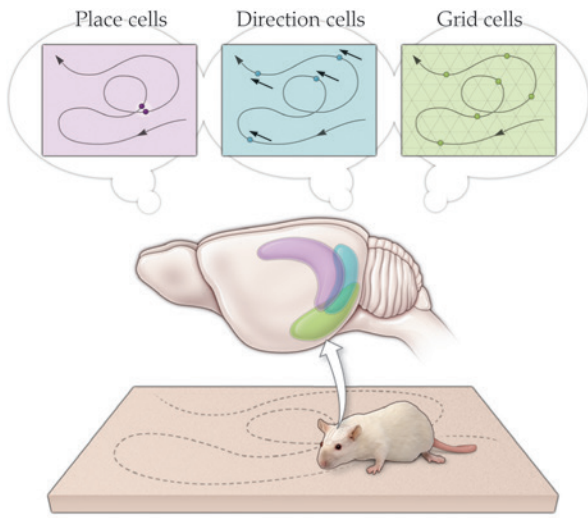


**1.** Touch on siphon stimulates sensory neuron, which stimulates motor neuron controlling gill muscle as well as interneuron. This activity produces withdrawal reflex.

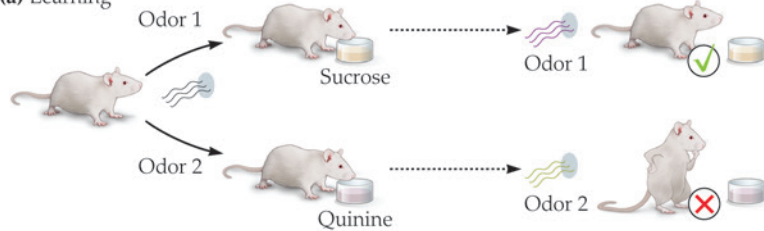
**2.** Habituation: After repeated stimulation, sensory neuron no longer produces enough neurotransmitter release to activate motor neuron.

**3.** Sensitization: Strong stimulus (tail shock) activates sensory neurons connected to tail, which activates the facilitating interneuron. Facilitating interneuron releases serotonin, which causes the sensory neuron to increase neurotransmitter release such that the motor neuron fires once again, producing gill withdrawal.

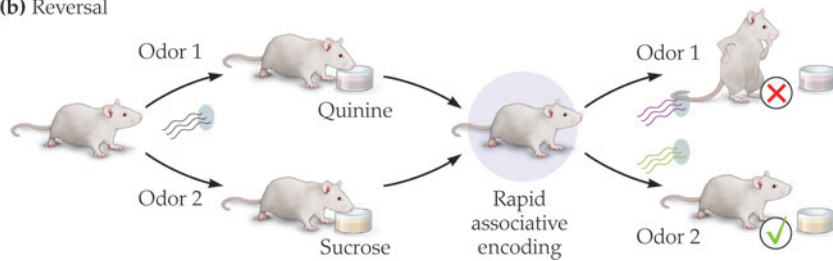


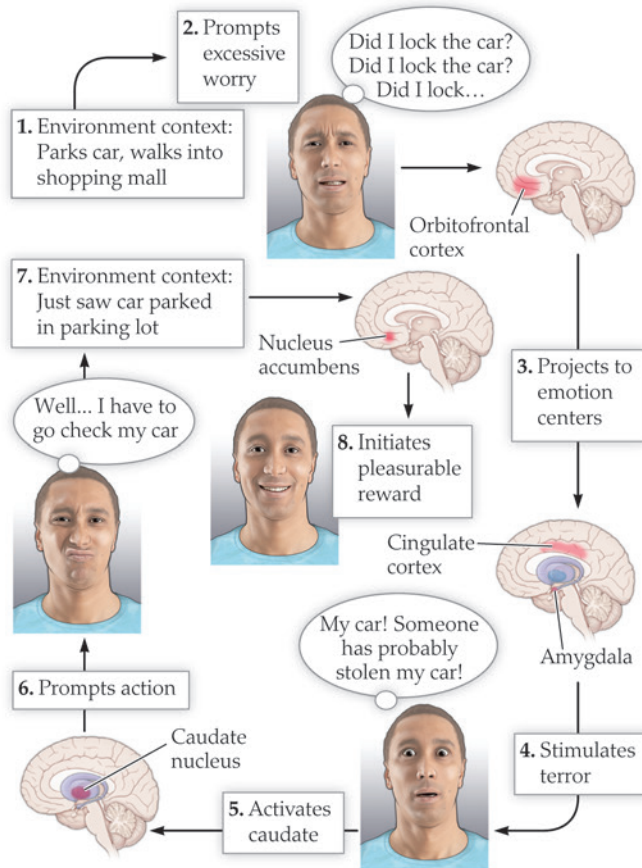


**(a) Learning**

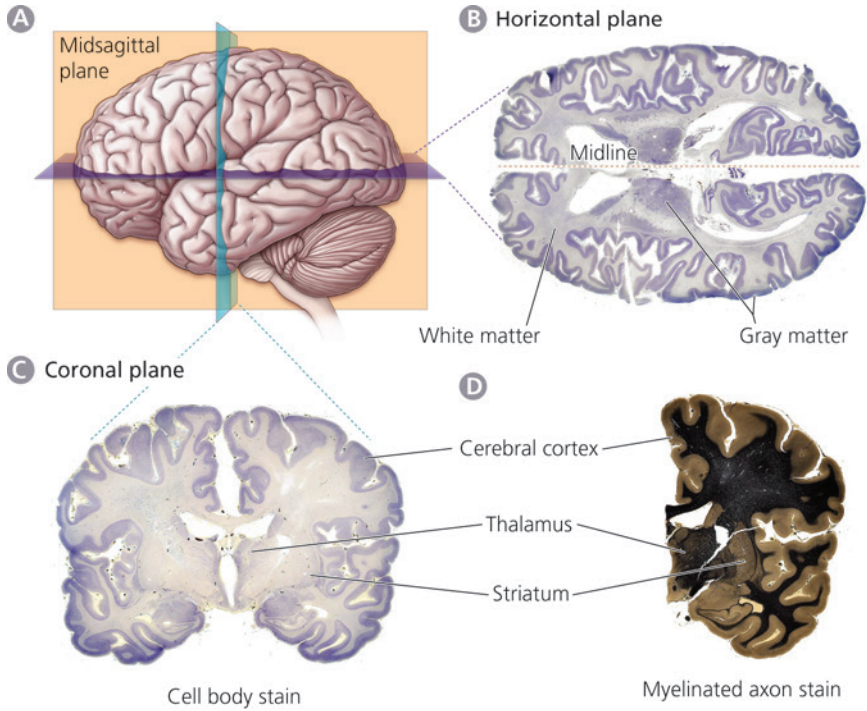


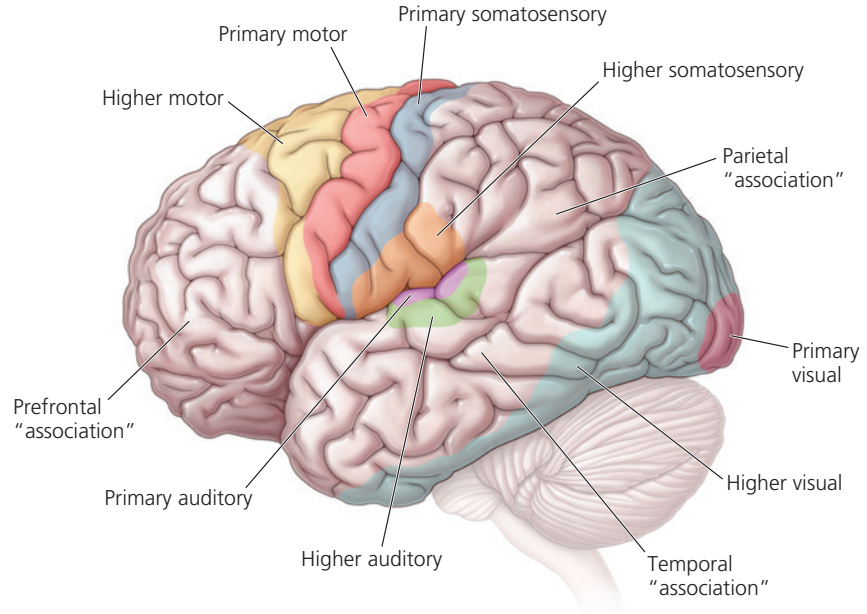
**(b) Reversal**

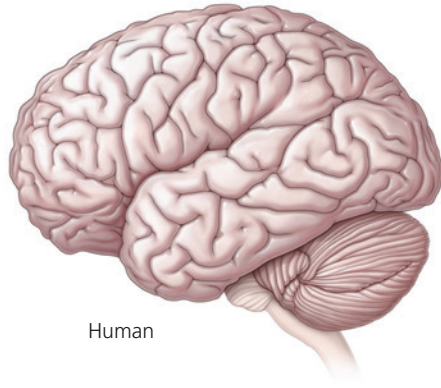




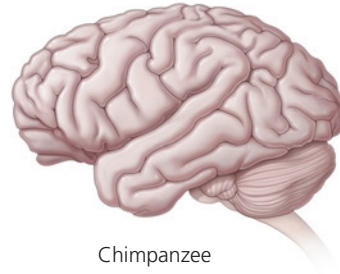








Human



Chimpanzee



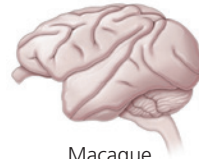
Mouse



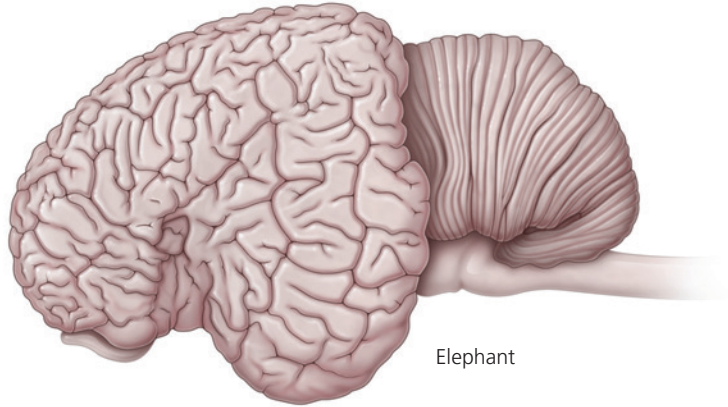
Rat



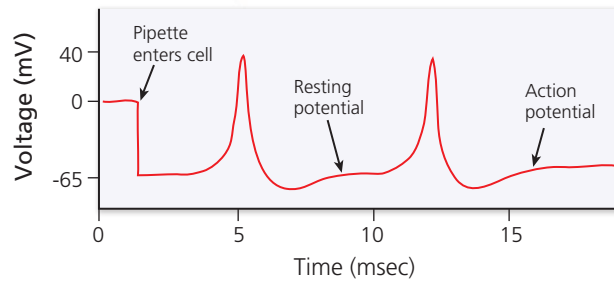
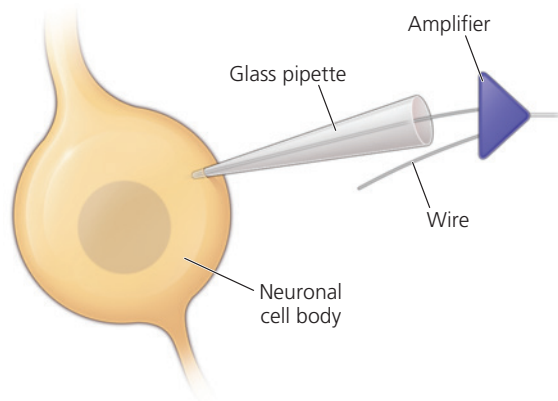
Cat

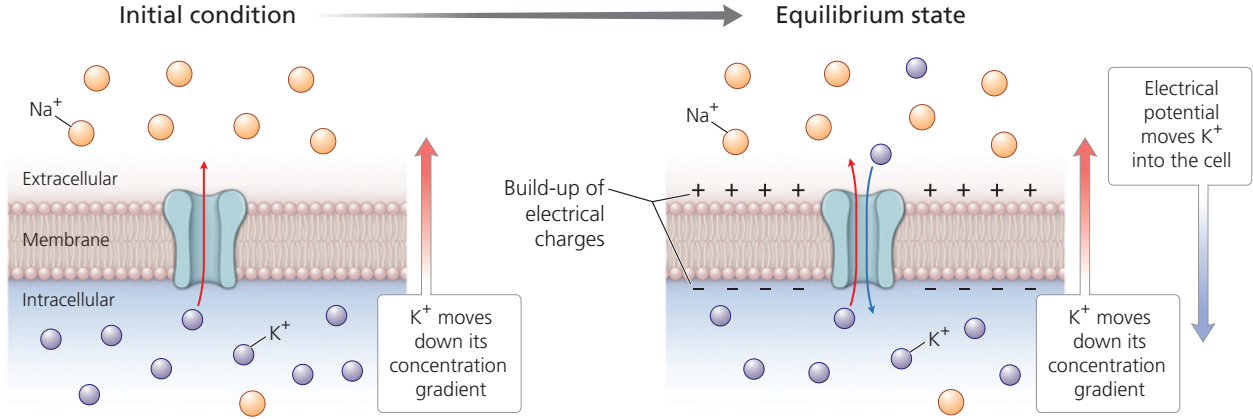


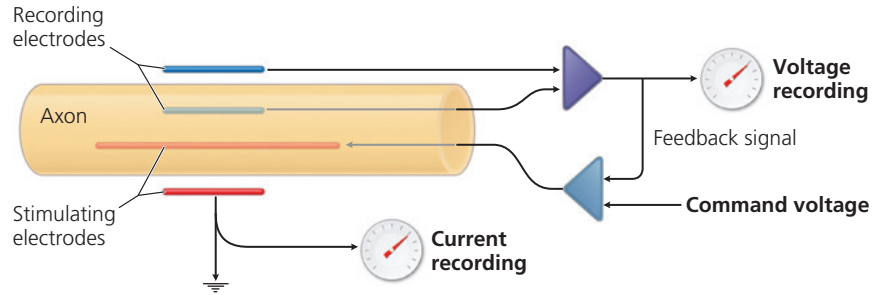
Macaque

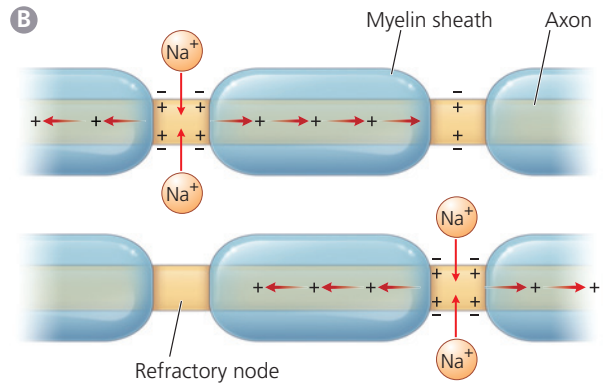
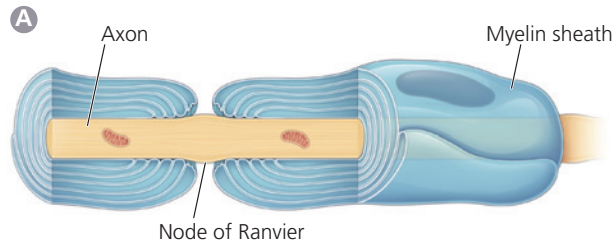


Elephant

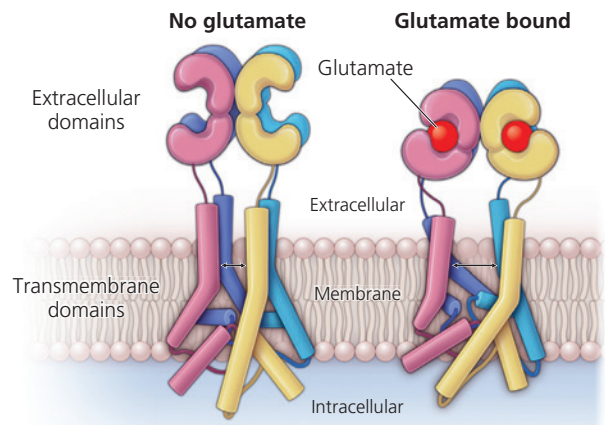




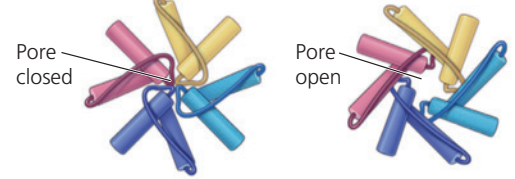




# NMDA Receptor

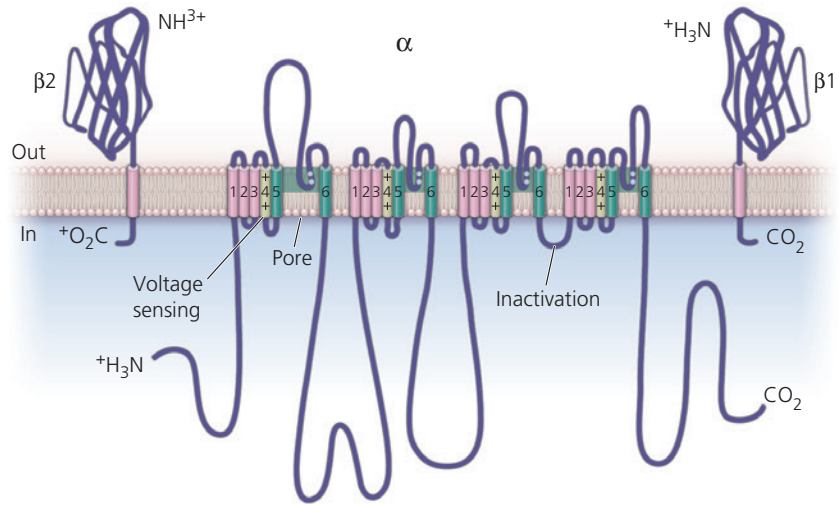


## View from inside cell (no magnesium)

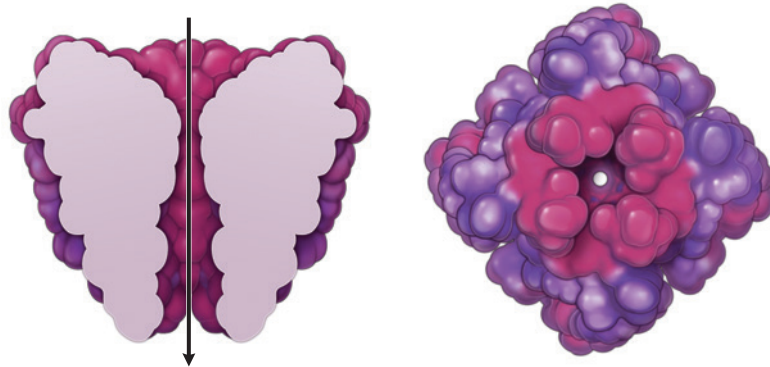


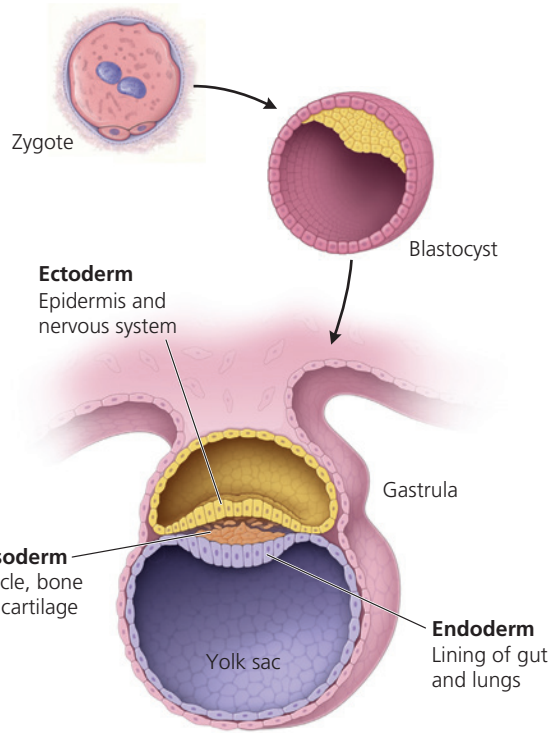


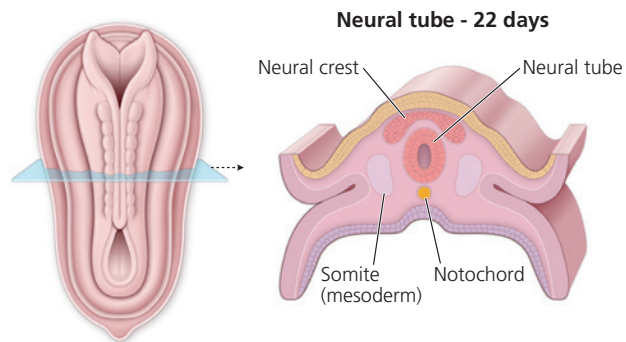
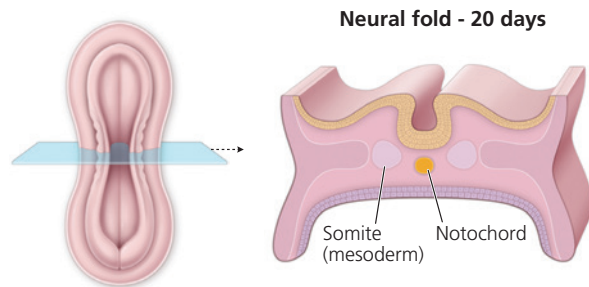
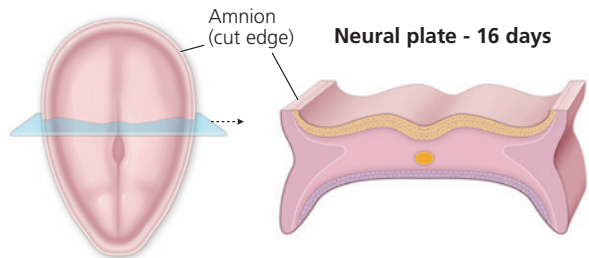
**A** 2D structure of a V-gated Na<sup>+</sup> channel



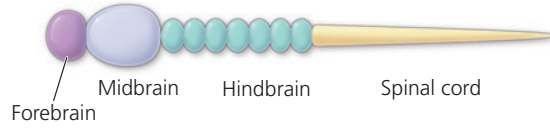
**B** 3D structure of an open Na<sup>+</sup> channel pore



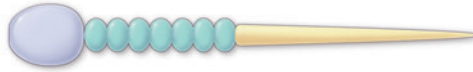




**A Normal RA concentration**



**B Increased RA concentration**



**C A model of RA effects**

