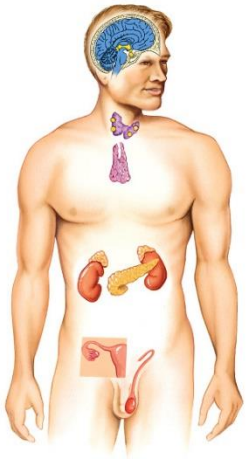
How do animals coordinate their bodily activities?

Lesson 13

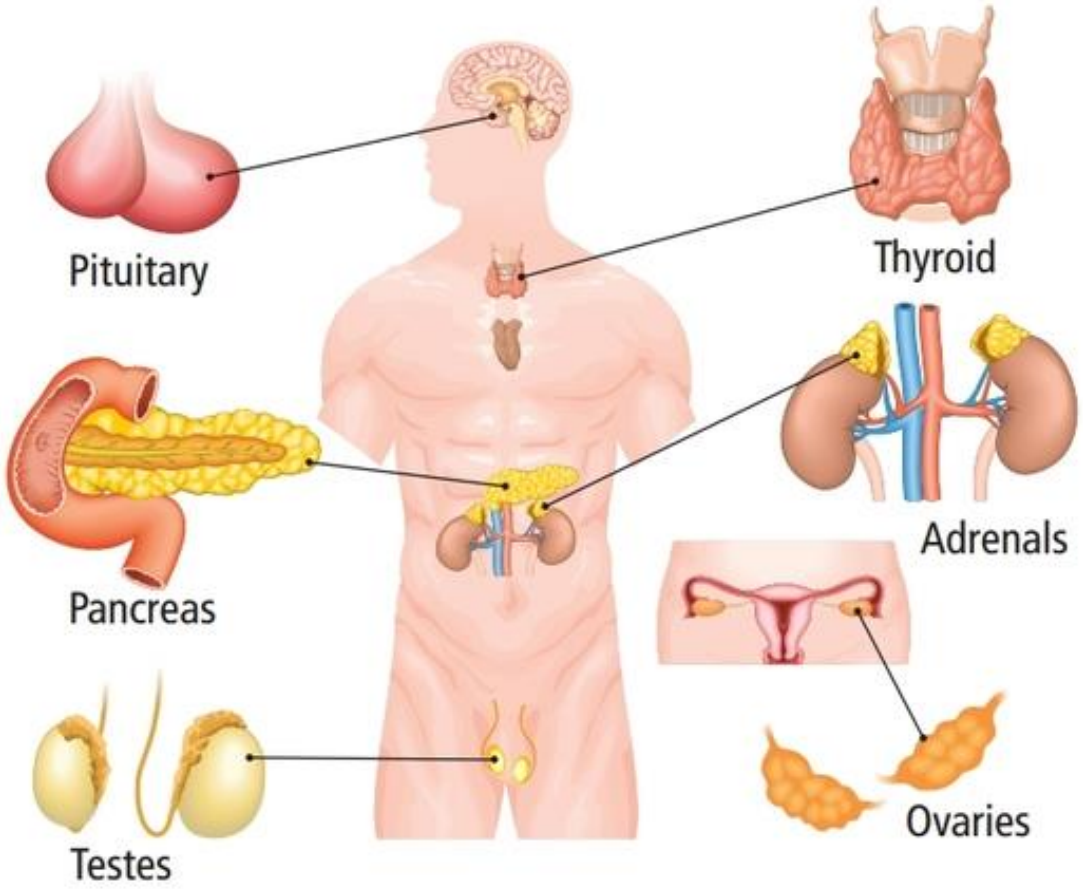
How do animals coordinate their bodily activities?



- All of the parts of an animal have to work together
- Animals must **coordinate** the activities of their cells, tissues, and organs
  - to coordinate means to work together
- Most animals have two systems for coordinating the activities of their parts (**endocrine system** and **nervous system**)
- Both system use chemicals
  - The chemicals act as signals to tell tissues and organs what to do

The Endocrine System

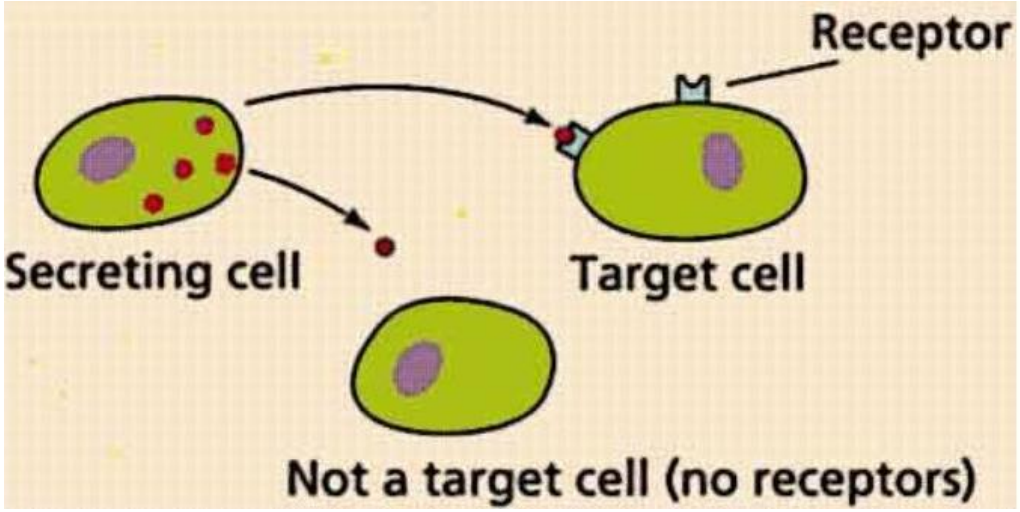
- Made of **glands** that secrete chemicals called **hormones**
  - **Glands** = organs that produce/synthesize specific substances and releases them when needed
  - **Hormones** = a chemical signal tha glands produce

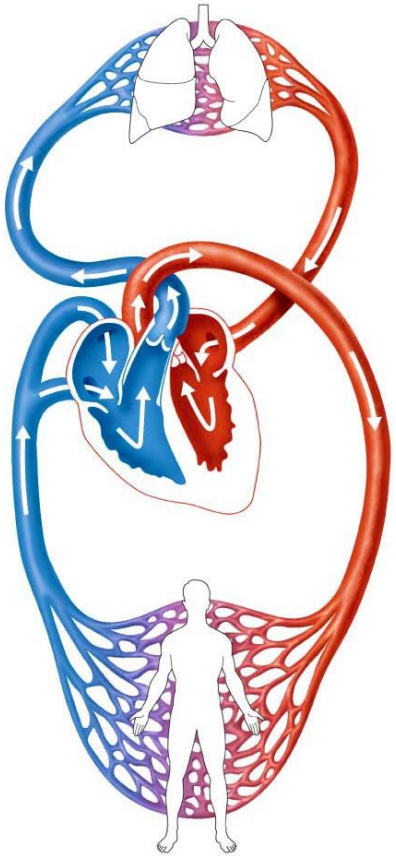


The Endocrine System

- The **circulatory system** carries the **hormones** all through the body
- The **hormones** touch every cell
  - However, the hormones affect only certain cells
  - The cells must have a particular type of protein that the hormone binds to which will cause a change in activity (think of a lock and key)

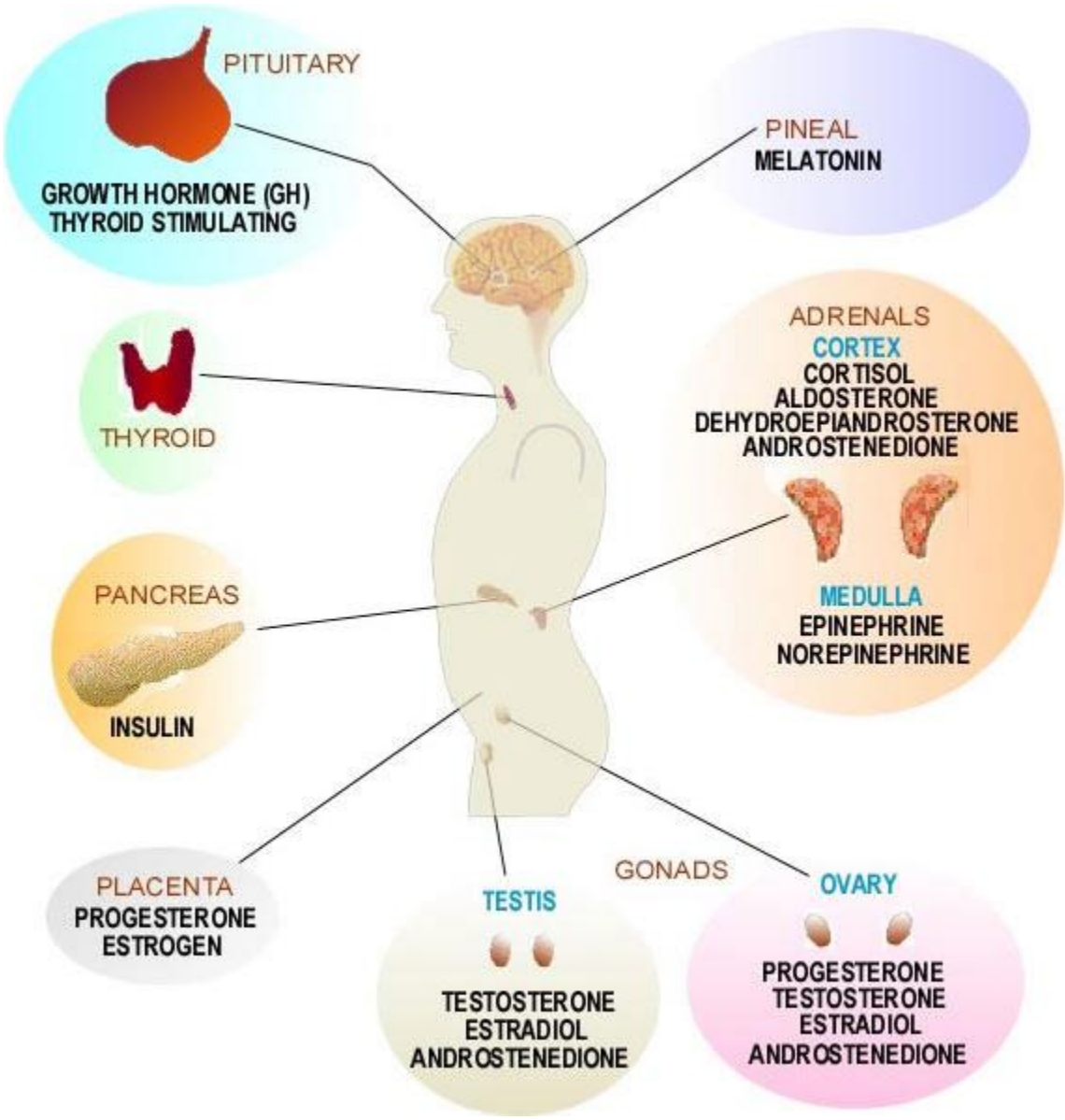
Hormones travel through the blood but they only affect those cells that have the right proteins!



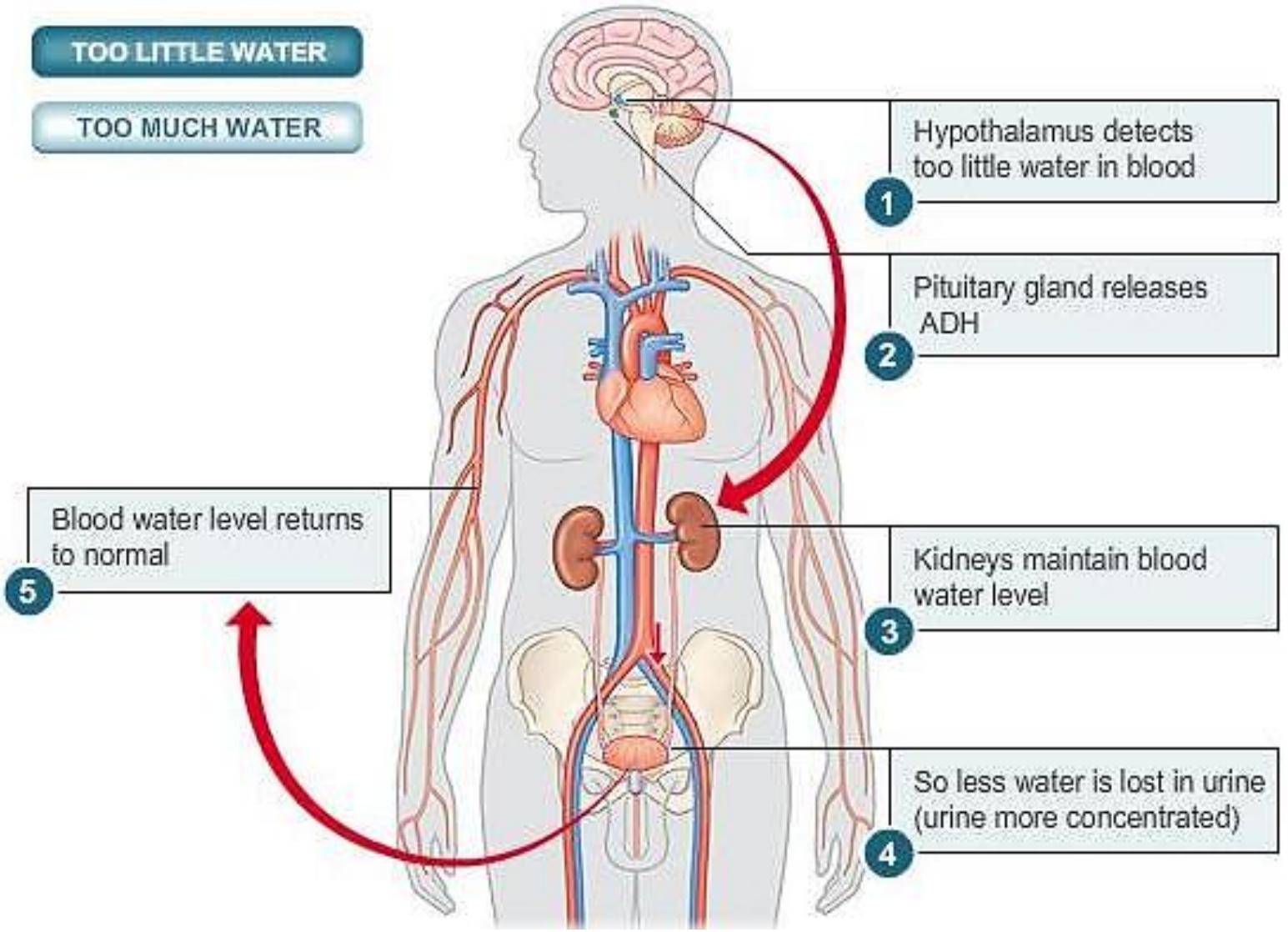


The Endocrine System

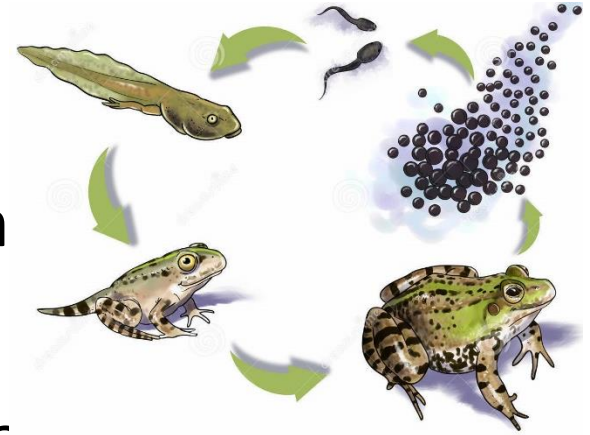
- There are many different hormones
- Each hormone may work on different kinds of cells
- Hormones are found in vertebrates and invertebrates



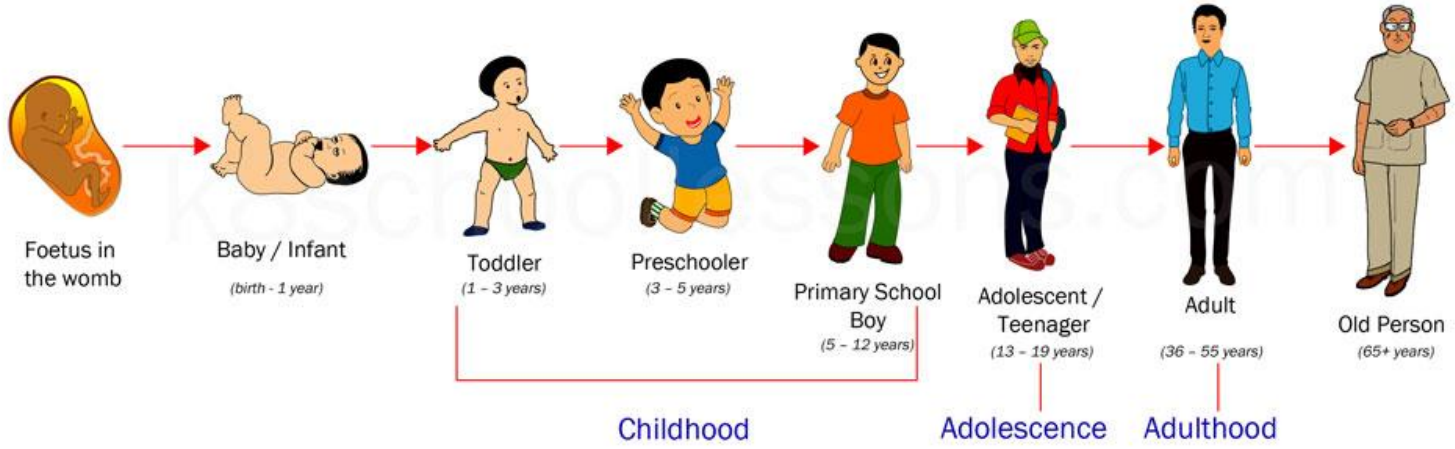
The Endocrine System - Example



The Endocrine System

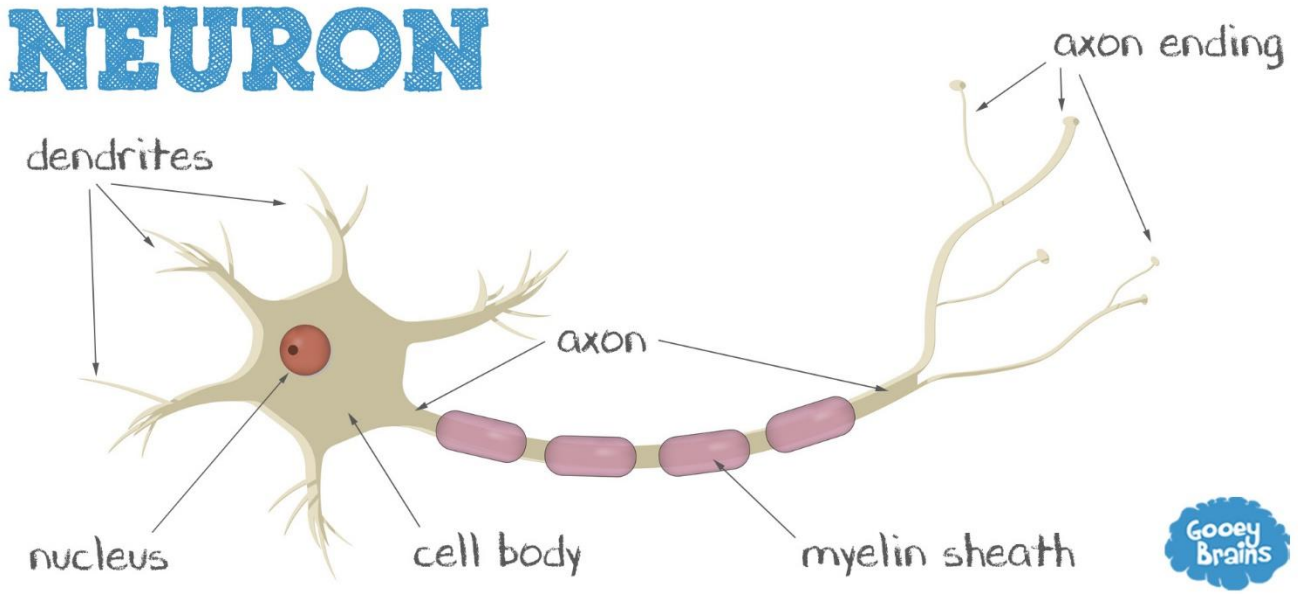


- The movement of hormones through the body takes a wh
- Hormones must get from glands to cells or organs
- The endocrine system is suited to control activities that happen slowly
- For example, hormones control the metamorphosis of a tadpole into a frog (almost 16 weeks!)
- Another example, in humans, from birth to adulthood (maturity) takes years!



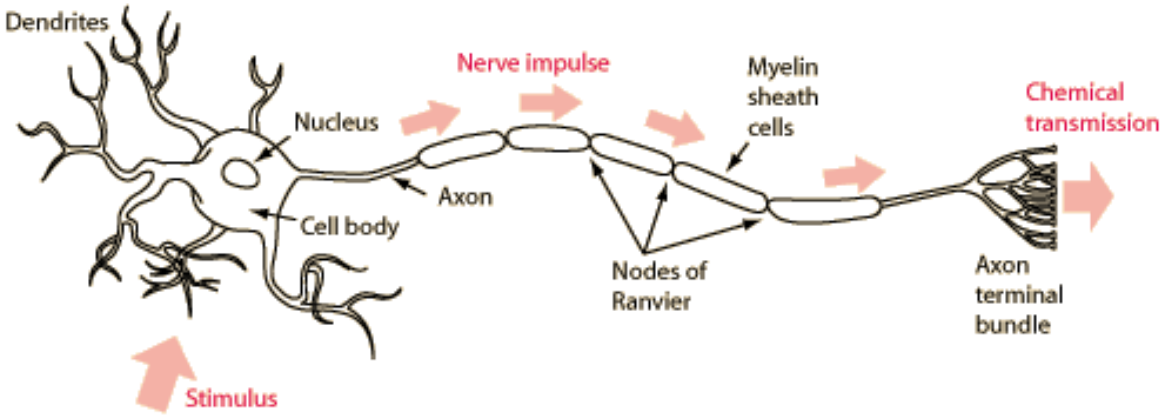
The Nervous System

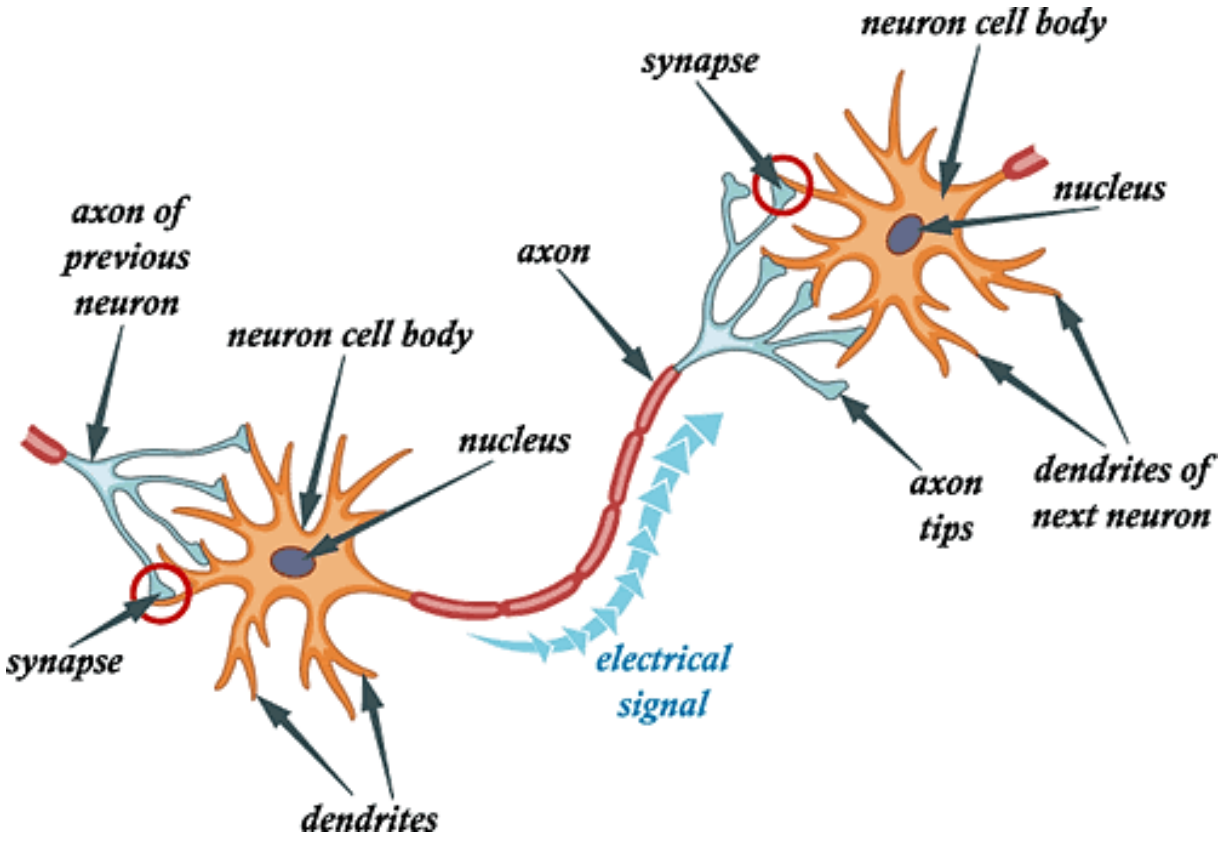
- A complex network of **nerves** and cells that carry messages to and from the brain and spinal cord to various parts of the body
- It does not need the circulatory system
- Nerve cells carry the messages
  - Nerve cells have long, thin branches at the ends
  - Some nerves cells are very long (e.g. some can reach from your lower back to the tips of your toes)



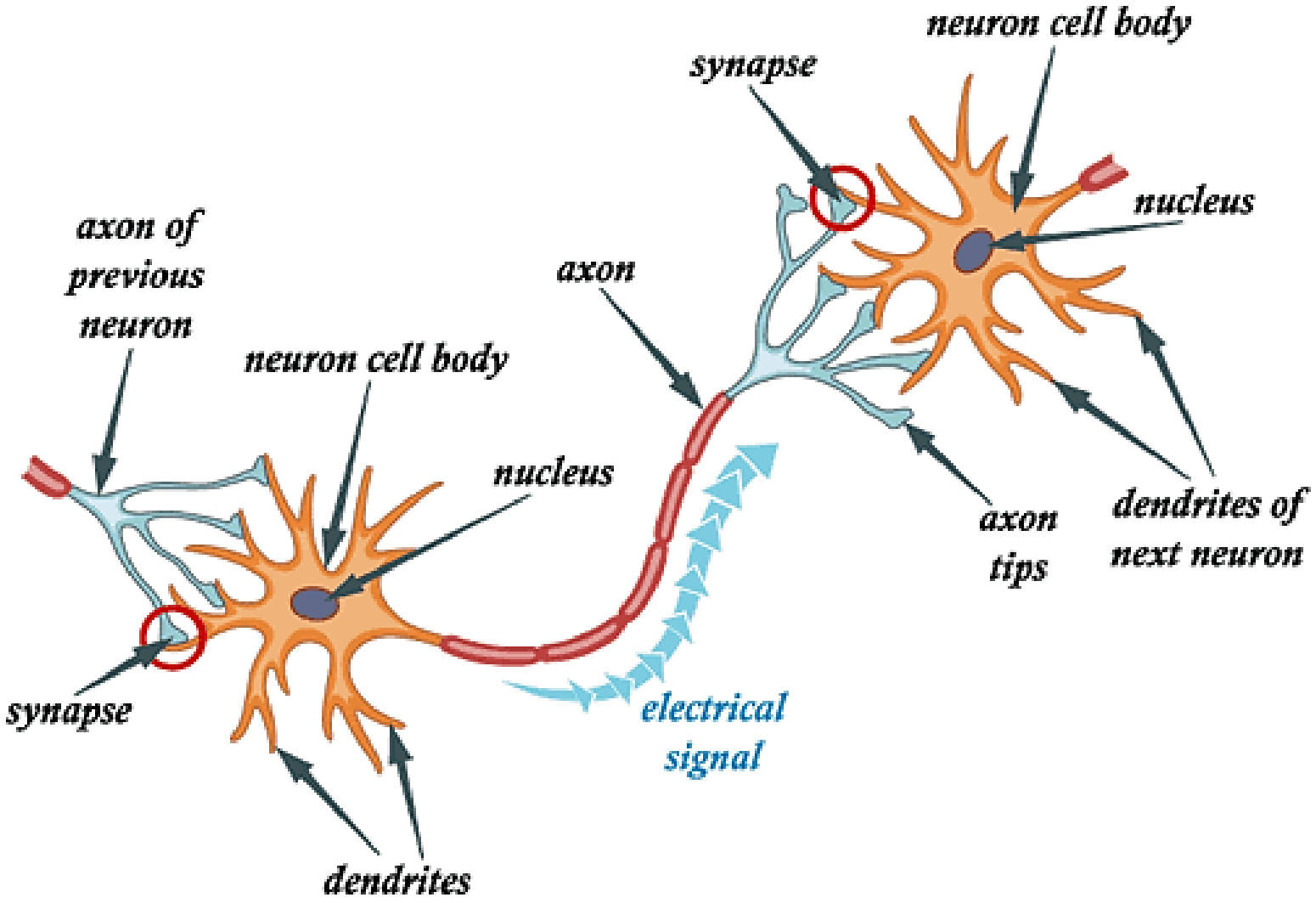
The Nervous System

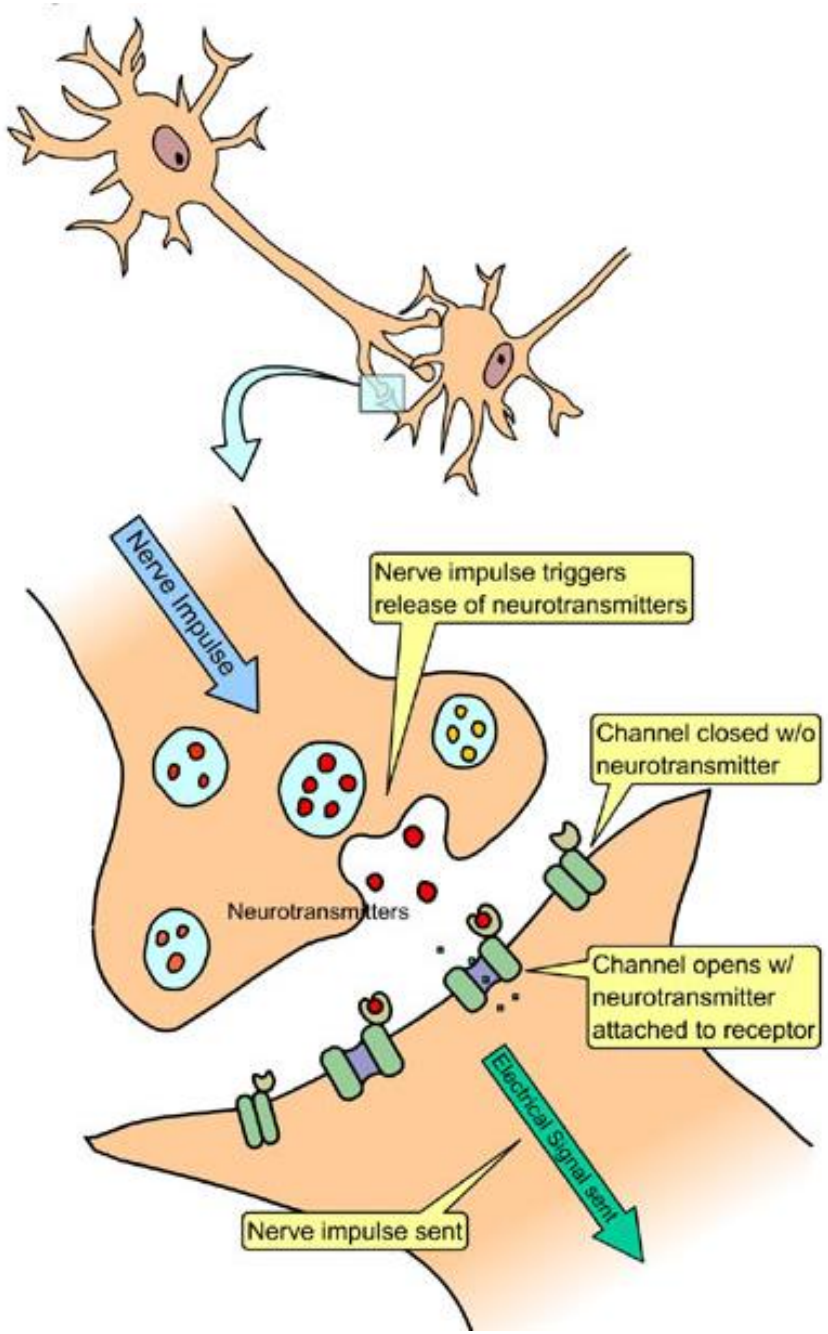
- Messages that travel along nerve cells are called **impulses**
  - One end of a nerve cell starts an impulse
  - The impulse travels across the cell to the other end
  - At this end, the impulse causes the cell to release a chemical signal called a **neurotransmitter**
  - The **neurotransmitter** binds to proteins on nearby nerve cells and these cells then change their activity
  - They continue to move impulses from cell to cell which is a way for messages to travel from one nerve cell to another



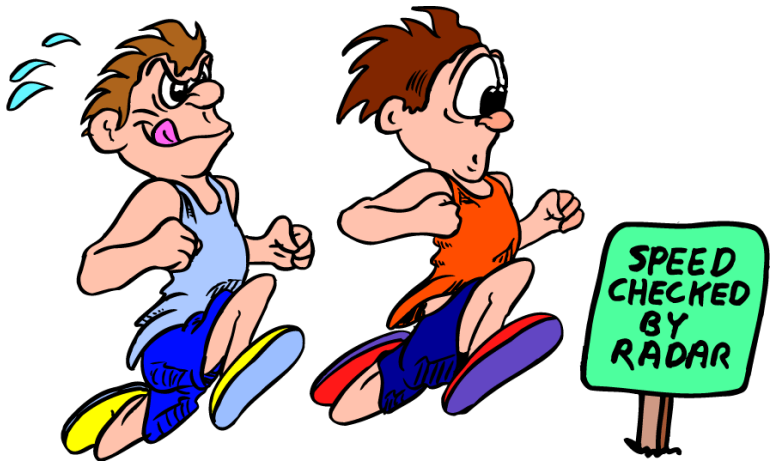


The Nervous System





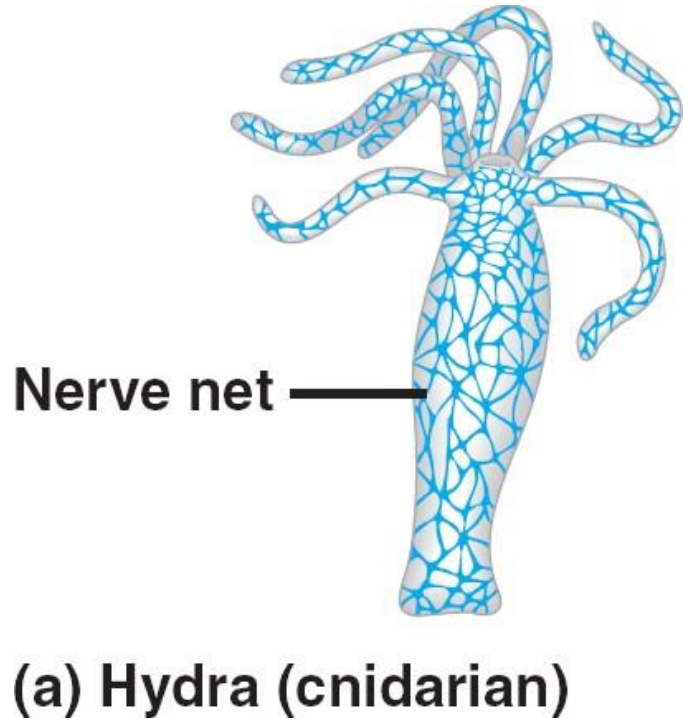
The Nervous System



- Impulses travel quickly along nerve cells
- The fastest impulses can reach speeds of 120 meters per second
  - Running the campus run in about 9 seconds!!
- The nervous system is suited to control activities that happen quickly
- For example, your nervous system directs the movements of your thumbs when you are texting

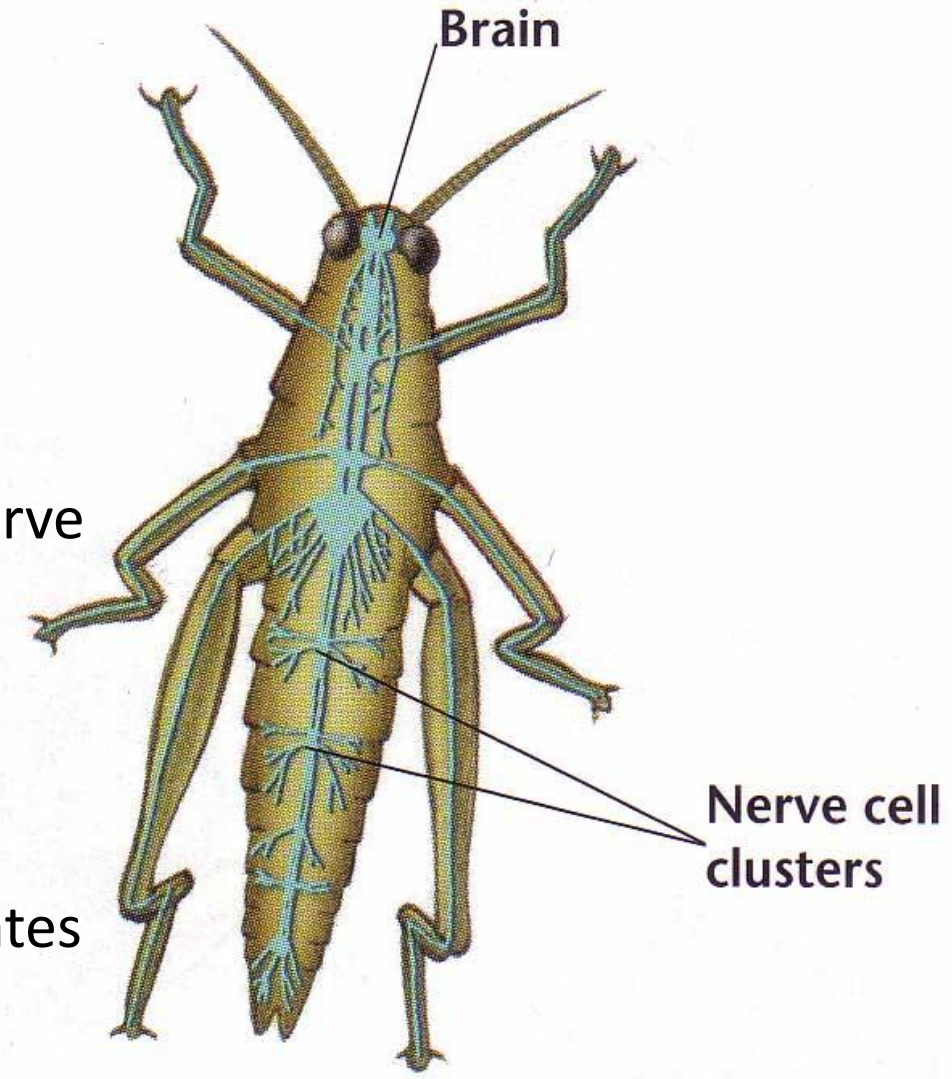
Invertebrate Nervous System

- Except for sponges, all animals have a nervous system
- Cnidarians (hydras and jellyfish) have the simplest nervous system
  - They do not have brains
  - They have a bunch of nerve cells that are loosely connected called a **nerve net** which is all cnidarians need to control their simple activities
    - The **nerve net** causes the hydra to shrink if it is touched and move its tentacles when feeding

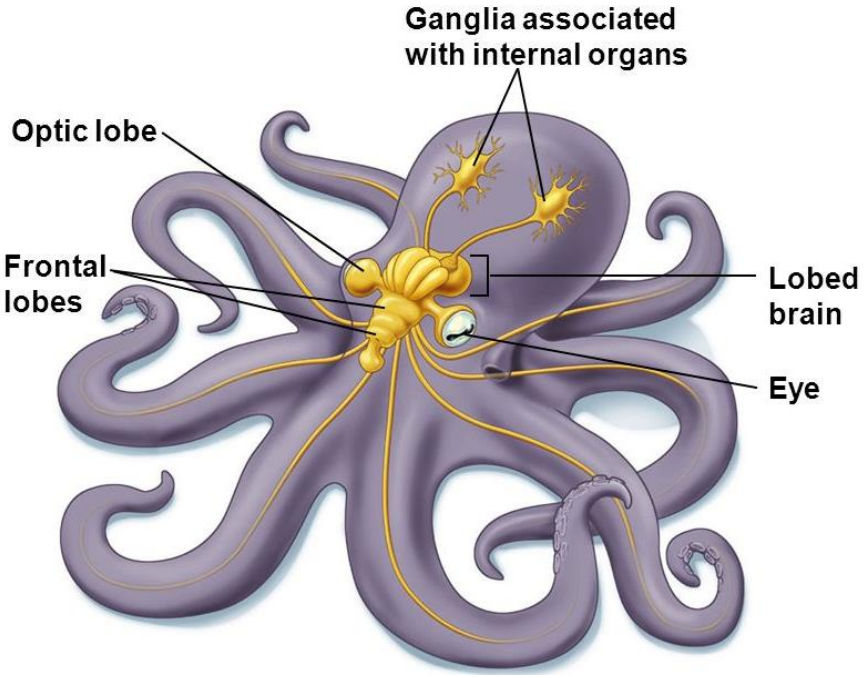


Invertebrate Nervous System

- Flatworms, segmented worms, and arthropods (insects, spiders etc.) are more developed than cnidarians
  - They have structures to sense their environment
  - The front end of the animal contains eyes and sometimes antennae
  - The front end also has clusters of nerve cells that serve as a simple brain
  - The brain receives information from the sense structures
  - Each body segment has a cluster of nerve cells that connect to each other and to the brain
  - The nervous system of these invertebrates coordinates movement, feeding, reproduction, and and other activities



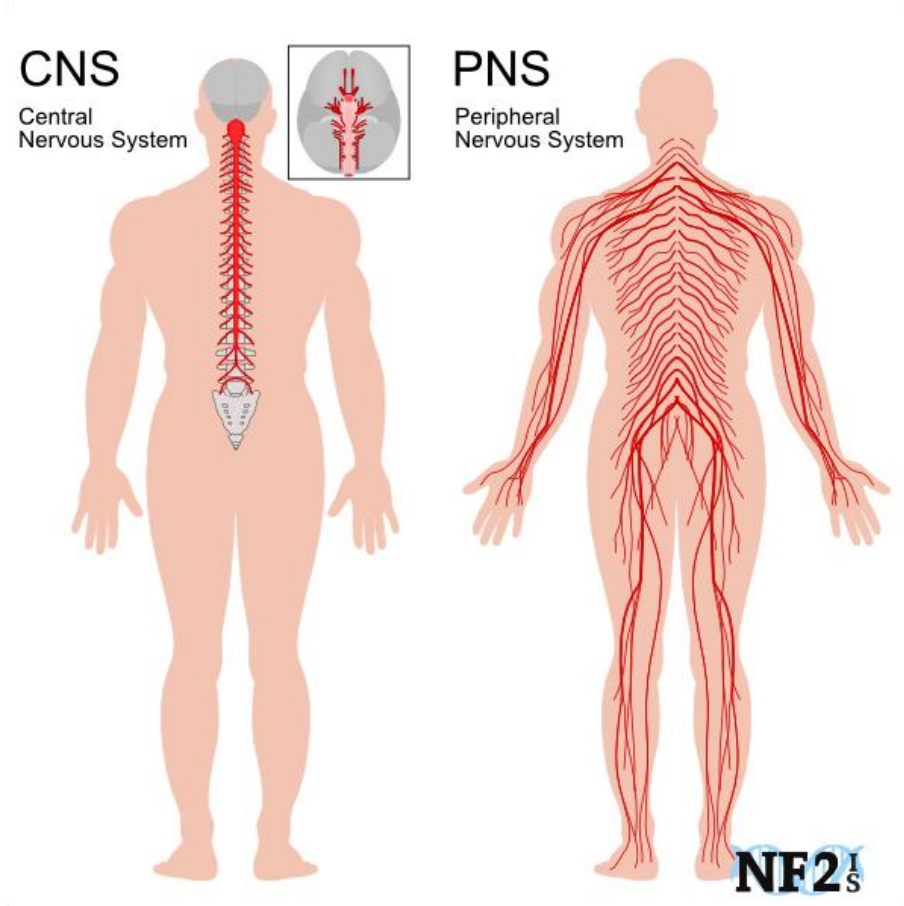
Invertebrate Nervous System



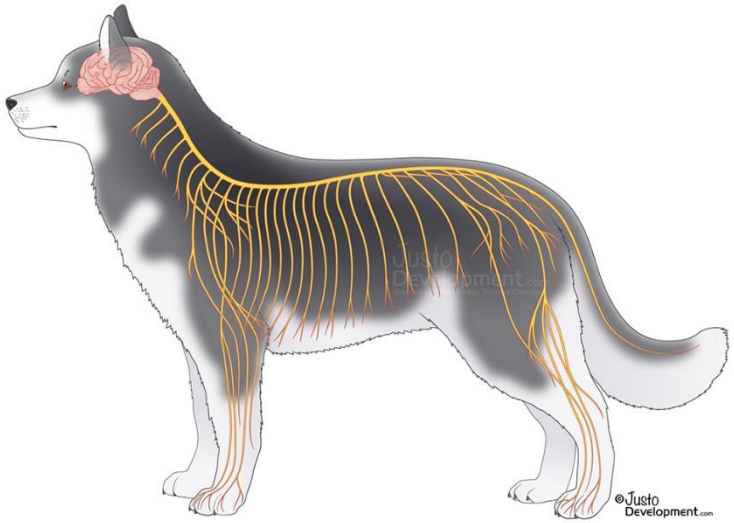
- Of all the invertebrates, squids and octopi have the most highly developed nervous systems
- Their brains contain millions of nerve cells
- Octopi can be taught to solve simple problems and they can learn to recognize objects based on their shape or feel

The Vertebrate Nervous System

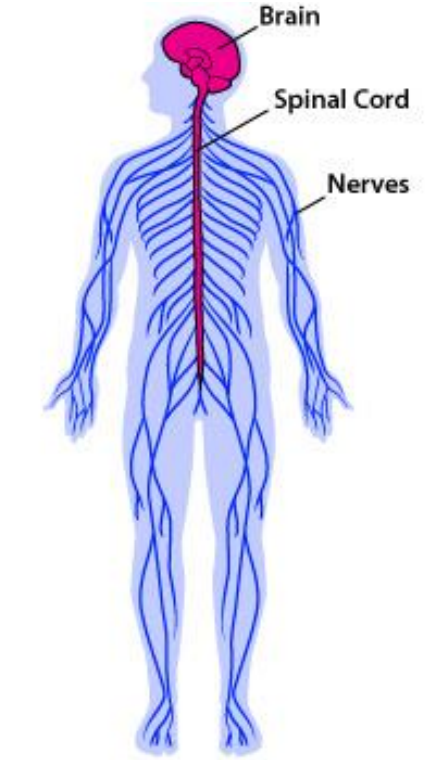
- Organized the same way in all vertebrates
- Divided into two parts
  - Central nervous system (CNS)
  - Peripheral nervous system (PNS)

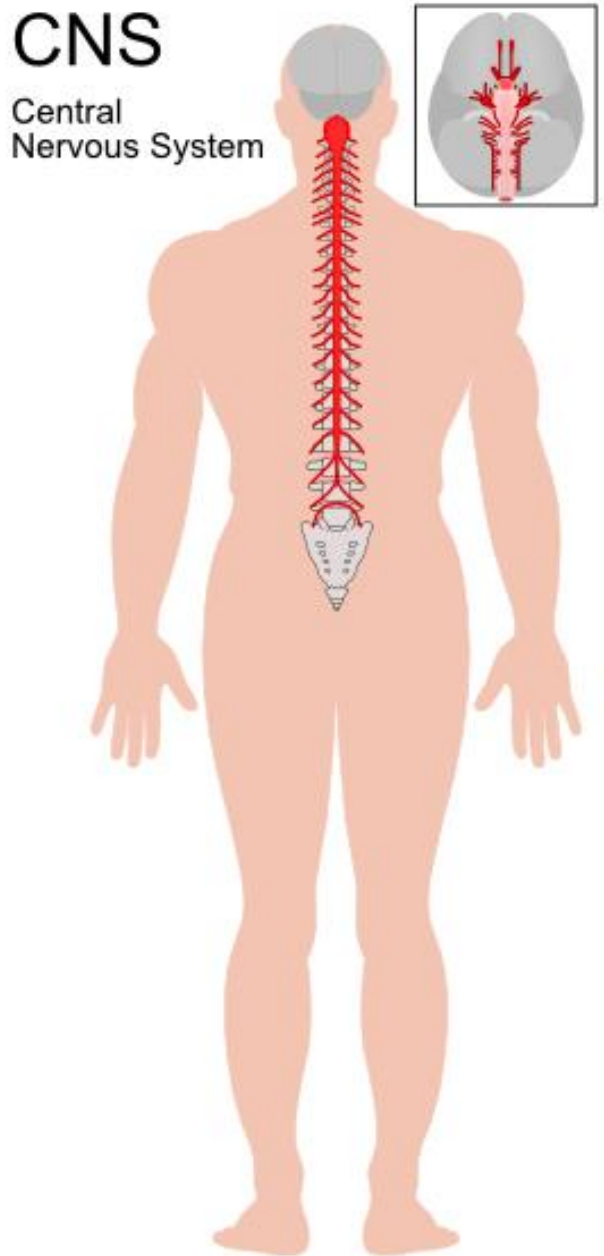


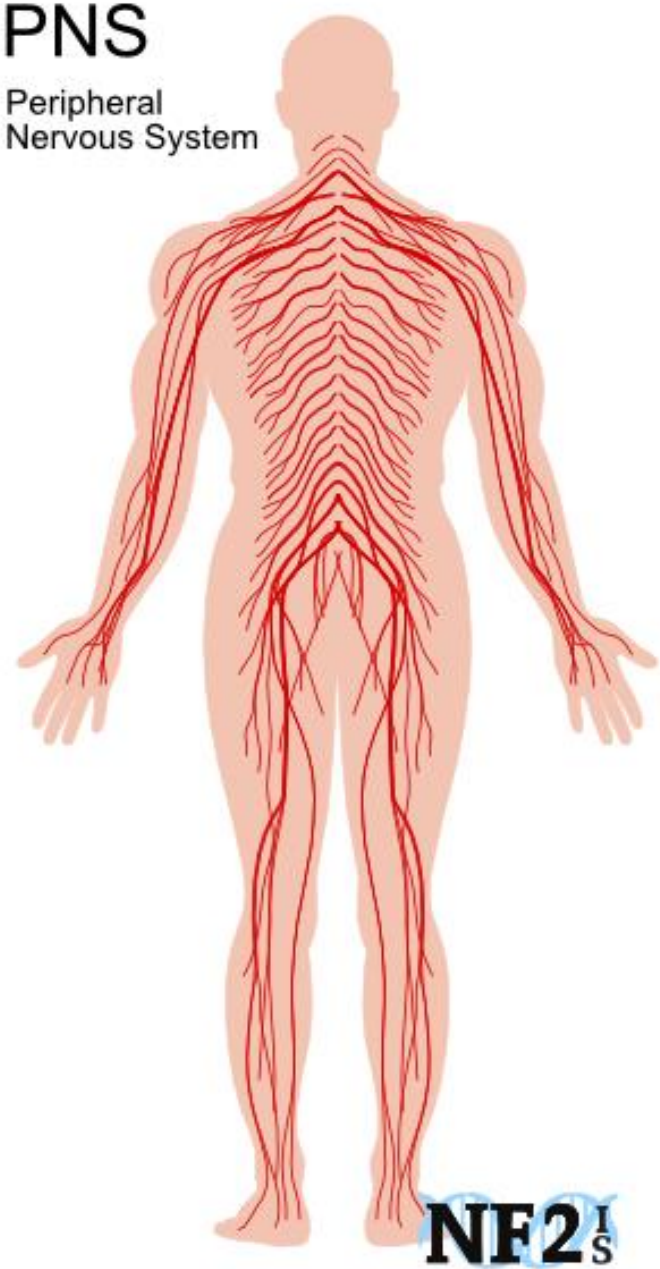
The Vertebrate Nervous System



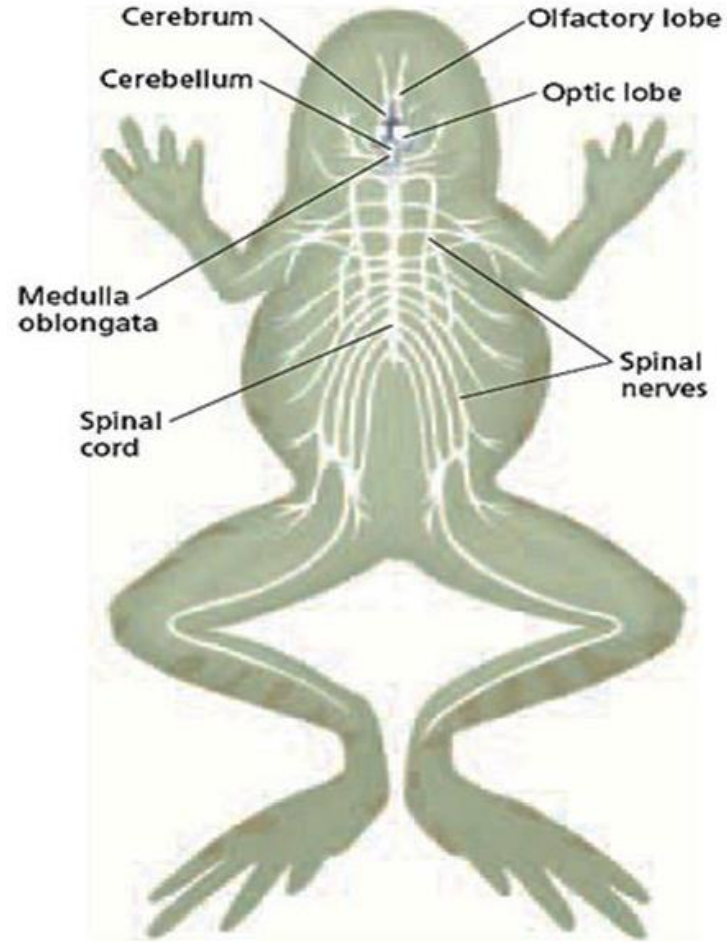
- Central nervous system (CNS)
  - Includes the **brain** and **spinal cord**
  - Coordinates and controls the activity of all parts of the body
- Peripheral nervous system (PNS)
  - Peripheral means outer
  - Includes all the **nerves** in the body that lie outside of the **spinal cord** and the **brain**
  - Connects the central nervous system with the rest of the body and carries messages between the CNS and other parts of the body





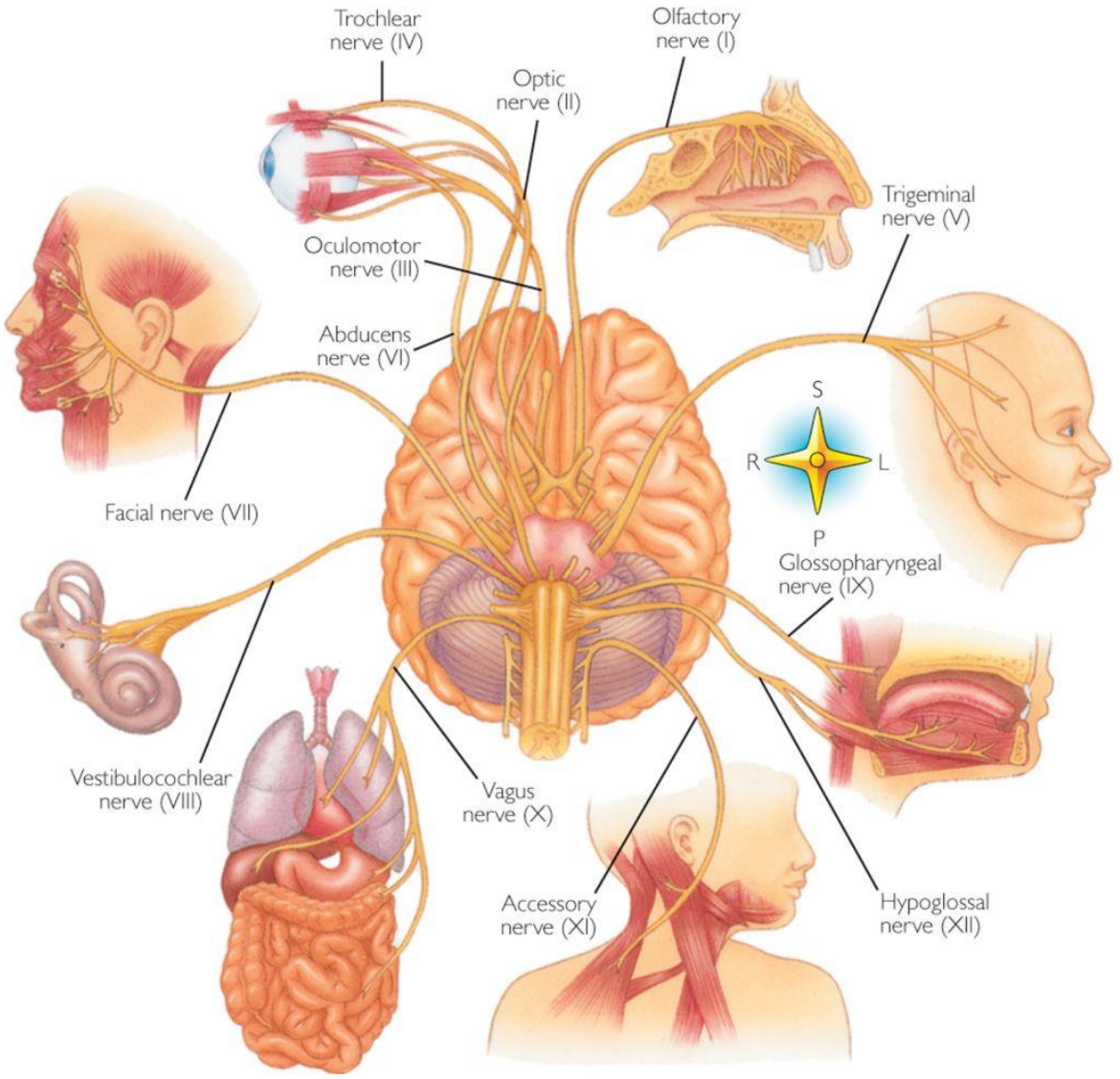


Frog nervous system



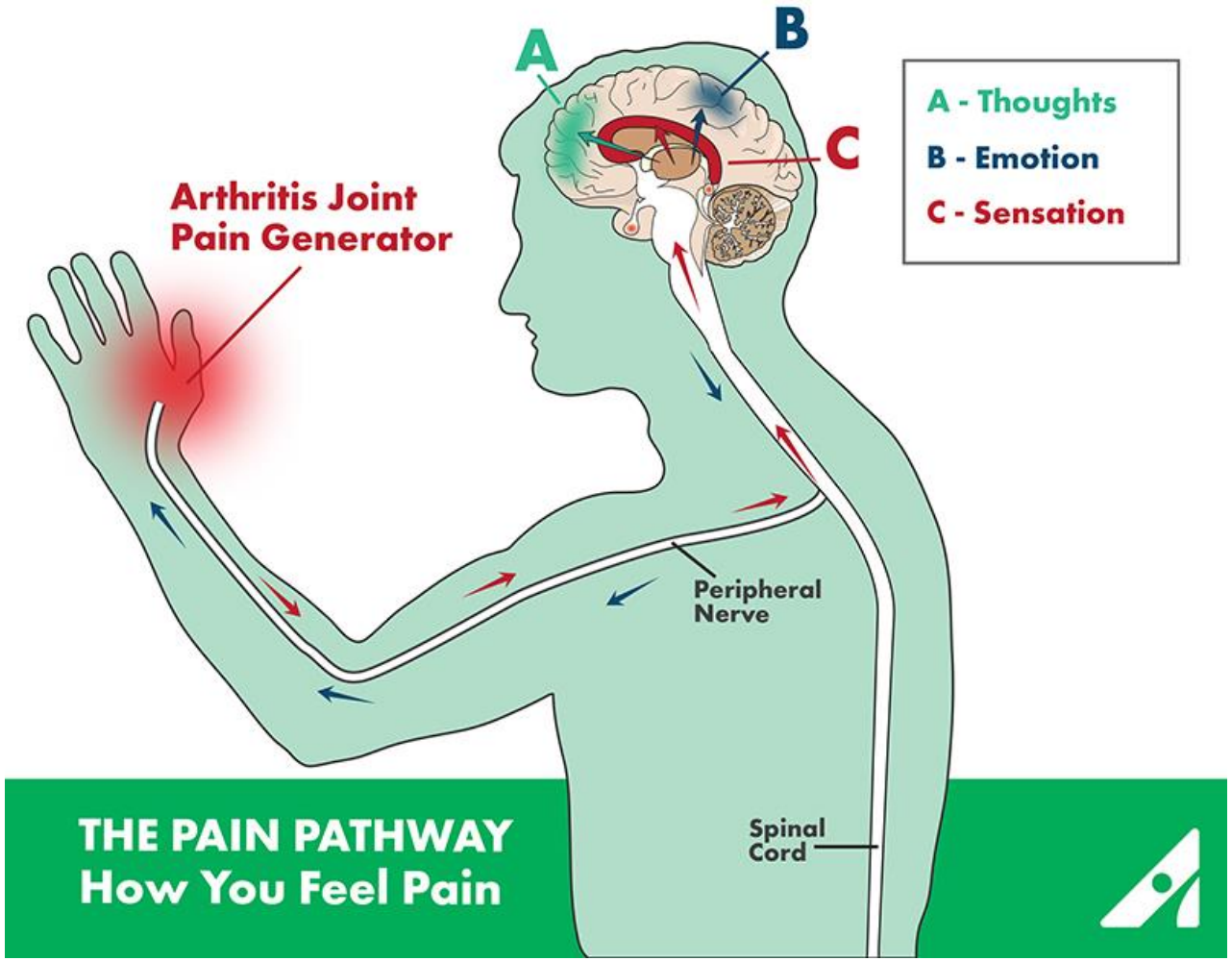
The Vertebrate Nervous System

- The **brain** is the **control centre** for the vertebrate nervous system
  - Interprets messages from the sense organs
  - Directs the movement of muscles
  - Controls how fast the heart beats
  - Controls how fast an animal breathes
  - Helps maintain balance when an animal walks
  - In some vertebrates, the brain is the centre of emotions and reasoning



The Vertebrate Nervous System

- The **spinal cord** links the **brain** and the <u>body below the neck</u>
  - Relays information from the body to the brain
  - It carries the brain's commands back to the body



Summary

- The **endocrine system** uses chemicals called **hormones**, which are carried by the blood and only affect the cells with the right proteins to attach to
- The **nervous system** uses chemical signals called **neurotransmitters**, which are released by nerve cells
- Cnidarians have a simple nervous system called a nerve net
- Most other **invertebrates** have a **simple brain** that is connected to nerve cells
- The **vertebrate** nervous system is most complex and is made of the **central nervous system** (CNS) and the **peripheral nervous system** (PNS)