

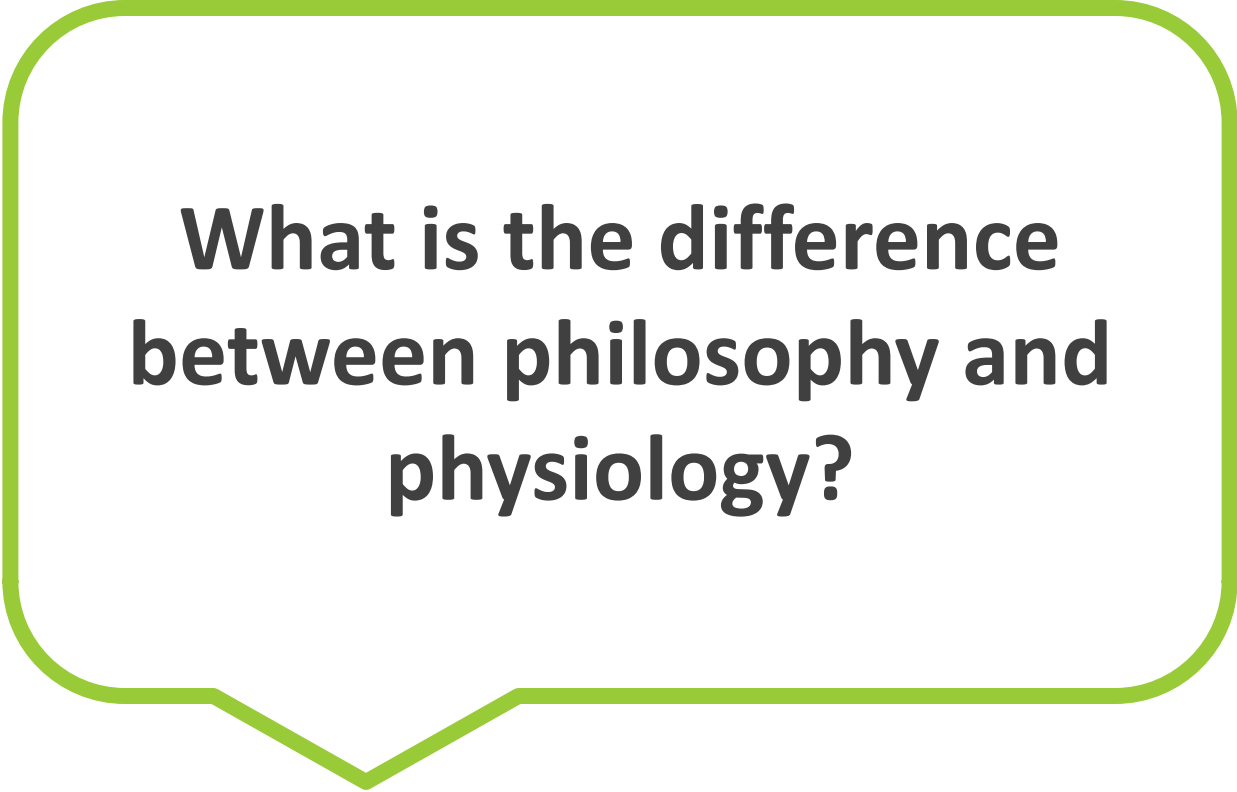
# The Influence of Physiology

By Amy Quarton

# Discussion Questions

---

- What is the difference between philosophy and physiology?
- How did the study of decapitation contribute to the development of psychology in the 18th and 19th centuries?
- How did phrenology contribute to the development of psychology in the 19th century?
- How did physiologists' experiments contribute to the development of psychology in the 19th century?
- How did the study of nerve cells contribute to the development of psychology in the 19th century?

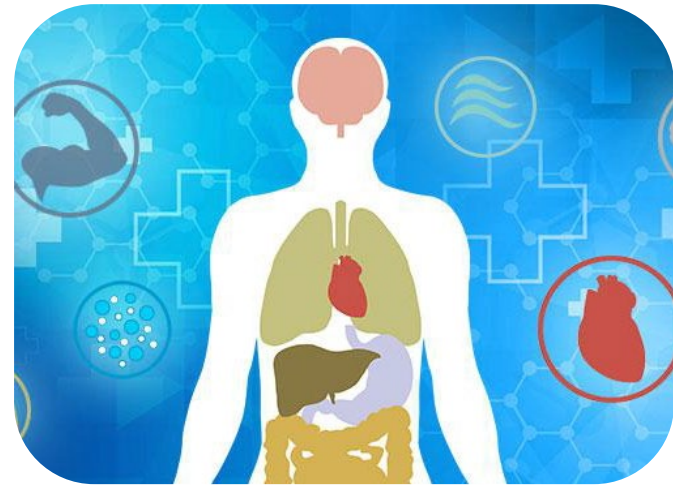


**What is the difference  
between philosophy and  
physiology?**

# What is the difference between philosophy and physiology?

---

- **Philosophy:** The study of knowledge, existence, and reality
- **Physiology:** The study of how living organisms operate and how their body parts function

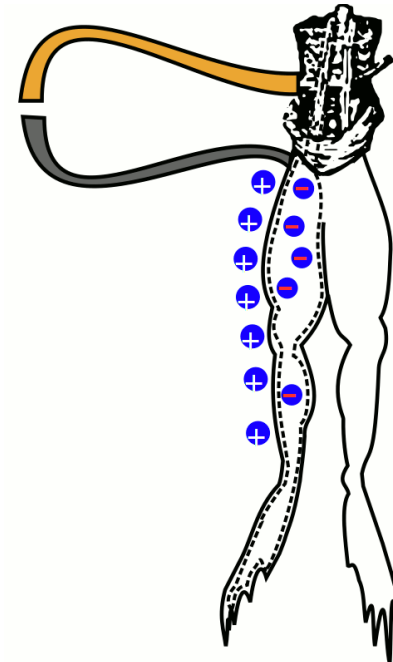


**How did the study of  
decapitation contribute to  
the development of  
psychology in the 18th and  
19th centuries?**

# How did the study of decapitation contribute?

---

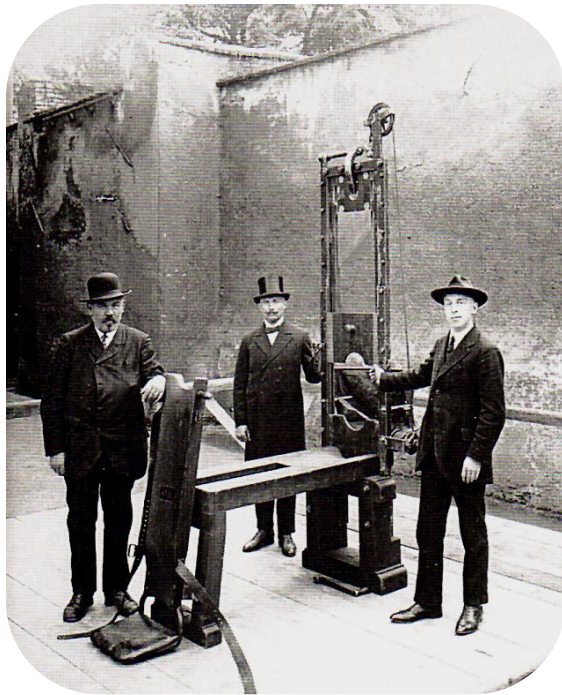
- A Scottish physician, **Robert Whytt** (1714-1766), adapted Luigi Galvani's method and inserted hot wires through the spines of decapitated frogs.
  - When the spine was destroyed, no amount of stimulation produced a response.
  - When the spine was intact, the legs responded to stimulation.
  - He concluded that the spinal cord is all that is needed for reflexes to occur.



# How did the study of decapitation contribute?

---

- A German physician and biologist, **Theodor Bischoff** (1807-1882), studied decapitated heads.



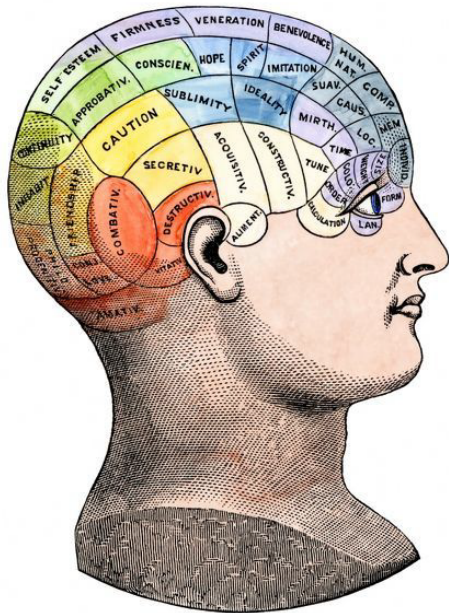
- The human heads were procured after execution by guillotine (shown here).
- He also collected the heads and embryos of dogs, guinea pigs, deer, foxes, and weasels.
- He concluded consciousness ends at death.

**How did phrenology  
contribute to the  
development of psychology  
in the 19th century?**



# How did phrenology contribute?

- In 1819, Franz Joseph Gall (1758-1828), a German physiologist, asserted that personality can be inferred from the bumps on the human skull.



- His ideas would later be known as **phrenology**.
- By feeling more than 100 skulls, he developed a map of 27 “fundamental faculties” or functions.

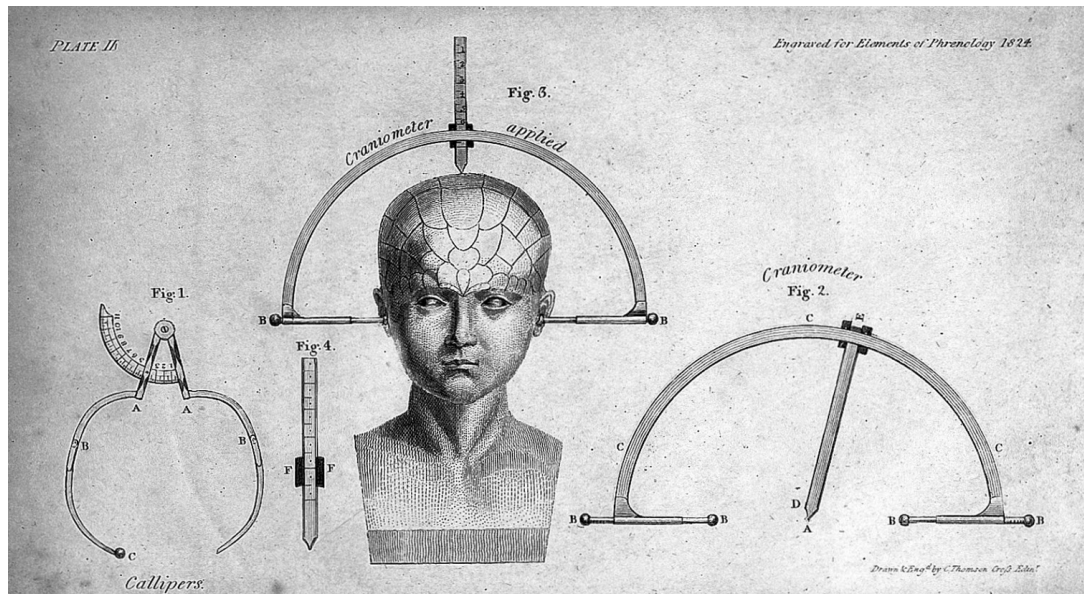
# How did phrenology contribute?

---

- Phrenologists believed:
  - Brain functions are localized *very* precisely within the brain.
  - Everyone has the same set of faculties, but there are individual differences in the strength of each one.
  - These faculties are inborn and fixed.
  - The “doctrine of the skull” says the strength of faculties can be inferred from skull shape.

# How did phrenology contribute?

- Other phrenologists created their own tools and techniques for measuring the geography of the skull, like this craniometer.



From George  
Combe (1828)

# How did phrenology contribute?

---

- What they got right:

- Gall was right that different parts of the brain do indeed have different functions.



- What they got wrong:

- The doctrine of the skull
- The map of 27 functions
- Their reliance on anecdotal evidence, which overlooks non-supporting cases



# How did phrenology contribute?

---

- Physiologists soon found evidence to disprove it, but phrenology remained popular until the 1840s.
  - In the early 1800s, Johann Spurzheim, a German physician, and George Combe, a Scottish lawyer, popularized phrenology in Europe and the USA.
  - Unlike Gall, Spurzheim said faculties could be shaped by early experiences, which was consistent with the American ideal that anyone can reach their goals.

**How did physiologists' experiments contribute to the development of psychology in the 19th century?**

# How did physiologists' experiments contribute?

---

- In 1815, a French physiologist, Jean Pierre Flourens (1794-1867), pioneered the use of localized brain lesions in rabbits and pigeons.
- His work supported the localization of function.
  - It provided scientific evidence to refute phrenologists' untested claims.

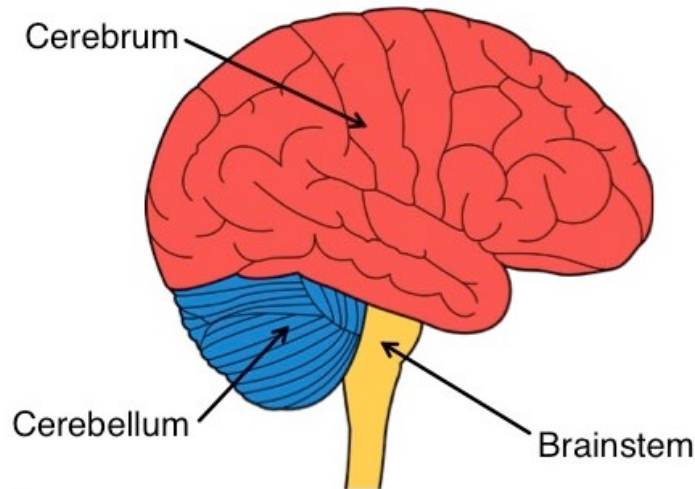




# How did physiologists' experiments contribute?

---

- Flourens surgically damaged brain tissue (**method of ablation**) and observed the effects.



- When the cerebrum was damaged, the animal struggled with perception.
- When the cerebellum was damaged, the animal struggled to coordinate its movements.
- When the brainstem was damaged, the animal died.



# How did physiologists' experiments contribute?

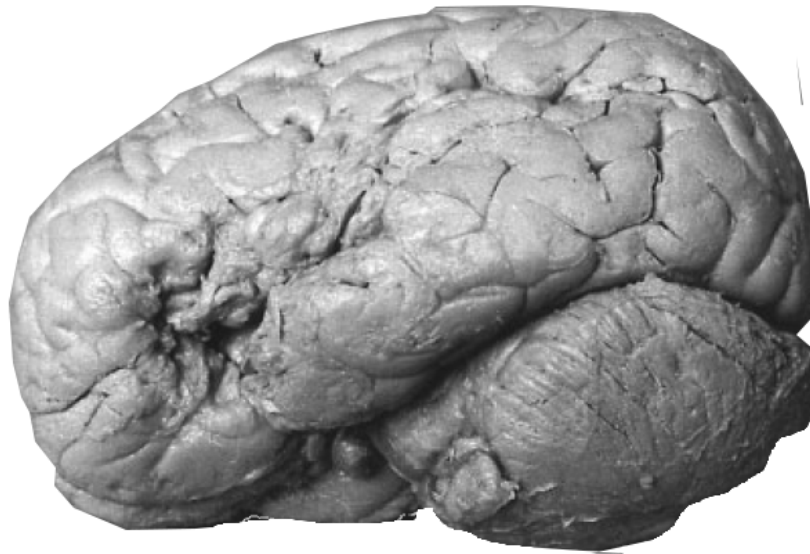
---

- Years later, in 1861, a French physician, Pierre Paul Broca (1824-1880), studied the brain of a patient with motor aphasia, the inability to speak.
  - His patient, Tan, could comprehend others' speech, but he was only able to say the word "tan".
  - After a natural death, Broca examined Tan's brain and found brain damage.
  - This is known as the clinical method.

# How did physiologists' experiments contribute?

---

- Broca concluded that the ability to produce speech was localized in the left frontal lobe, an area now known as **Broca's area**.



An image  
of Tan's  
brain

# How did physiologists' experiments contribute?

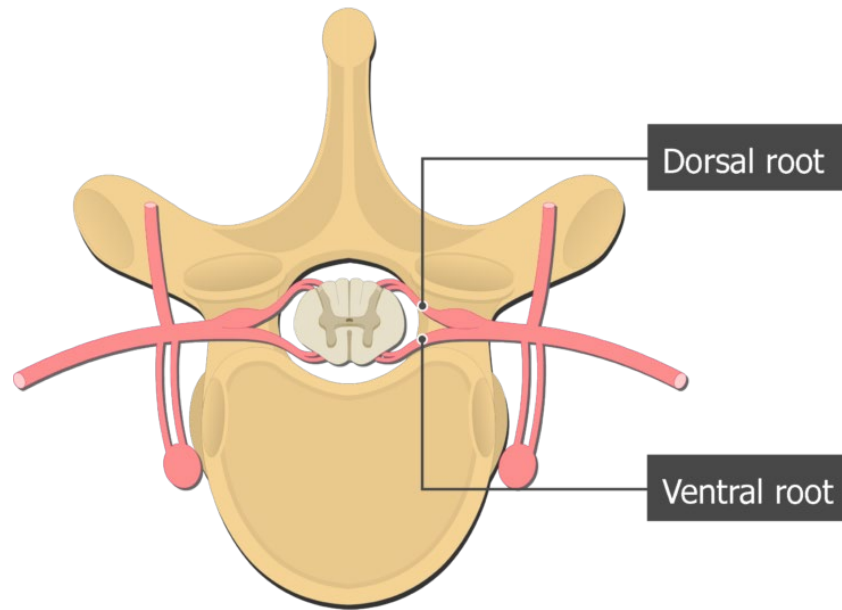
---

- **François Magendie** (1795-1855), a French physiologist, experimented with spinal cord lesions in puppies.
  - When he cut the dorsal/posterior root, the puppies could move their legs but could not feel pinches.
  - When he cut the ventral/anterior root, the puppies could not move their legs but could feel pinches.

# How did physiologists' experiments contribute?

---

- Magendie and **Sir Charles Bell** created the Bell-Magendie law:
  - Sensory information enters the spinal cord through the dorsal/posterior roots.
  - Movement information leaves the spinal cord through the ventral/anterior roots.



# How did physiologists' experiments contribute?

---

- **Hermann von Helmholtz** (1821-1894) was a German physician and physicist.
- He researched a variety of topics (e.g., seeing, hearing, and feeling) and contributed numerous publications to the field of physiology.
- He also taught Wilhelm Wundt, the father of experimental psychology.

# How did physiologists' experiments contribute?

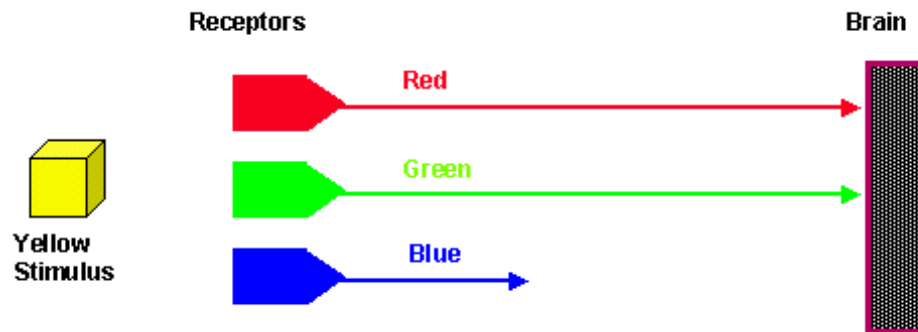
---

- Helmholtz studied the speed of neural impulse and contributed to the widespread use of reaction time as a method in psychology.
  - He tried to determine how quickly nerve impulses travel by experimenting with frogs and humans.
  - He tested frog muscles and gathered rates of about 30 meters (90 feet) per second.
  - He tested skin reactance in humans and gathered rates of about 60 meters (180 feet) per second.

# How did physiologists' experiments contribute?

---

- Helmholtz also studied visual perception and invented the ophthalmoscope.
  - He (and [James Maxwell](#)) found they could create any color by mixing red, green, and blue light.
  - They concluded humans have three kinds of nerve fibers that respond to the three primary colors.



# How did physiologists' experiments contribute?

---

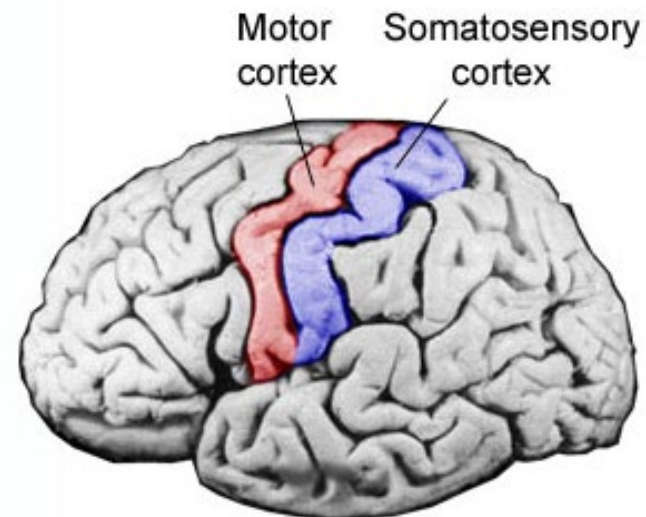
- **Thomas Young** made the same discovery at about the same time.
  - Thus, the theory is known as Young-Helmholtz **trichromatic theory of color vision**.
  - Note that Maxwell is not credited in the name of the theory.
  - This is an example of a multiple.



# How did physiologists' experiments contribute?

---

- In the **late 1800s**, two German physicians, **Gustav Fritsch** (1839-1927) and **Eduard Hitzig** (1838-1907), used electricity to map brain functions.
- Their work provided the first experimental evidence that the motor cortex is responsible for voluntary movement.

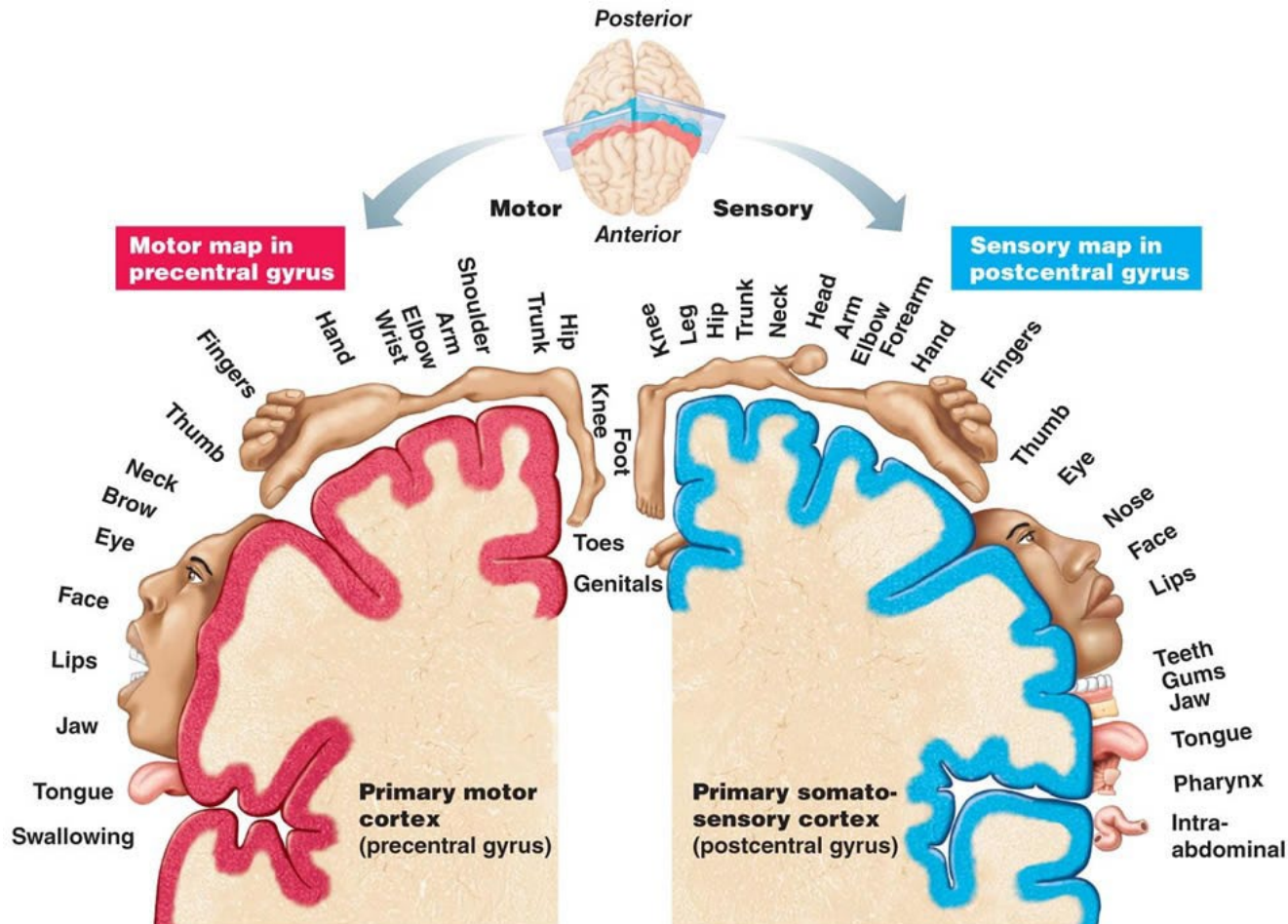


# How did physiologists' experiments contribute?

---

- They restrained live dogs, cut away their skulls to expose their brains, and stimulated different parts of the cerebrum using batteries.
  - When they touched one part of the motor cortex, the feet moved.
  - When they touched another part, the tail moved.
  - When they touched yet another part of the cortex, the tongue moved.

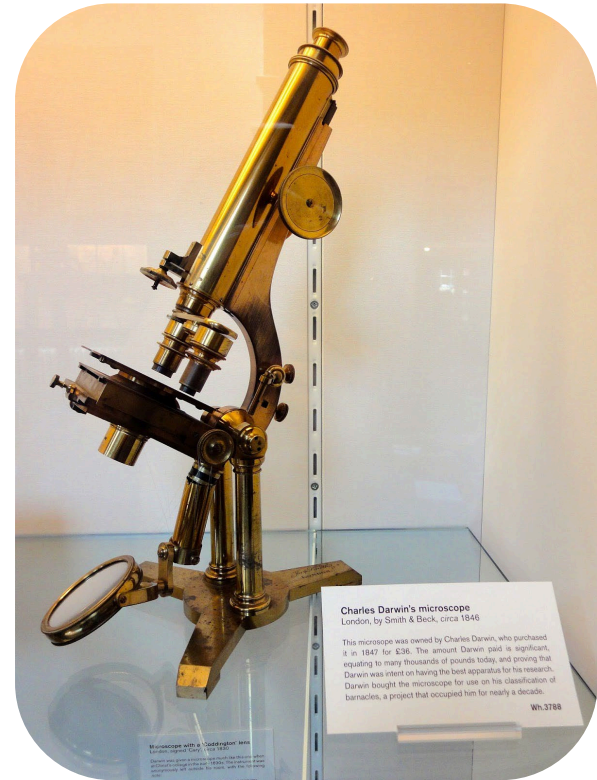
# How did physiologists' experiments contribute?



**How the study of nerve  
cells contribute to the  
development of psychology  
in the 19th century?**

# How the study of nerve cells contribute?

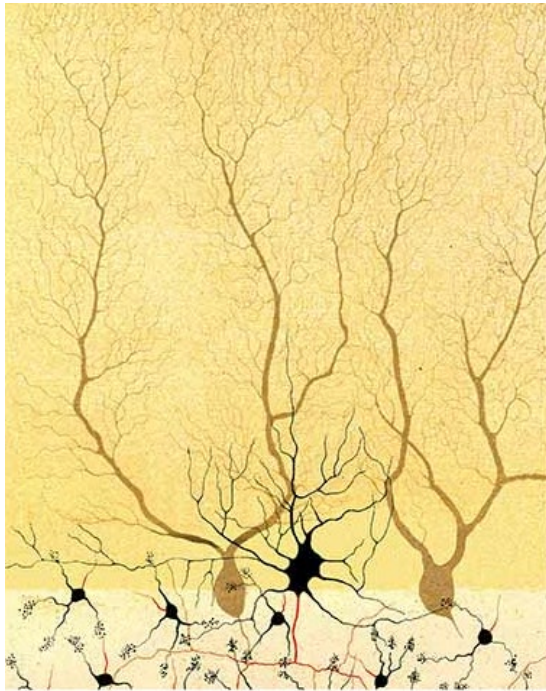
- The first microscope was made in 1590, and researchers could see bacteria as early as 1675.
- In the 1800s, technological advancements allowed scientists to “see” things they had never seen before, including nerve cells.



Charles Darwin's  
microscope made in 1847

# How the study of nerve cells contribute?

---



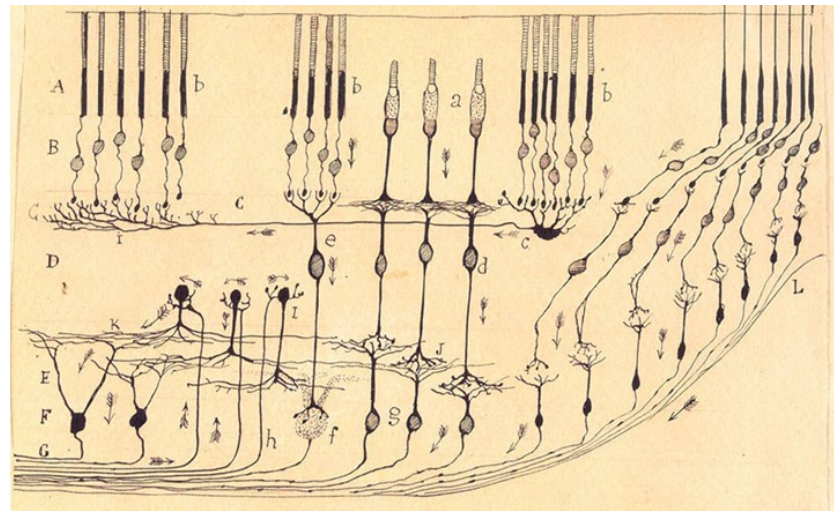
Golgi's illustration of a brain cell (1882-83)

- In 1873, Camillo Golgi (1843-1926), an Italian biologist and pathologist, created a staining technique using silver nitrate.
- He was then able to reveal the structure of nerve cells.



# How the study of nerve cells contribute?

- **Santiago Ramón y Cajal** (1852-1934), a Spanish neuroscientist and pathologist, suggested there must be a “space” between nerve cells.
- In **1906**, he and Golgi shared the Nobel Prize for establishing the neuron as the basic unit of the nervous system.

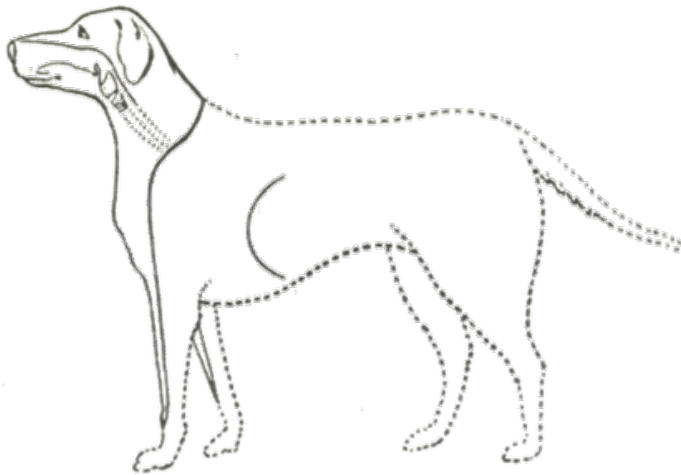


Cajal's drawing of cells in the retina

# How the study of nerve cells contribute?

---

- **Sir Charles Scott Sherrington** (1857-1952) was an English neurophysiologist.
- He studied “spinal dogs” who had their spinal cords partially cut from their brains.



Sherrington's figure (1906)

- Their reflexes were more pronounced than those of intact dogs.
- He concluded the cortex had an inhibitory effect on reflexes.



# How the study of nerve cells contribute?

---

- Sherrington published *The Integrative Action of the Nervous System* in 1906 to explain how the nervous system coordinates the body parts and organs into a unified whole.
  - Reflexes are the simplest unit of nervous integration.
  - Complex behaviors are the result of reflexes chained together in a sequence (reflex chaining).
  - The synaptein (or synapse) is the site where basic reflexes interact to create more complex behavior.

# How the study of nerve cells contribute?

---

- He also predicted the presence of **neurotransmitters**, the chemicals that cross the synapse to promote or inhibit neuron firing.
- In **1932**, he won a Nobel Prize with **Edgar Adrian** for their work on the functions of neurons.

