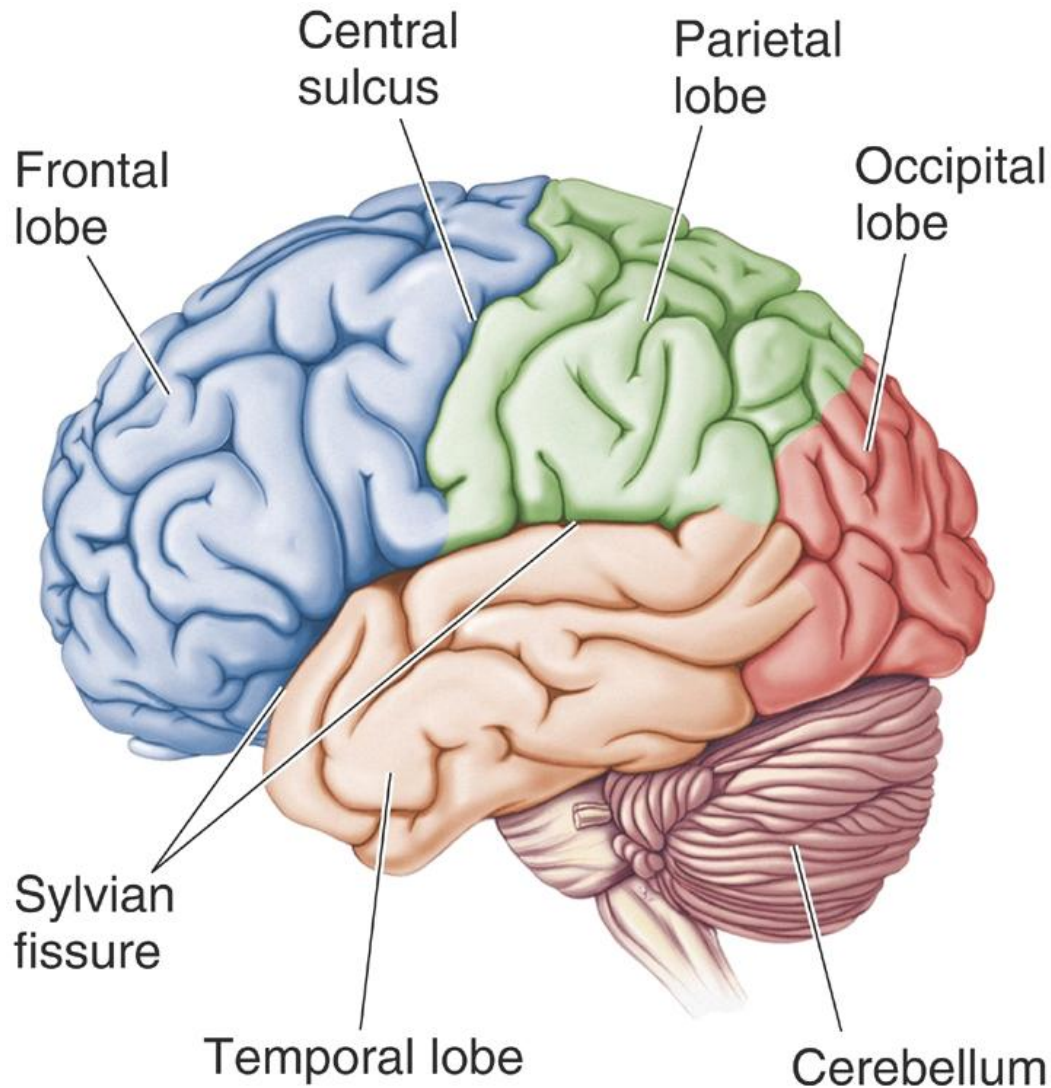


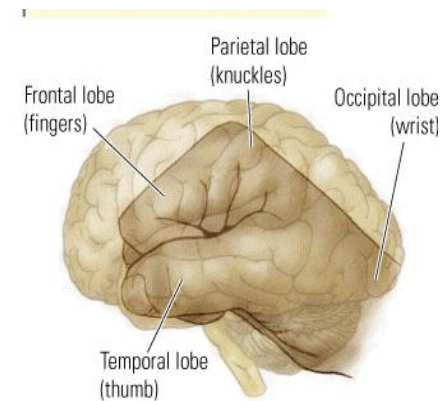
Bear, Connors, Paradiso  
Neuroscience: Exploring the Brain  
3<sup>rd</sup> edition

Chapter 1: Past Present Future



Same pattern in everyone

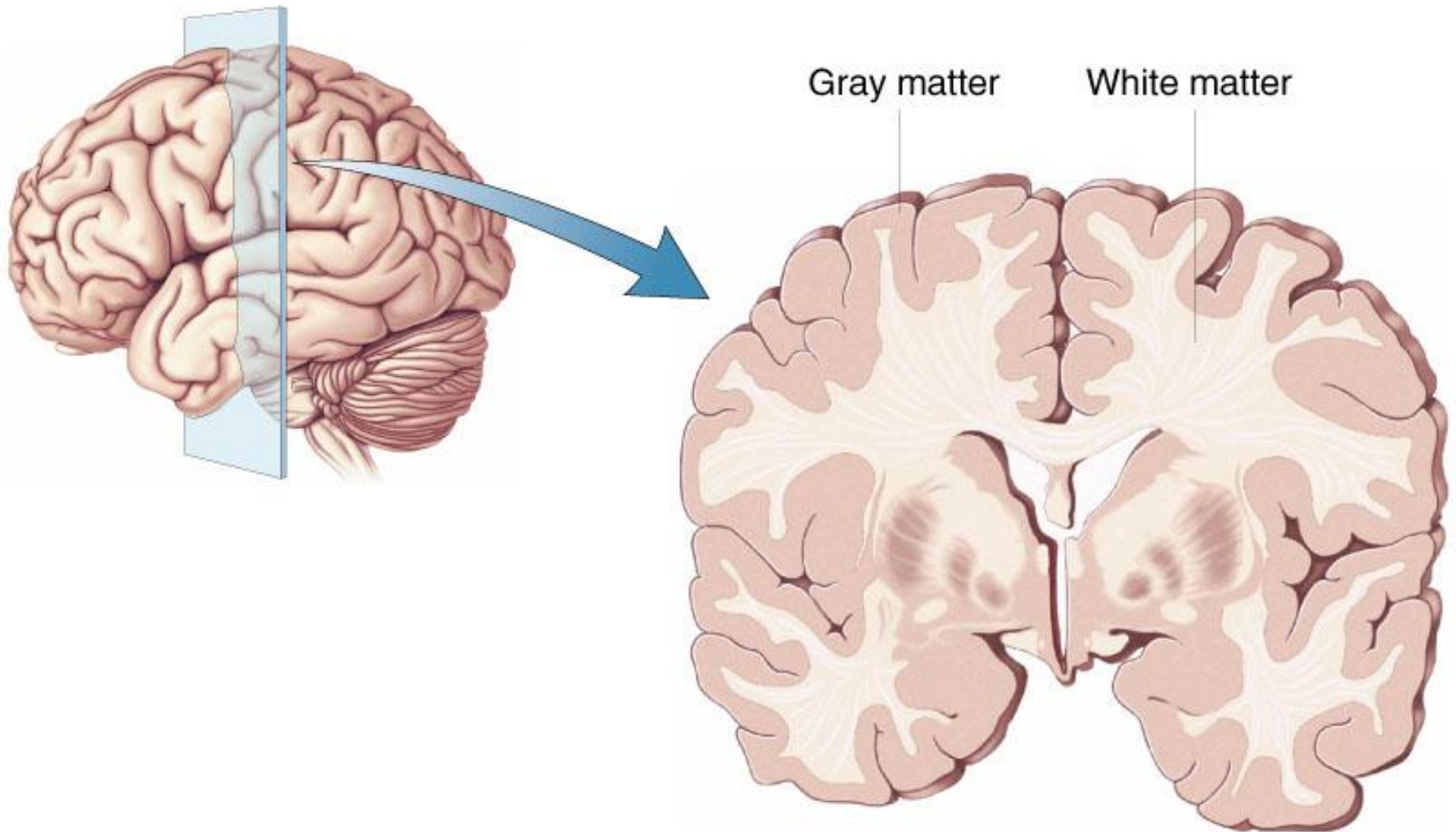
Why?



Neuroscience: Exploring the Brain, 3rd Ed, Bear, Connors, and Paradiso Copyright © 2007 Lippincott Williams & Wilkins

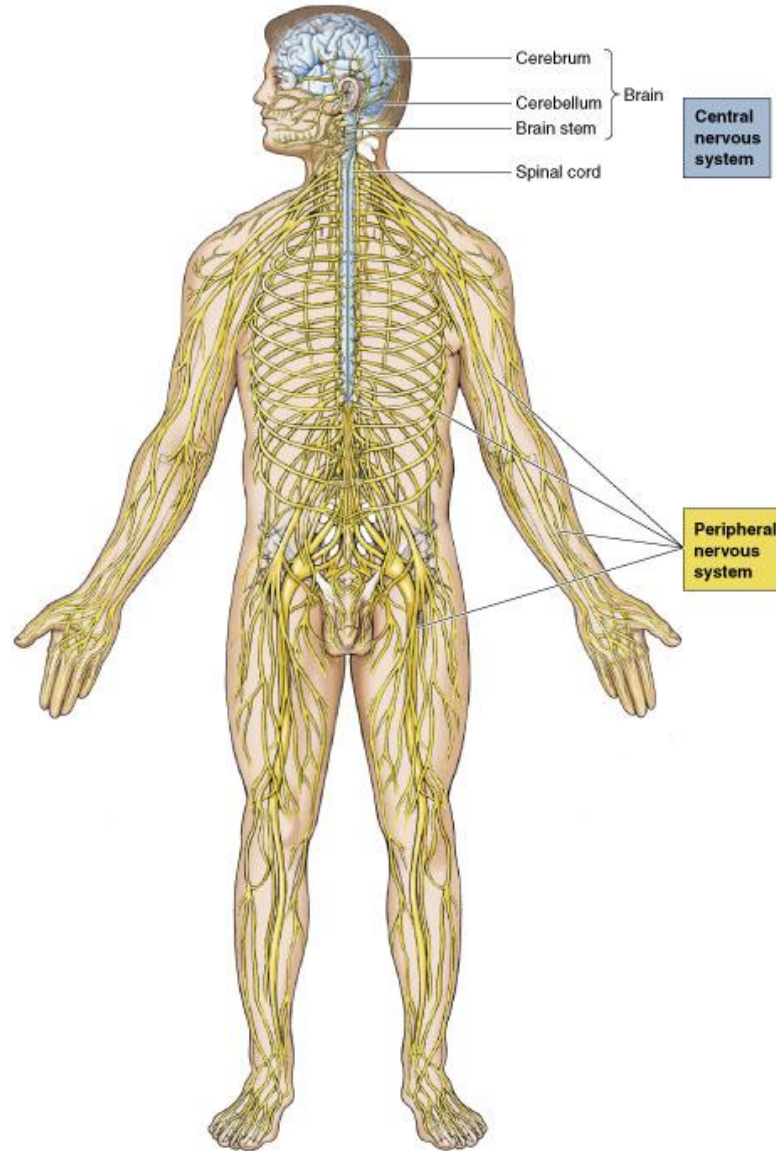
Gyrus, gyri; sulcus, sulci Deep sulci are fissures

**Figure 1.6**  
White matter and gray matter. The brain has been cut open to reveal these two types of tissue.



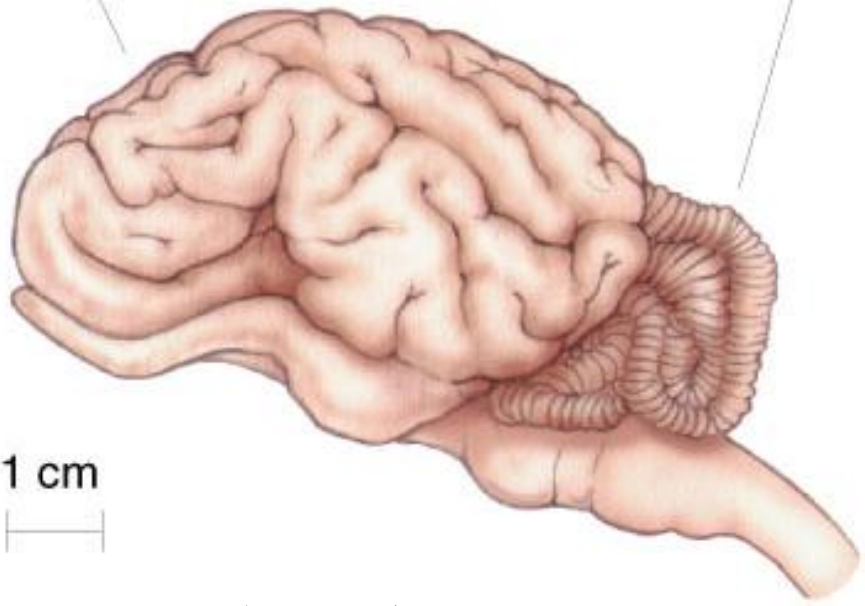
**Figure 1.7**

The basic anatomical subdivisions of the nervous system. The nervous system consists of two divisions, the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS consists of the brain and spinal cord. The three major parts of the brain are the cerebrum, the cerebellum, and the brain stem. The PNS consists of the nerves and nerve cells that lie outside the brain and spinal cord.



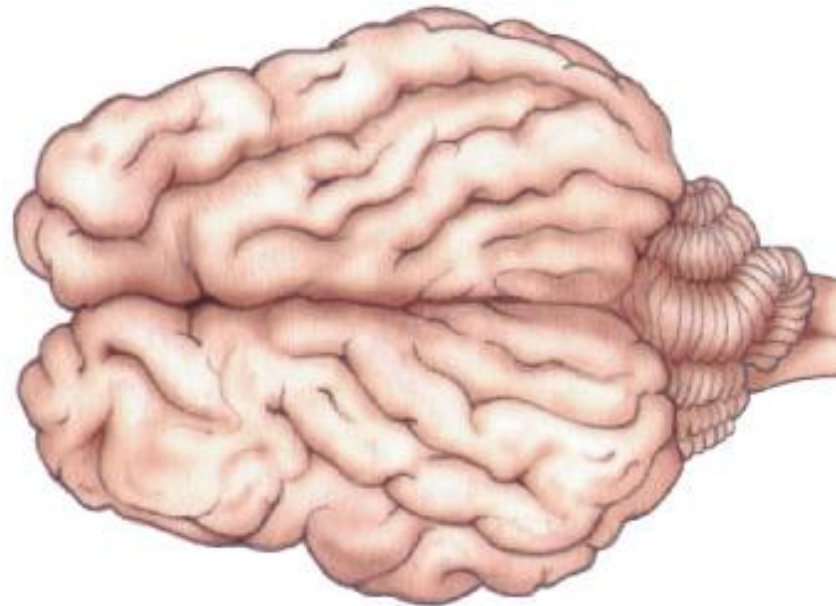
Cerebrum

Cerebellum



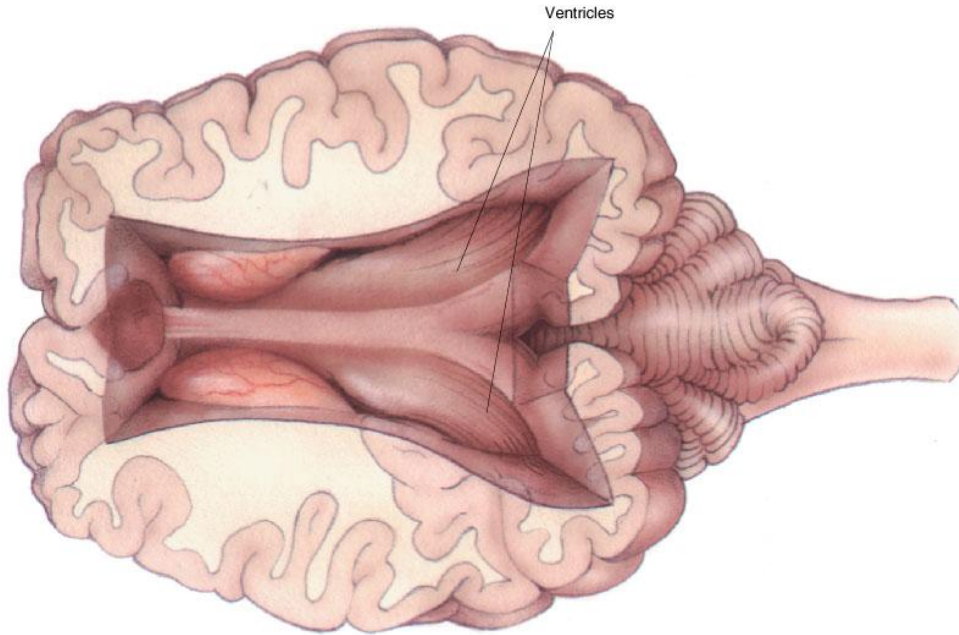
1 cm

~~Side view~~



~~Top view~~

Figure 1.3  
A dissected sheep brain showing the ventricles.



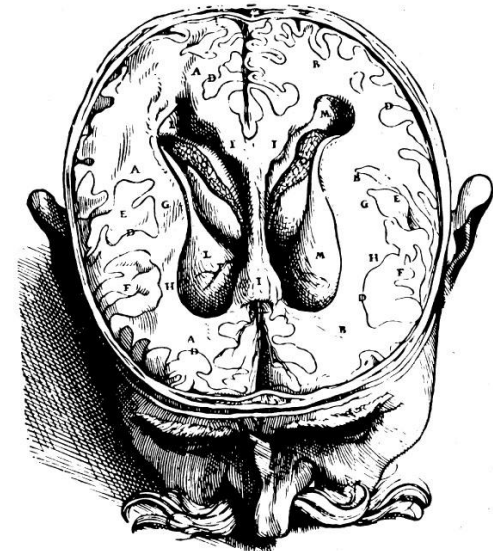
© 2001 Lippincott Williams & Wilkins

# Galen

## 200 AD

Blood  
Phlegm  
Yellow bile  
Black bile  
Moved by nerves  
1500 years!!!

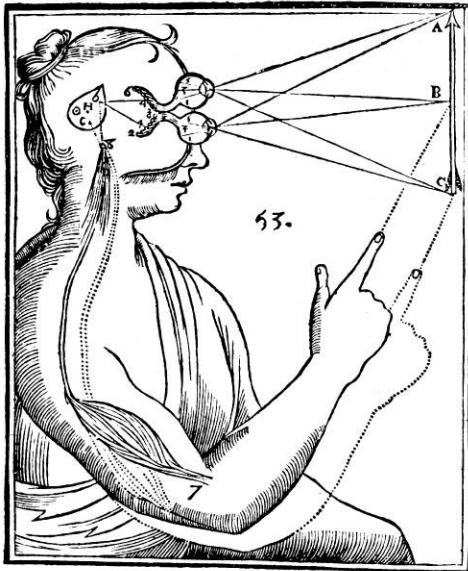
Figure 1.4  
Human brain ventricles depicted during the Renaissance. This drawing is from *De humani corporis fabrica* by Vesalius (1543). The subject was probably a decapitated criminal. Great care was taken to be anatomically correct in depicting the ventricles. (Source: Finger, 1994, Fig. 2.8.)



© 2001 Lippincott Williams & Wilkins

Figure 1.5

The brain according to Descartes. This drawing appeared in a 1662 publication by Descartes. Hollow nerves from the eyes project to the brain ventricles. The mind influences the motor response by controlling the pineal gland (H), which works like a valve to control the movement of animal spirits through the nerves that inflate the muscles. (Source: Finger, 1994, Fig. 2.16.)



© 2001 Lippincott Williams & Wilkins

– Decartes 1600  
Added “mind”

– Galvani 1790

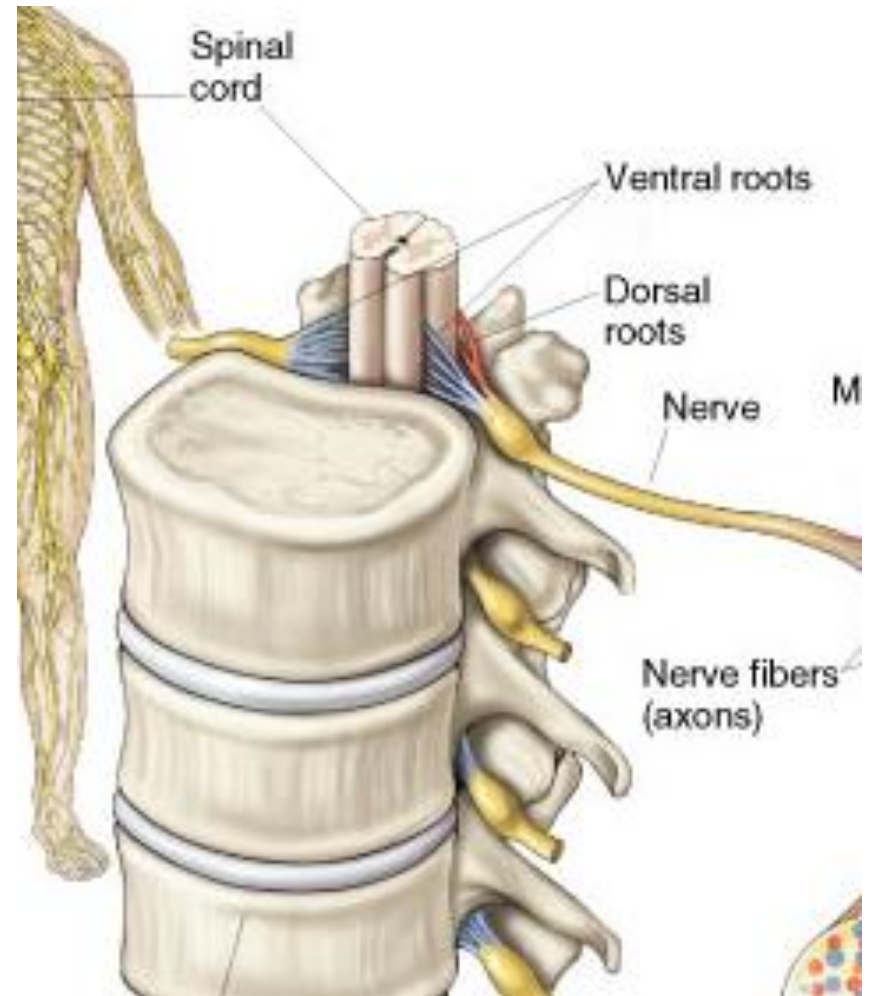
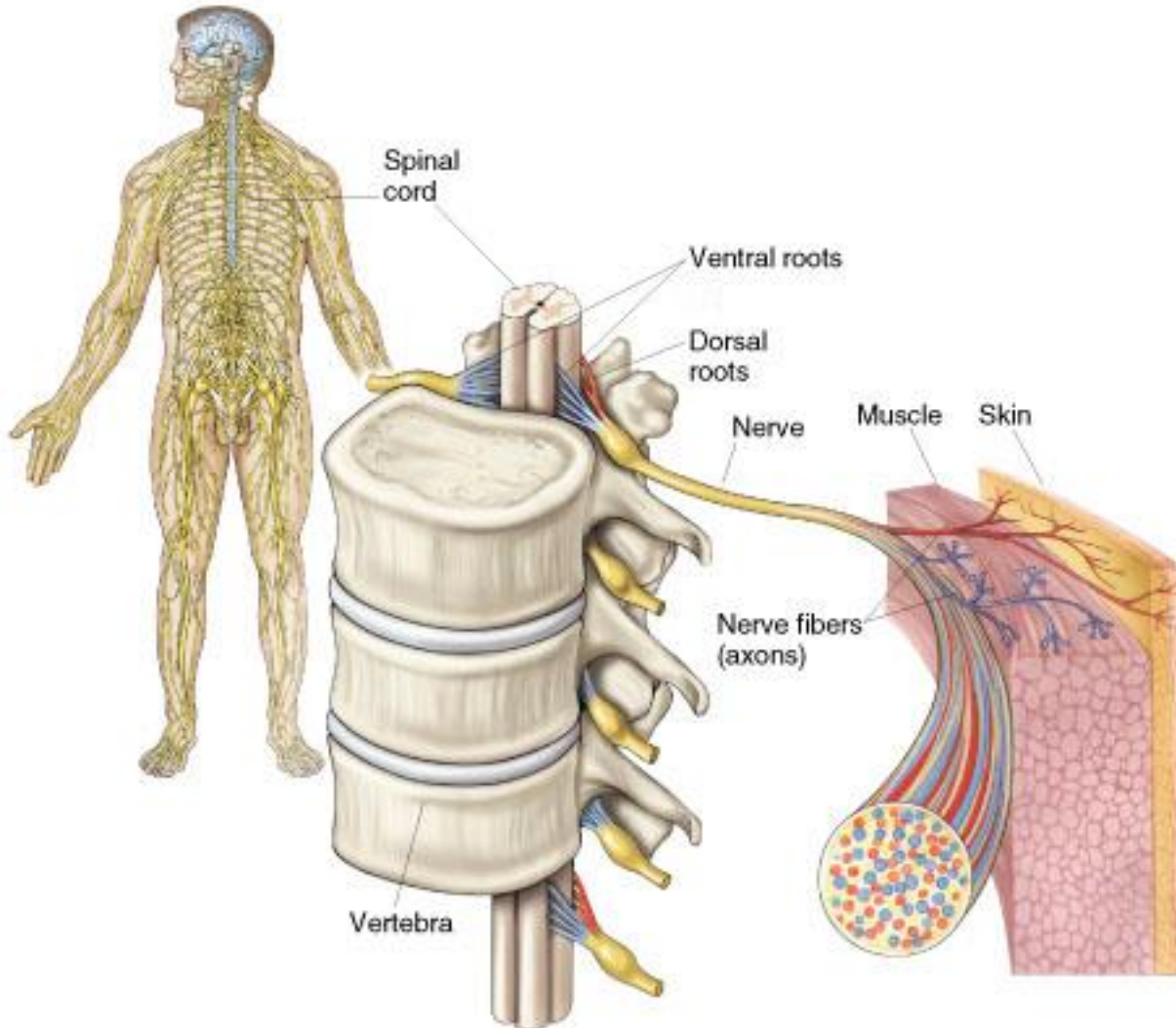


Figure 1.9

Spinal nerves and spinal nerve roots. Thirty-one pairs of nerves leave the spinal cord to supply the skin and the muscles. Cutting a spinal nerve leads to a loss of sensation and a loss of movement in the affected region of the body. Incoming sensory fibers and outgoing motor fibers divide into spinal roots where the nerves attach to the spinal cord. Bell and Magendie found that the ventral roots contain only motor fibers and the dorsal roots contain only sensory fibers.



VENTRAL motor efferent

DORSAL sensory afferent

Different directions

**SAME**

**VENTRAL**

**DORSAL**

**GANGLIA**

**nerve**



# Francolis Magendie 1822

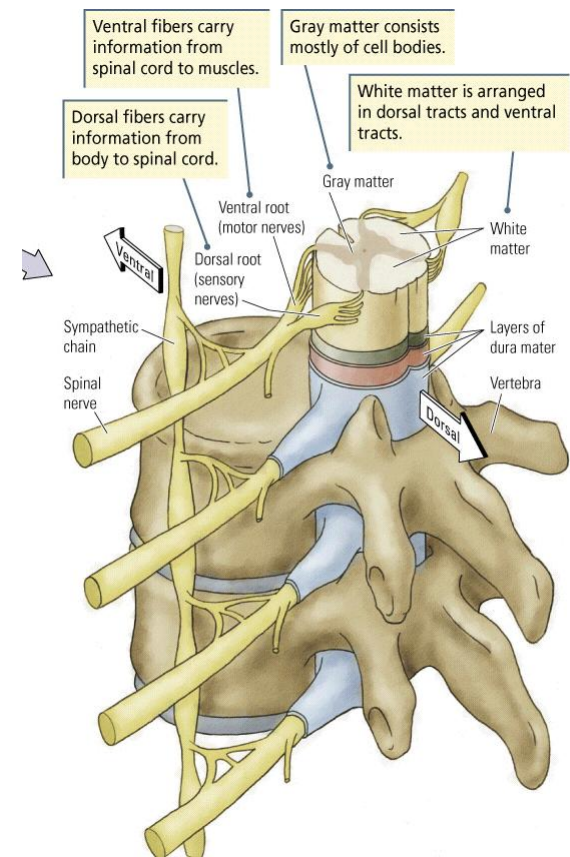
## France

# Charles Bell 1811

## Scotland

Bell's palsy – motor portion of facial  
nerve (7<sup>th</sup>)

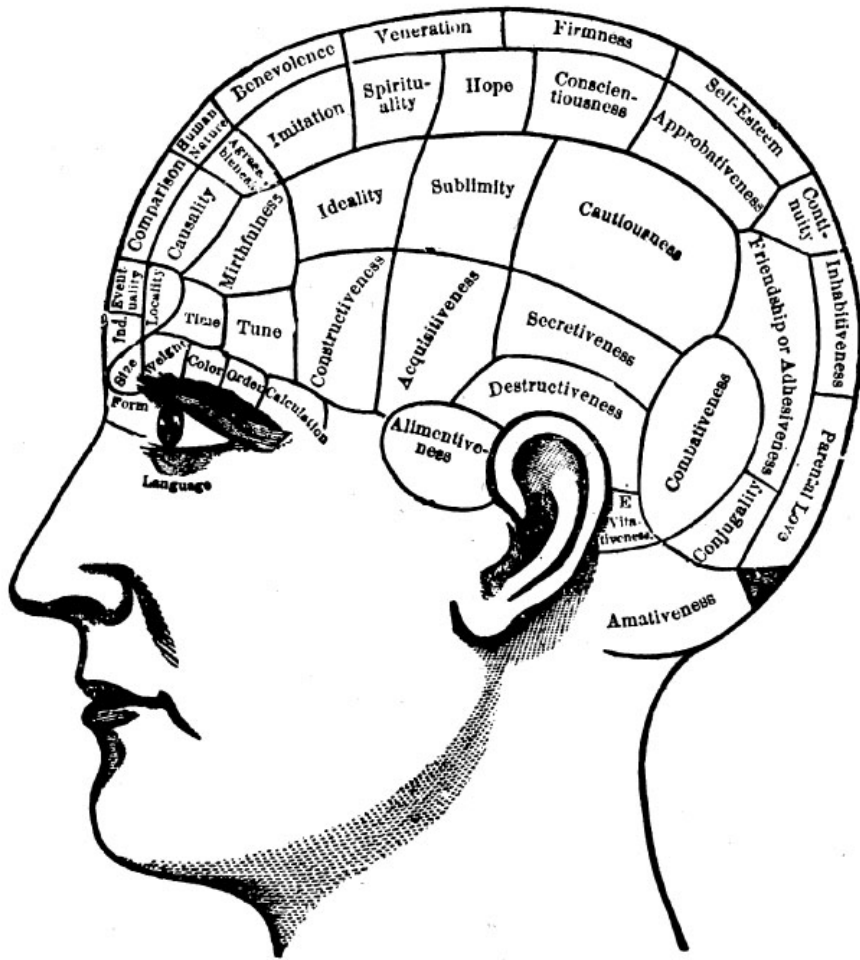
dorsal or ventral? Cranial nerves are  
different



# idiopathic

- trauma
- tumor
- meningitis
- herpes
- ear infection
- high blood pressure
- diabetes
- upper respiratory infection

Figure 1.10  
 A phrenological map. According to Gall and his followers, different behavioral traits could be related to the size of different parts of the skull. (Source: Clarke and O'Malley, 1968, Fig. 118.)



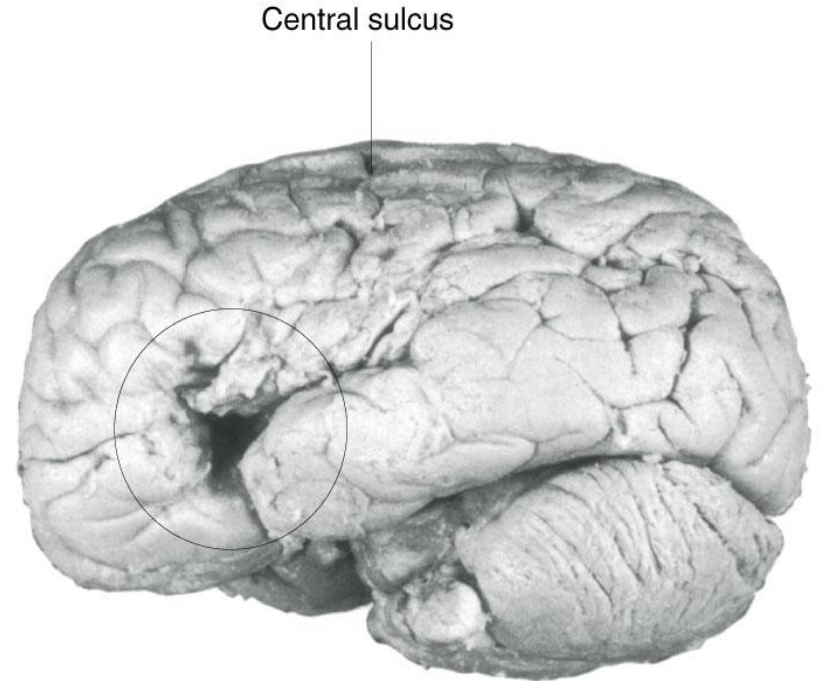
© 2001 Lippincott Williams & Wilkins

Gall 1820

vs Flourens

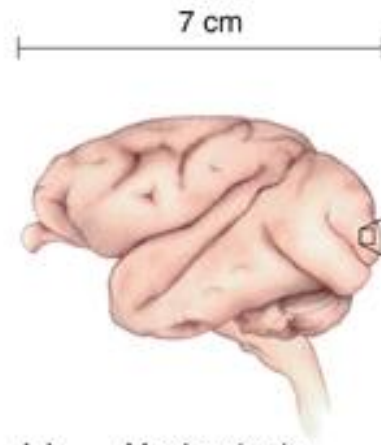
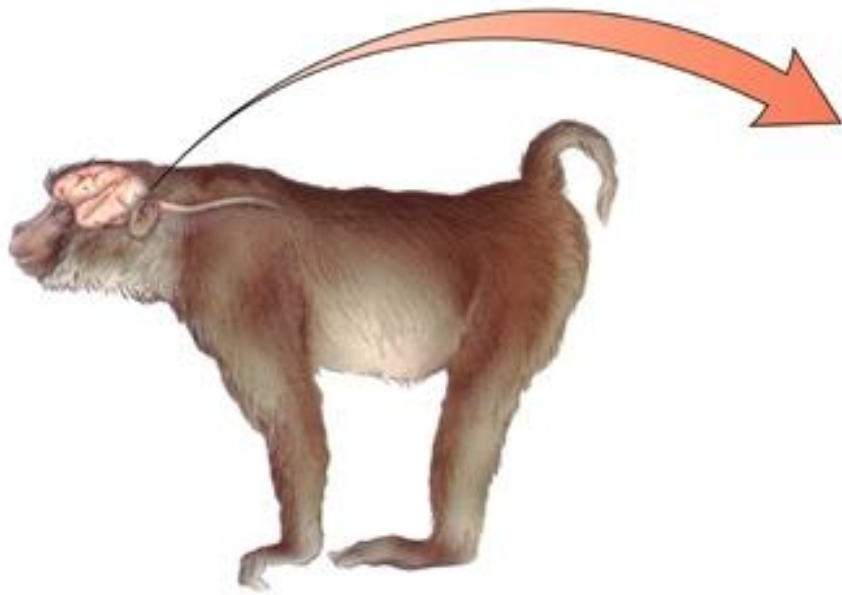
# RELATIONSHIP STRUCTURE/ FUNCTION

Figure 1.12  
 The brain that convinced Broca of localization of function in the cerebrum. This is the preserved brain of a patient who had lost the ability to speak before he died in 1861. The lesion that produced this deficit is circled. (Source: Corsi, 1991, Fig. III, 4.)

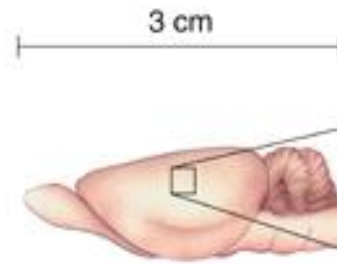


© 2001 Lippincott Williams & Wilkins

Broca - 1860



(a) Monkey brain



(b) Rat brain

Neuroscience: Exploring the Brain, 3rd Ed, Bear, Connors, and Paradiso Copyright © 2007 Lippincott Williams & Wilkins

**darwin**

1	
2	
4	
8	
16	
32	100
64	
128	
256	
512	
1,024	100
2,048	
4,096	
8,192	
16,384	
32,768	100
65,536	
131,072	
262,144	
524,288	
1,048,576	100
2,097,152	
4,194,304	
8,388,608	
16,777,216	
33,554,432	100 33 million 500 years later
67,108,864	
134,217,728	
268,435,456	
536,870,912	
1,073,741,824	100
2,147,483,648	
4,294,967,296	
8,589,934,592	
17,179,869,184	
34,359,738,368	100
68,719,476,736	
137,438,953,472	
274,877,906,944	
549,755,813,888	
1,099,511,627,776	100
2,199,023,255,552	
4,398,046,511,104	
8,796,093,022,208	
17,592,186,044,416	
35,184,372,088,832	100
70,368,744,177,664	
140,737,488,355,328	
281,474,976,710,656	
562,949,953,421,312	
1,125,899,906,842,620	100 1000 years later

# Why Animal Models?

structures/ events shared across species

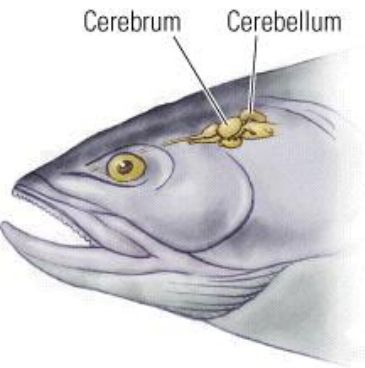


- less than 1% of the number used for food
- Experiments must advance knowledge
- Pain and distress minimized
- All alternatives exhausted first

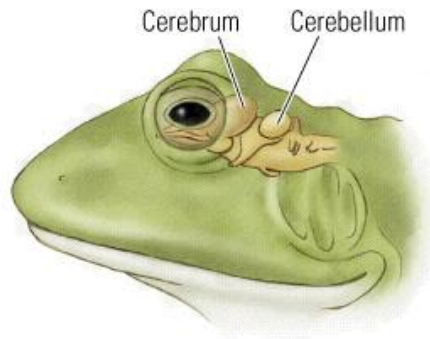


They've Saved More People Than 911.

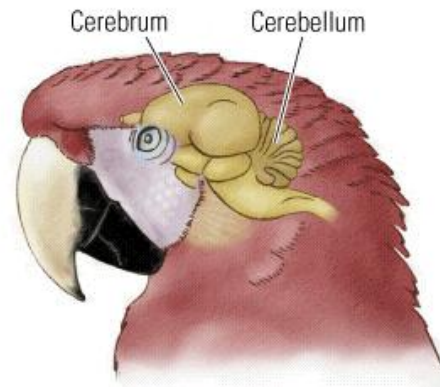
all chordates have cerebrum and cerebellum



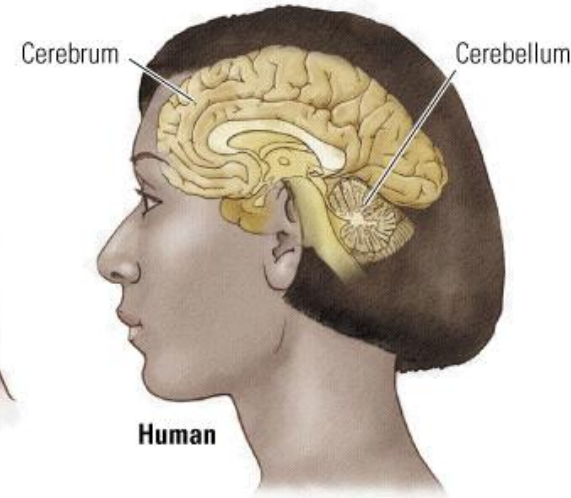
Fish



Frog

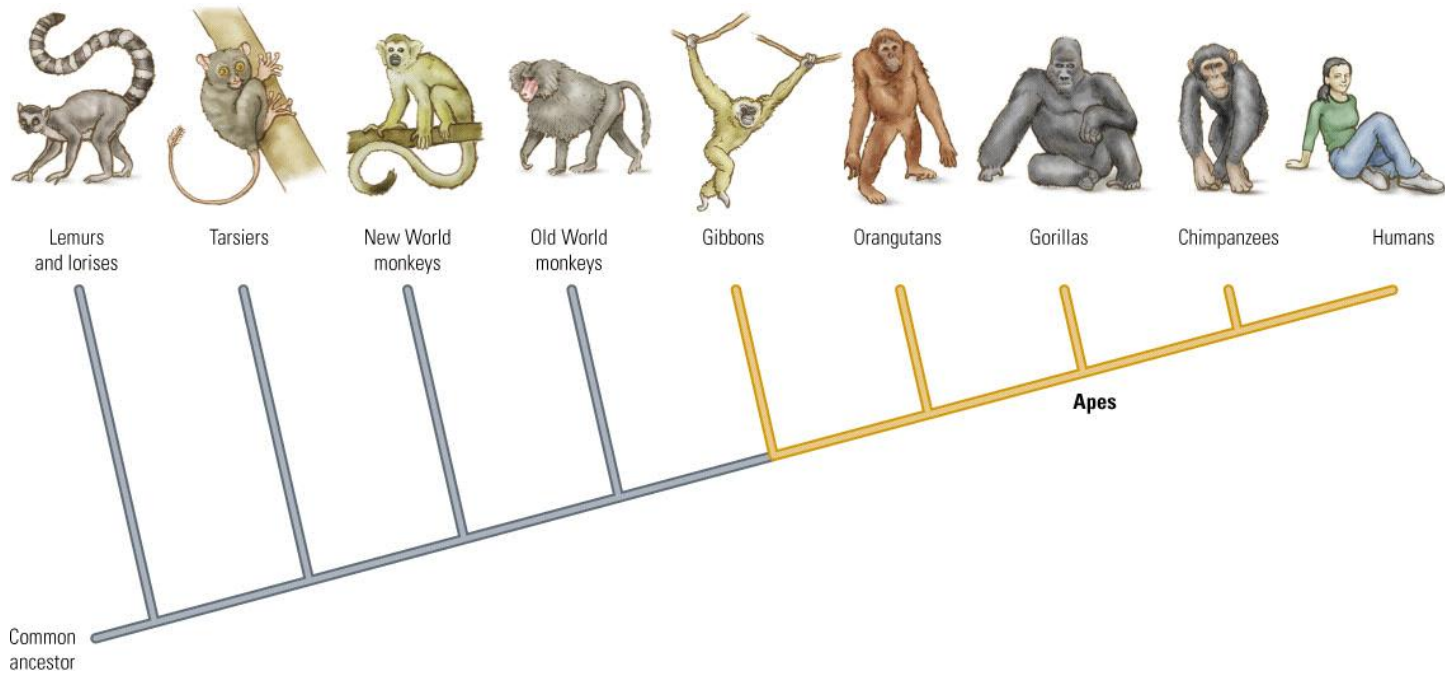


Bird



Human

4000 species of mammals



brains get bigger, differences in scaling  
cortex  
limbic system

# Who studies the brain?

Levels of analysis:

- Molecular
- Cellular
- Systems
- Behavioral

Table 1.3 **Some Major Disorders of the Nervous System**

DISORDER	DESCRIPTION
Alzheimer's disease	A progressive degenerative disease of the brain, characterized by dementia and always fatal
Cerebral palsy	A motor disorder caused by damage to the cerebrum at the time of birth
Depression	A serious disorder of mood, characterized by insomnia, loss of appetite, and feelings of dejection
Epilepsy	A condition characterized by periodic disturbances of brain electrical activity that can lead to seizures, loss of consciousness, and sensory disturbances
Multiple sclerosis	A progressive disease that affects nerve conduction, characterized by episodes of weakness, lack of coordination, and speech disturbance
Parkinson's disease	A progressive disease of the brain that leads to difficulty in initiating voluntary movement
Schizophrenia	A severe psychotic illness characterized by delusions, hallucinations, and bizarre behavior
Spinal paralysis	A loss of feeling and movement caused by traumatic damage to the spinal cord
Stroke	A loss of brain function caused by disruption of the blood supply, usually leading to permanent sensory, motor, or cognitive deficit

# ANNUAL – USA ALONE

Alzheimer's disease (5.1 million; 172 billion)

Parkinson's disease (1.5 million, 25 billion)

Depression (10-19%; 44 billion)

Schizophrenia (3 million) (Cost 62.7 billion/year)

Stroke (4 million) (Cost \$43 billion/year)

Addiction – ?? (Cost \$200 billion / year???)



- 1. *Observation and question*  
WHY???
  - 2. *Hypothesis* make a prediction
    - IF....THEN (MUST be testable)
  - 3. *Designing an Experiment*
    - test a hypothesis.
- \*\*\*\*\*All good experiments have controls
- 4. *Data Interpretation*
    - "What do these results mean?".
  - 5. *Conclusions* - inference
    - The data suggest.....