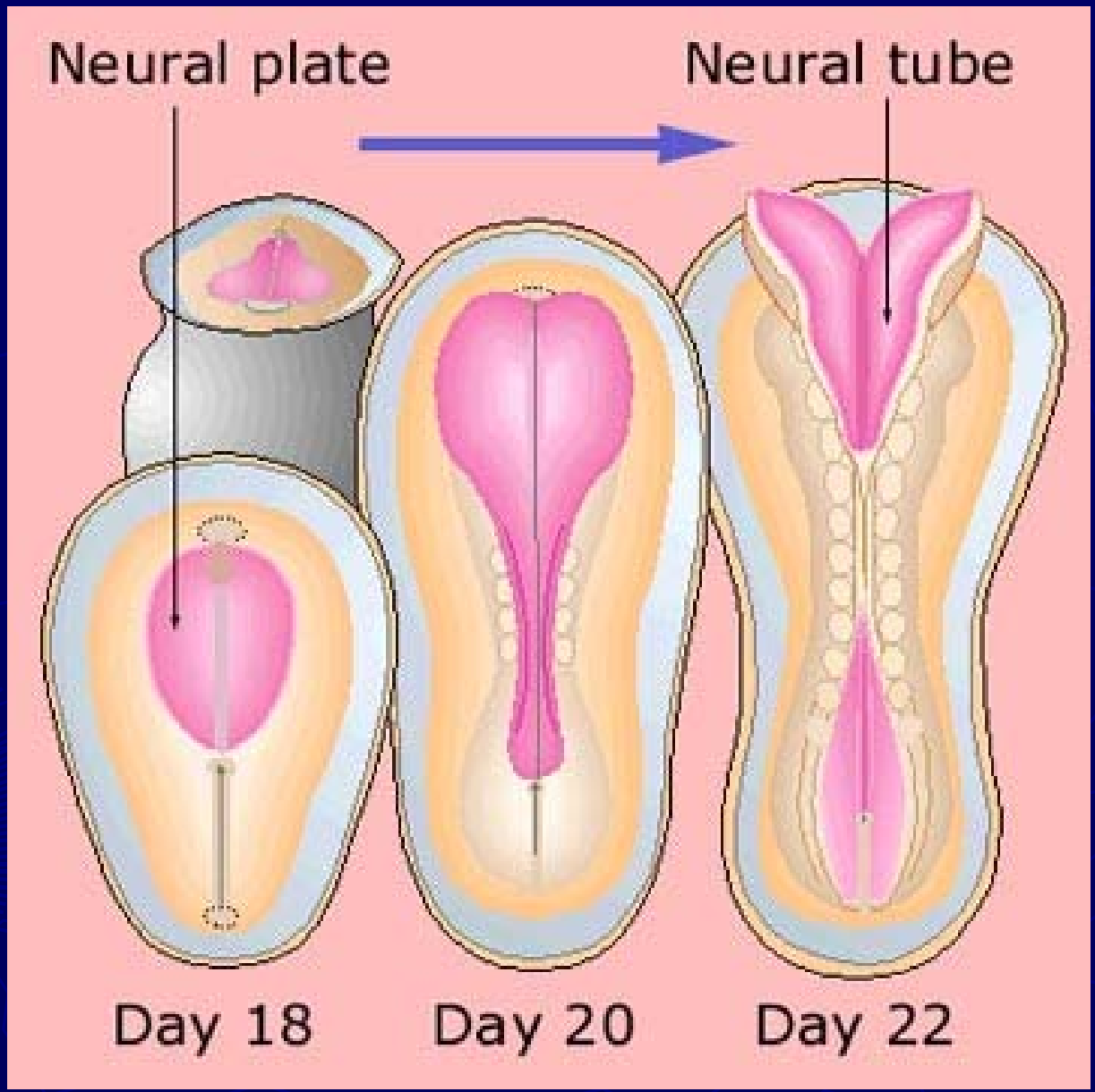
The Nervous System

The Developing Nervous System

- 3rd week of embryonic life. Small thickening on top of embryo running from head to (nearly) tail.
- After a few days left & right edges of the *neural plate* zip together and fuse lengthwise to form the *neural tube*.


Neural plate
Neural tube
Day 18
Day 20
Day 22

The Developing Nervous System

- At 1 month the head end of the neural tube develops three thickenings – develop into:

  Hindbrain

  Forebrain

  Midbrain

- Enclosed by cranial bones.

- Lower edge of hindbrain marks beginning of spinal cord.

- Brain & spinal cord -

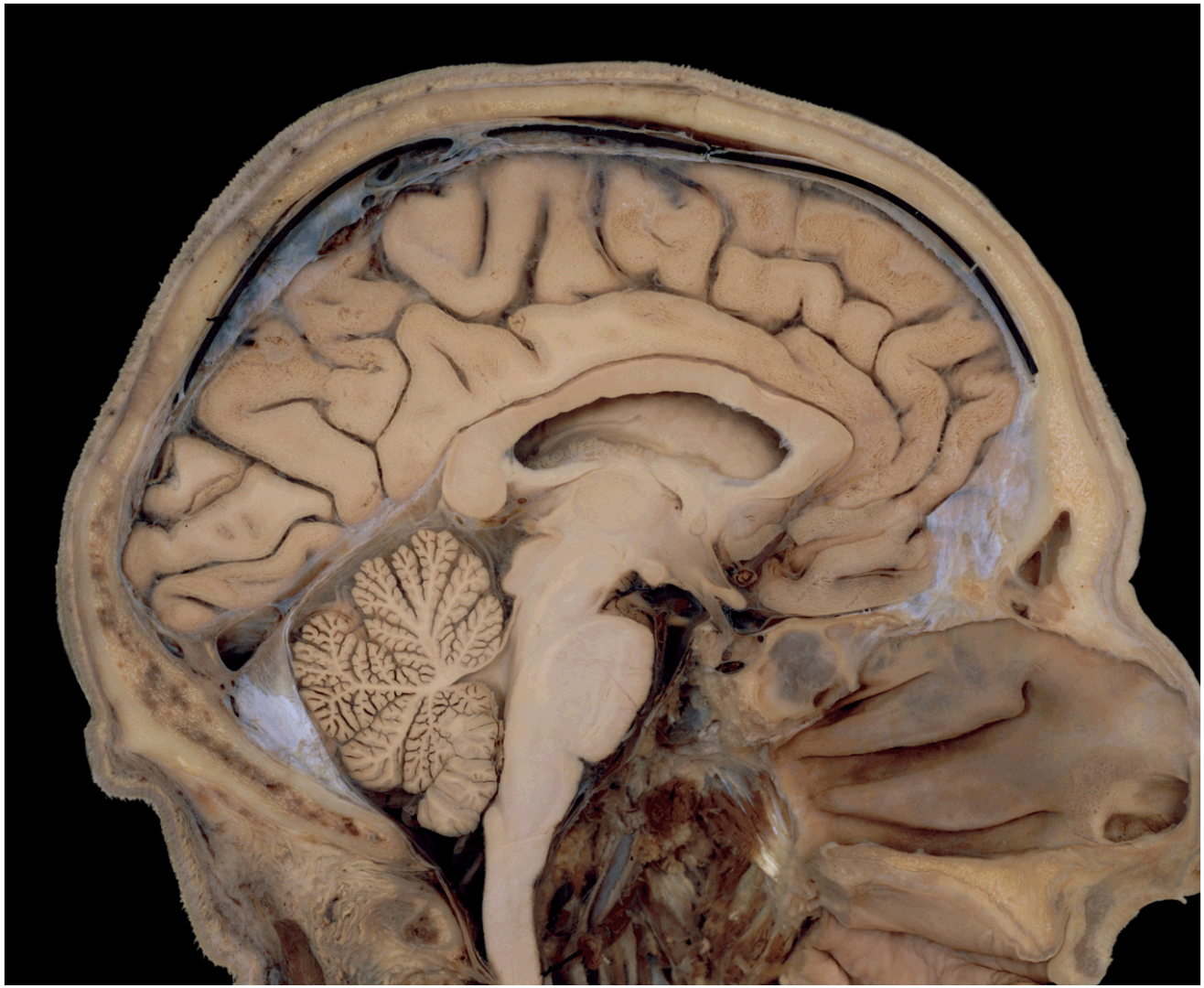
Preliminary facts about YOUR brain

- Huge. About 10 to 10 billion neurons — (units carrying electric signals underlying thought).
- Single neurons can connect with many other neurons. Brain has enormous computing power!
- Men's brains are generally bigger than women's.
- Human brain is 3 times larger, relative to body size, than the chimp (our closest relative).

But wait there's more.....

- Consists of two *hemispheres* - more or less mirror images of each other.
- Anatomically similar, hemispheres function differently.
- **Left** hemisphere dominant for _____, **right** for _____.
- Brain divided into three major parts, **hindbrain**, **midbrain**, **forebrain** (cortex).

The Hindbrain



The Hindbrain

- **Medulla**

  Regulation of heart rate , blood pressure, rate of respiration

  Simpler animals – crawling or swimming motions.

The Hindbrain

- **Pons**

  Controls some of the stages of sleep.

The Hindbrain

- **Cerebellum**:

  Knows what each part of the body is doing.

  Receives information from frontal lobes, knows what movements this lobe intends to accomplish.

  Monitors information about posture/balance, produces eye movements that compensate for changes head position.

The Hindbrain

- **Cerebellum**:

  MAY play a role in learning of new movements & movement skills.

  Very well developed in humans & primates.

The Hindbrain

- **Cerebellum**:

(1) Controls overall bodily balance

(2) Sequencing & timing of precise skilled movements

The Midbrain

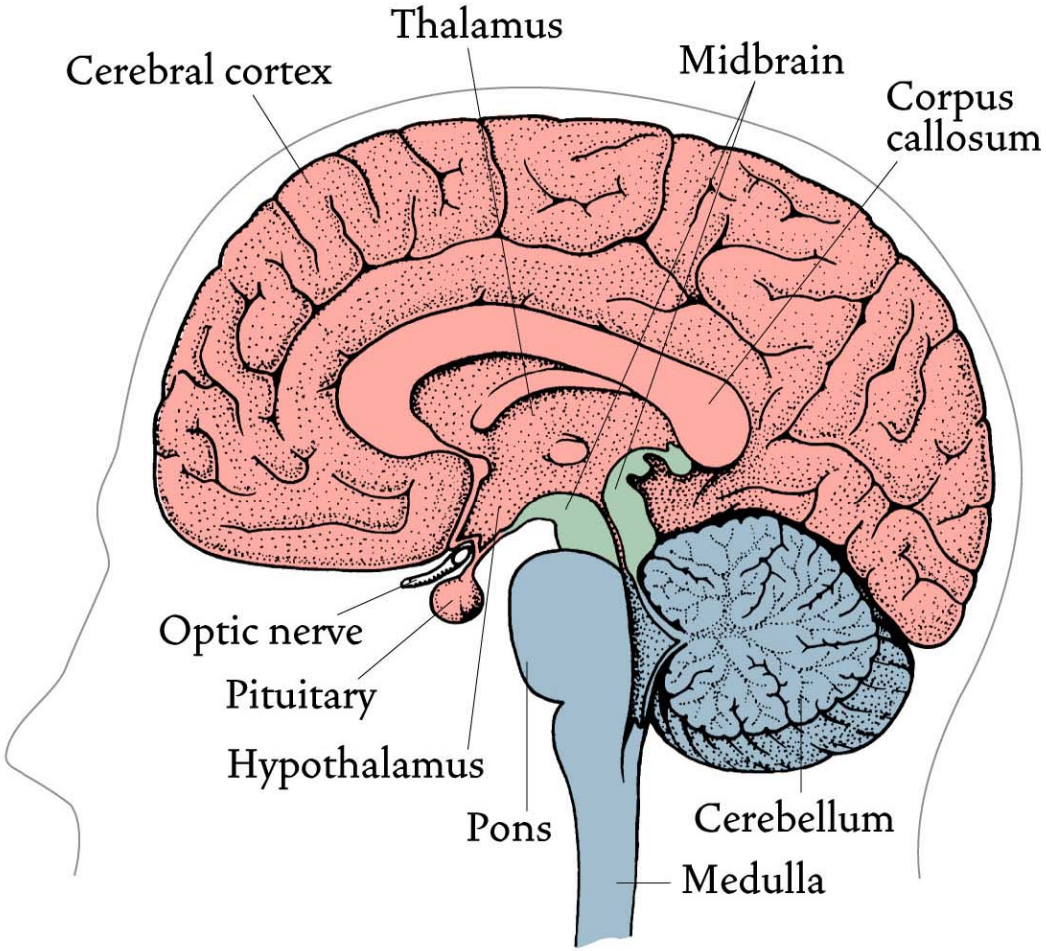


Figure 2.9: The human brain

The Midbrain

- Auditory & visual stimuli - eye movement.
- Control movements used in sexual behaviour & fighting, decrease sensitivity to pain.

The Forebrain

- Everything above the midbrain.
- Mammals (primates) have the largest forebrains.
- In humans – it's so large that it surrounds & hides from view all the midbrain and half the hindbrain.

The Forebrain

- Most obvious part is the part that is wrinkled – the *cortex*

- The cortex is the outer shell of the brain and is most important for psychological functions.

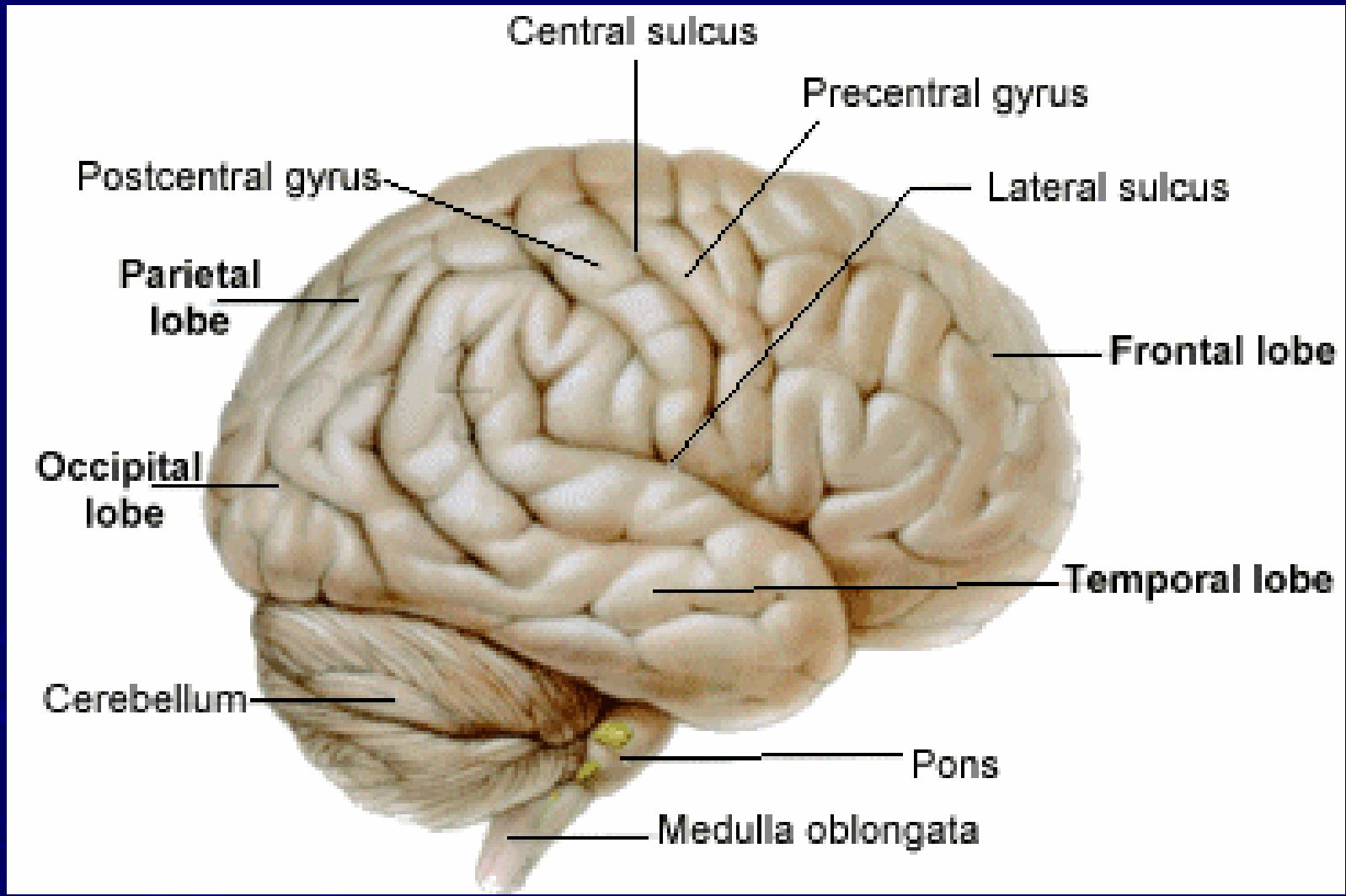
The Cortex

- Primates/complex mammals it accounts for more than ½ the brains volume (80% in humans).
- Part of the brain that makes us human?
- Humans gain flexibility of behaviour by having a large cortex.
- Cortex is 2-3mm thick – made possible by convolutions – if flat would occupy about 2 feet.

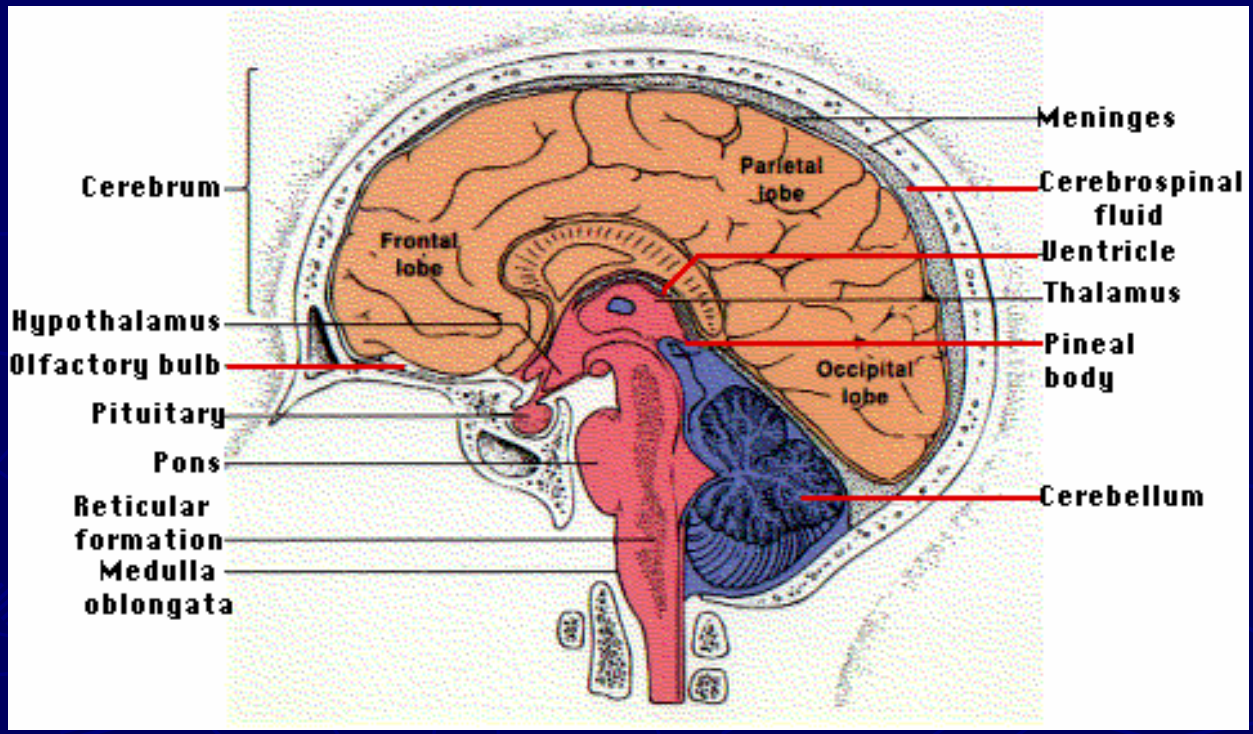
The Cortex

- Tasks performed by nonmammals in subcortical regions (limbic system/midbrain) performed by cortex in mammals.

- As cortex enlarged in mammalian brain evolution subcortical structures (midbrain) act more as relay stations/ middle managers.


Central sulcus
Precentral gyrus
Postcentral gyrus
Lateral sulcus
Parietal lobe
Frontal lobe
Occipital lobe
Temporal lobe
Cerebellum
Pons
Medulla oblongata

Subcortical Structures of Forebrain



Thalamus:

Hypothalamus:

Basal ganglia:

Subcortical Structures of Forebrain

- Limbic system

Amygdala

Hippocampus

Branches of the Nervous System

- **Central nervous system**
- **Peripheral nervous system**

1. ***Somatic nervous system***
2. ***Autonomic nervous system***

Branches of the Nervous System

- Afferent nerves

- Efferent nerves

Branches of the Nervous System

- Cranial Nerves

  12 pairs - enter/exit from hindbrain (pons/medulla).

  Poke through holes in skull - afferent/efferent functions.

  Control movements of & carry sensations from head & neck.

  Regulate glandular secretions in head.

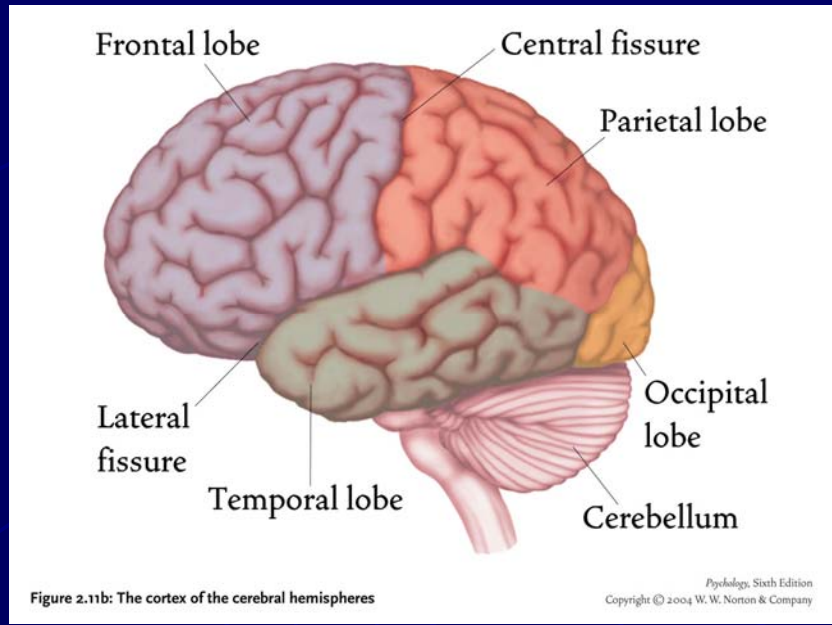
  Control visceral functions.

The Four Lobes of the Cortex

- **Occipital lobe**

Back of the brain

Receives input from the eyes (at the front of the head!) via the thalamus

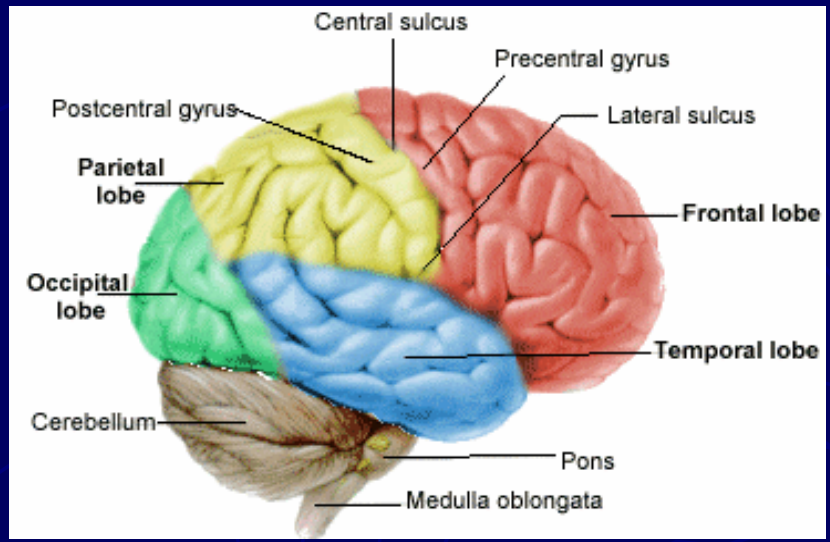


The Four Lobes of the Cortex

- **Parietal lobe:**

  Important for spatial perception.

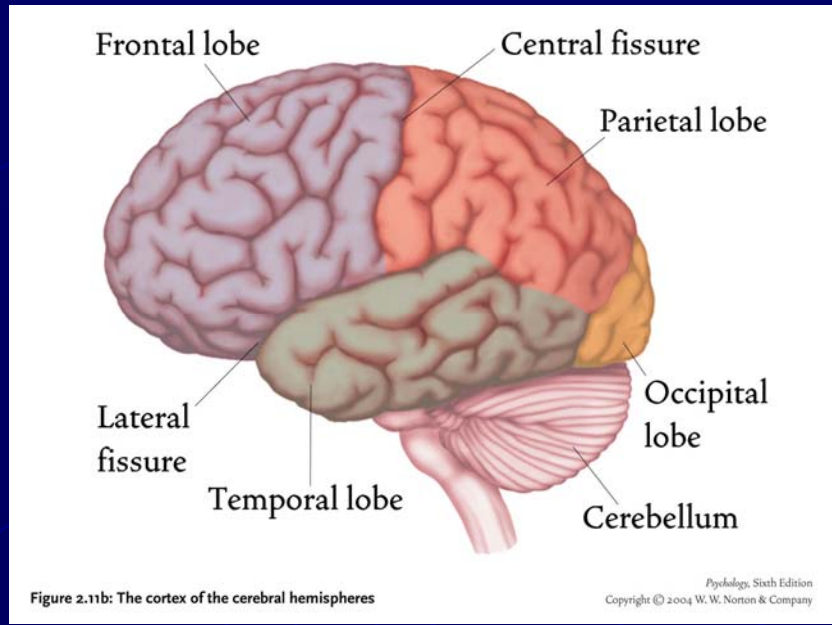
  Postcentral gyrus



The Four Lobes of the Cortex

- **Temporal lobe:**

  Receiving area for auditory information.

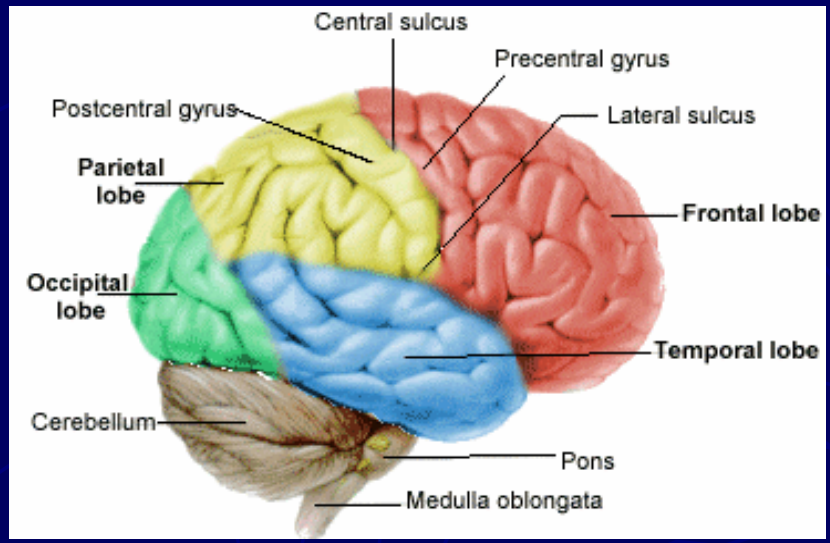


The Four Lobes of the Cortex

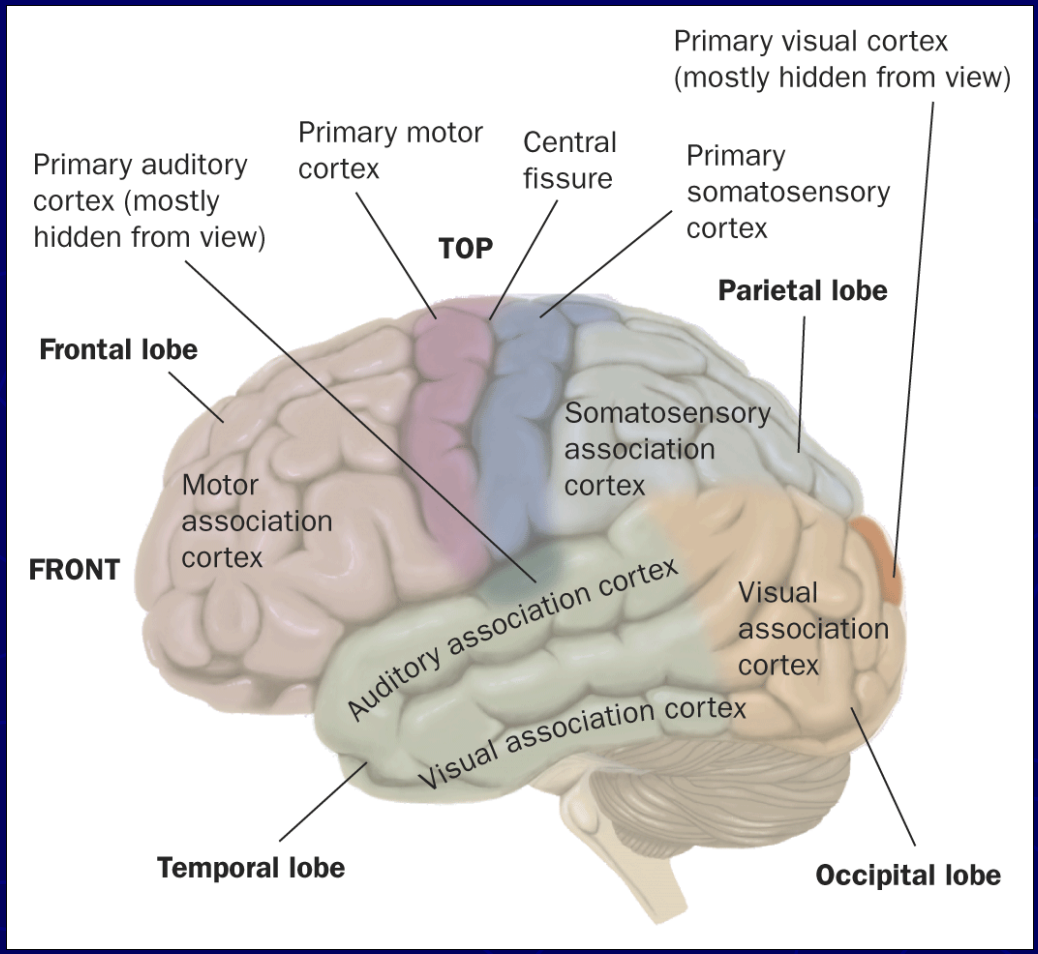
- **Frontal lobe:**

  Responsible for motor output, motor planning.

  Precentral gyrus



Primary/Association Areas



Primary areas –

Association areas -

Primary Motor Area

- Discovered in 1860's.
- Mild electric currents applied to parts of the cortex in animals.
- Very specific effects.
- Evidence of *contralateral control* - operates in all nervous systems.

Primary Motor Area

- Canadian Neurosurgeon Wilder Penfield – worked with epileptics needing surgery to remove diseased cells.

  400 fully conscious people helped confirm that the primary motor area lies in the frontal lobe and stimulation there led to movement of specific parts of the body.

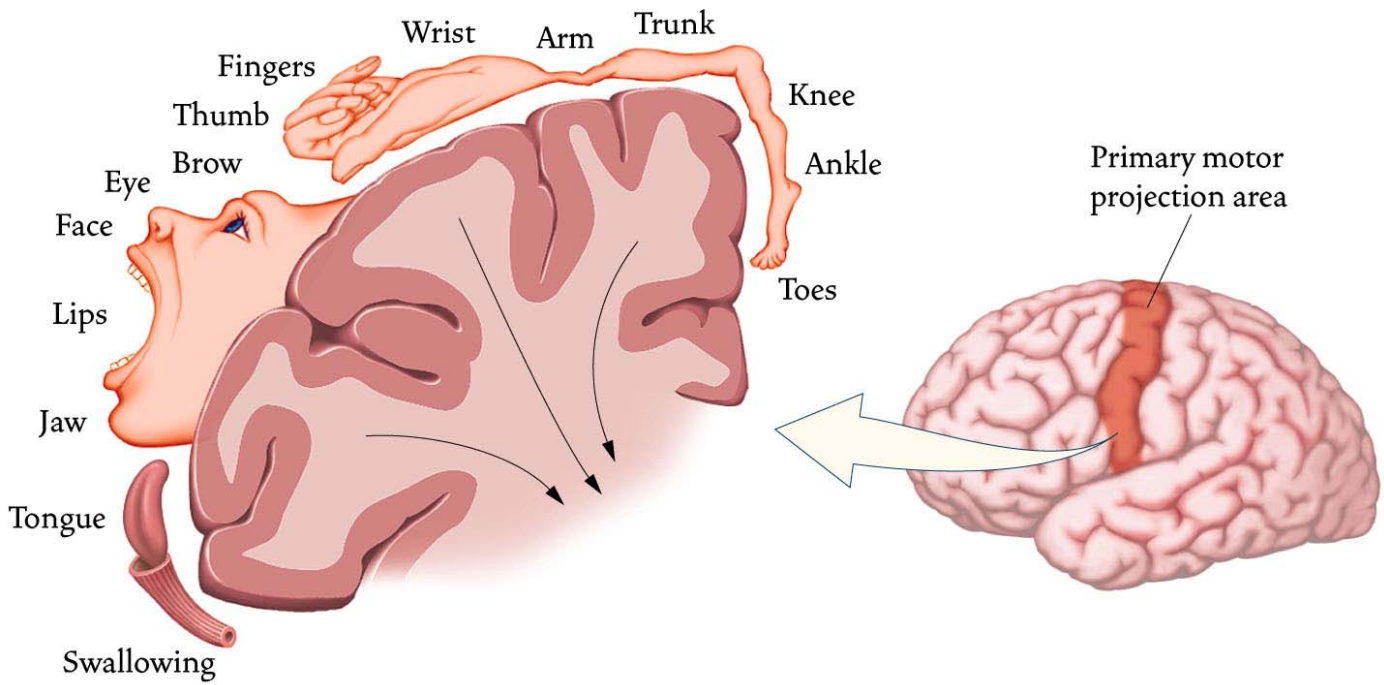


Figure 2.12: The primary motor projection area

The homunculus

Mapping body surface onto the motor cortex.

It is mapped UPSIDE DOWN

- Equal sized areas of body DO NOT receive equal amounts of cortical space. Parts that move with greater precision receive more cortical space than those over which we have less control.

Primary Sensory Areas

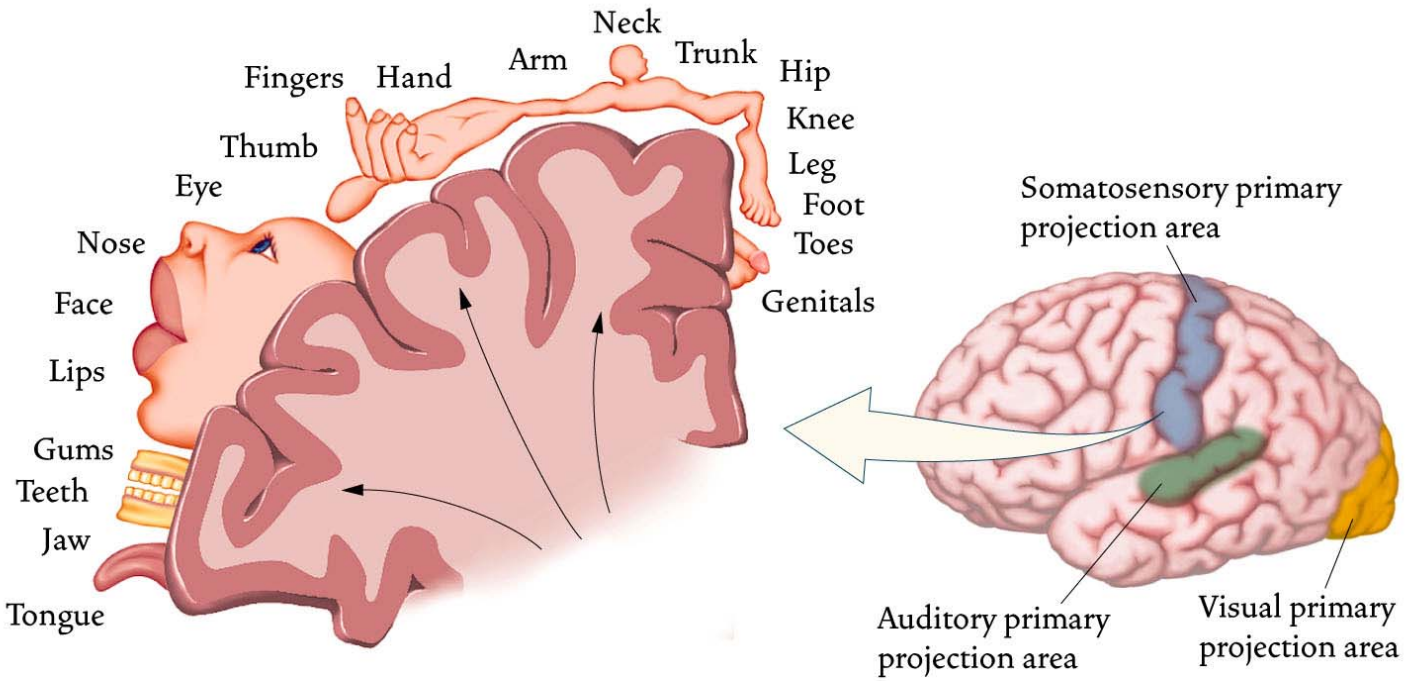


Figure 2.13: The primary sensory projection areas

Primary Sensory Areas

- Stimulation at particular point - report tingling somewhere in the opposite side of body.
- Less frequently experiences of cold, warmth or movement.
- Each part of the body surface sends its sensory information to a particular part of the somatosensory cortex.
- Sensation is also contralateral

Primary Sensory Areas

- Parts of the body that are most sensitive to touch receive more cortical space.