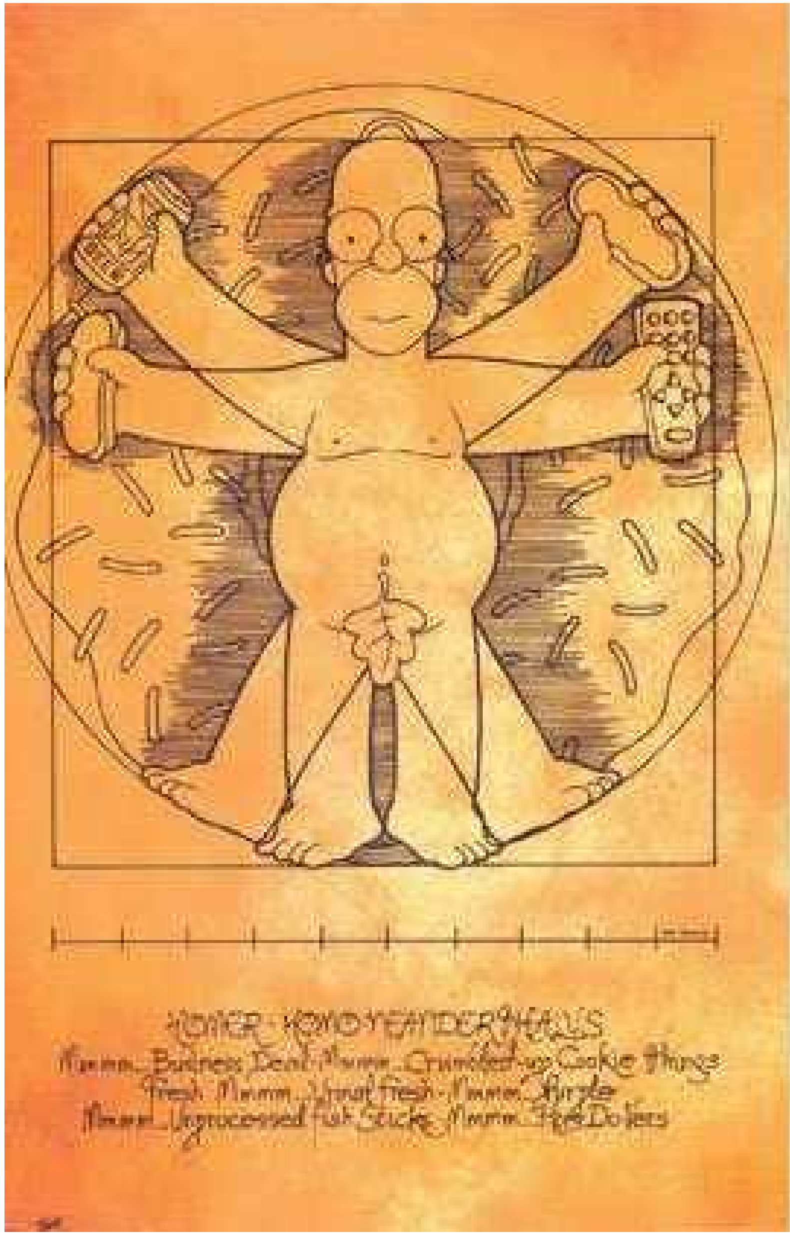
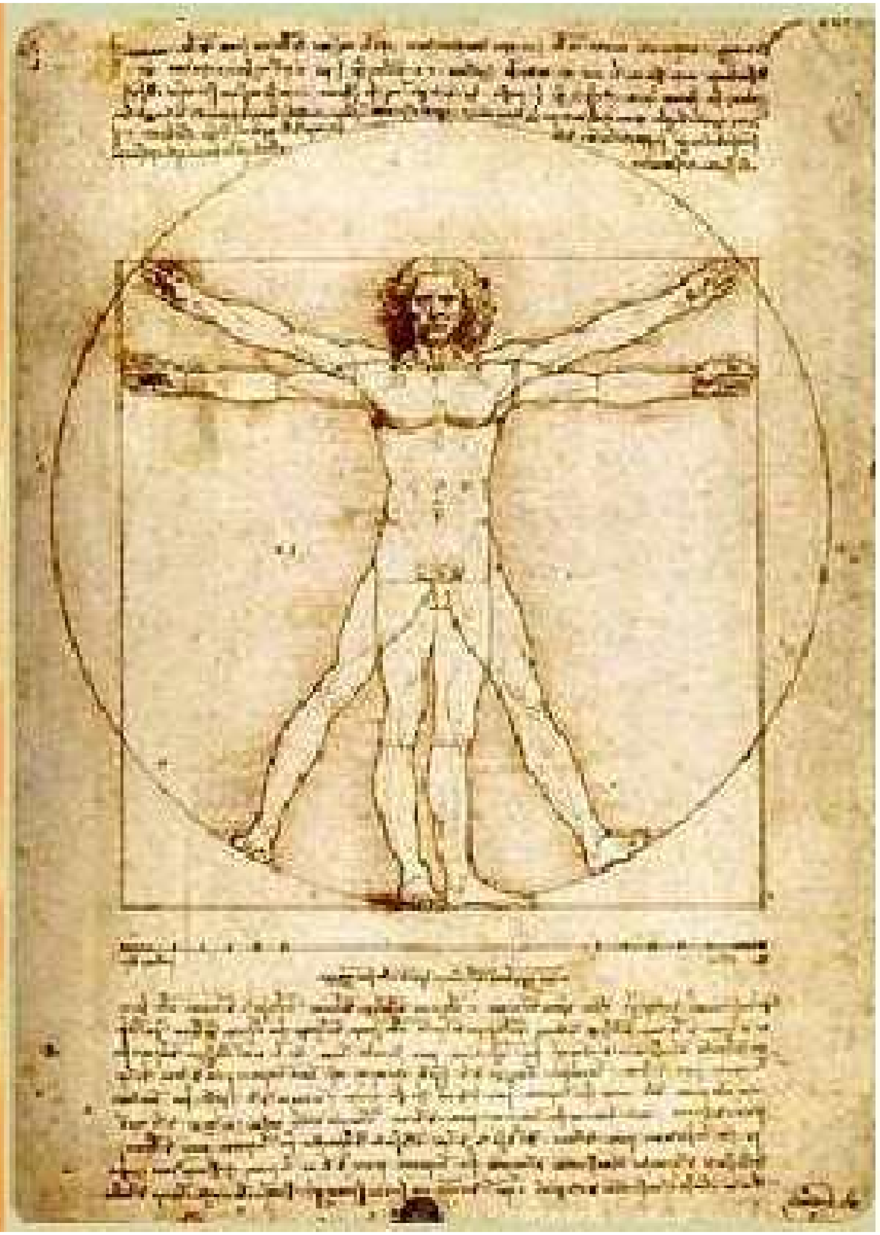
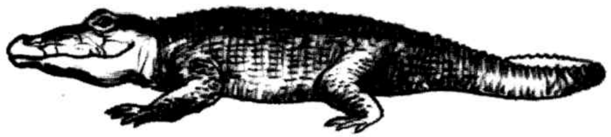
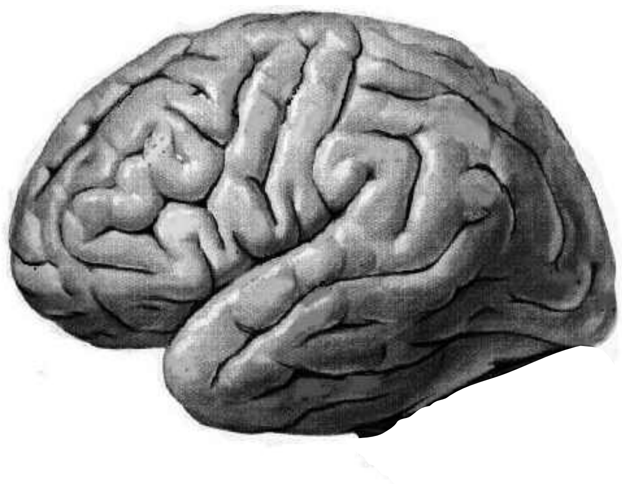
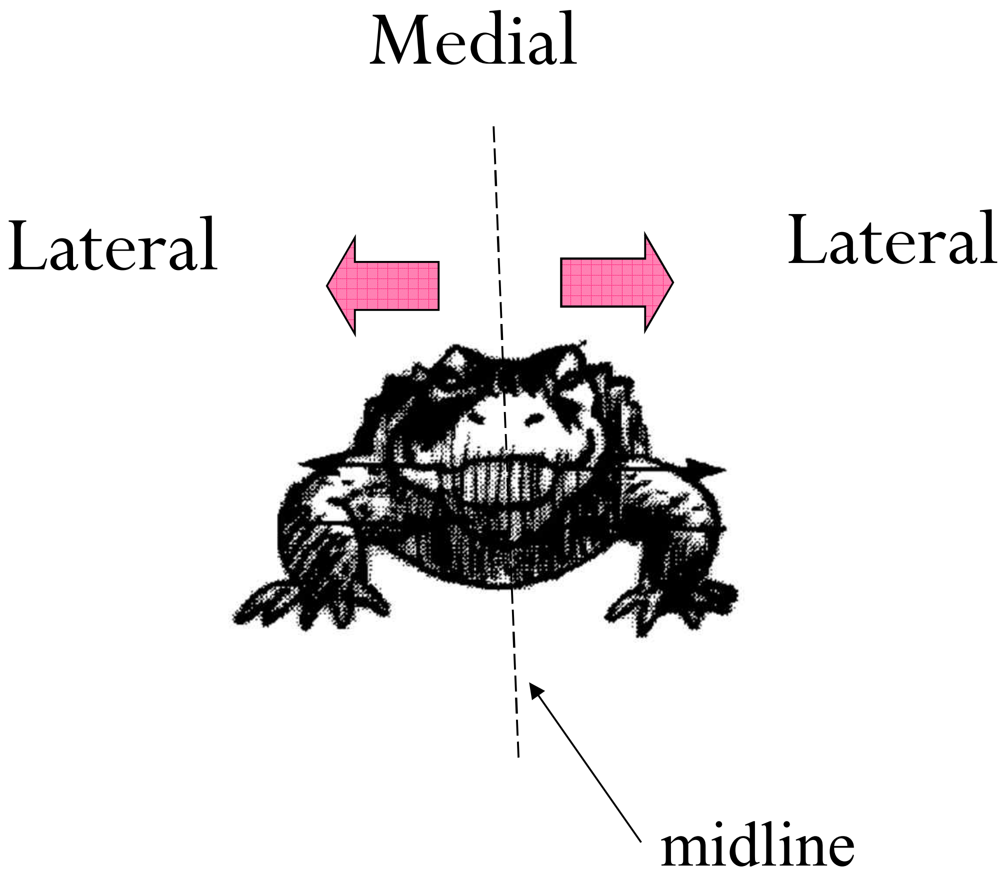




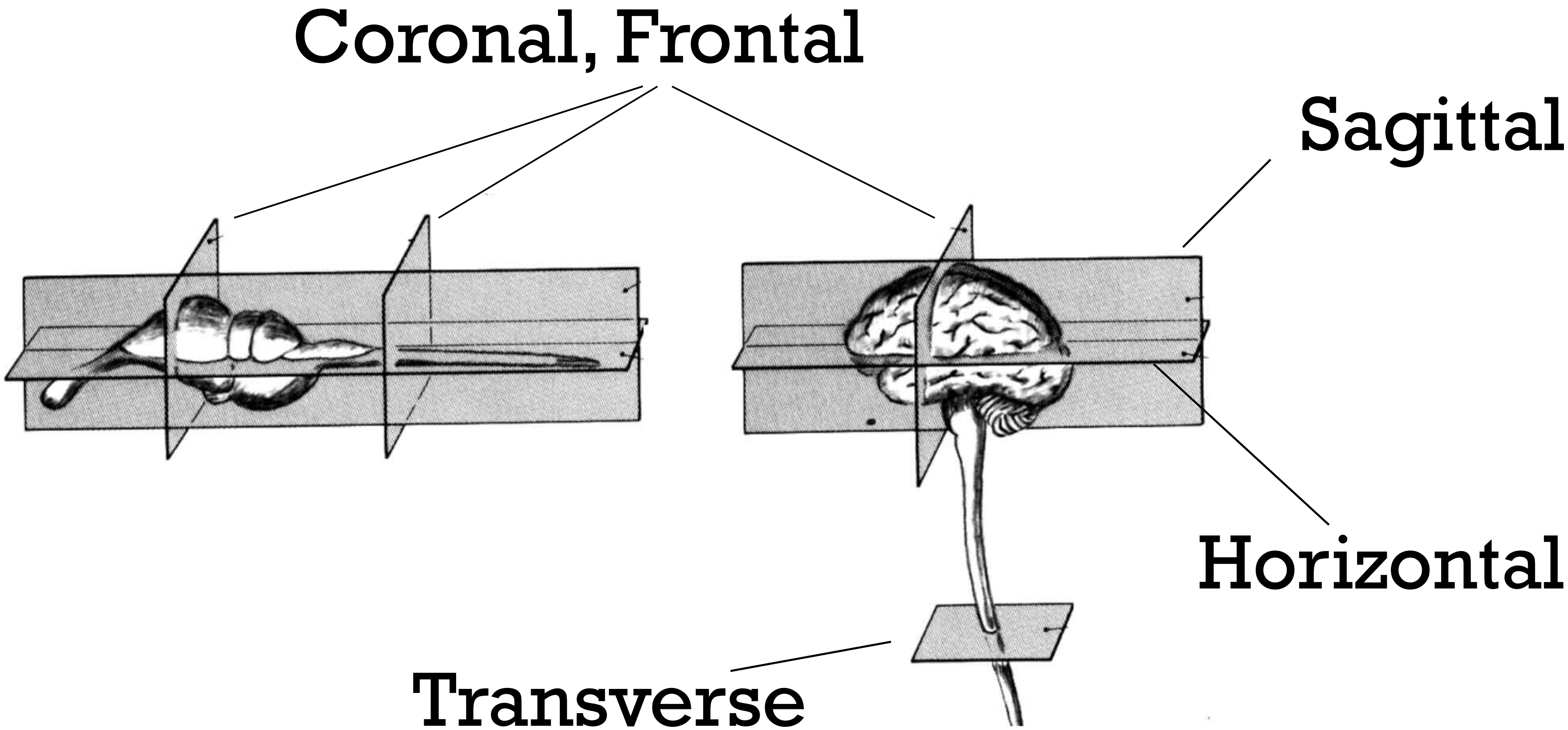
Here are some slides to help on definition of anatomical terms.


Dorsal
Rostral
Caudal
Ventral


Dorsal (Superior)
Rostral
(Anterior)
Caudal
(Posterior)
Ventral (Inferior)


Medial
Lateral
Lateral
midline

Sectioning planes

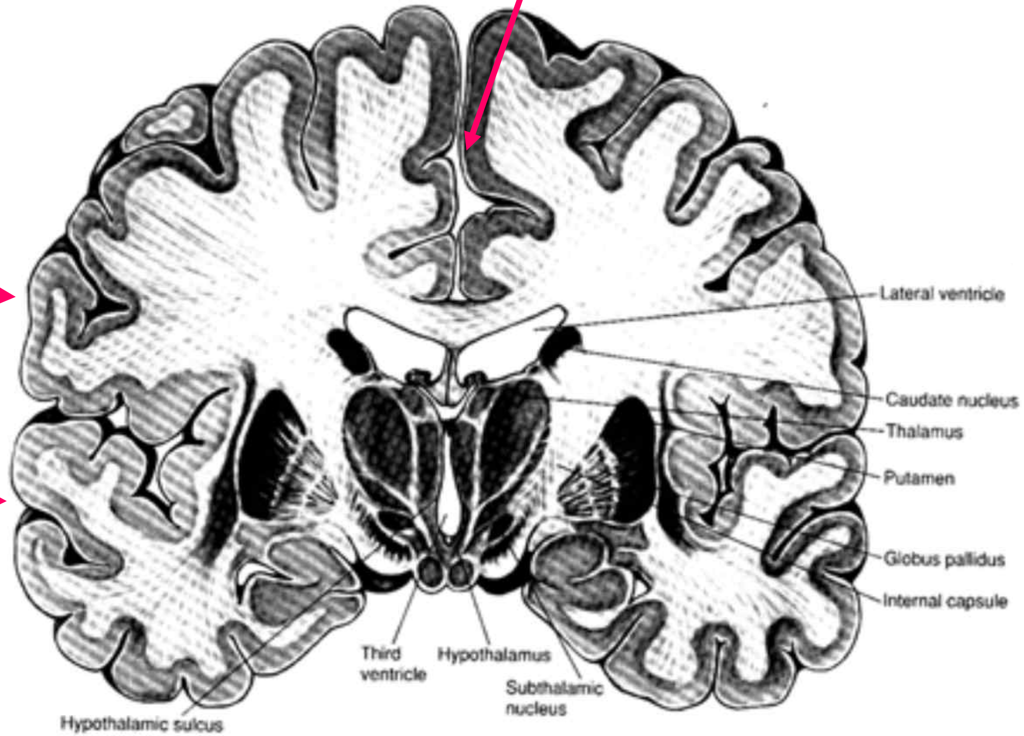


fissure

convolutions

gyrus

sulcus



Ch. 45 Organization of the Nervous System (Reading HW)

General design of the nervous system

- Basic functional unit: neuron
  - CNS contains more than 100 billion neurons
  - 200,000 synaptic connections
  - Signal move only in the forward direction
- Sensory receptors
  - Sensory experience from sensory receptors (Fig. 46-1)
  - Tactile receptors, visual receptors, auditory receptors
  - Somatosensory Nervous System (Fig. 45-2)
  - Information flows in multiple sensory areas (1) spinal cord (2) medulla, pons, and mesencephalon (midbrain) (3) cerebellum (4) thalamus (5) cerebral cortex
- Motor division: effectors (more details in Ch. 6~8 later on)
  - Control the various bodily activities
  - Motor functions (1) contraction of skeletal muscles (2) contraction of smooth muscle (3) secretion by exocrine and endocrine glands
  - Skeletal Motor Nervous System (Fig. 45-3)

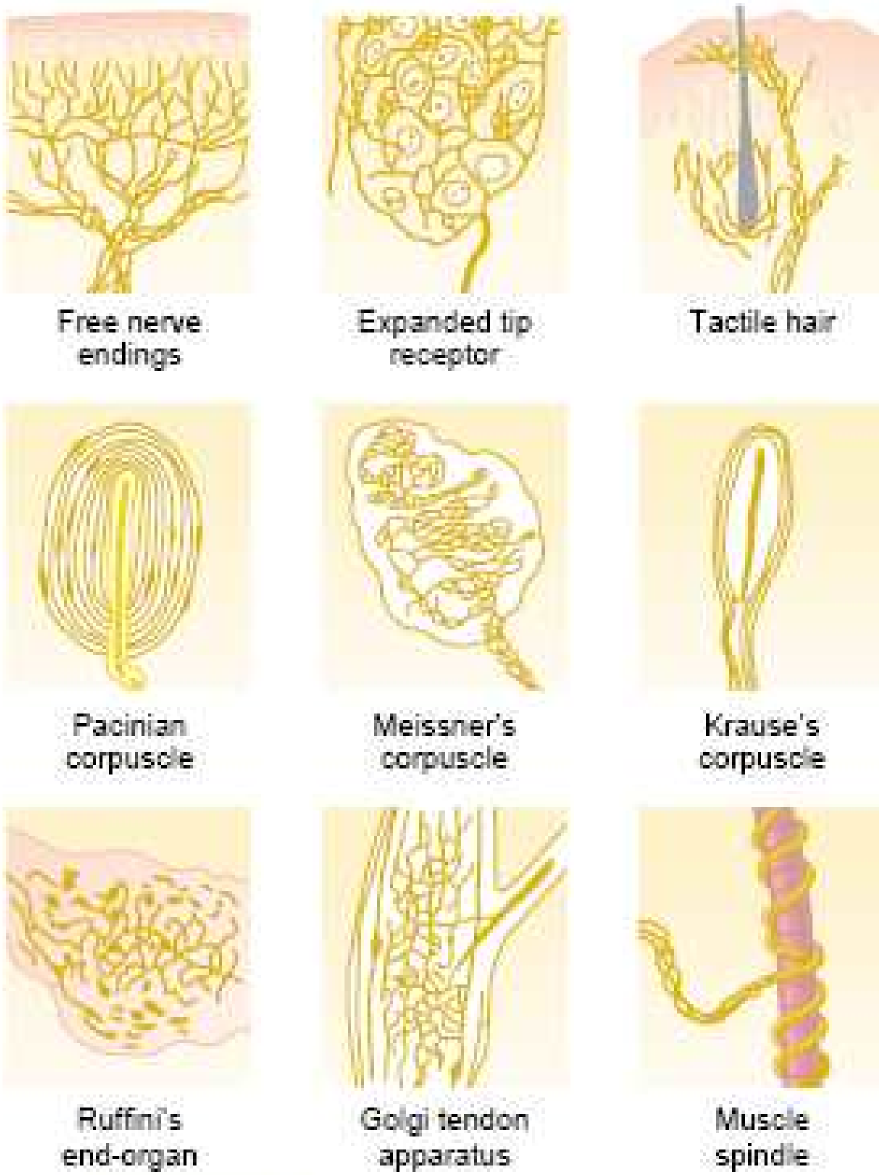


Figure 46–1

Several types of somatic sensory nerve endings.

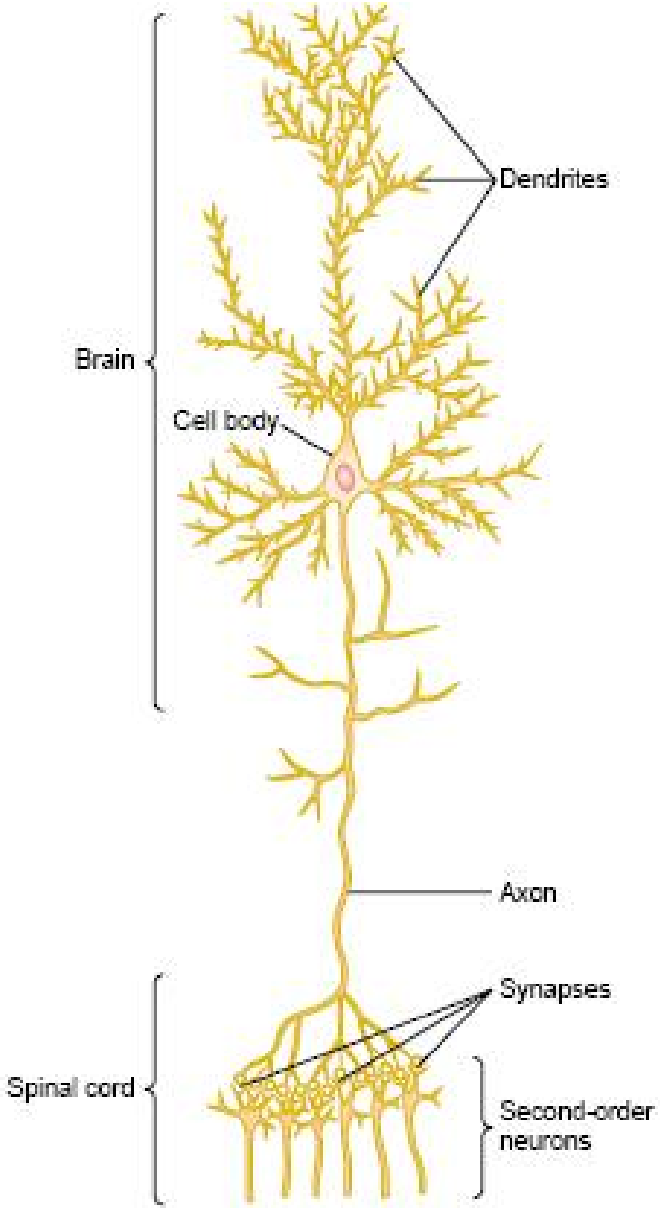


Figure 45–1

Structure of a large neuron in the brain, showing its important functional parts. (Redrawn from Guyton AC: Basic Neuroscience: Anatomy and Physiology. Philadelphia: WB Saunders Co, 1987.)

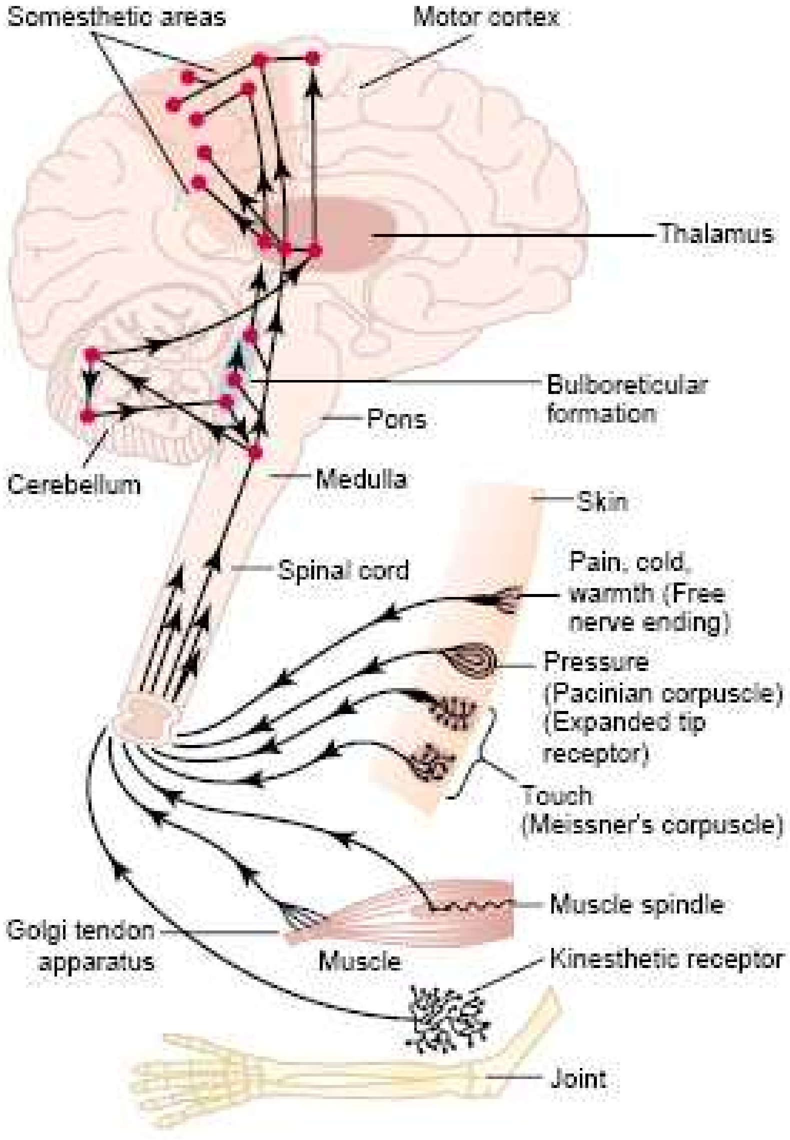


Figure 45–2

Somatosensory axis of the nervous system.

- **Cereblium (*in Latin, little brain*): *an important role in the integration of sensory perception,* coordination *and* motor control.**

- ***Thalamus (in Greek, it means room): Its function* includes *relaying sensation, special sense and motor signals to the* cerebral cortex, *along with the regulation of* consciousness, *sleep and alertness.***

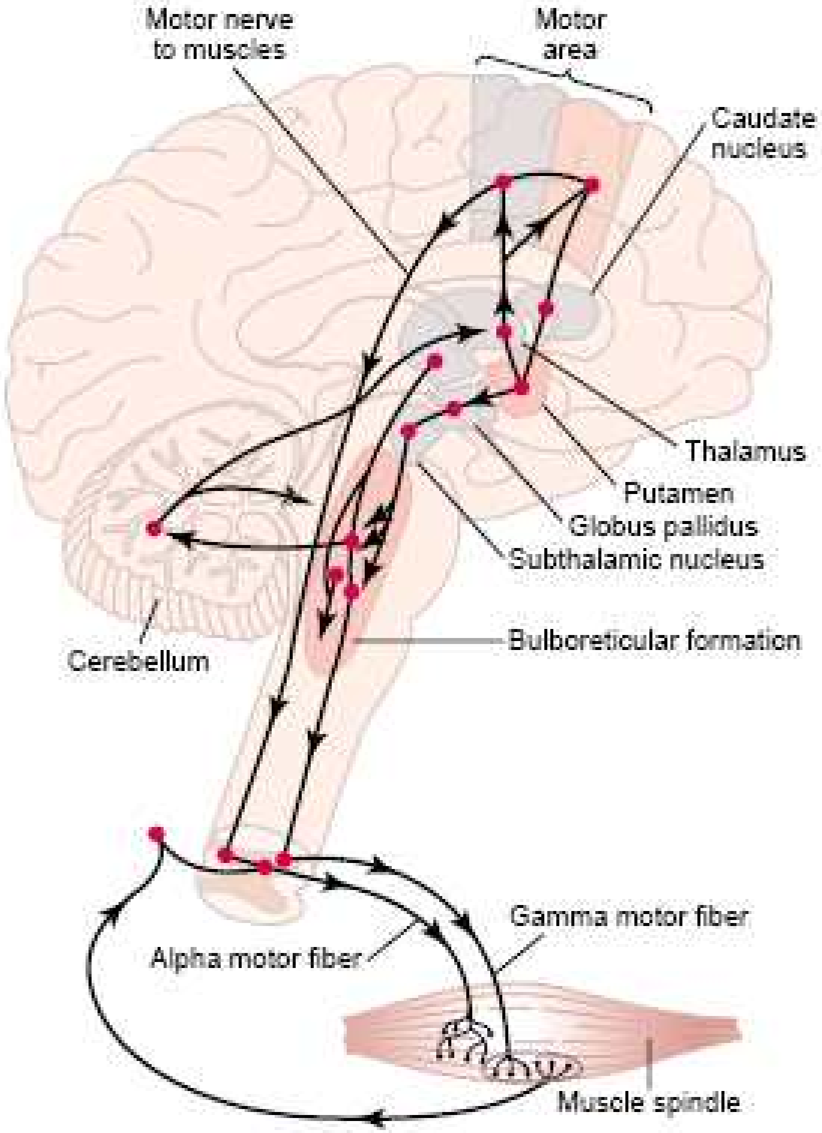


Figure 45–3

Skeletal motor nerve axis of the nervous system.

- Processing of information – “integrative” function of the nervous system
  - Nervous system processes incoming information such that appropriate mental and motor responses occur
  - More than 99% of sensory information is discarded
  - Attention is the key
  - Channeling and processing of information is called the integrative function of the nervous system
  - Roles of synapses
    - Synapse is the junction point from one neuron to the next
    - A site for control of signal transmission
    - Synapses determine the directions of the nervous signals
    - Facilitator and inhibitory
    - Synapses perform a selective action often blocking weak signals, allowing strong signals, selecting and amplifying certain weak signals, and channeling signals in many directions rather than in one direction
- Storage of information - memory
  - Information storage in cerebral cortex, basal regions, spinal cord
  - Facilitation: each time certain types of sensory signals pass through sequences of synapses. These synapses become more capable of transmitting the same type of signal next time
  - Once memory is stored the nervous system, it becomes part of the brain processing mechanism.

Major Levels of CNS Function

- Spinal Cord Level
  - Not just pathway for signals
  - Without the brain, spinal cord functions include (1) walking (2) reflexes from painful objects against gravity (3) control local blood vessels, gastrointestinal movements, (4) urinary excretion
- Lower Brain or Subcortical Level
  - Cerebellum, medulla, pons, mesencephalon
  - Salivation in response to the taste of food controlled by medulla, pons, mesencephalon, amygdala, hypothalamus
  - Emotional patterns anger, excitement, sexual response, pain reaction even without the cerebral cortex
- Higher Brain or Cortical Level
  - Cerebral cortex = memory storehouse
  - Cortex never functions alone but always in association with lower centers of the nervous system
  - Thought process

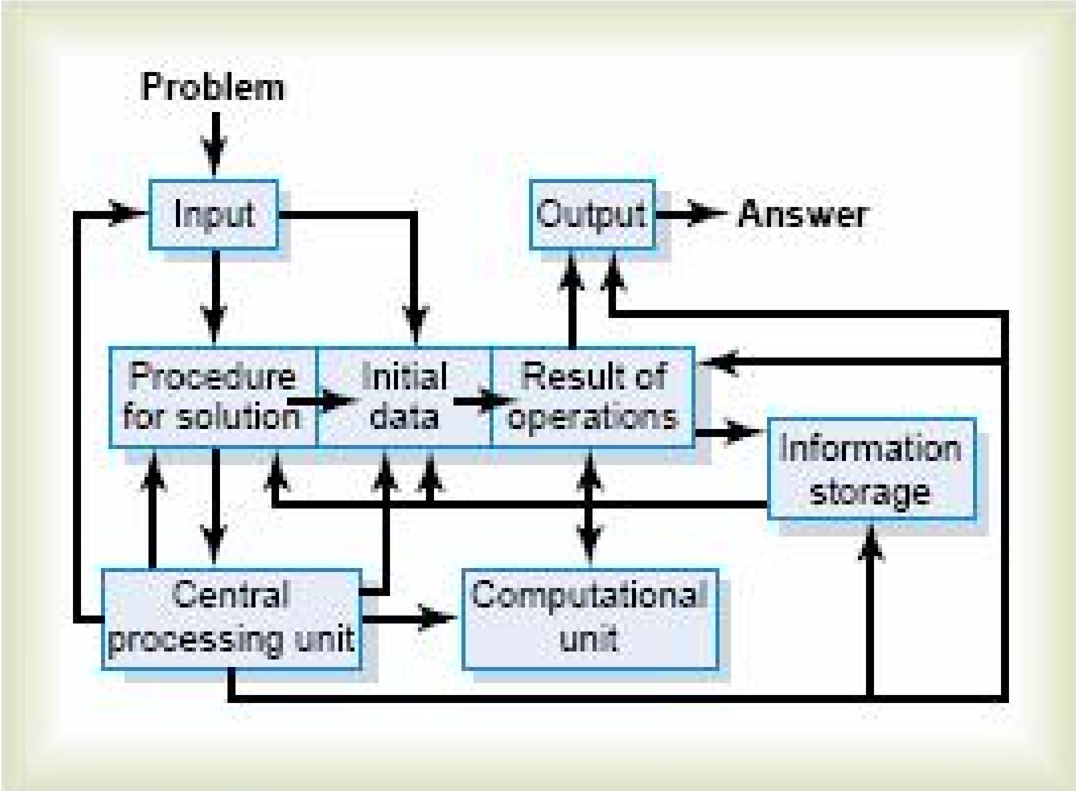


Figure 45–4

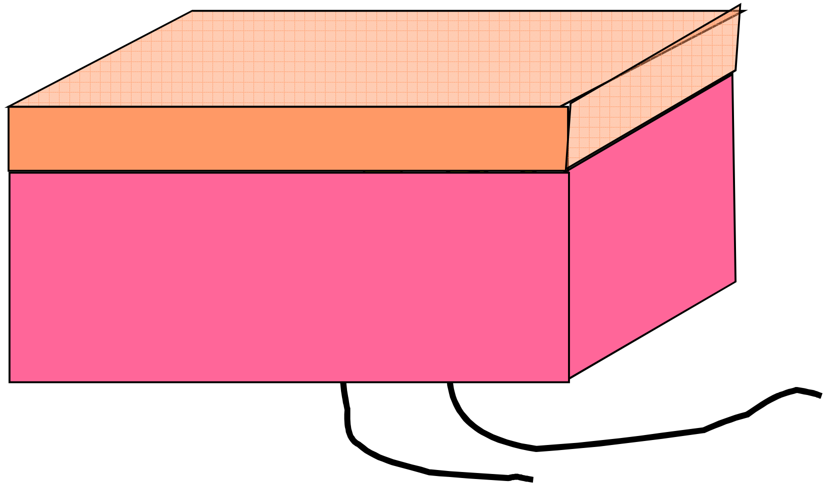
Block diagram of a general-purpose computer, showing the basic components and their interrelations.

Functional Specialization of the Brain

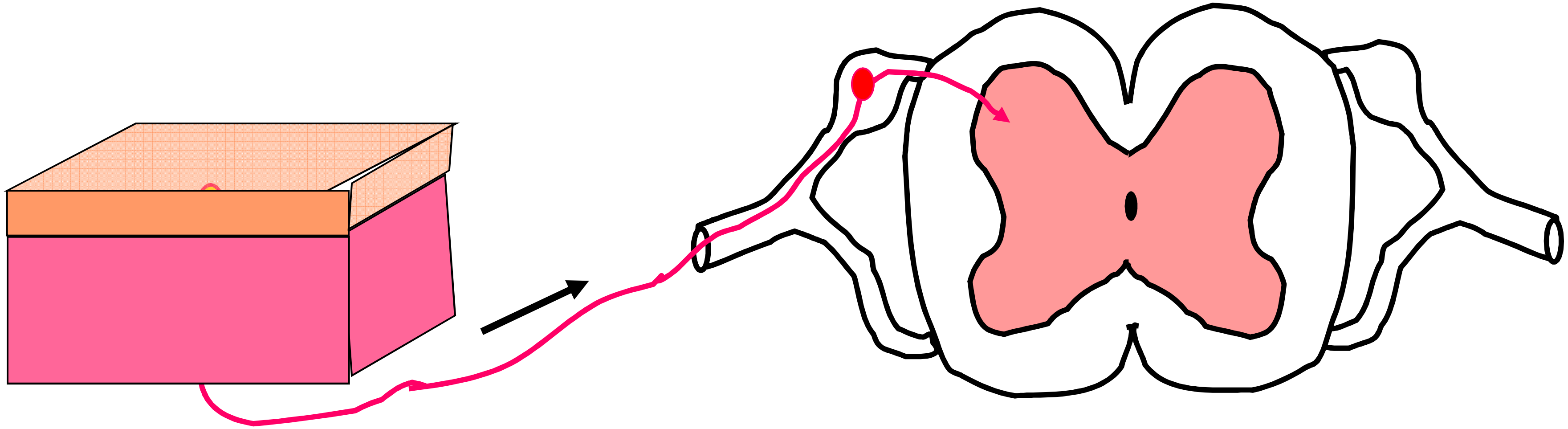
Preview

Skin Senses

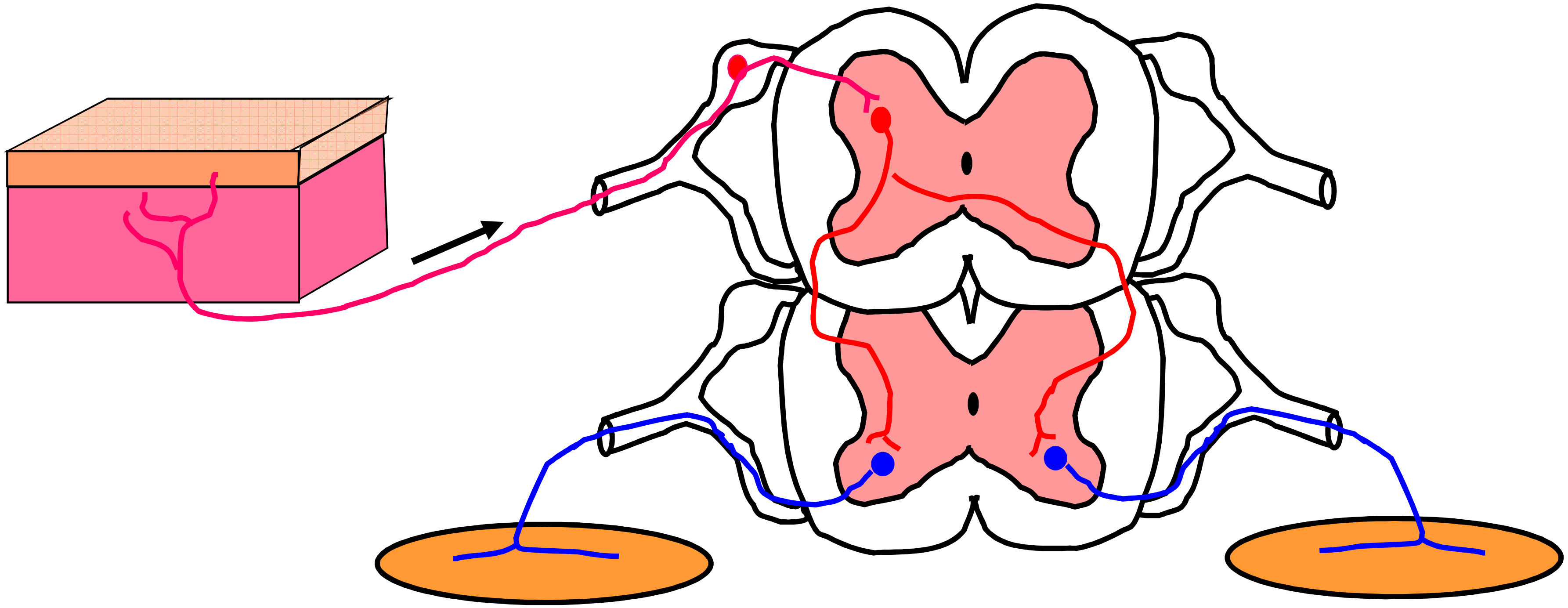
aka Somesthesis



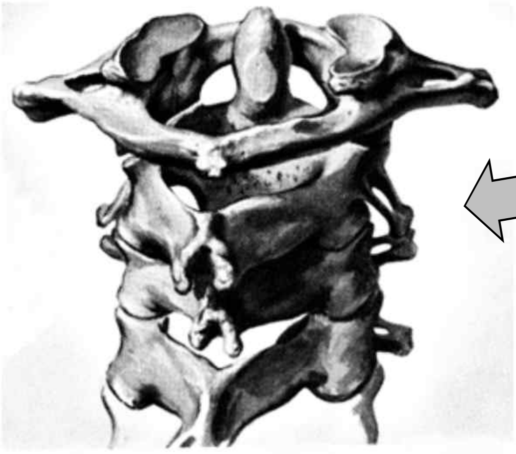
Generally includes light touch, pressure, vibration,temperature and pain



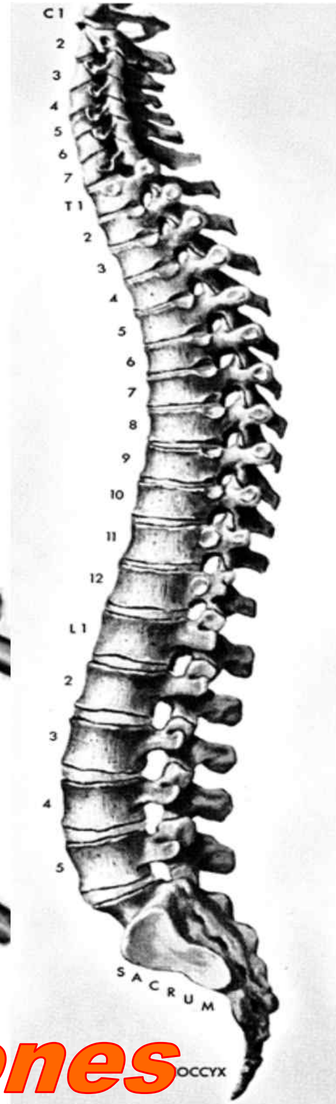
Response of receptor is conveyed over a nerve fiber into the CNS.

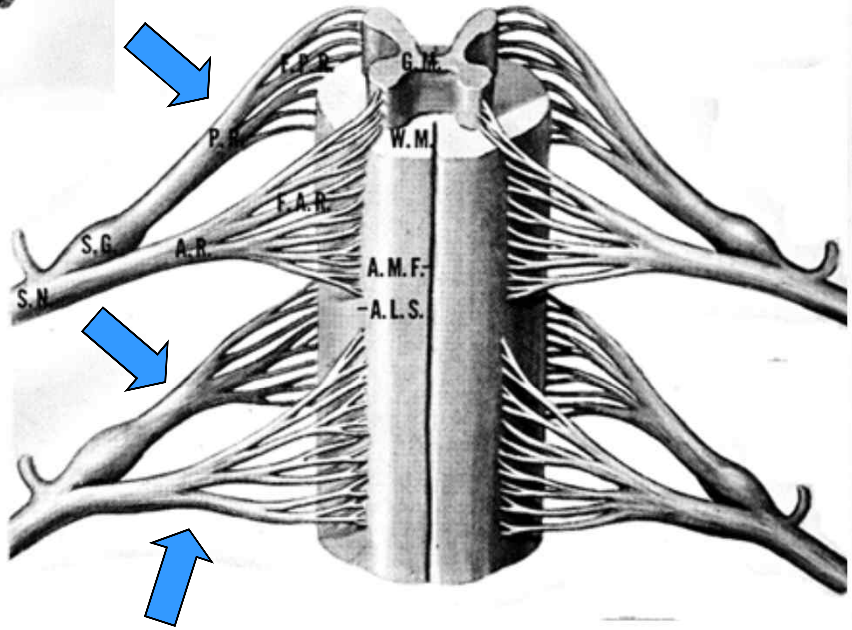


Some of the input is used to coordinate local reflexes.



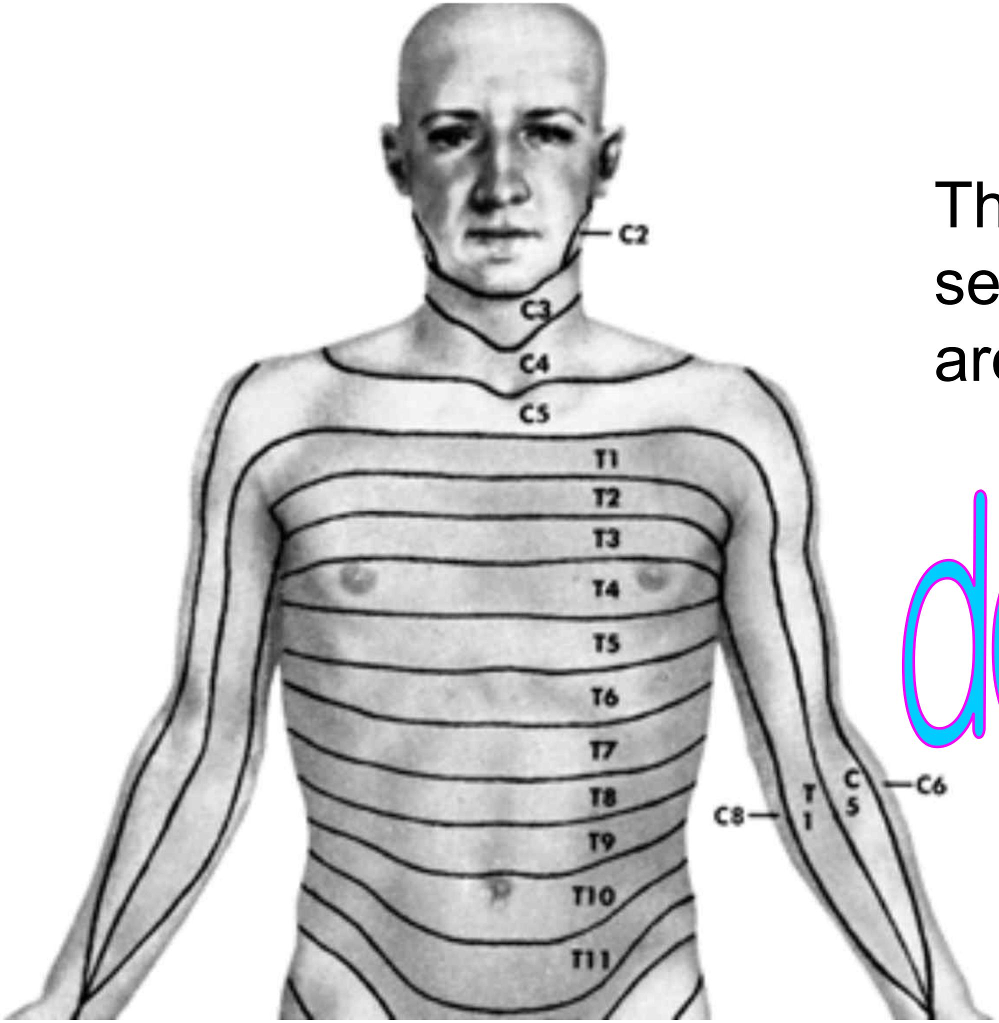
vertebrae





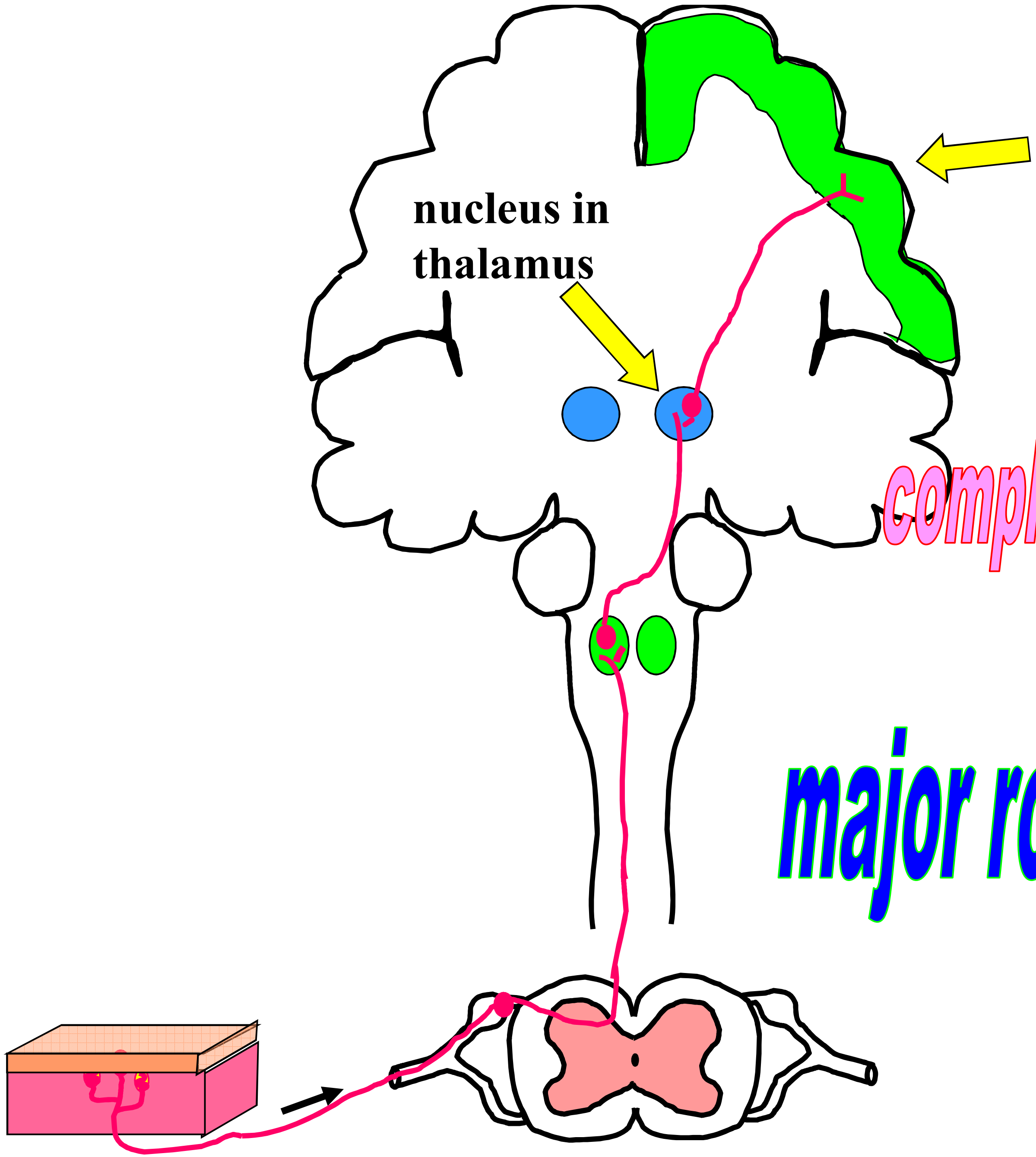
nerve roots

Fibers from different zones of the body enter along the length of the spinal cord.



The skin zones which are served by different nerve roots are called

dermatomes

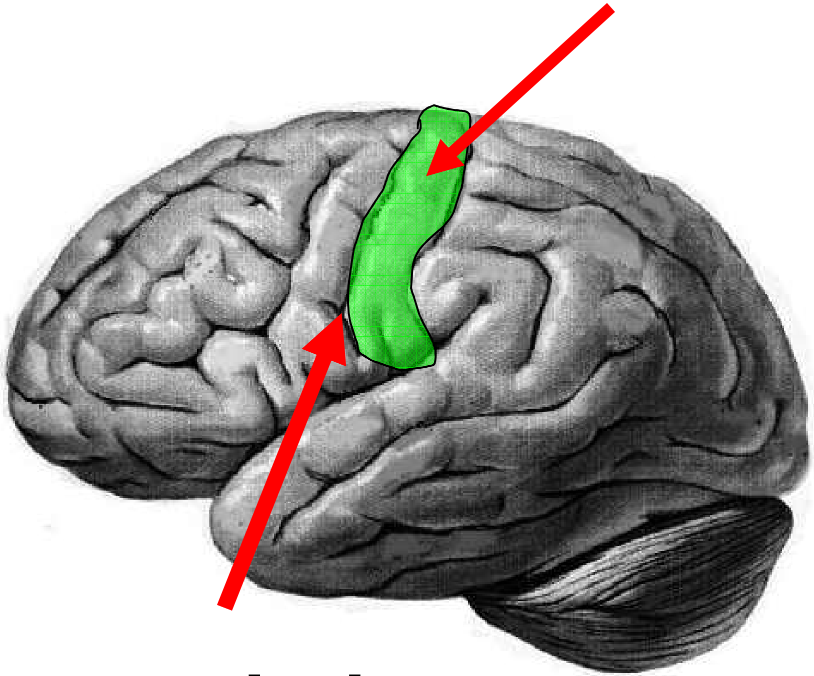


S1

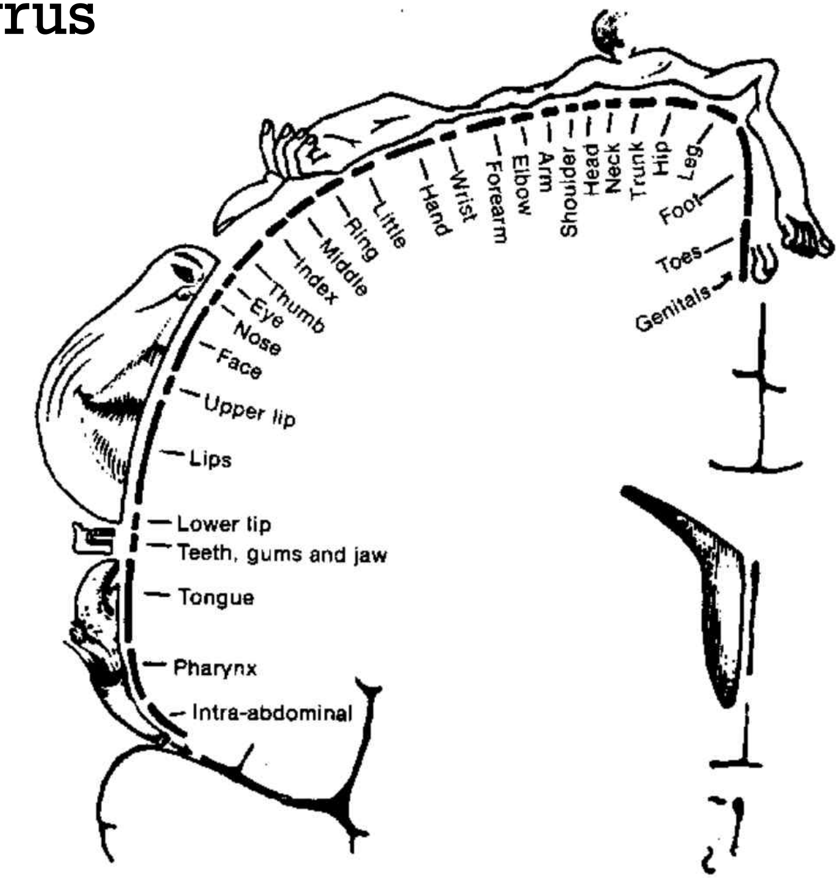
completely contralateral

major route to cortex

postcentral gyrus



central sulcus
(or fissure)

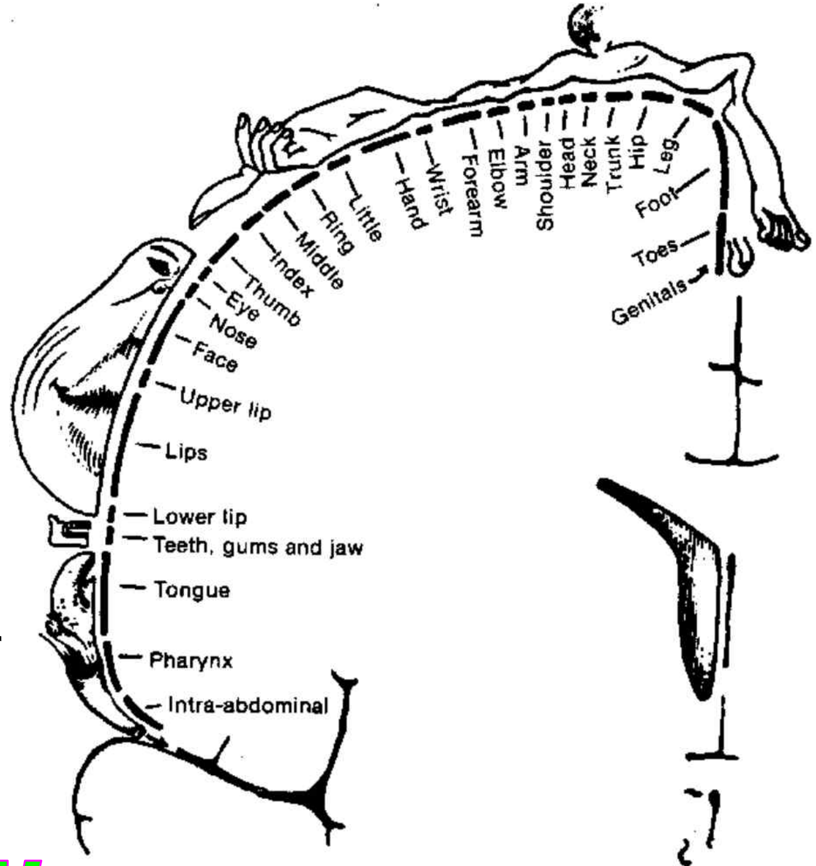


Penfield & Rasmussen, 1950

sensory homunculus

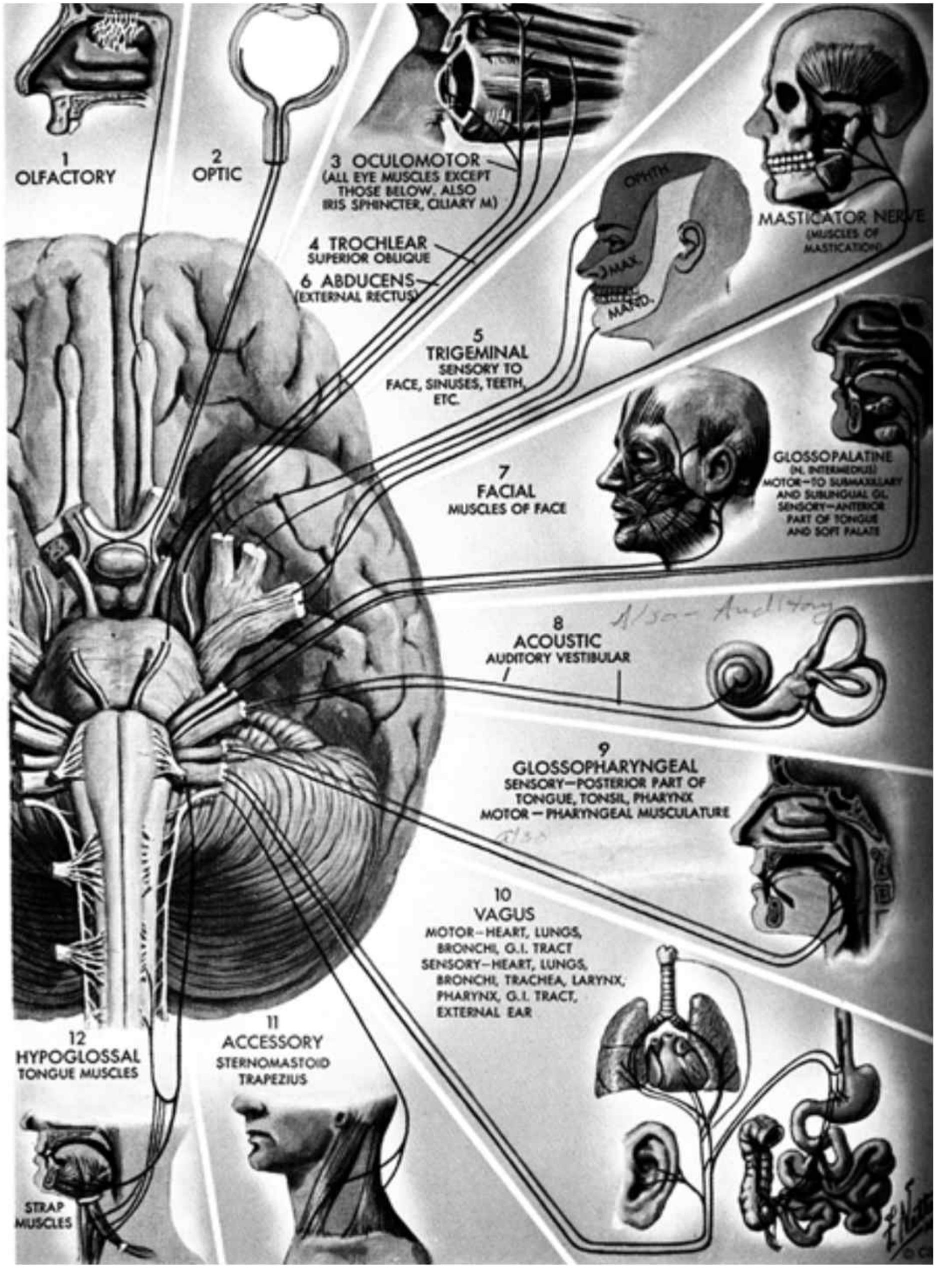
Note the regions of the body project
to specific regions of the brain. This is called

topographic mapping

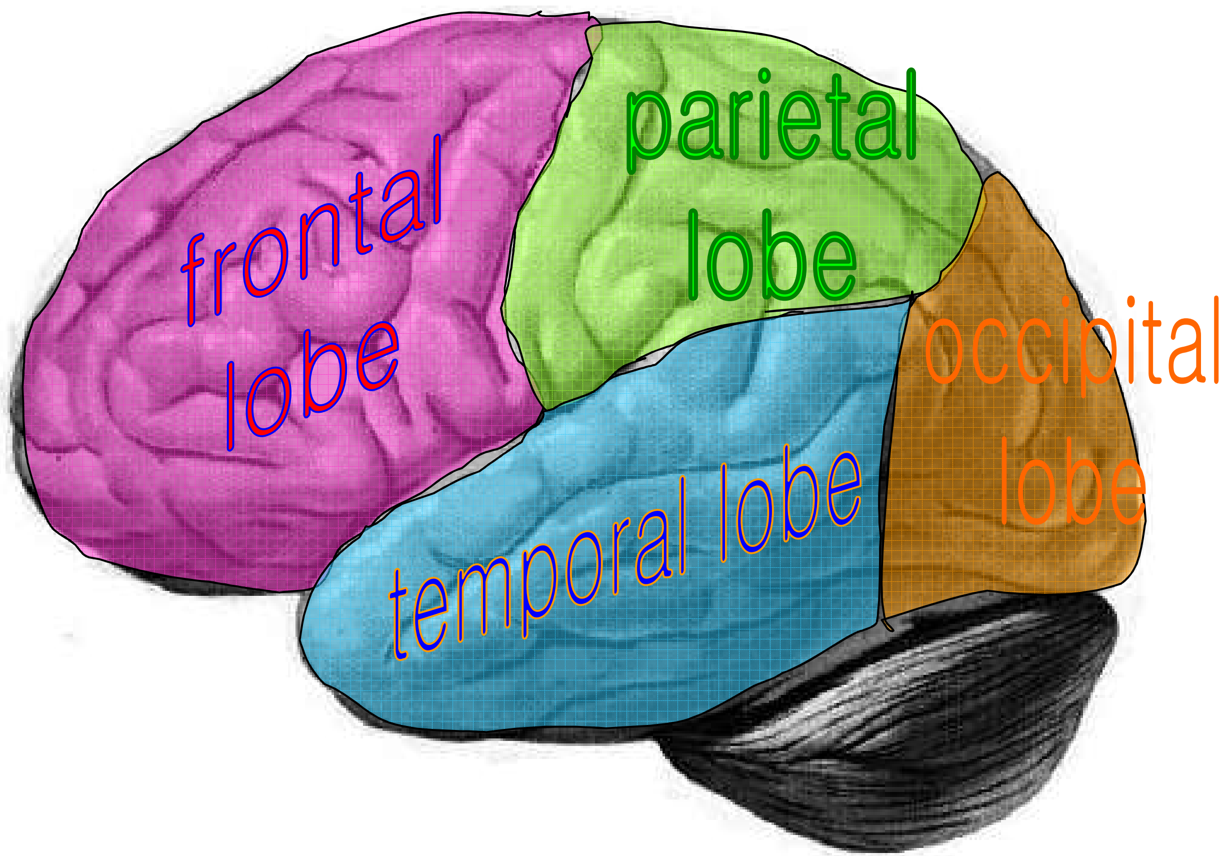


Note also the mismatch of
relative size. The amount of
cortex relates to

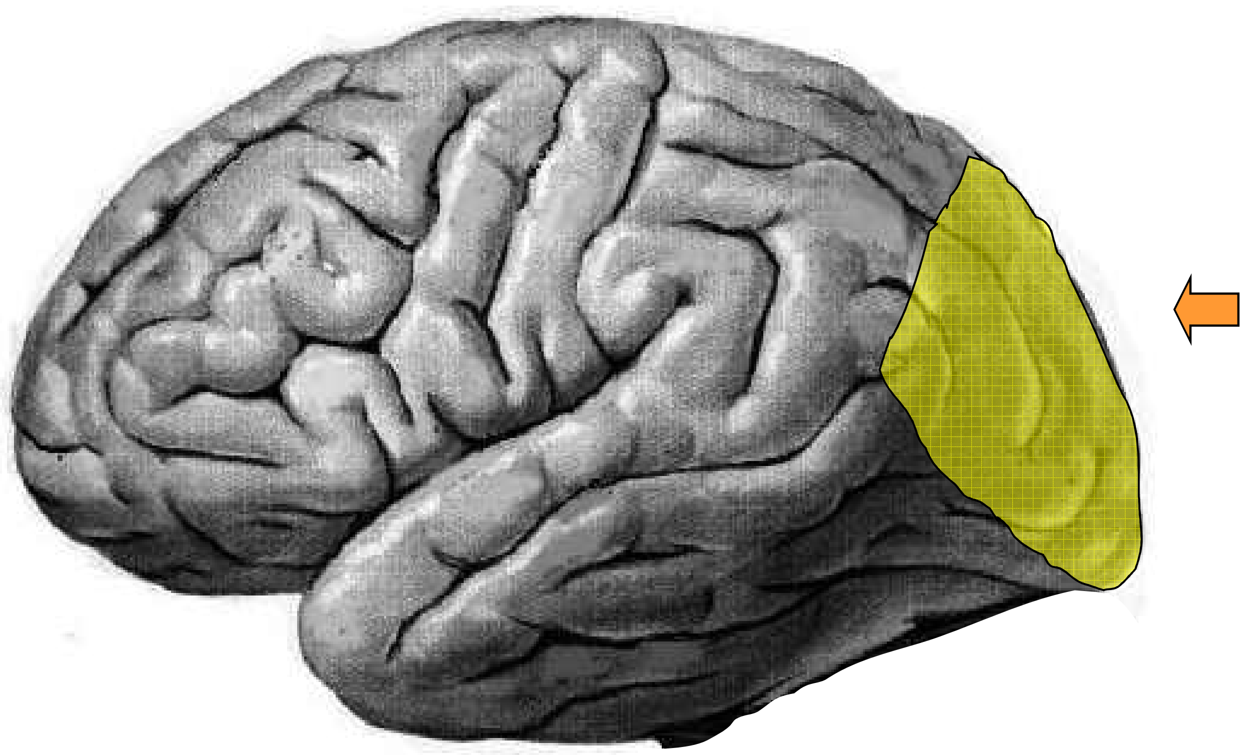
sensitivity and acuity



Cranial nerves provide some of the input.



The cerebrum is divided into four lobes.



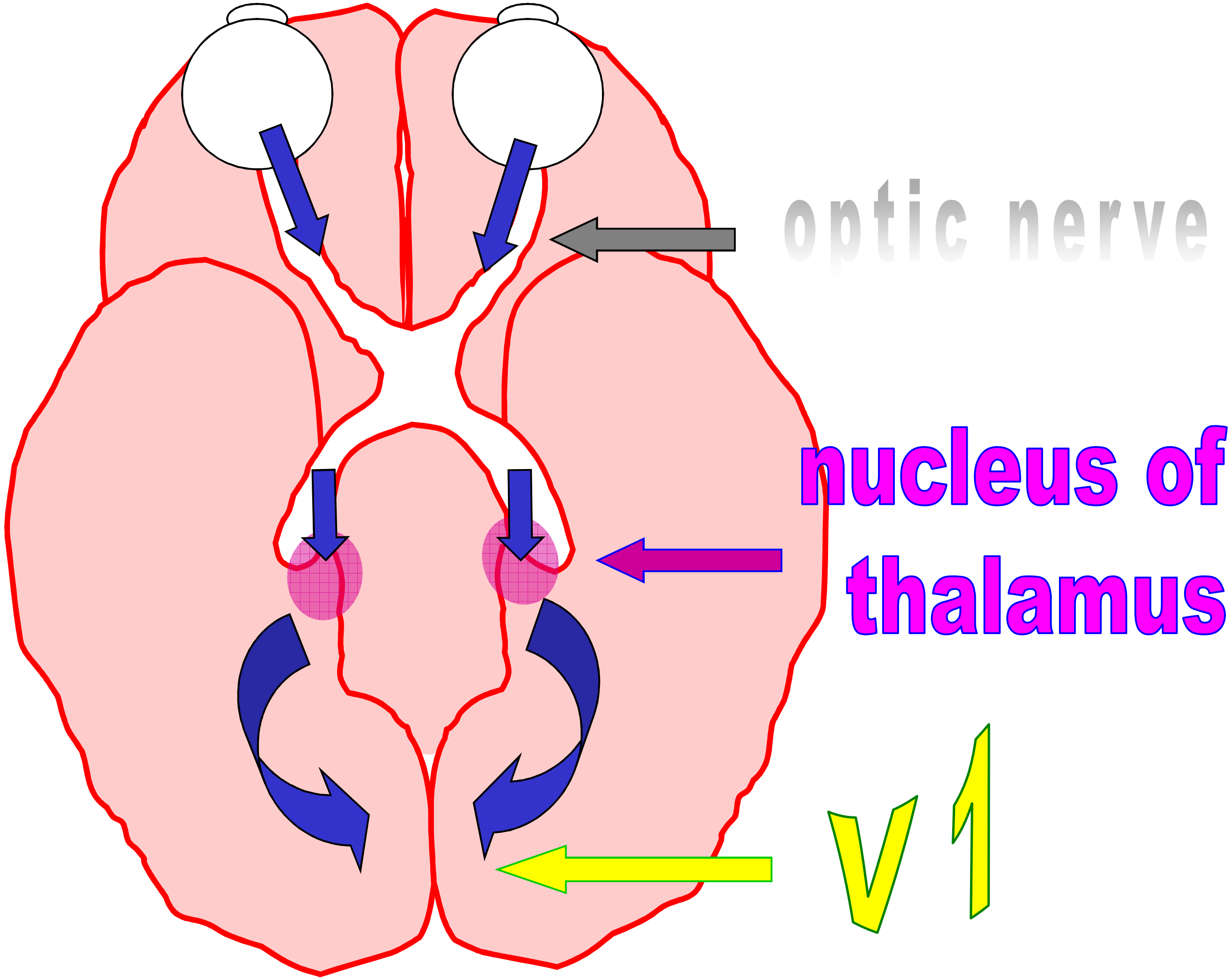
Classic Visual Cortex

midline view of brain

Primary Visual Cortex

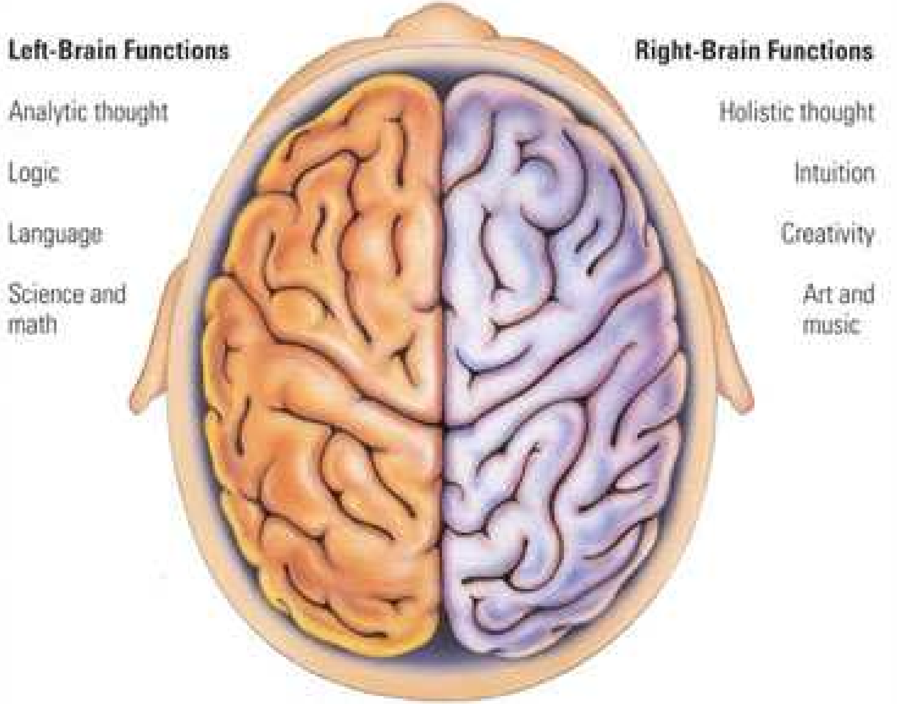
aka V1

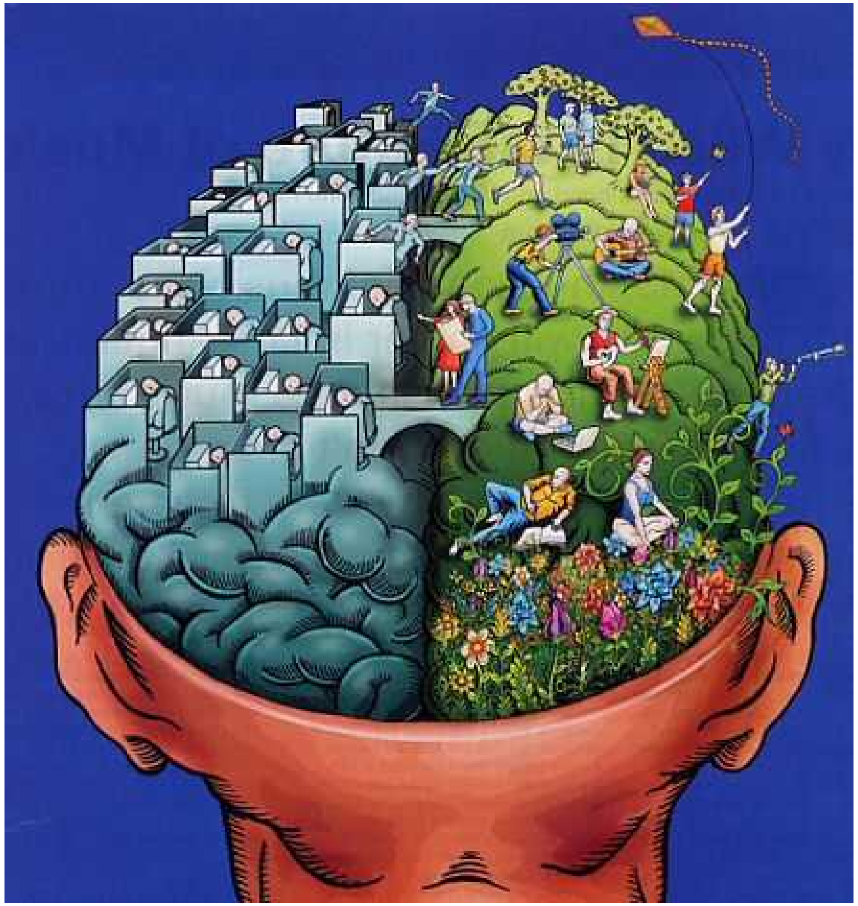
path to V1

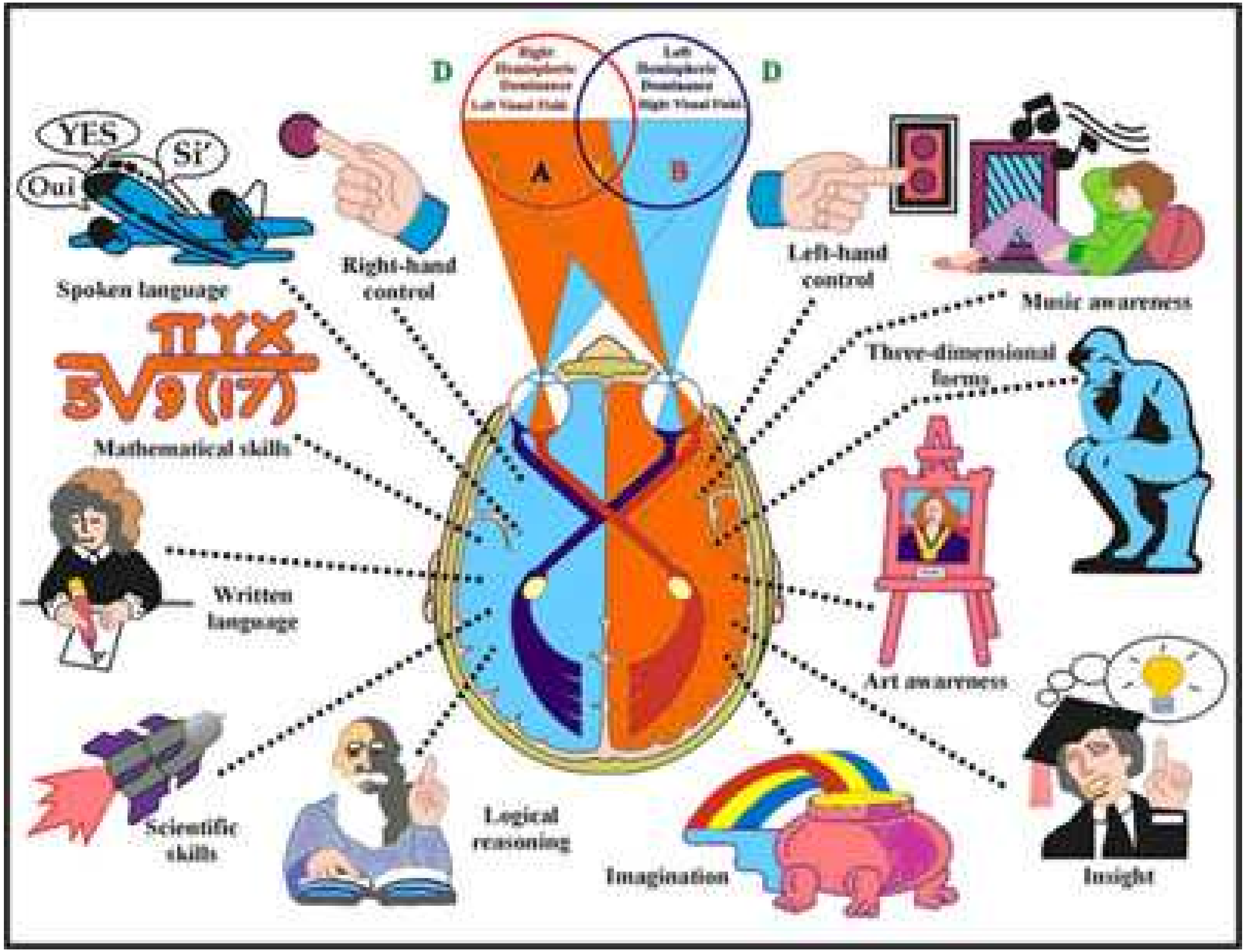


EXPERIENCE =

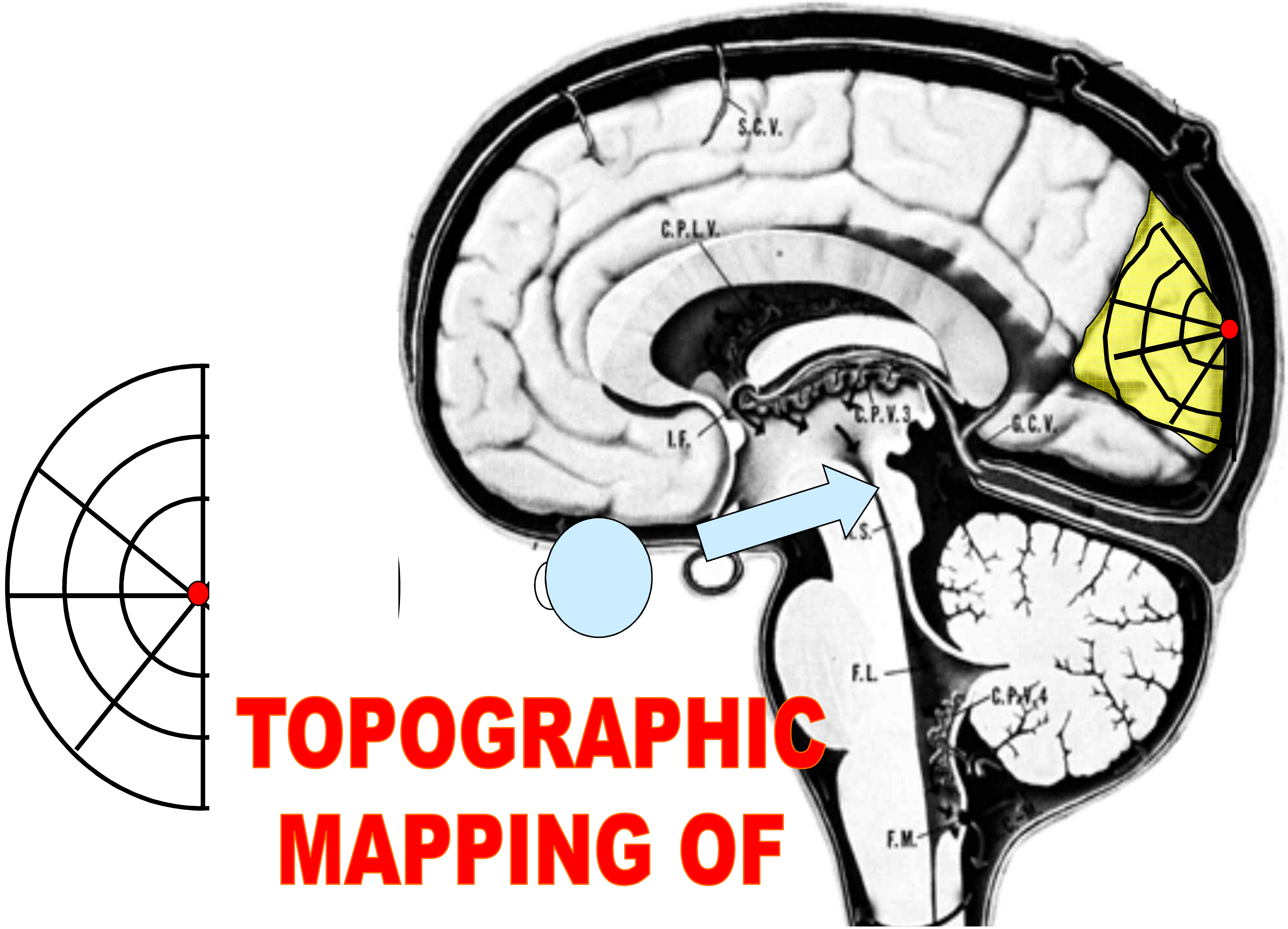
USABILITY/ANALYTIC + DESIGN/CREATIVE







D
D
A
B
YES
Si'
Oui
Spoken language
Right-hand
control
Left-hand
control
Music awareness
Three-dimensional
forms
Mathematical skills
Written
language
Art awareness
Scientific
skills
Logical
reasoning
Imagination
Insight



TOPOGRAPHIC MAPPING OF THE IMAGE

WHAT is fMRI?

https://www.youtube.com/watch?v=lLORKtkf2n8

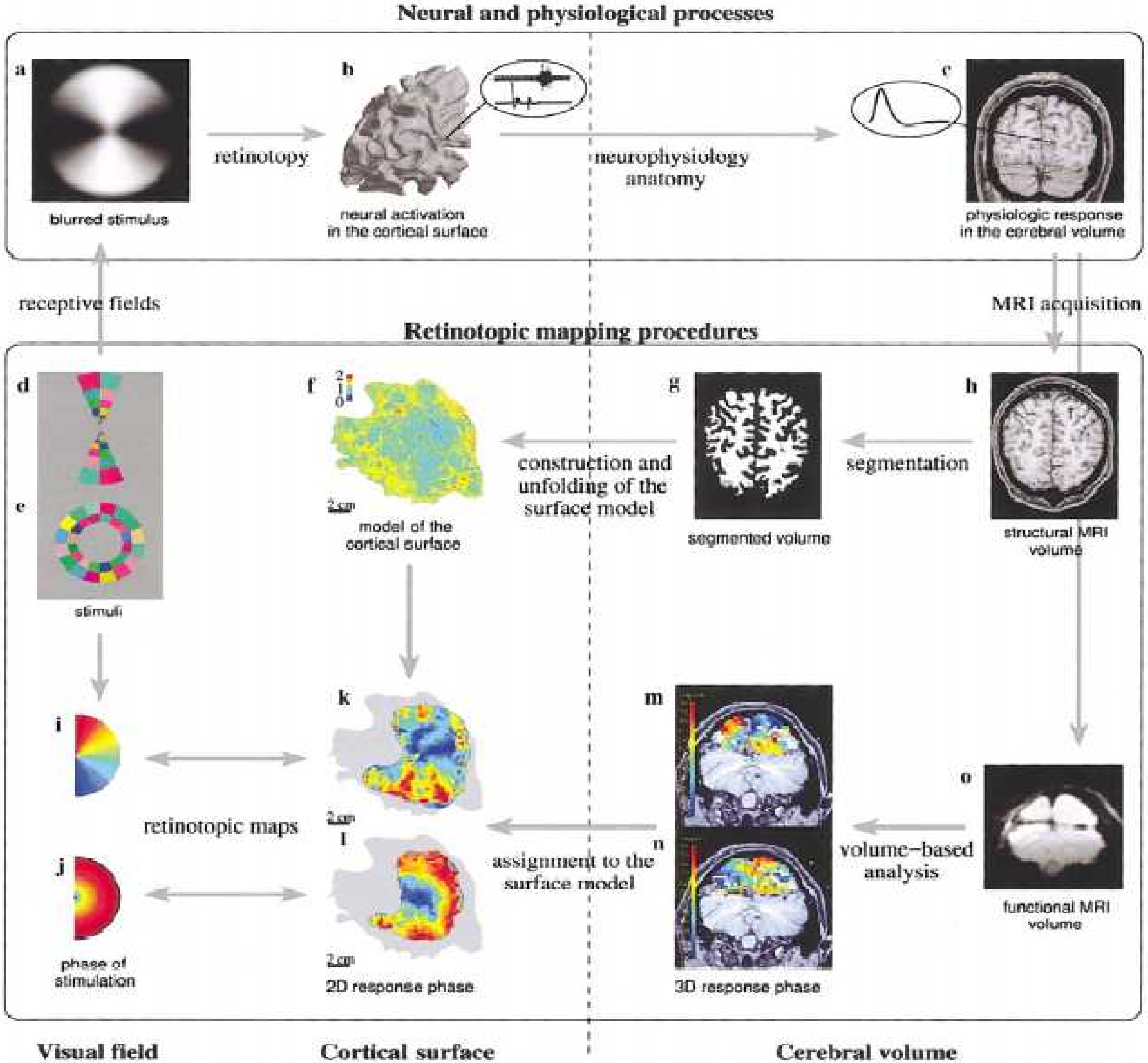
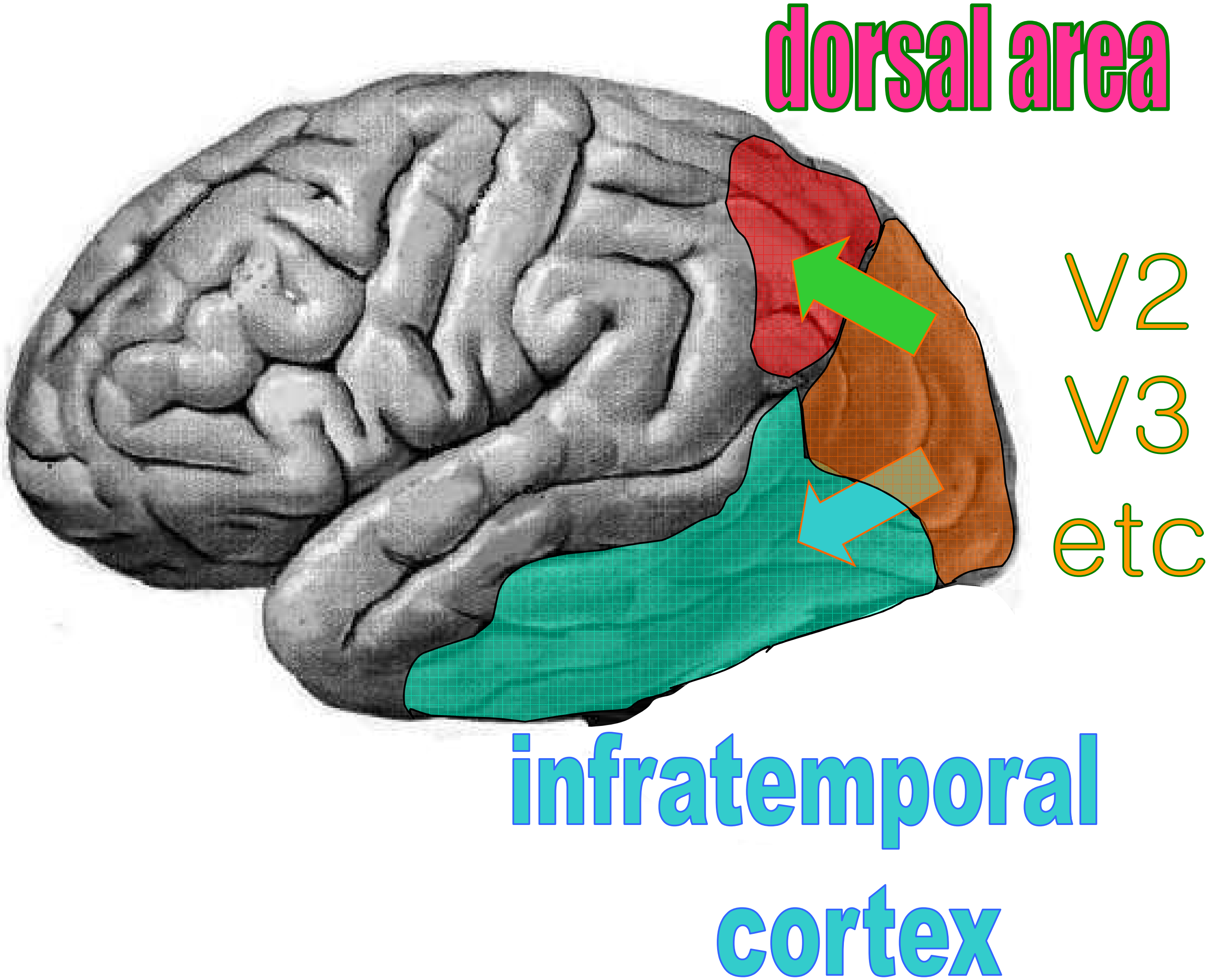
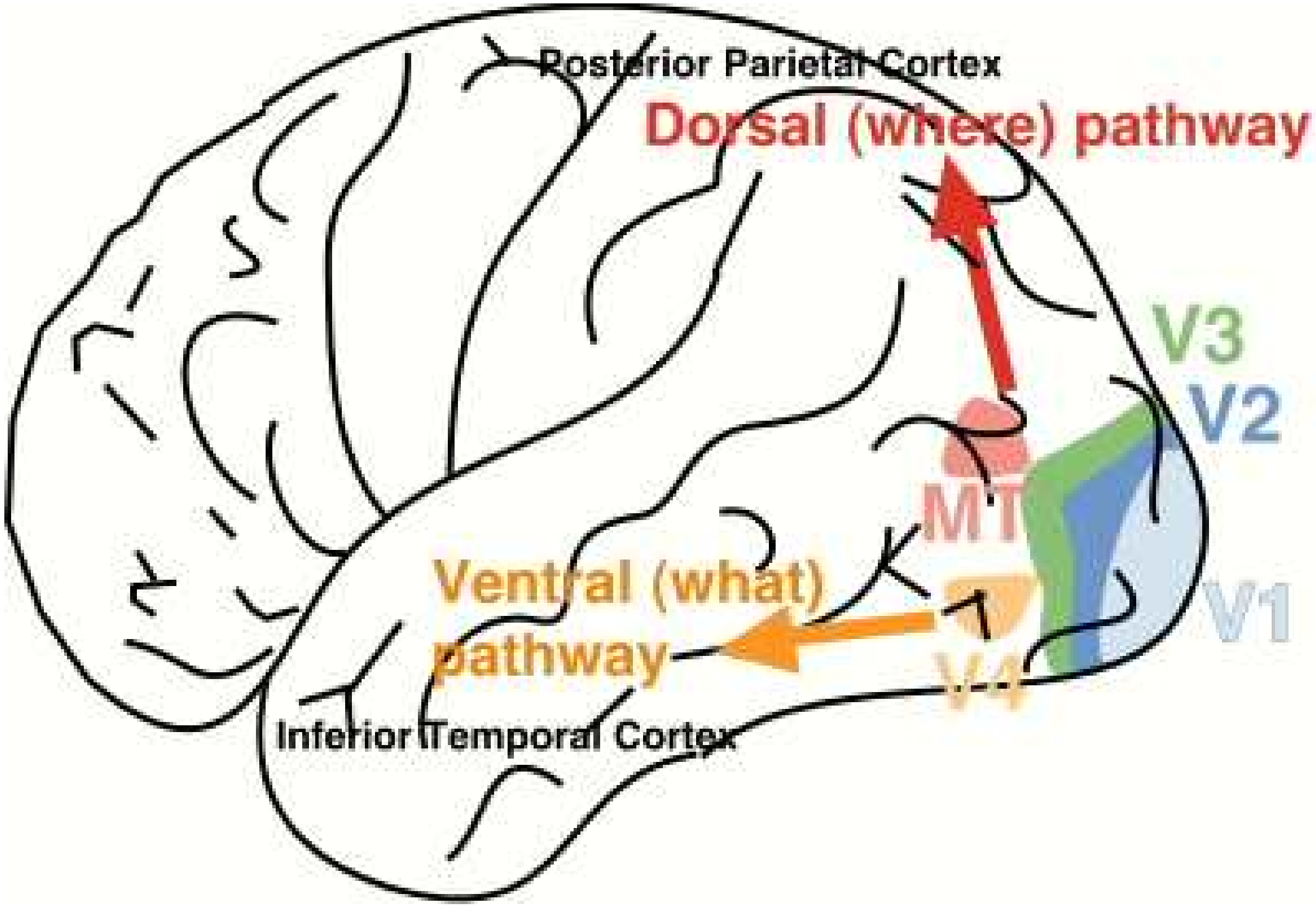


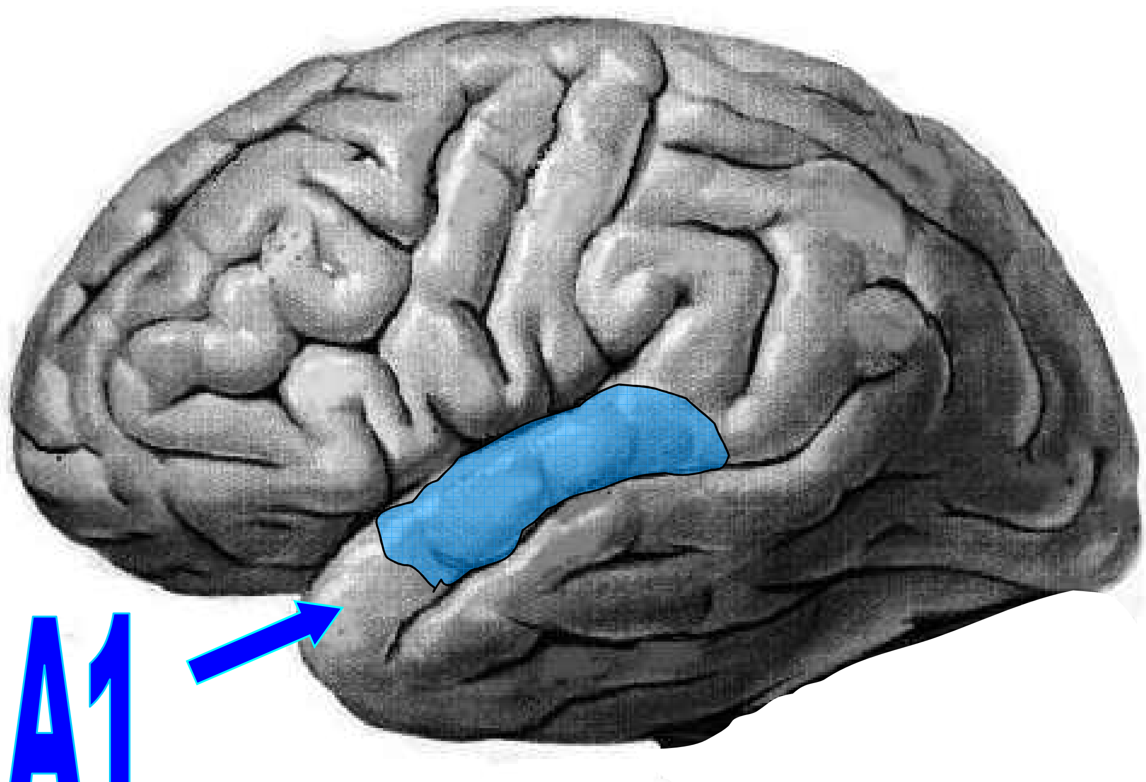
FIG. 1. Overview of fMRI retinotopic mapping procedures and the neural and physiological processes involved. Functional retinotopic mapping data are obtained in response to stimuli encoding the polar angle (d) and eccentricity (e) coordinates of the visual field. Concerning the neural processing of visual information, we separately consider the spatial integration of visual information, represented by the receptive field size of cortical neurons, and the point-to-point relationship between the centers of the receptive fields and the cortical surface, represented by retinotopy. The effect of receptive fields of cortical neurons can be described in this context as a spatial smoothing of the stimulus in the visual field (a). Retinotopy projects the "blurred" stimulus onto the cortical surface, where it gives rise to corresponding neural activation (b). Neurophysiological processes transform the neural activation into variations of blood oxygenation. Anatomy defines the way these variations are embedded in the three-dimensional Cartesian space of the cerebral volume (c) (note the difficulty of illustrating the "true" neural and physiological responses, and the "true" cortical surface or volume, as opposed to measured responses and reconstructed representations). A high-resolution structural MR volume is acquired (h) and segmented and the gray matter/white matter interface is dilated to approach the center of the cortex (g). A model of the cortical surface is reconstructed from the segmentation and is unfolded. The color coding overlaid here represents the distortion of local area induced in the flattening process, expressed as the ratio of triangle surfaces in 2D with respect to 3D. A ratio of 1 means no distortion (f). BOLD-sensitive functional MR volumes are acquired (o) and analyzed in 3D



Subsequent work has shown that vision is more extensive.



Posterior Parietal Cortex
Dorsal (where) pathway
V3
V2
MT
V1
Ventral (what) pathway
V4
Inferior Temporal Cortex

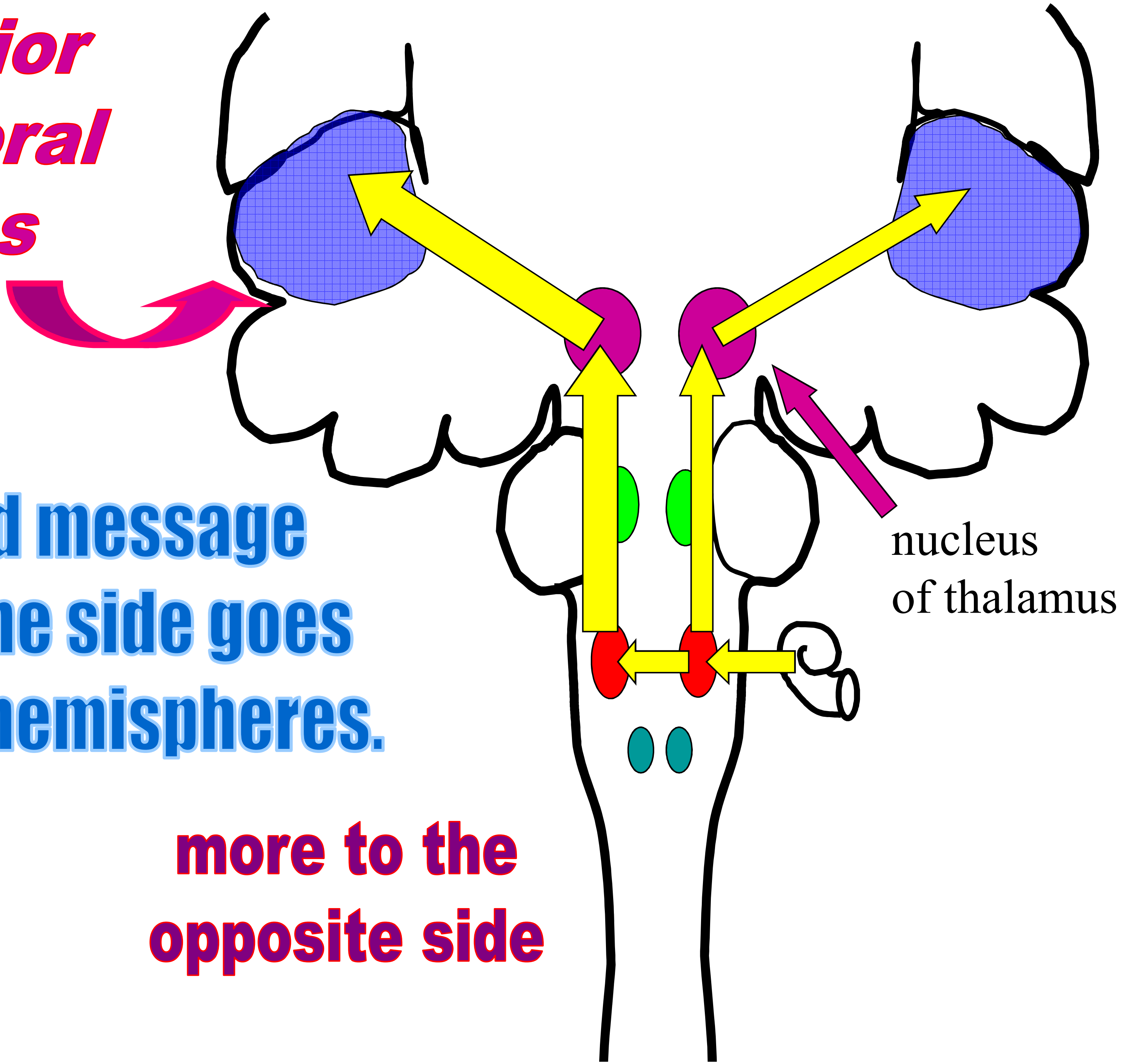


A1

superior temporal gyrus

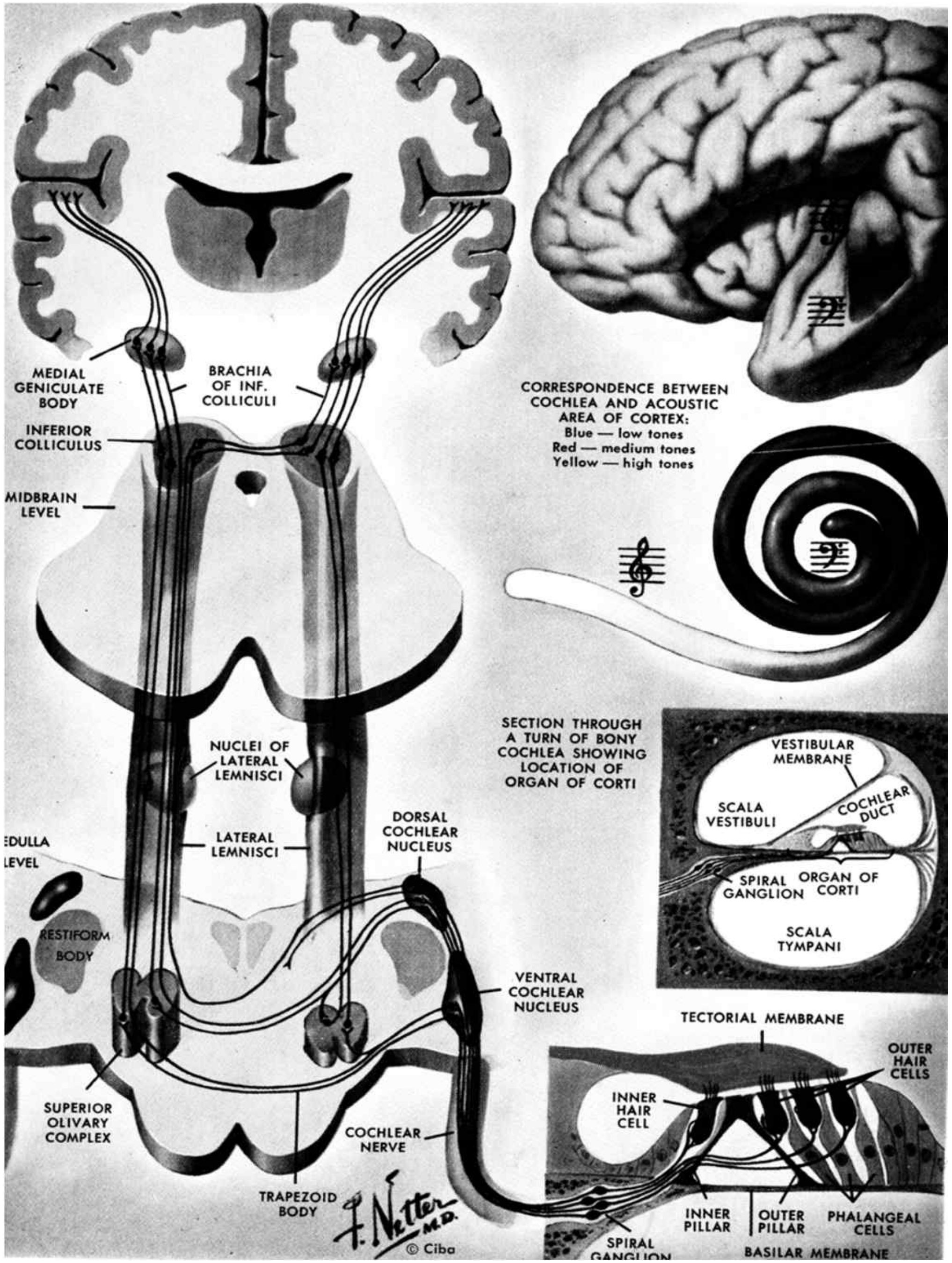
Primary Auditory Cortex

Superior Temporal Gyrus



Sound message from one side goes to both hemispheres.

more to the opposite side



Here is a more elaborate diagram.

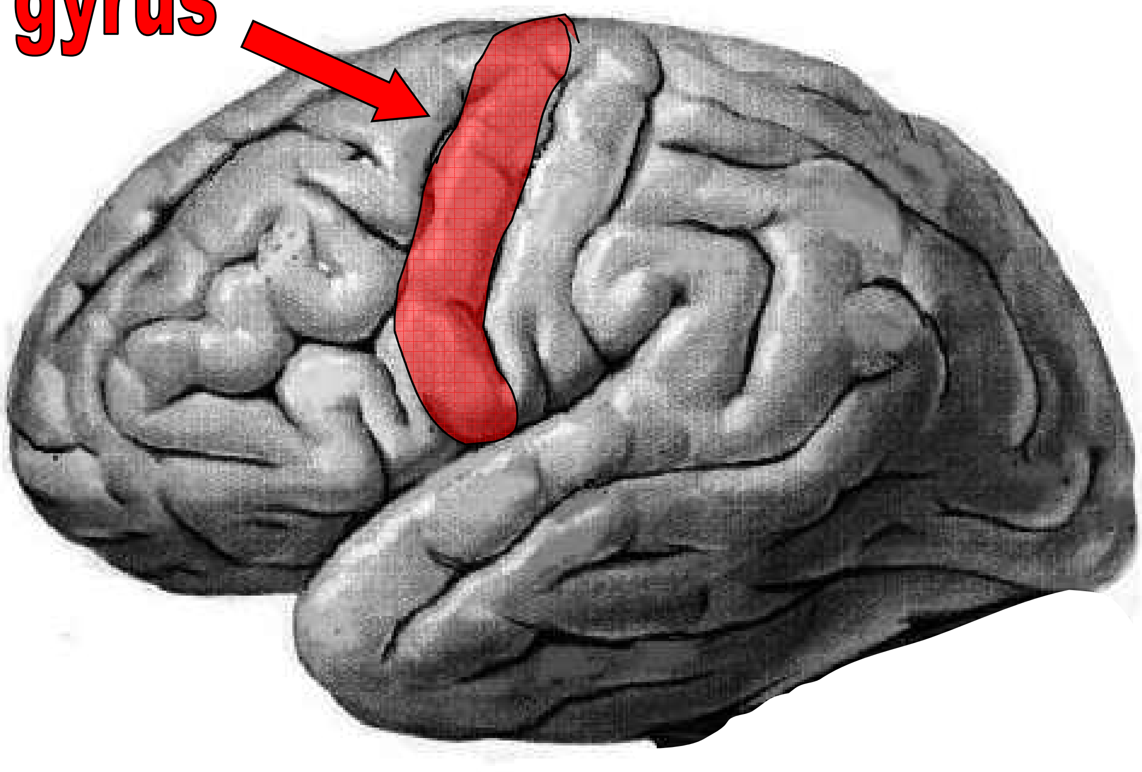
Shows

bilateral

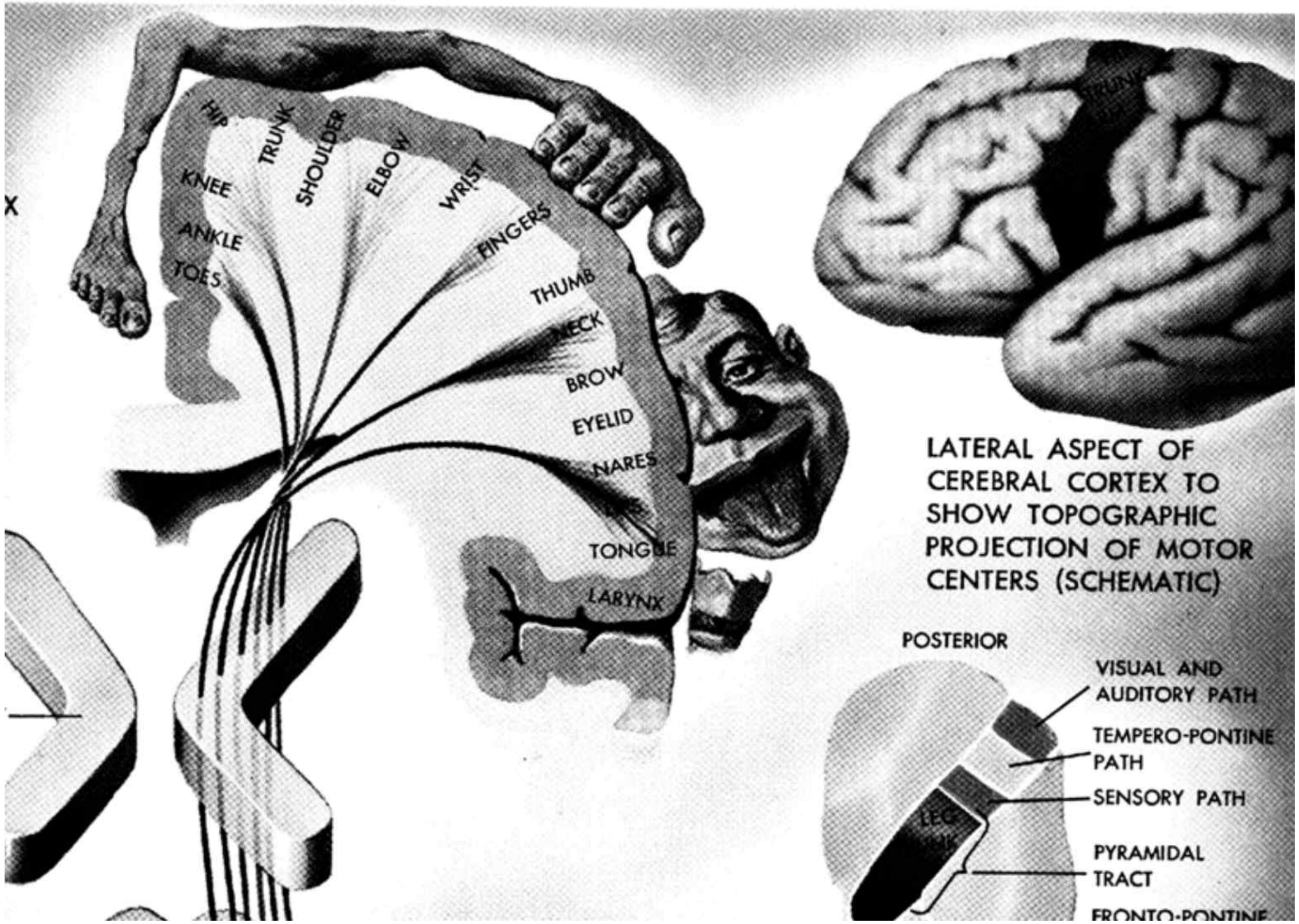
input to the brain.

precentral gyrus

M 1



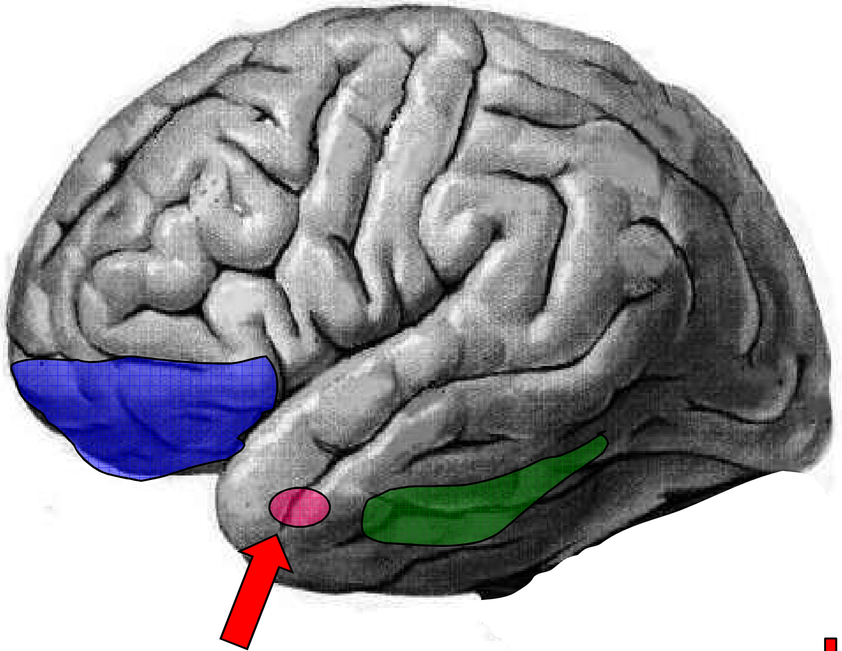
Primary Motor Cortex

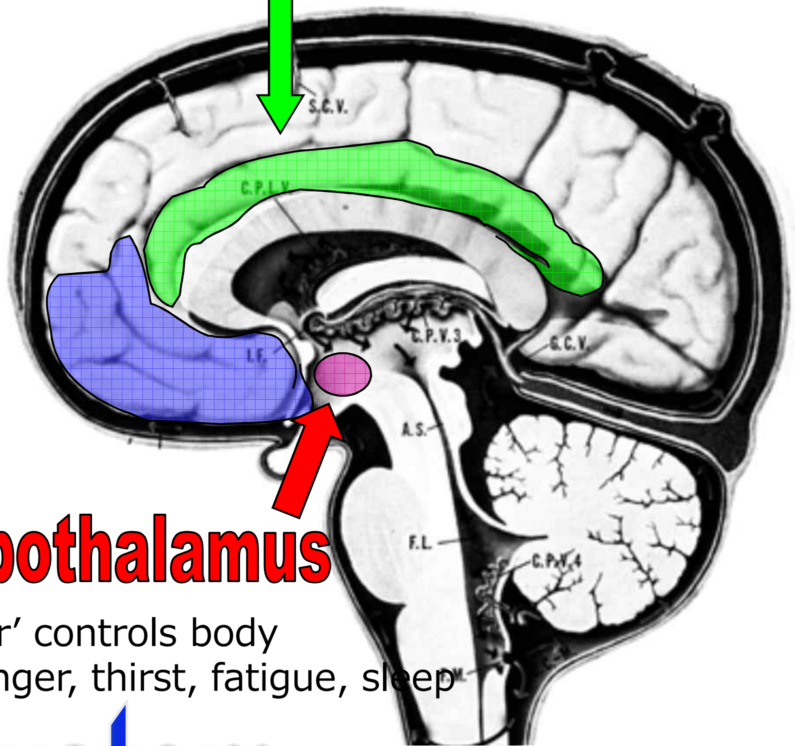


There is a motor “homunculus.” It is predominantly contralateral in its control of muscle activity.

Roles in depression and schizophrenia

cingulate cortex





amygdala

='almond'
processing of
memory and
emotional reactions

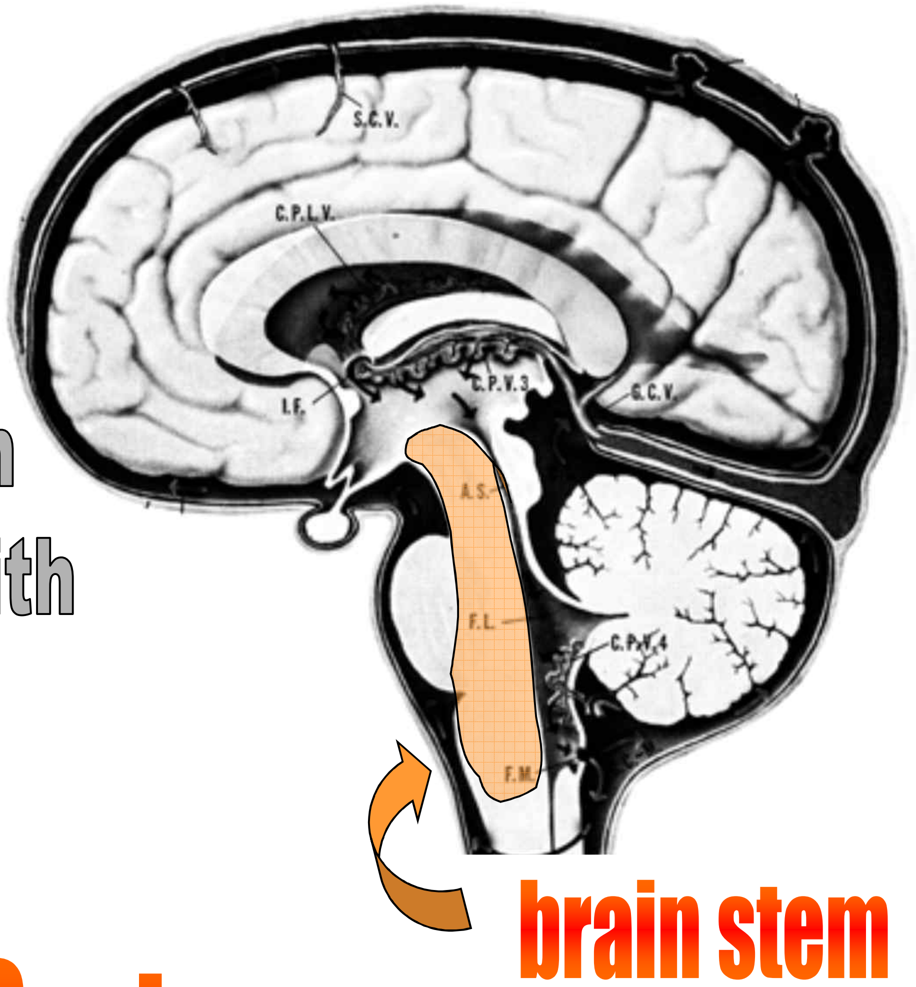
hypothalamus

='room, chamber' controls body temperature, hunger, thirst, fatigue, sleep

Limbic System

But some work grouped some of these brain structures in a system which controlled emotion.

Autonomic Nervous System affects
- Heart rate
- Digestion
- Respiratory rate
- Salivation
- Perspiration
- Pupillary dilation



Also, these forebrain structures connect with th brain stem to regulate the

Autonomic System