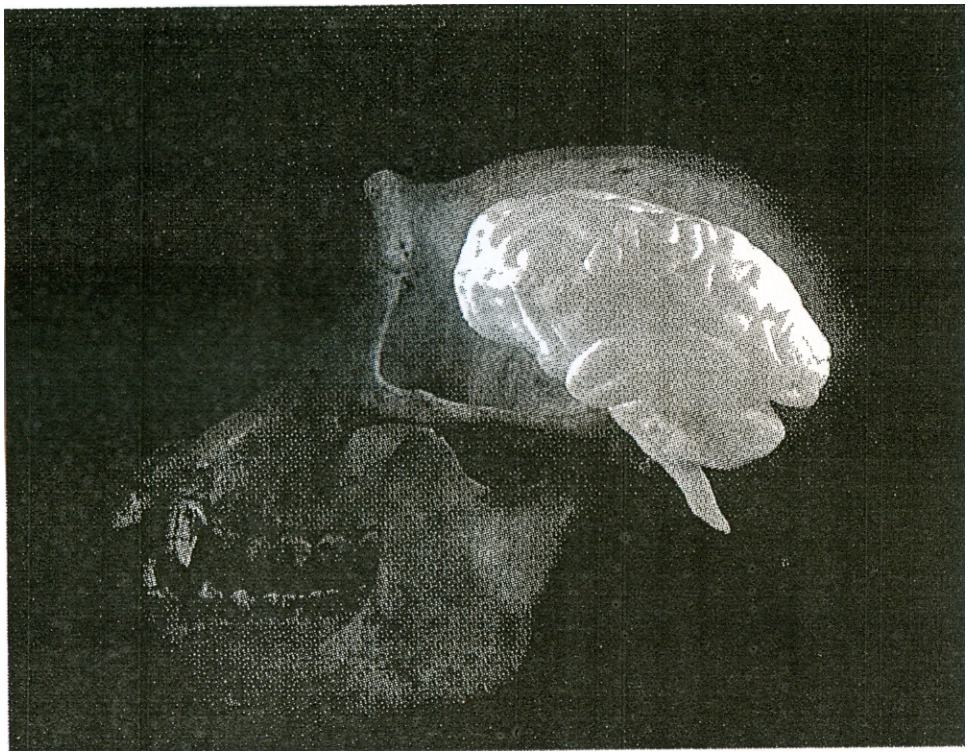
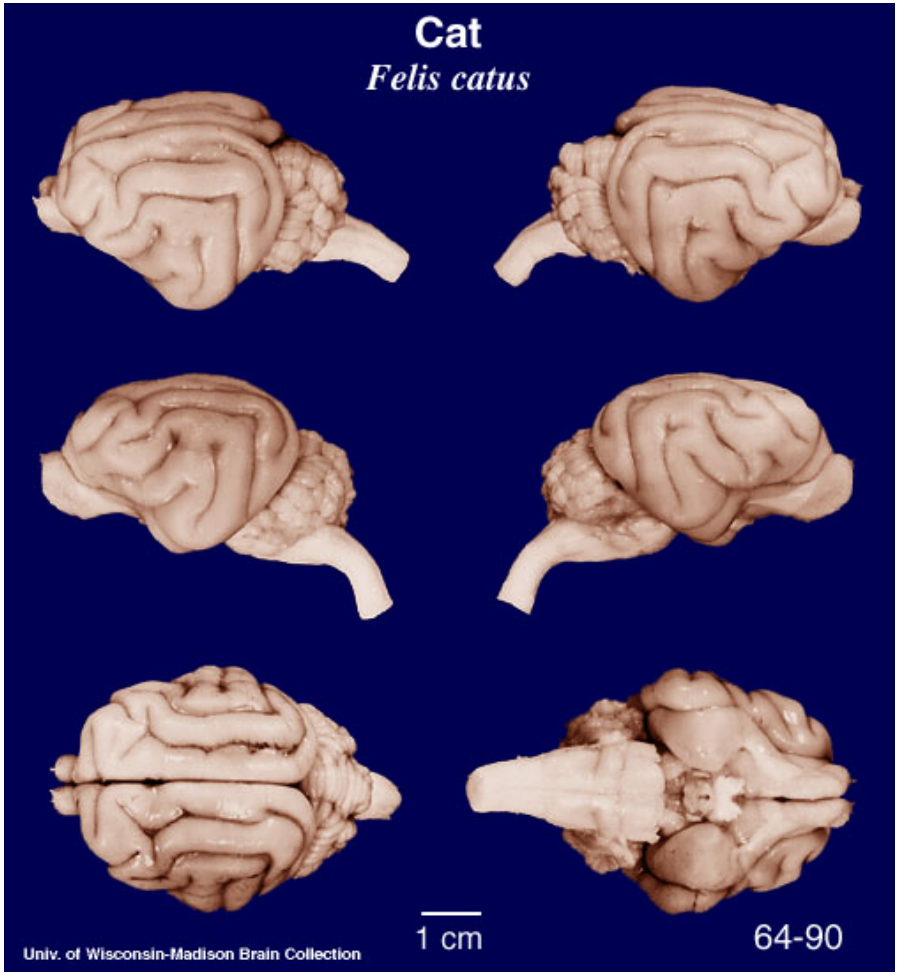
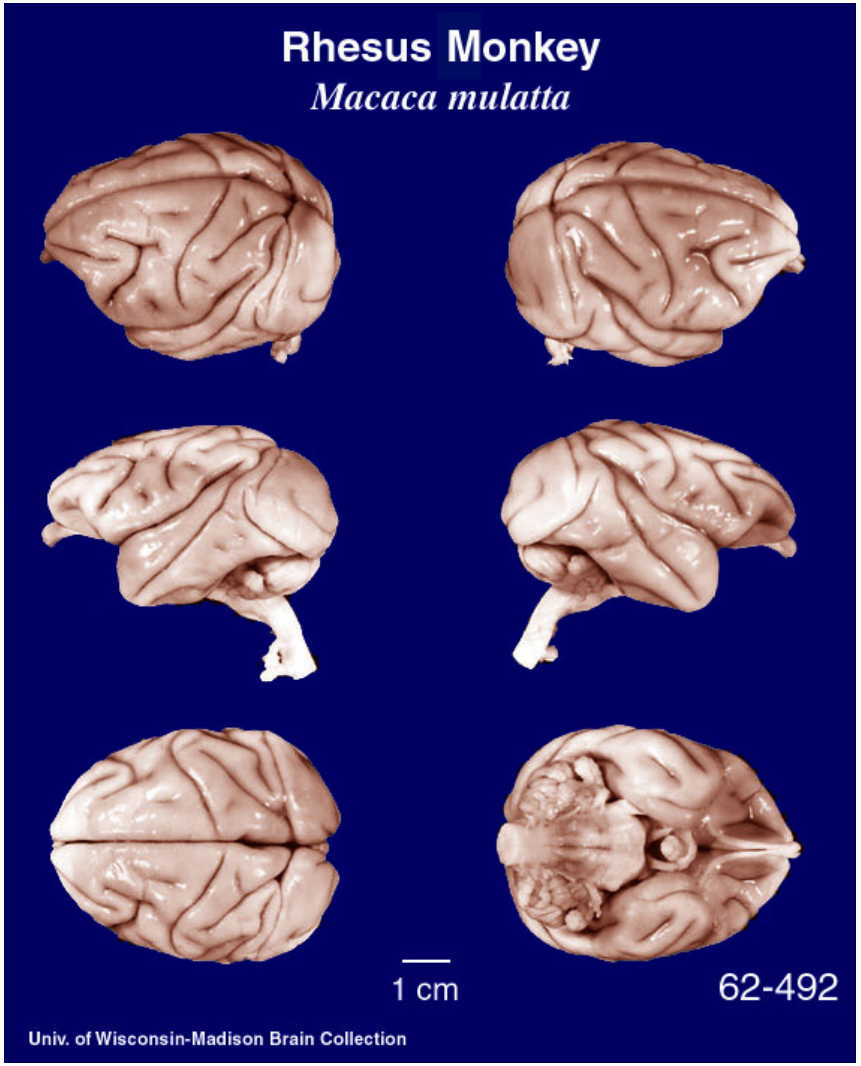
Primate Brains



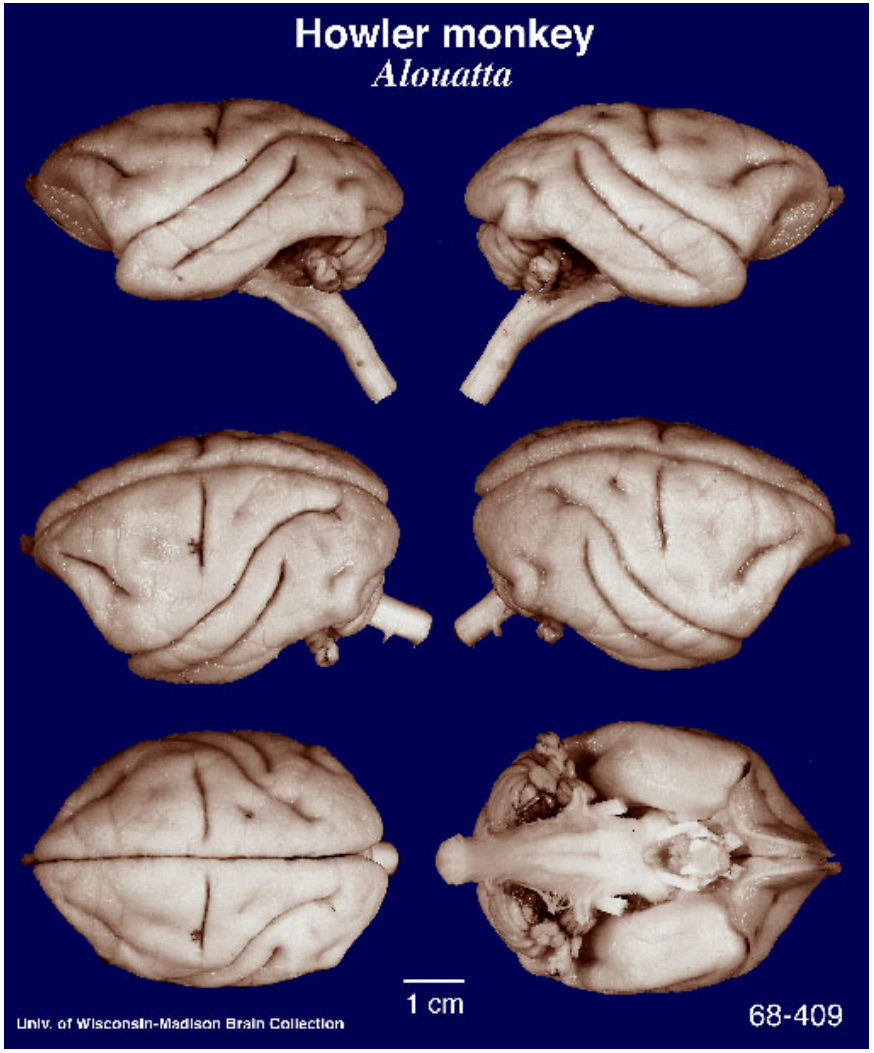
Cogs 143 * UCSD

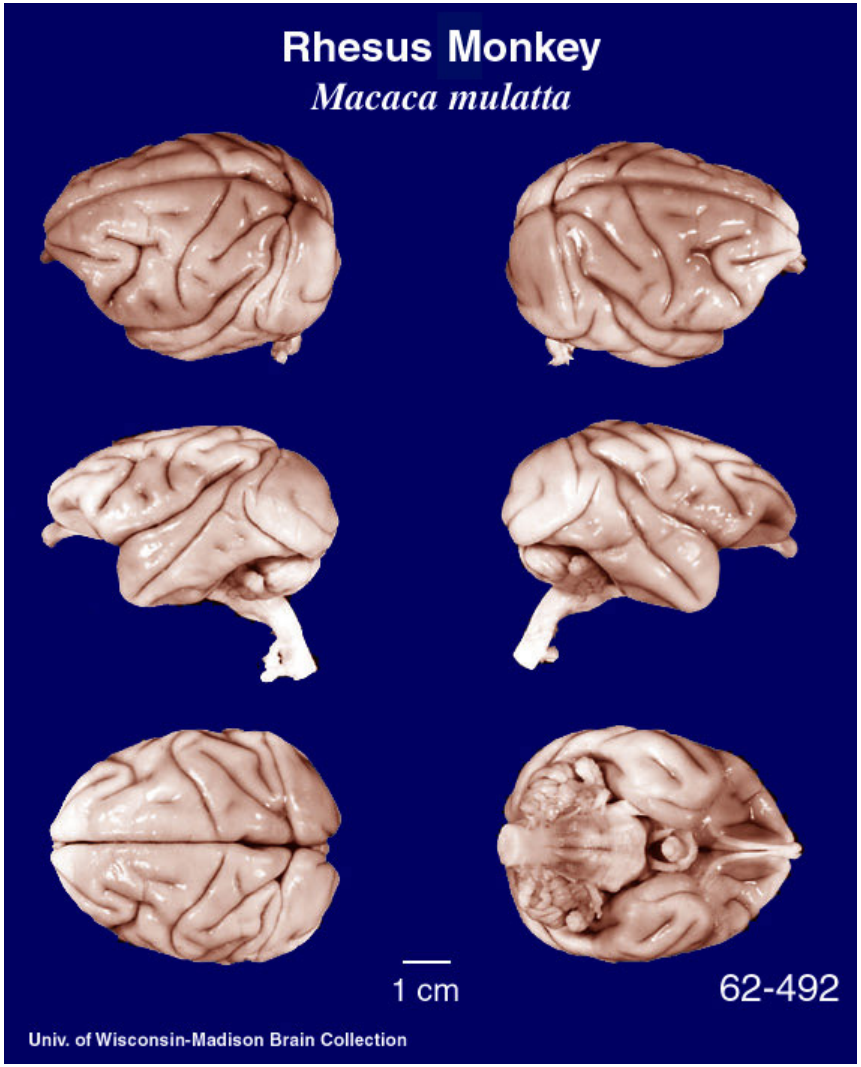
Primate brains larger than similar-sized mammal



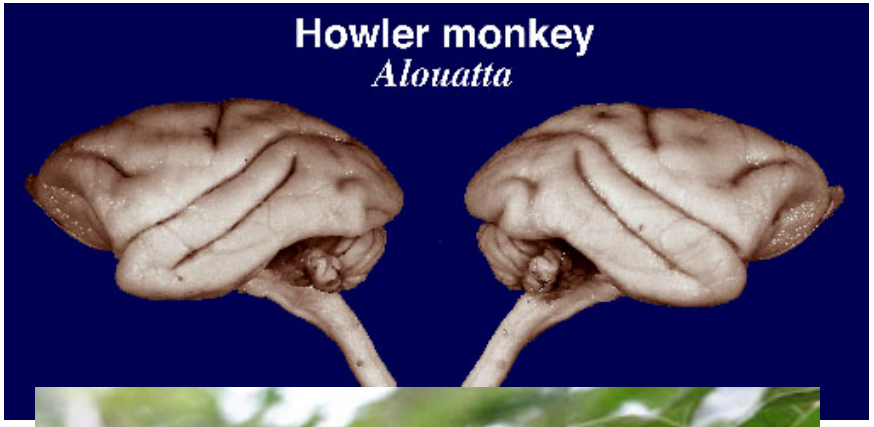


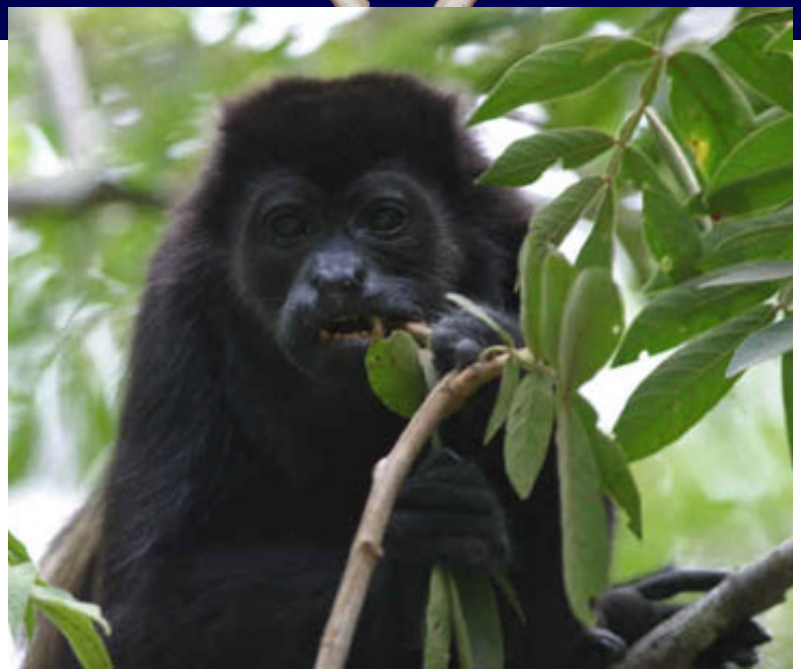
Brain differences within Primates



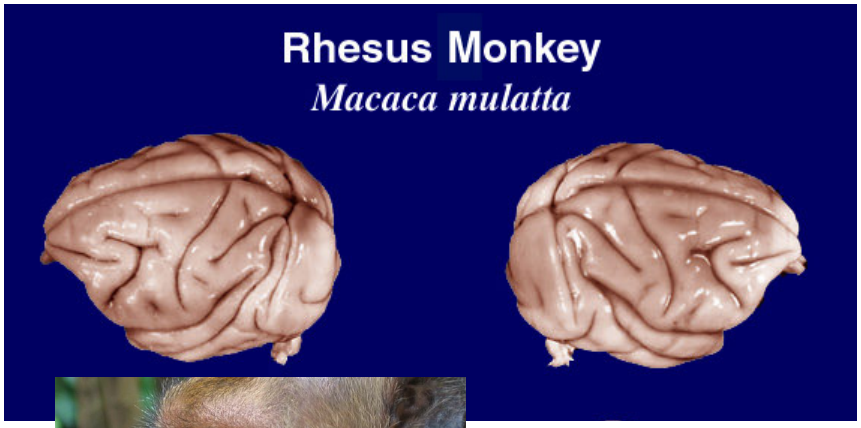


Brain differences within Primates



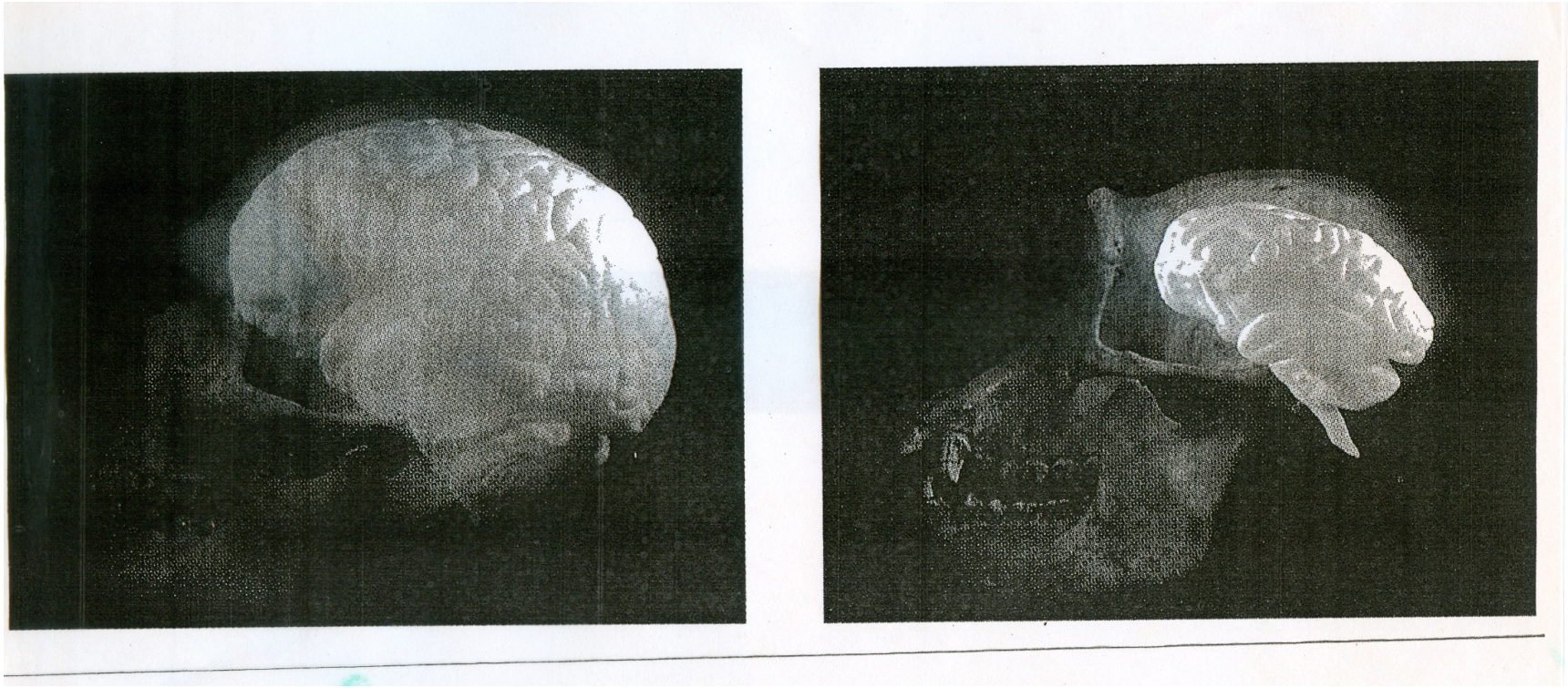


Folliovore



(More omnivorous) Frugivore

Human brains the largest of any primate



Human

Other ape

Human neo-cortex particularly expanded

Human

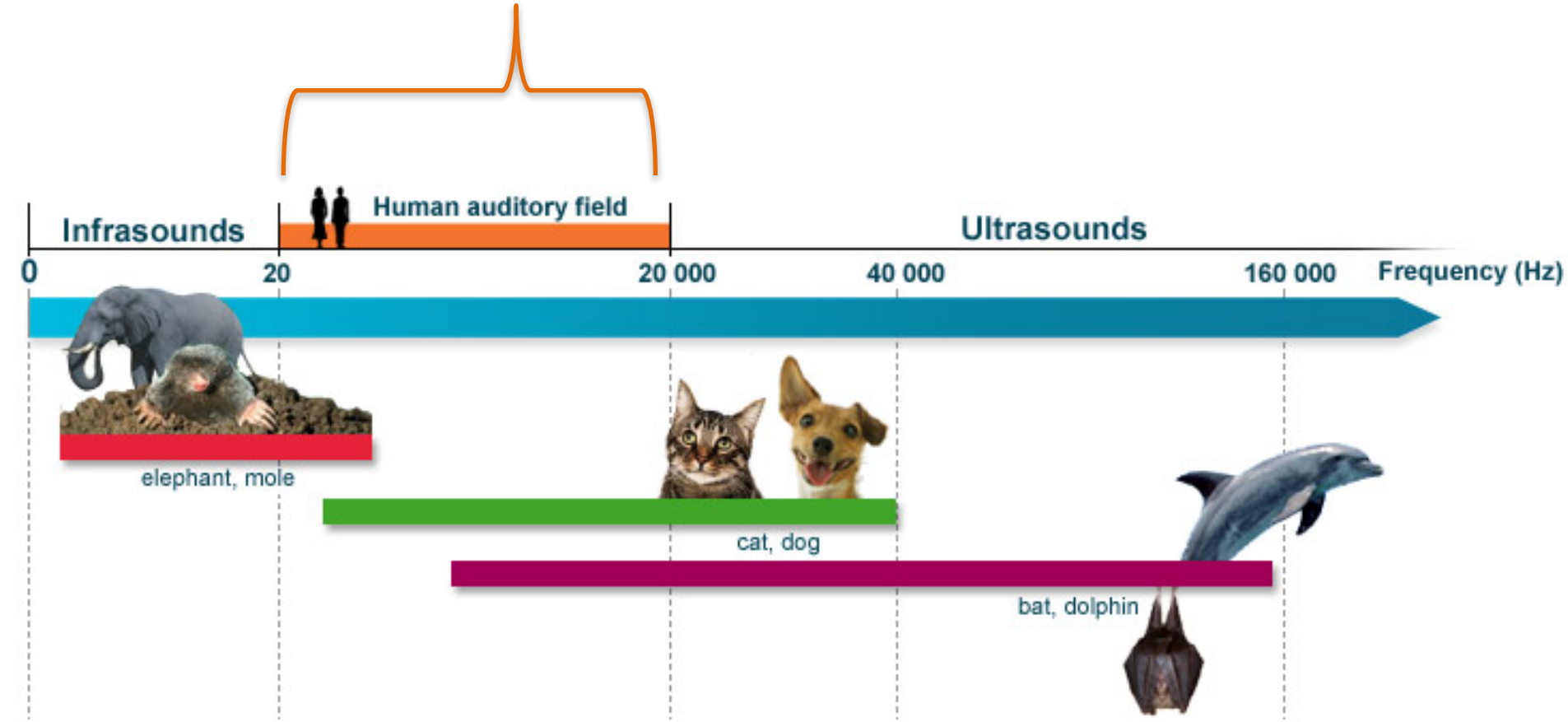
Chimpanzee

Sensori-Motor Integration

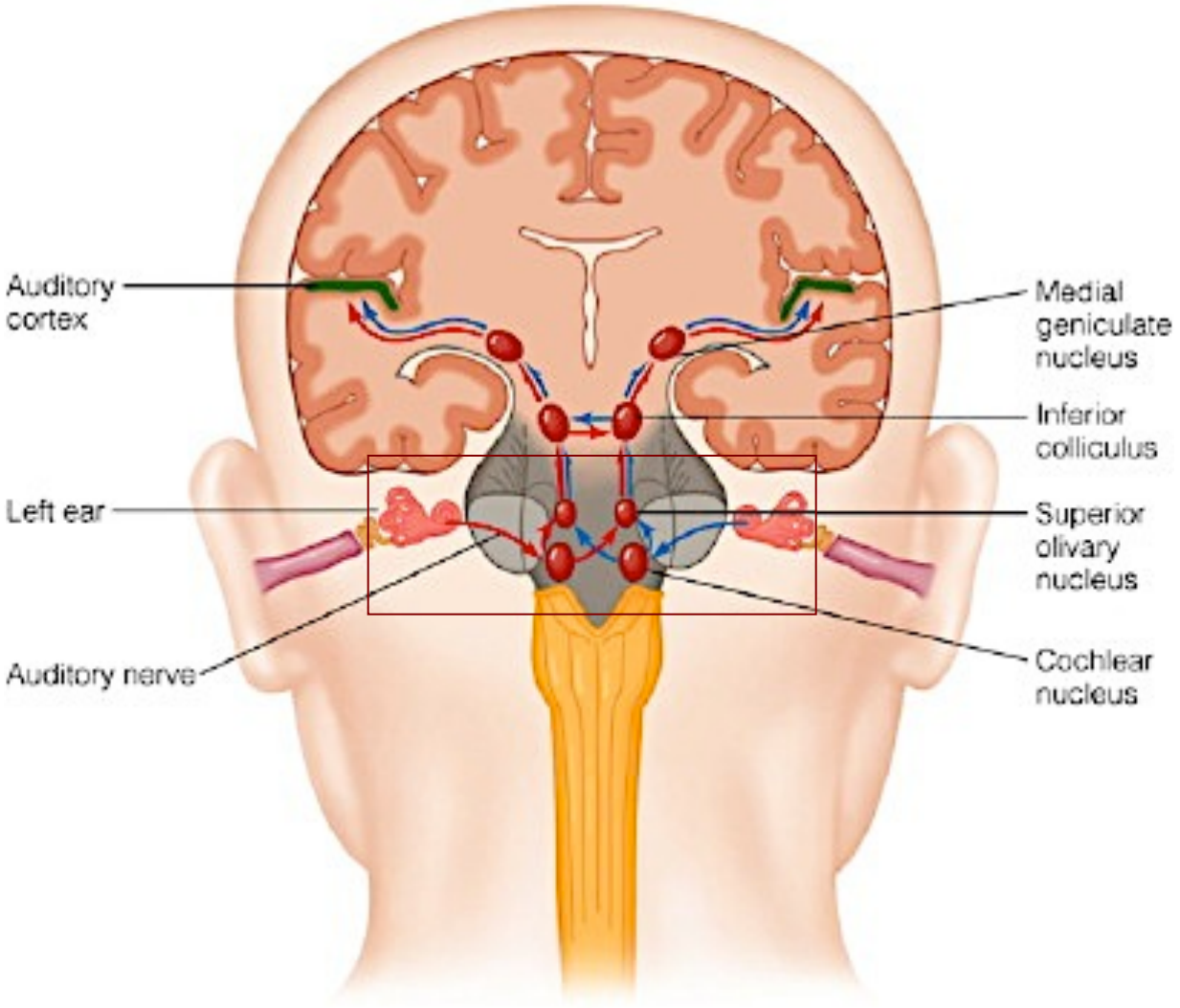
How are sensory inputs
processed
and integrated with
other modalities?

Audition

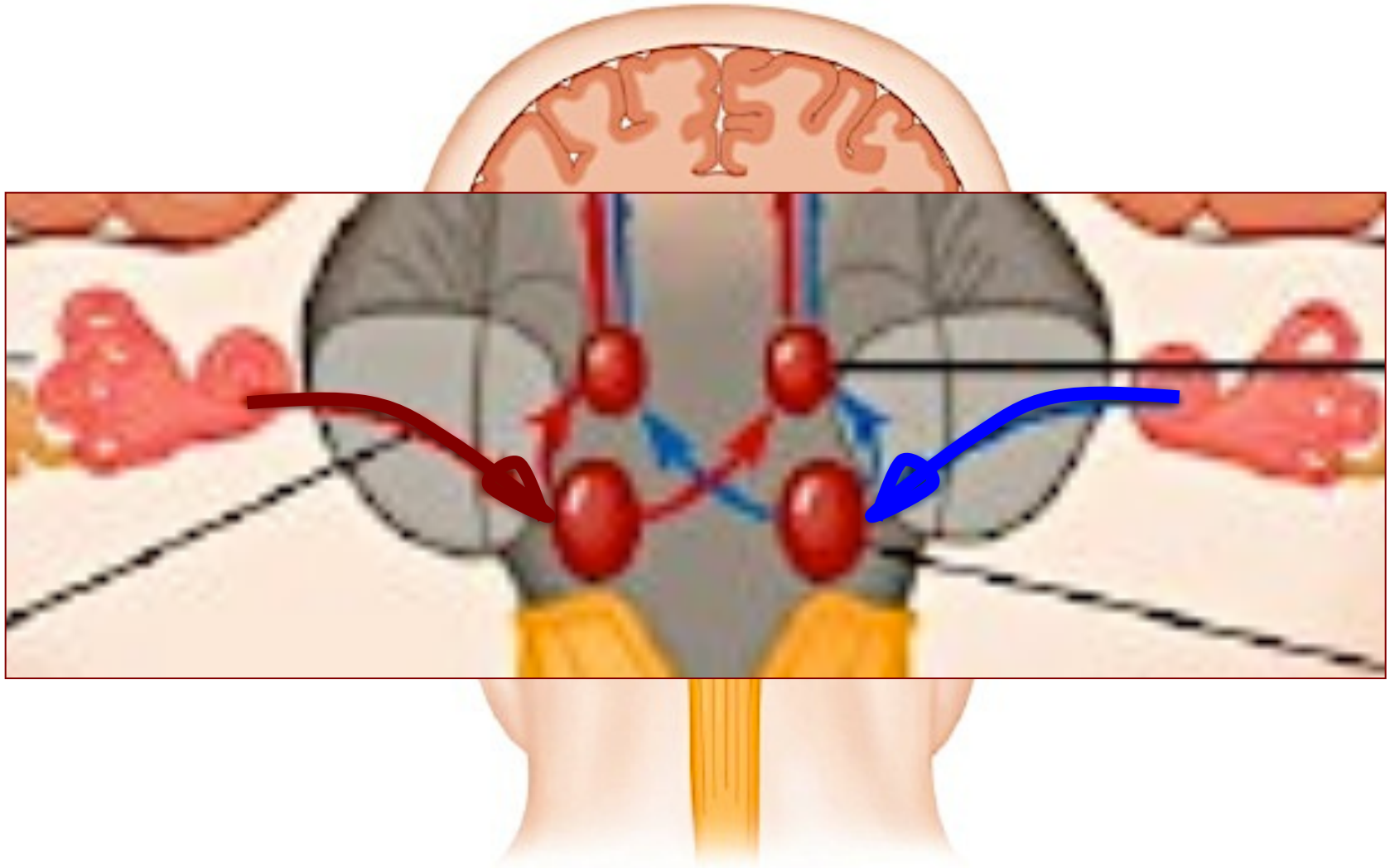
Primates hear ~ 20-20,000 Hz



Auditory Pathway

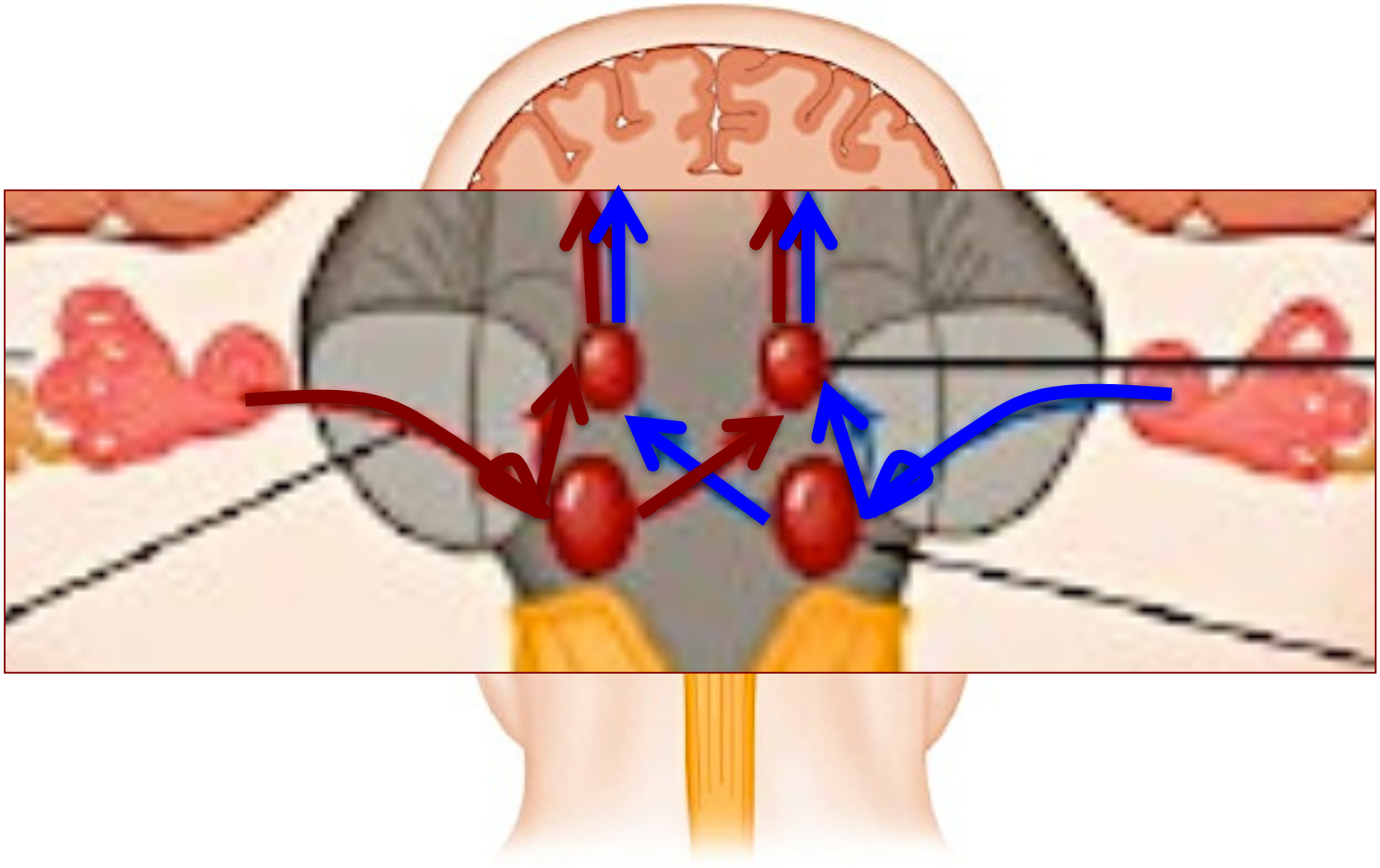


Auditory Pathway



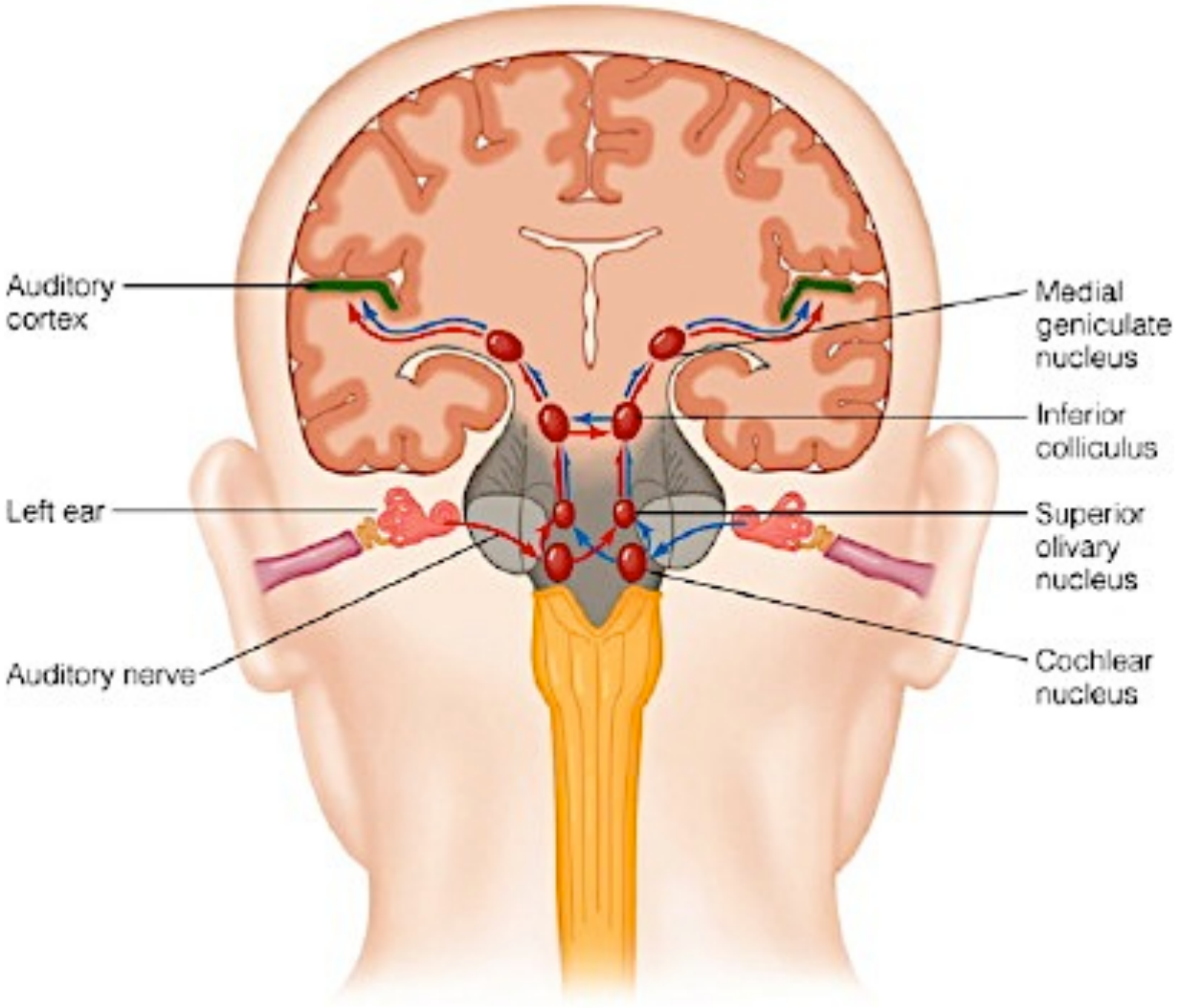
Inputs to first (Cochlear Nucleus) hindbrain site are <u>Monaural</u>

Auditory Pathway



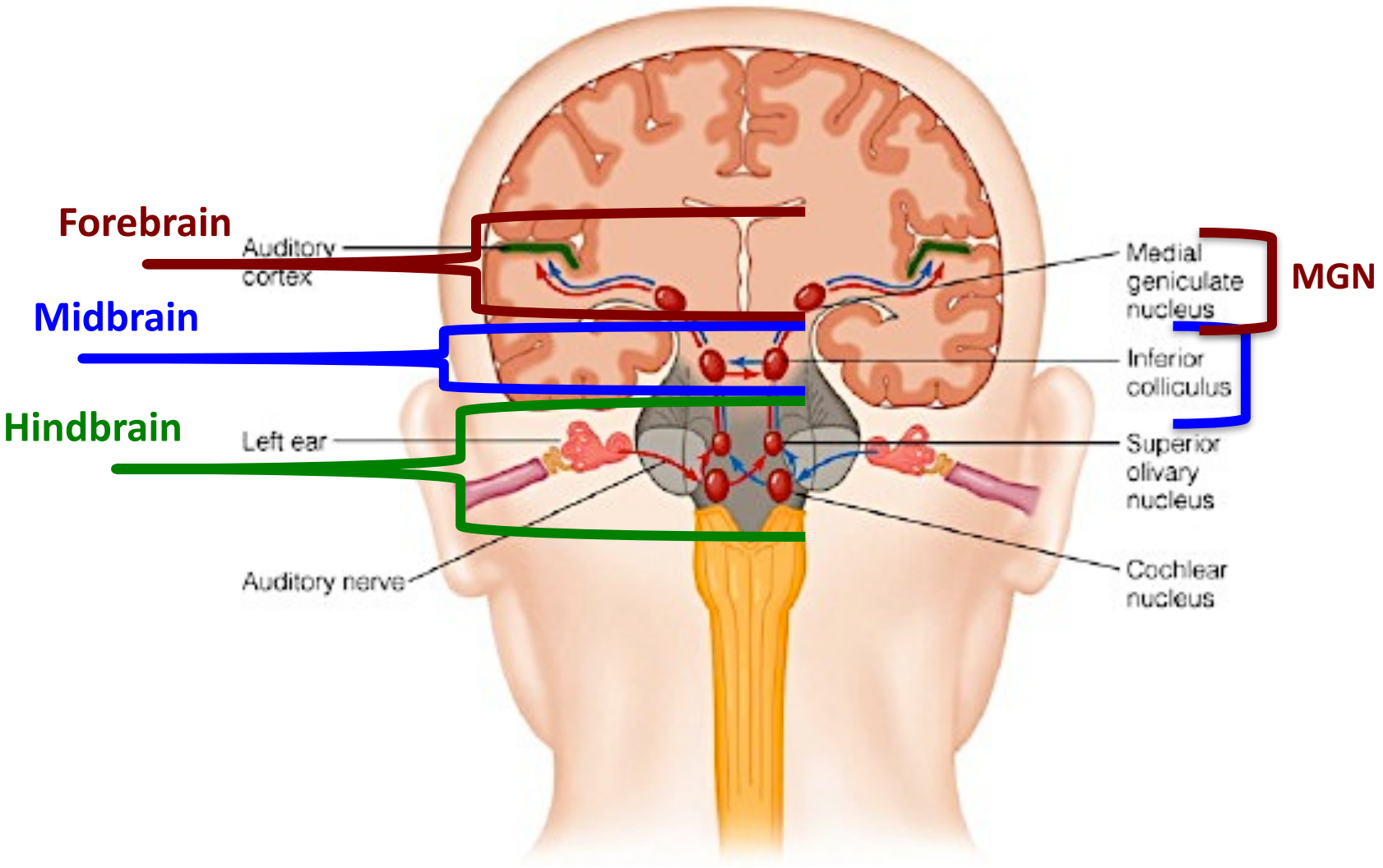
The rest of the path way is Binaural

Auditory Pathway

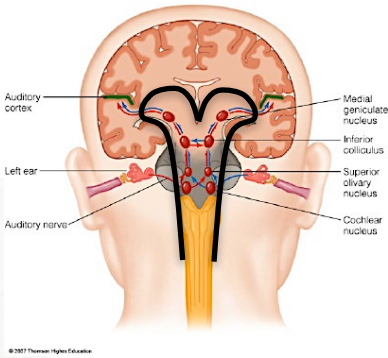


The rest of the path way is <u>Binaural</u>

Auditory Pathway



The Brainstem



Projects aud info to cortex

MGN of Thalamus

Visual Tracking

Superior colliculus

Auditory Tracking

Inferior colliculus

Tectum

Orient Head

Tegmentum

Pons

Medulla

Localize sound sources

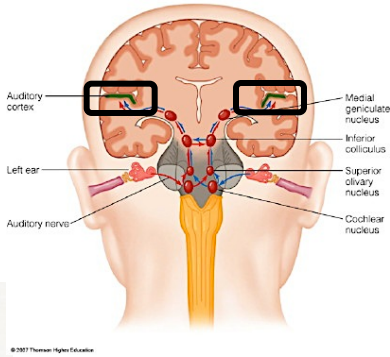
Pineal gland

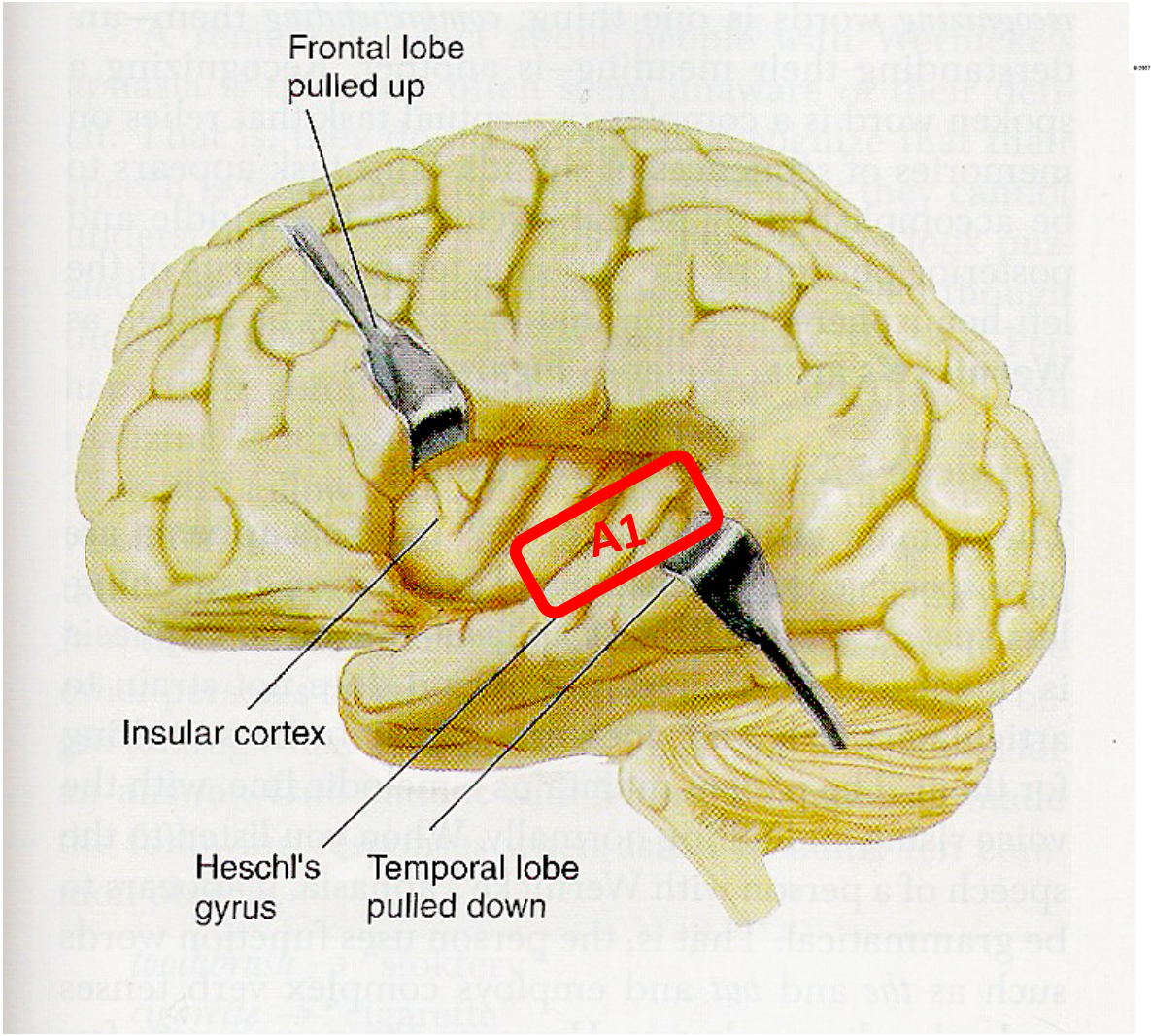
Midbrain

Map localization w/visual, Direct head to source

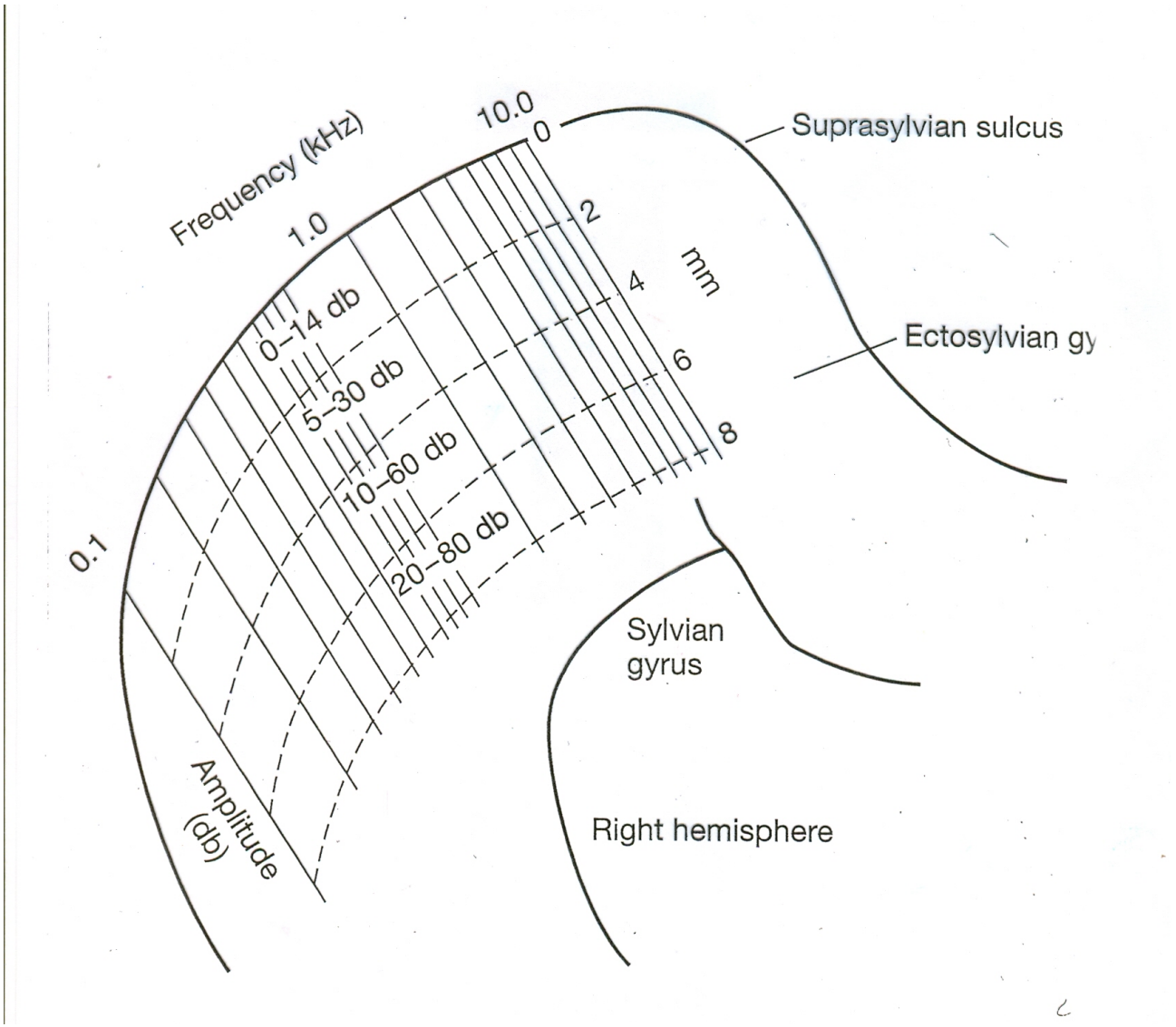
Posterolateral view of brainstem

Primary Projection Area (A1) in Cortex



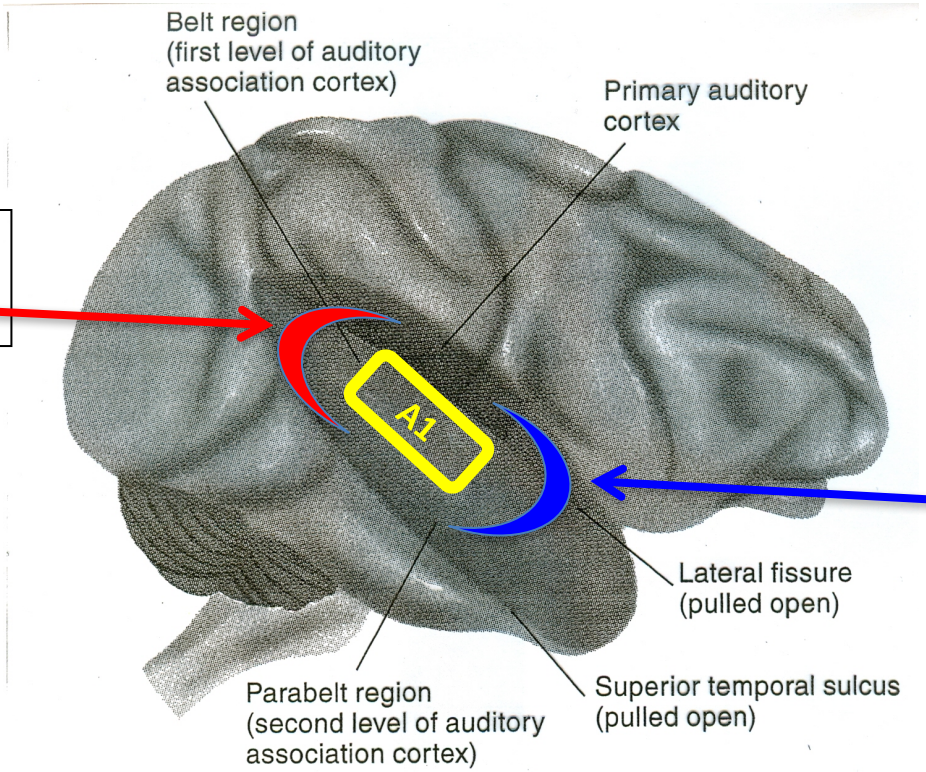


Tonotopic (Frequency & Amplitude) Map in A1



Monkey Auditory Cortex

Higher Auditory for Localization



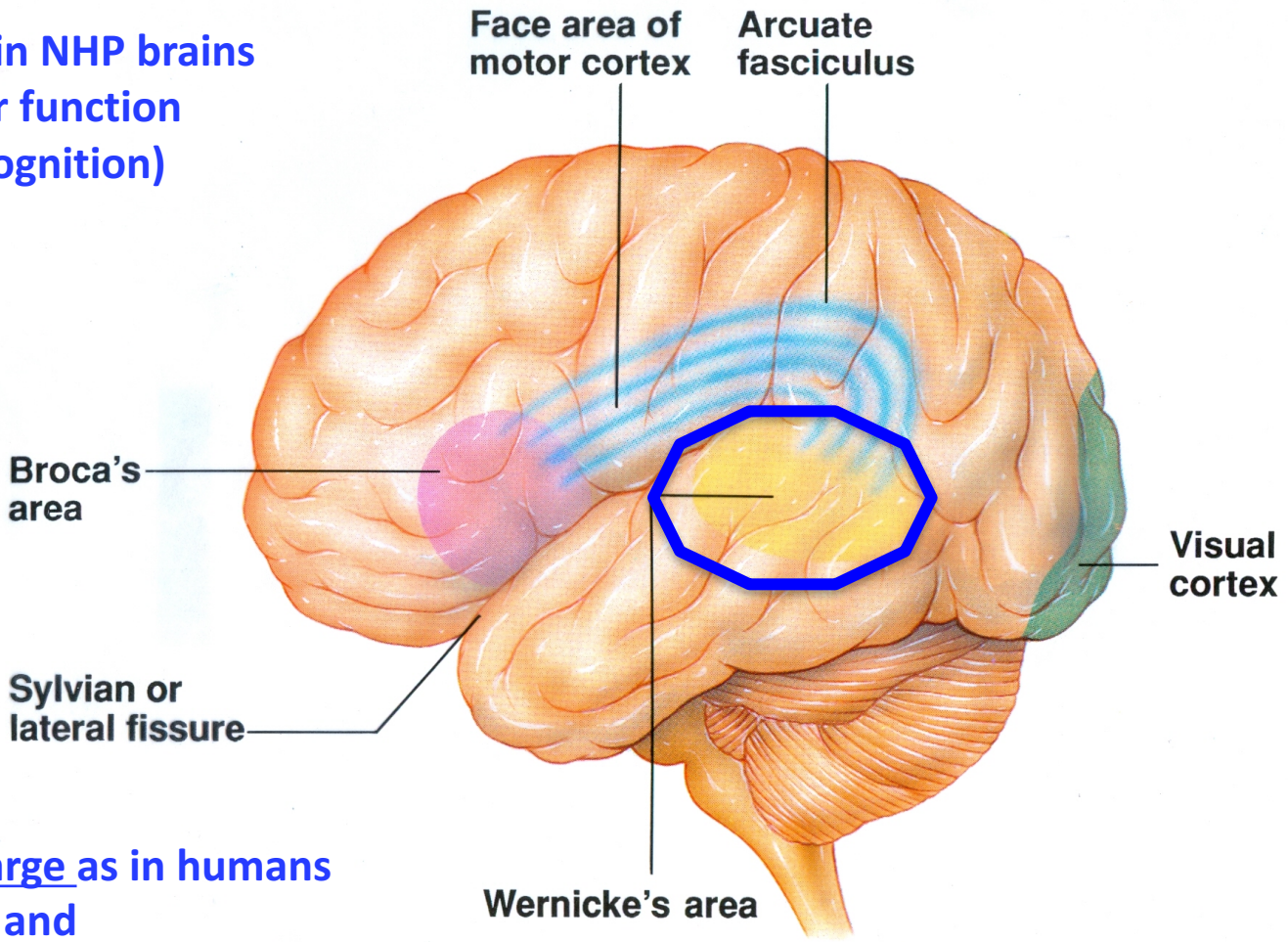
Higher Auditory for Identity

Figure 7.13

A lateral view of the monkey brain, showing the location of the primary auditory cortex, the belt region (first level of auditory association cortex), and the parabelt region (second level of auditory association cortex). The temporal lobe has been pulled down to expose the cortex on the upper and lower banks of the lateral fissure, and the superior temporal sulcus has been pulled apart.

"Higher" Auditory cortex in Humans includes Wernicke's Area for Speech

Similar area in NHP brains w/similar function (call recognition)

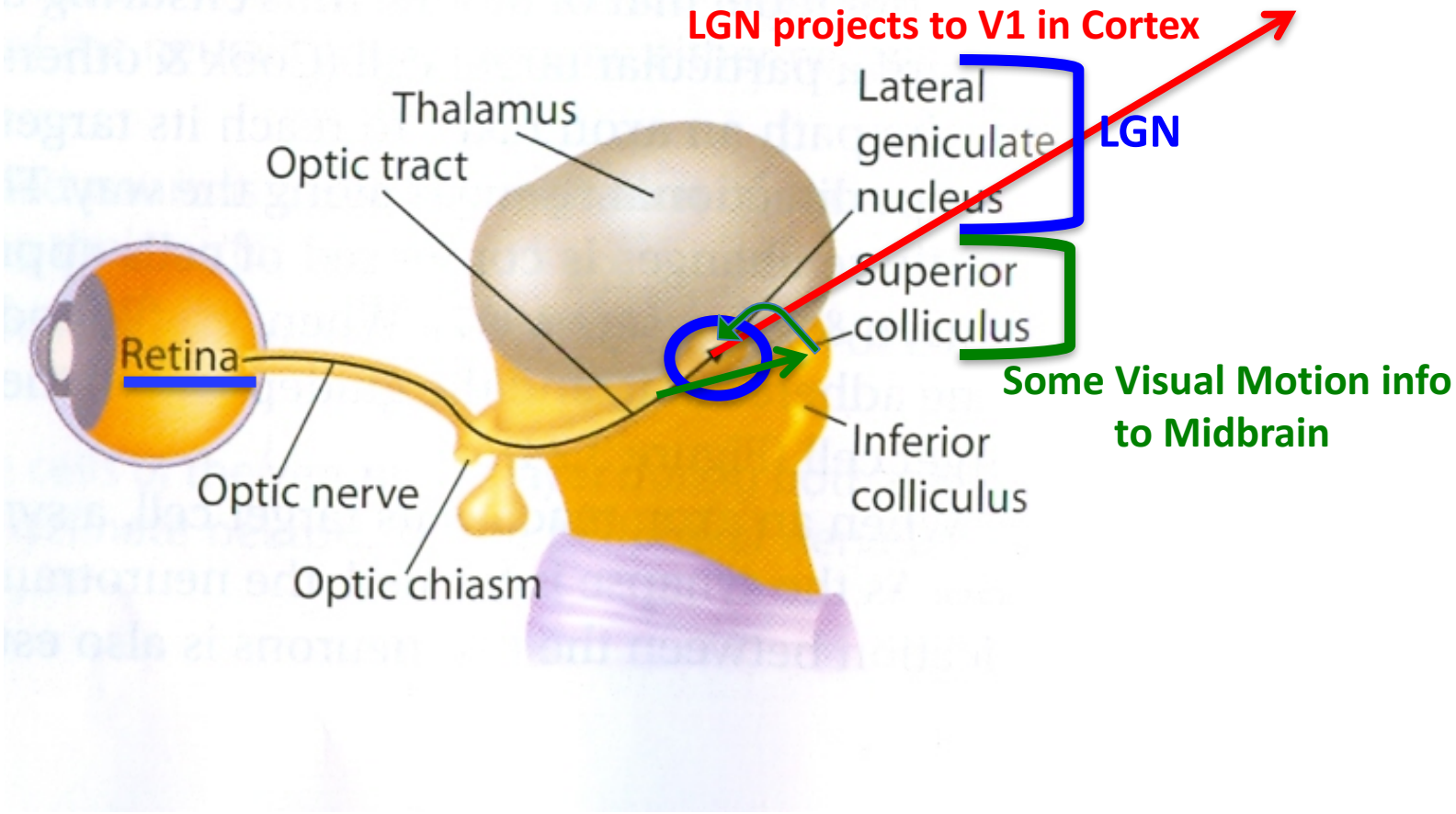


BUT not as large as in humans and not as asymmetrical (much larger in *our* LEFT hemisphere) !

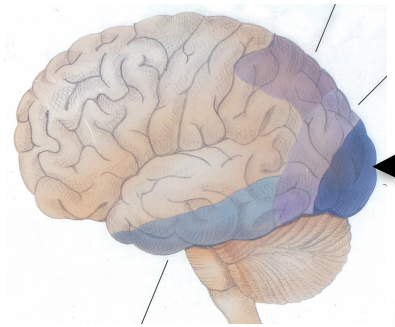
Vision

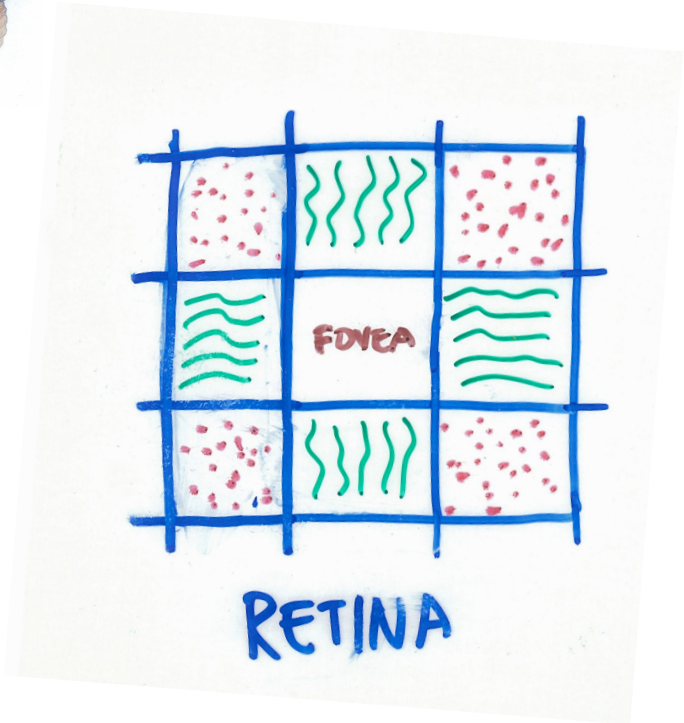
Vision

Most connections direct to Forebrain



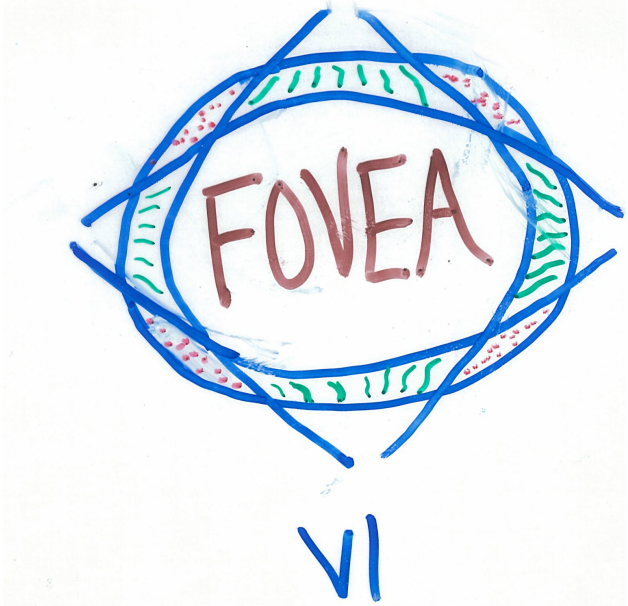
Retina Mapped in V1





V1: A "Topological" Map of Retina

(Preserves the spatial relationships of sensory surface)

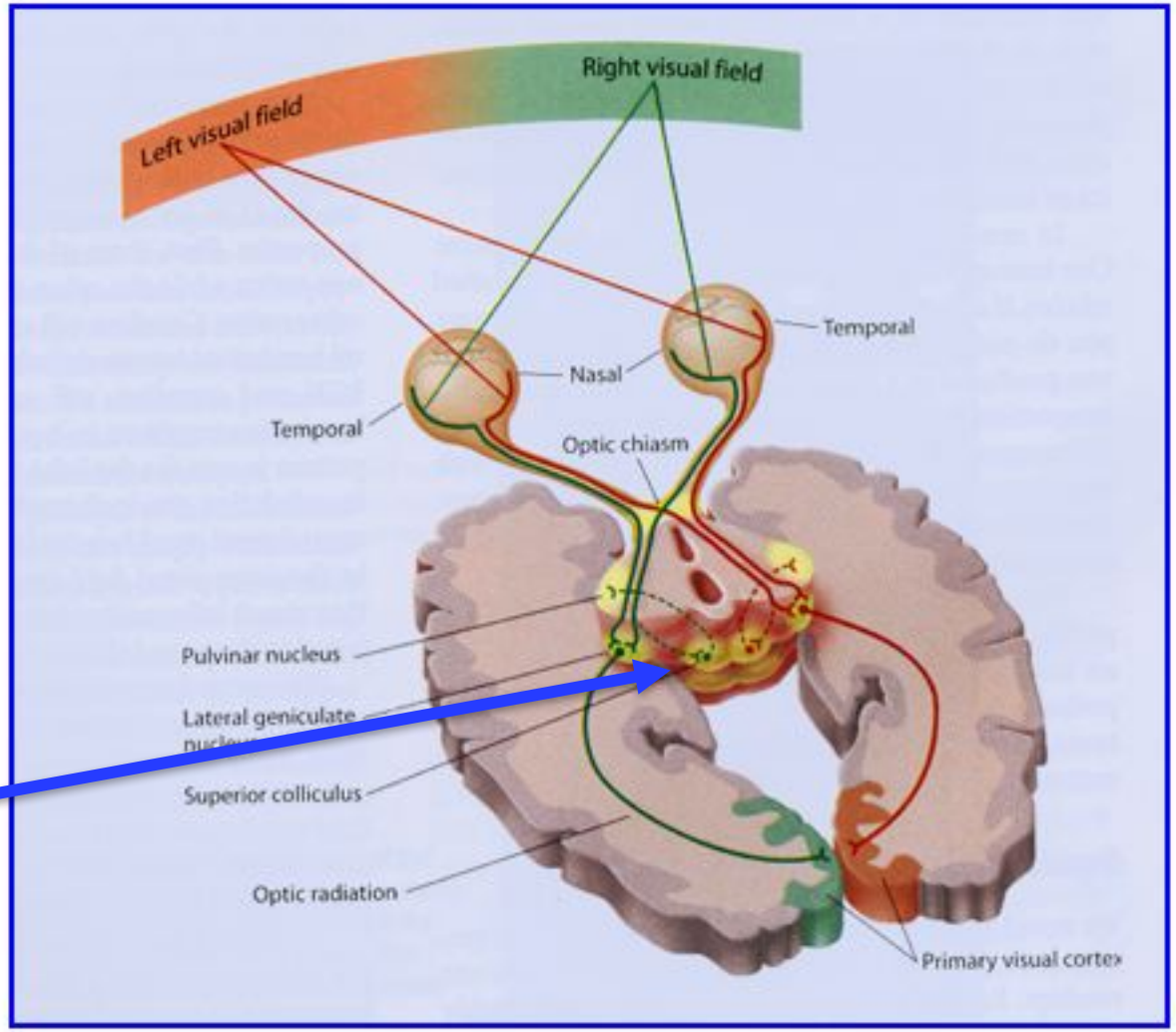


Fovea greatly "magnified" in cortical map

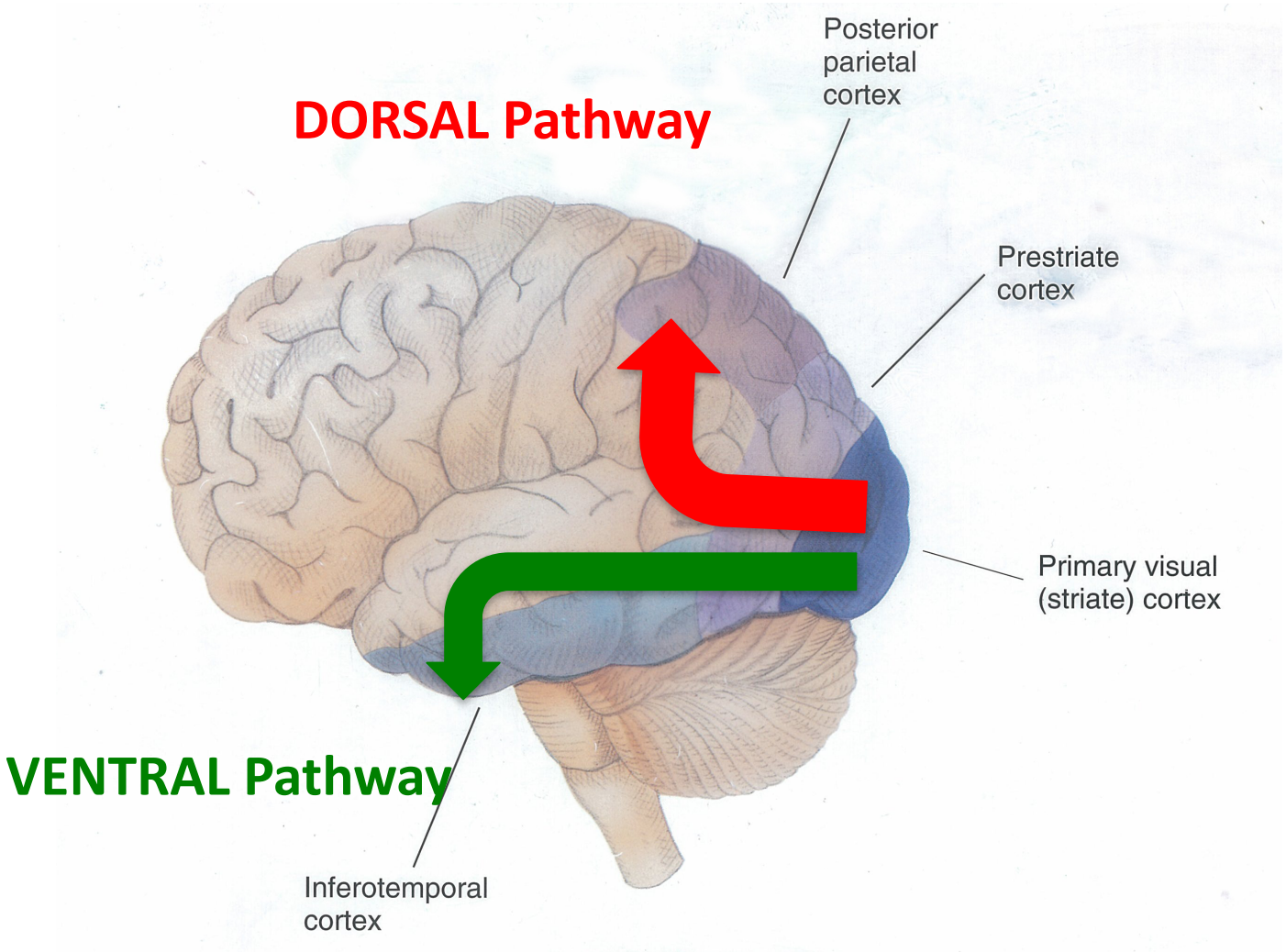
Cross-Over in Visual System

Right Visual Field crosses to Left Brain – Left Visual Field crosses to Right Brain

Midbrain's division of field helps orient to center



Two Major Visual Pathways



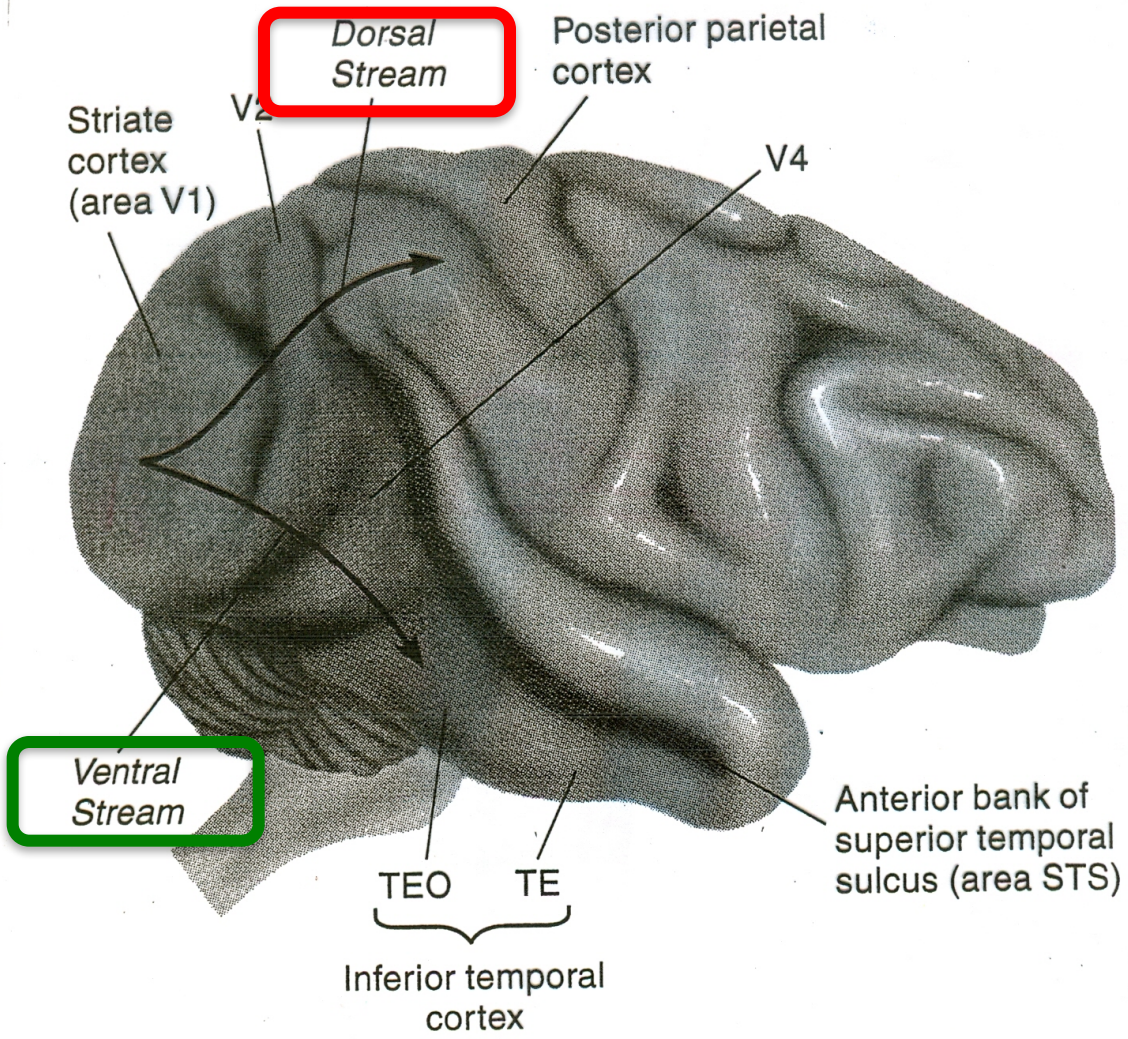


Figure 6.37

Areas of visual cortex in the rhesus monkey brain.
(Adapted from Zeki, S. M. *Journal of Physiology,* 1978, *277,* 227–244.)

Dorsal ("Where/How") Pathway – For Motion & Depth

MST: Optic Flow

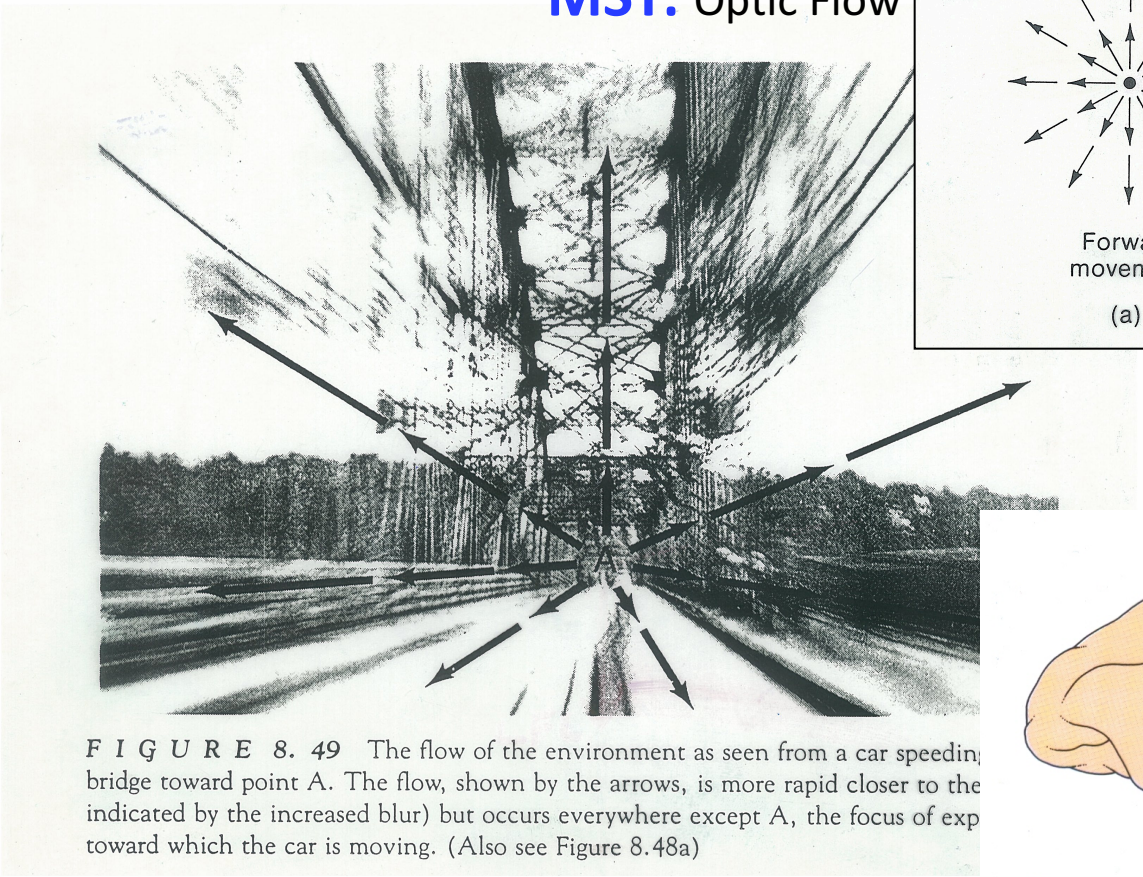
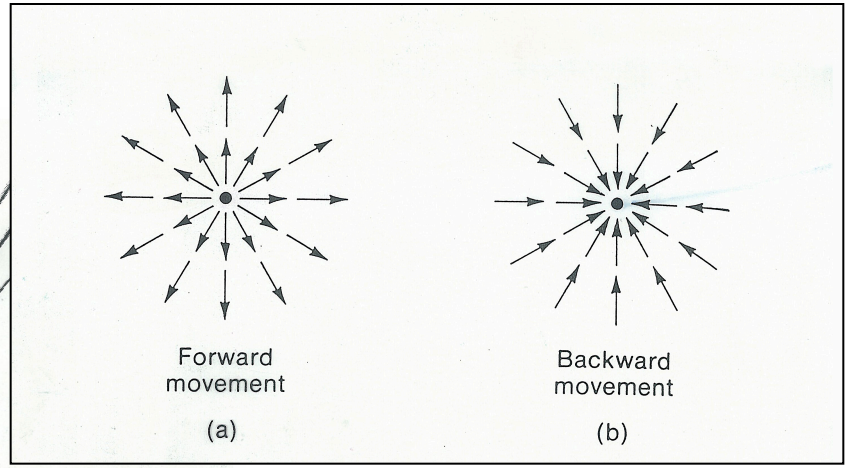
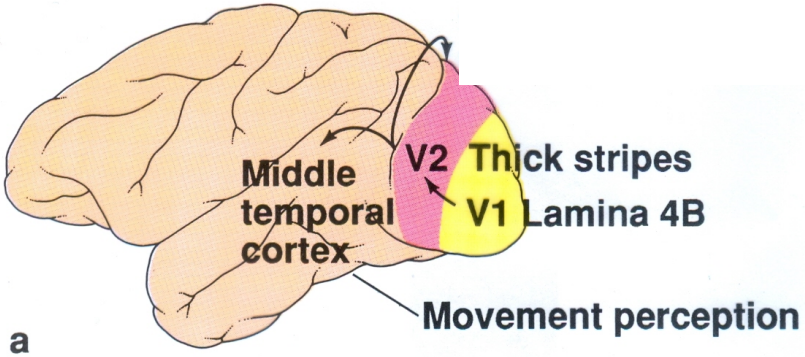


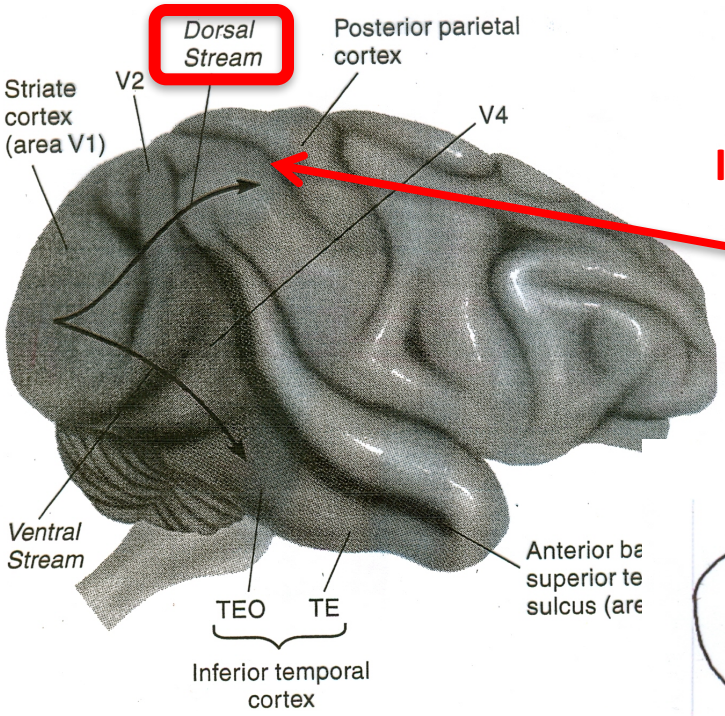
FIGURE 8.49 The flow of the environment as seen from a car speedin bridge toward point A. The flow, shown by the arrows, is more rapid closer to the indicated by the increased blur) but occurs everywhere except A, the focus of exp toward which the car is moving. (Also see Figure 8.48a)



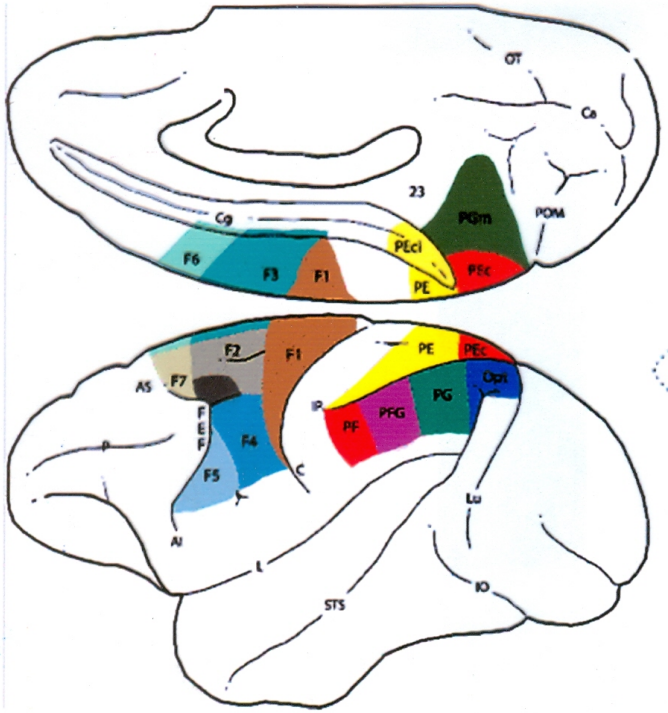
MT: Motion Detectors

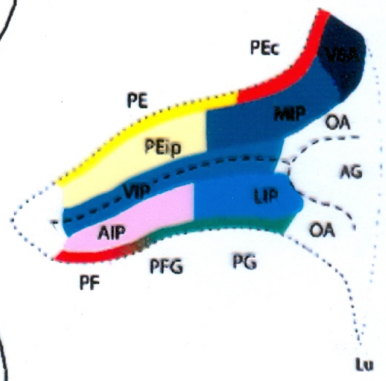


Dorsal Pathway – "How"

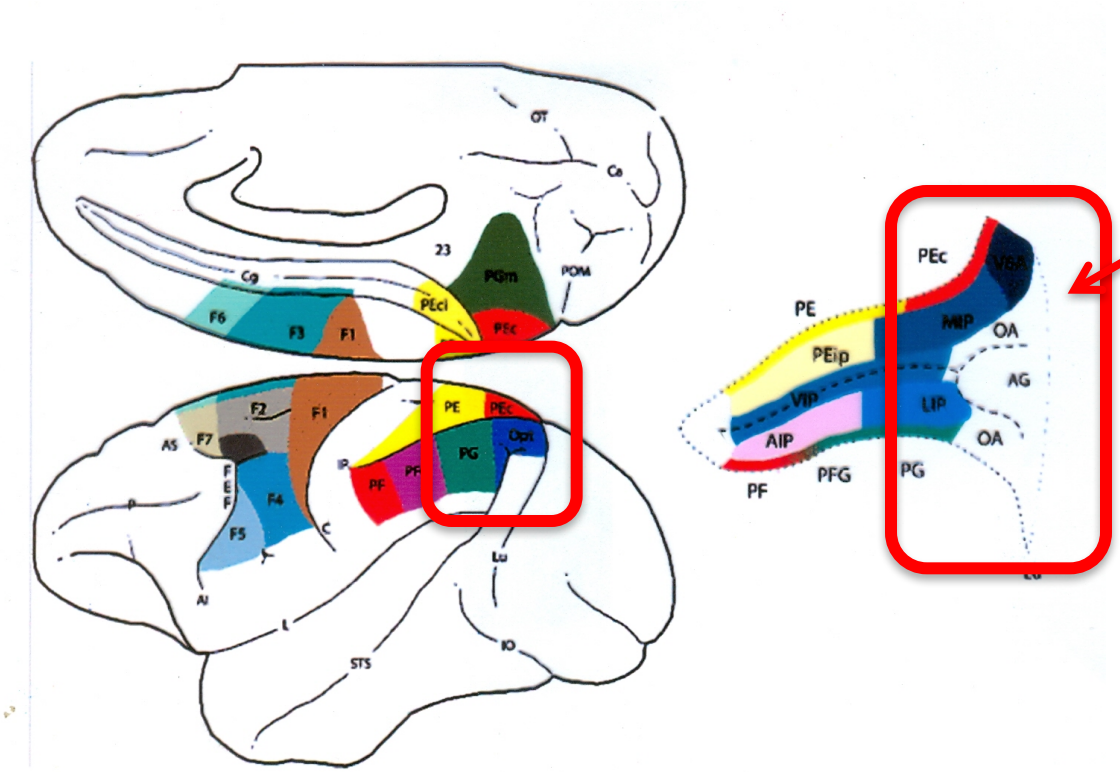


Intra-Parietal Sulcus





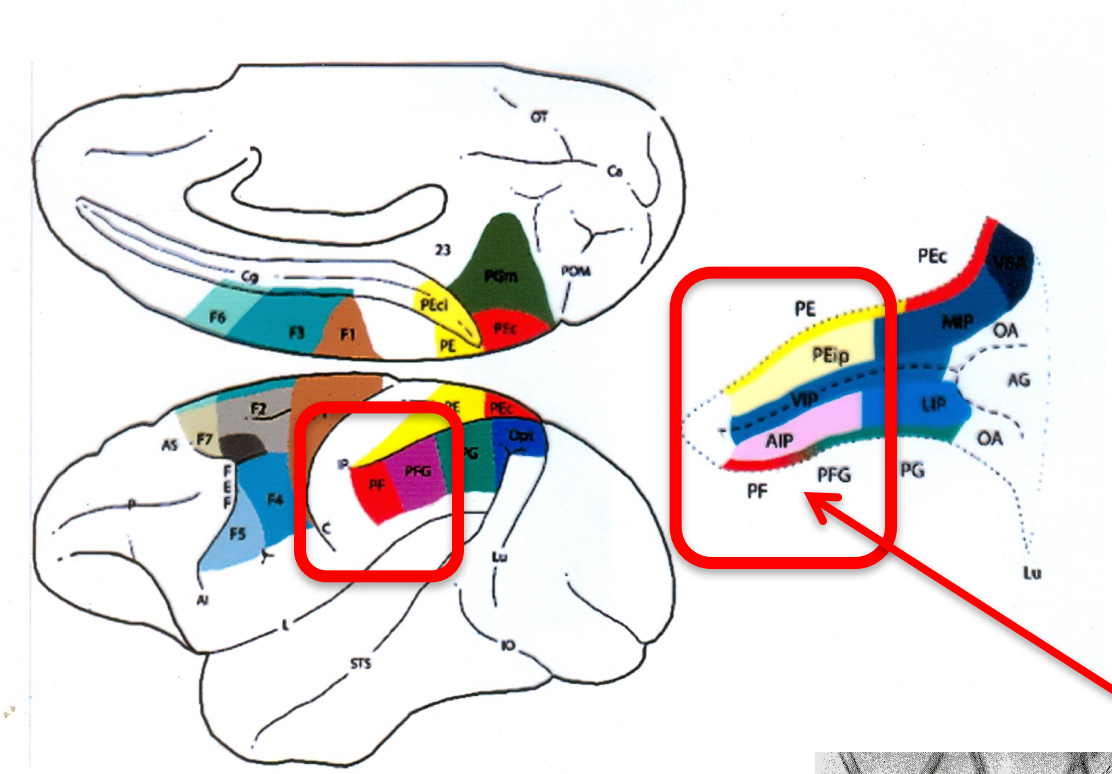
Dorsal Pathway – “How”



CIP (Caudal Intra-Parietal)

= **Object shape & location**

Dorsal Pathway – “How”



CIP (Caudal Intra-Parietal)

= **Object shape & location**

AIP (Anterior Intra-Parietal)

= **Object affordances**

Who/ What Pathway

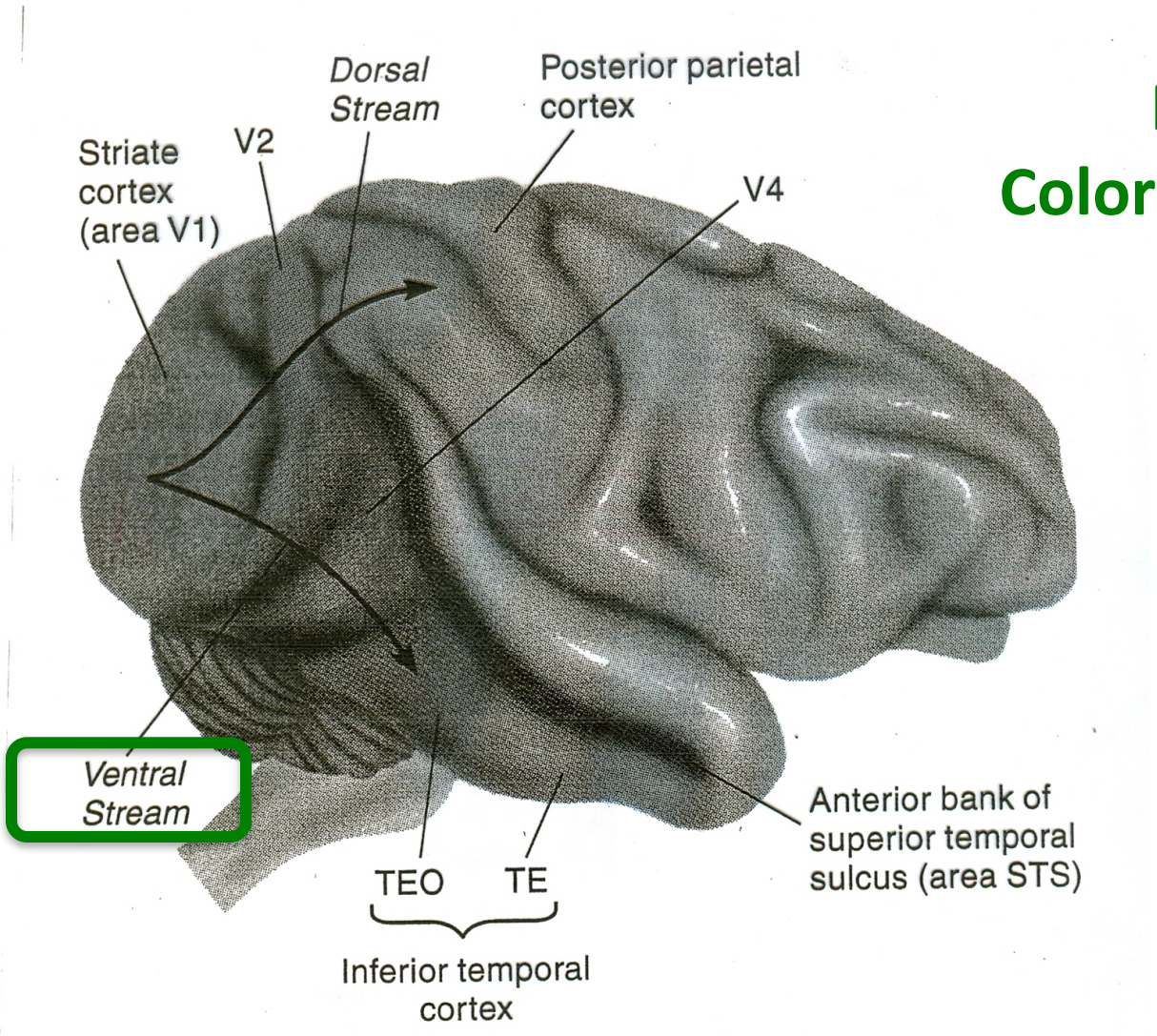
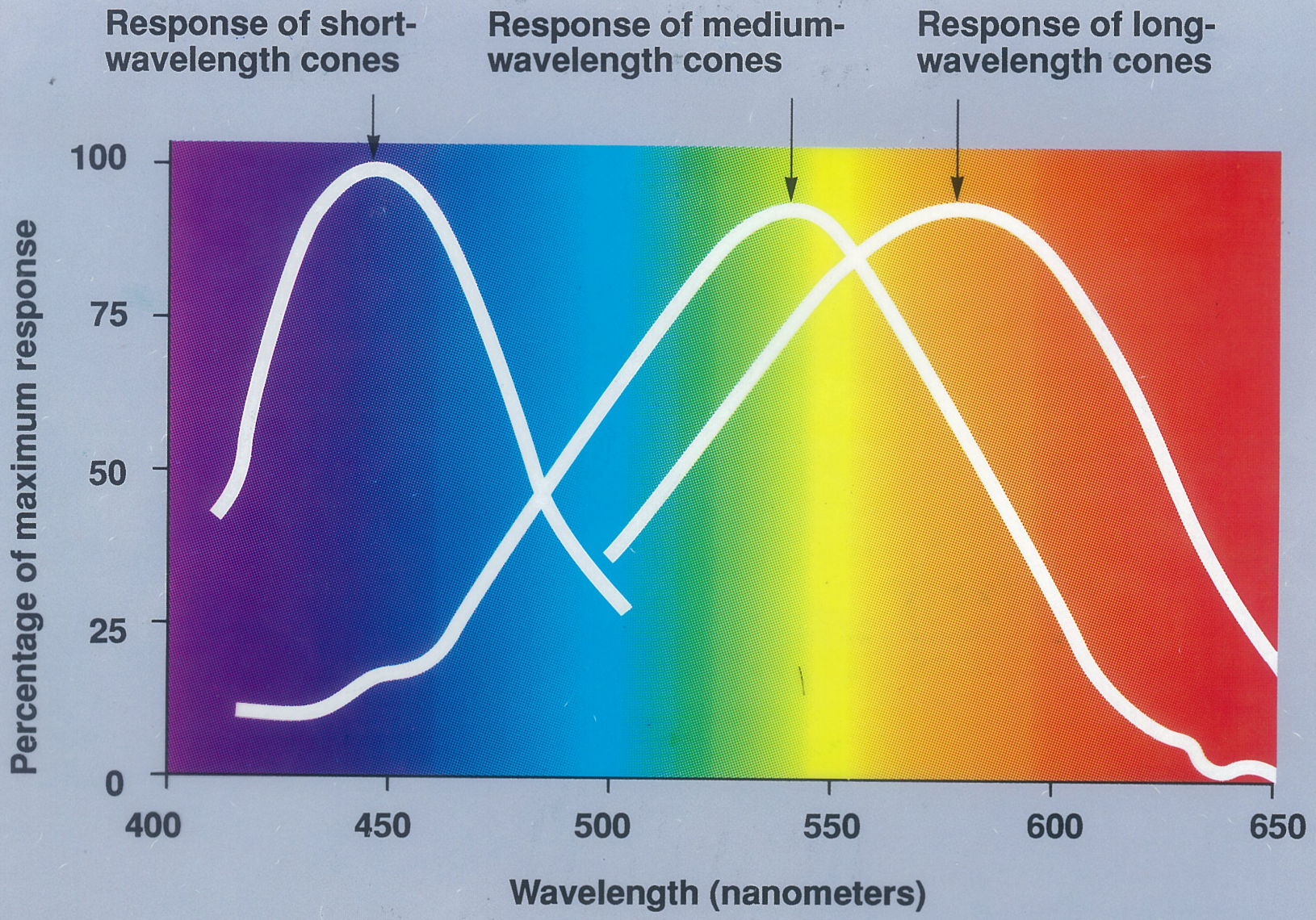


Figure 6.37

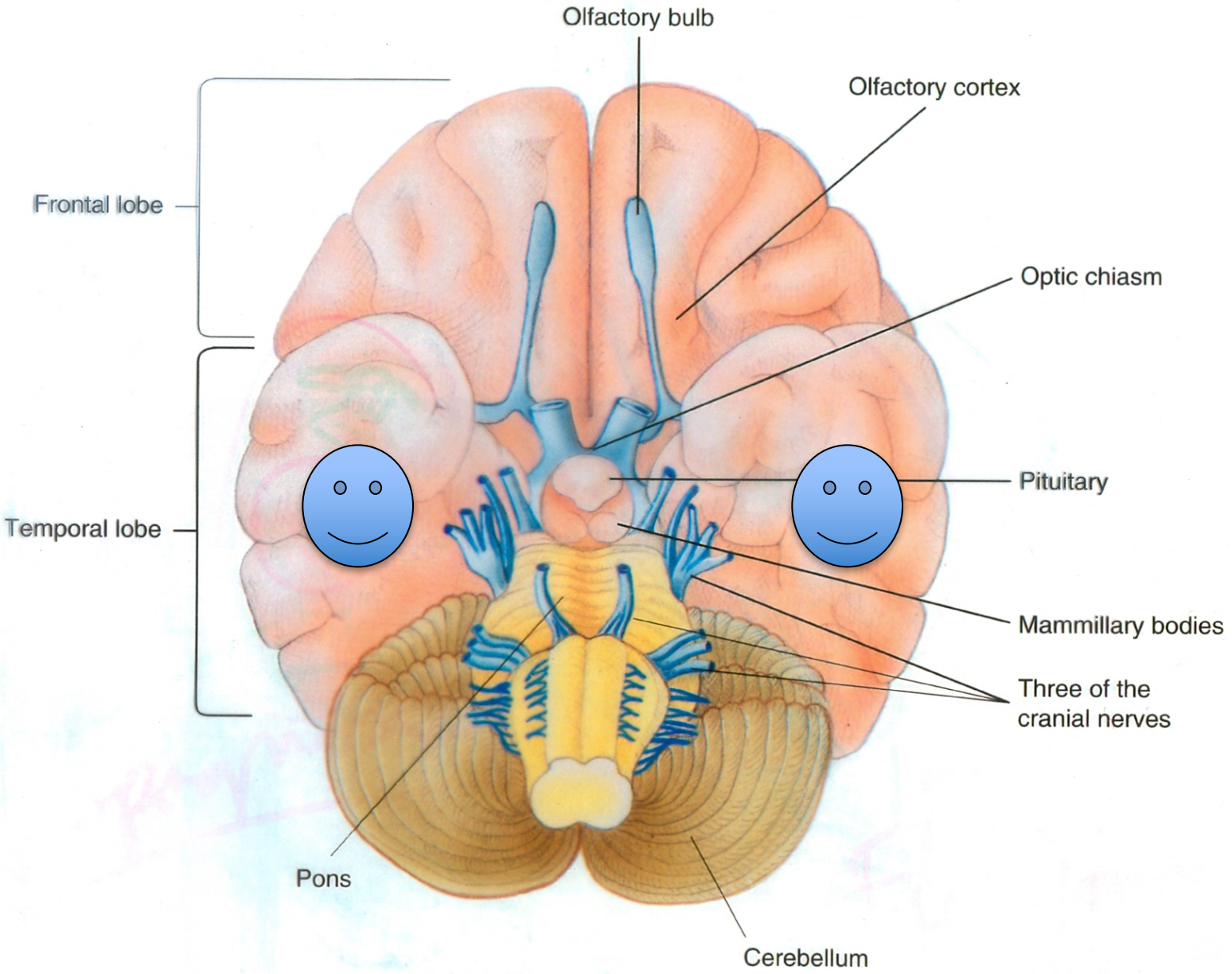
For Color & Detail



Response to various wavelengths

T 24

The Inferior Surface of the Human Brain



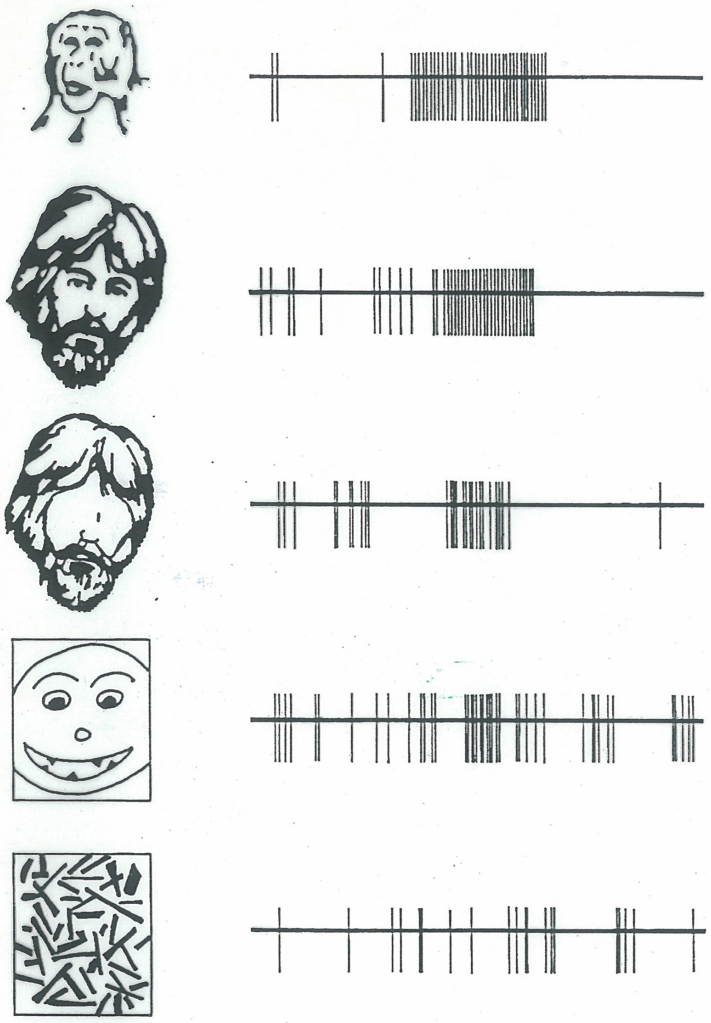


Figure 3.24

Responses of a neuron in a monkey's area IT to various stimuli. This neuron responds best to a full face, as shown by its response to monkey and human faces in the top two records. Removing the eyes or presenting a caricature of a face reduces the response. This neuron does not respond to a random arrangement of lines. (From Bruce, Desimone, & Gross, 1981.)

IT

(Inferior Temporal)

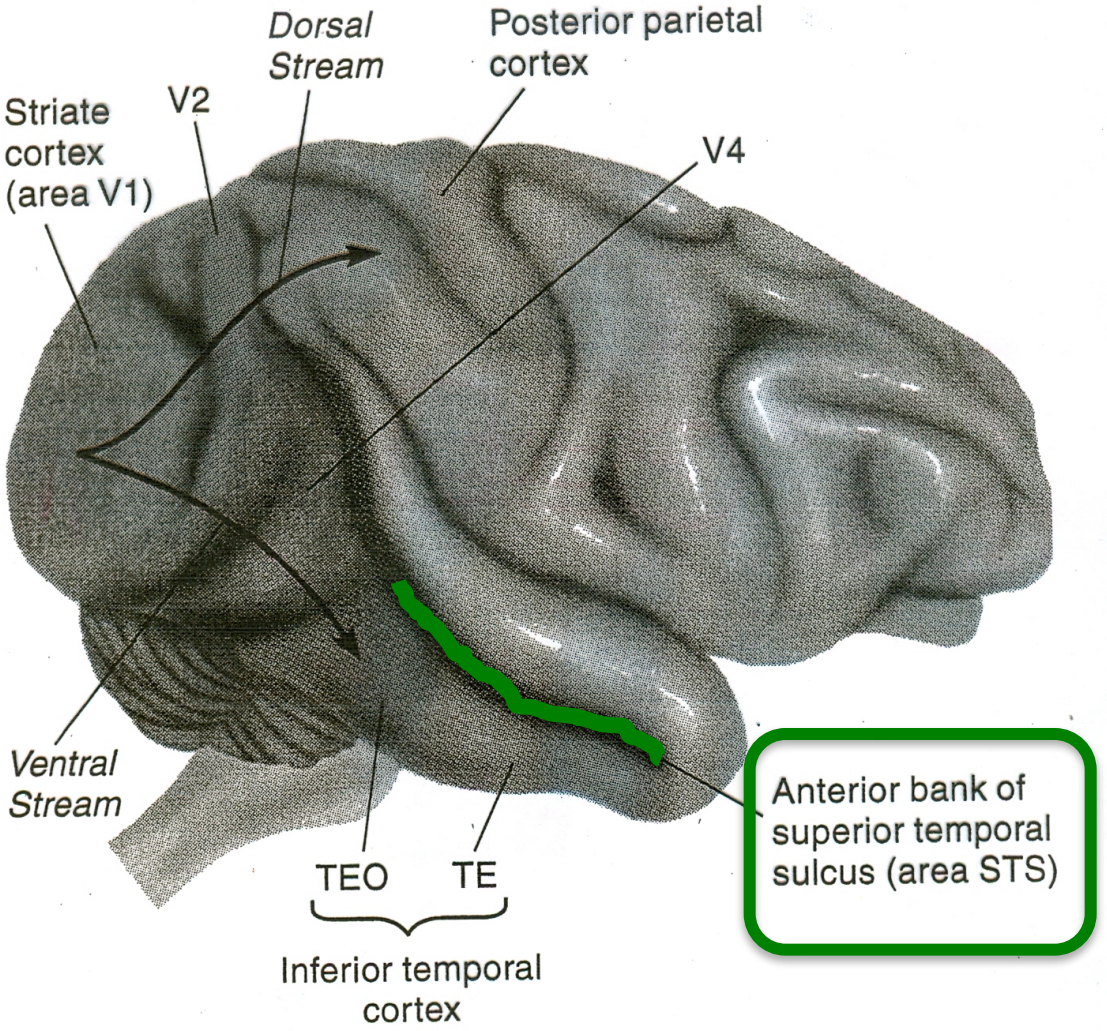
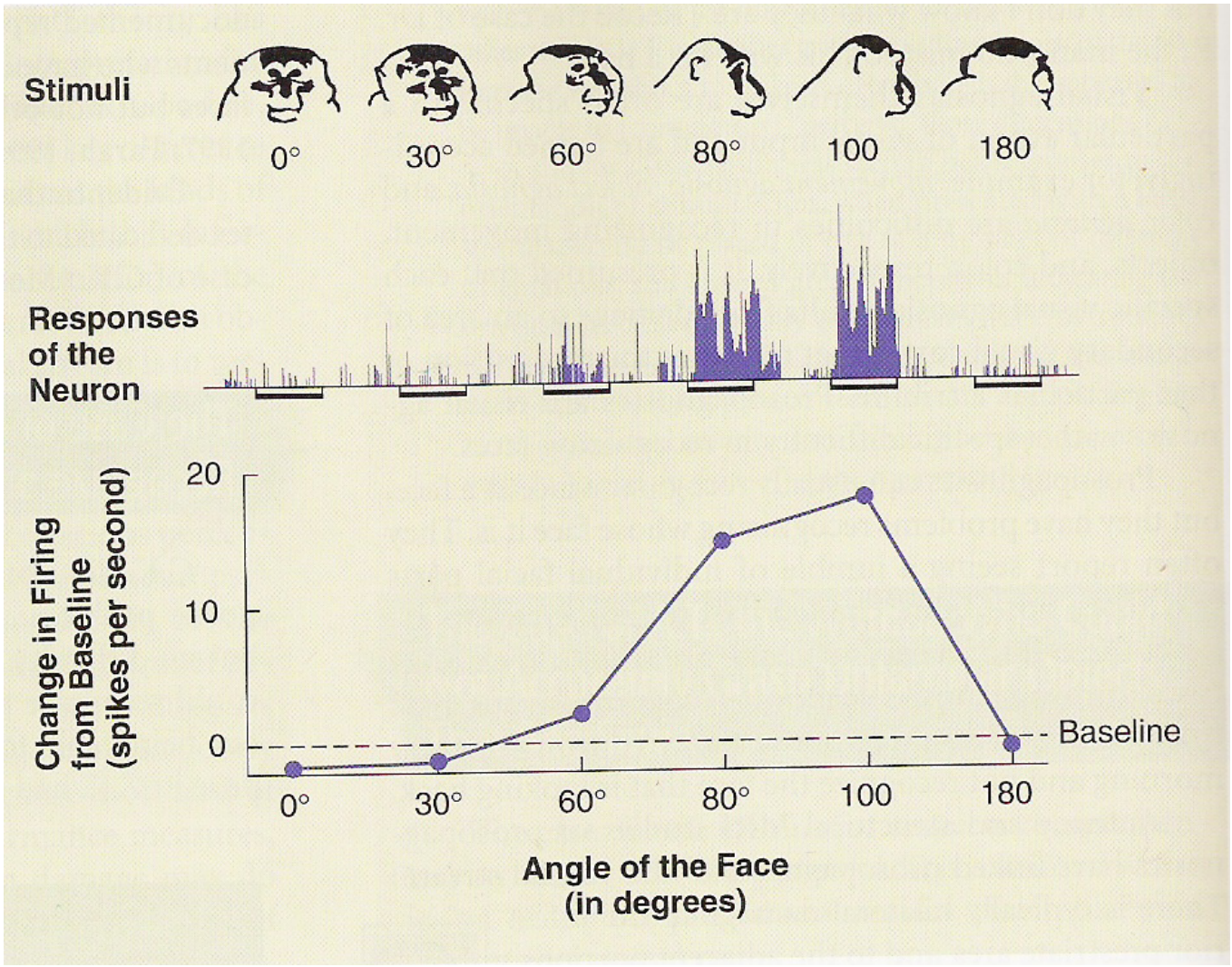


Figure 6.37

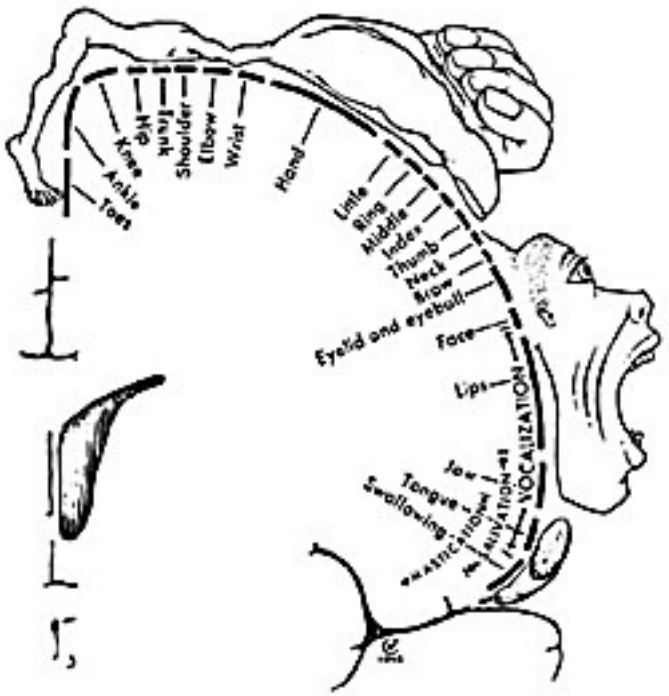
Areas of visual cortex in the rhesus monkey brain.
(Adapted from Zeki, S. M. *Journal of Physiology,* 1978, *277,* 227–244.)

Superior Temporal Sulcus (**STS**) – Biological Motion



Somatosensory

Tactile Sensitivity, esp Face & Hands



Topological Map w/Magnification

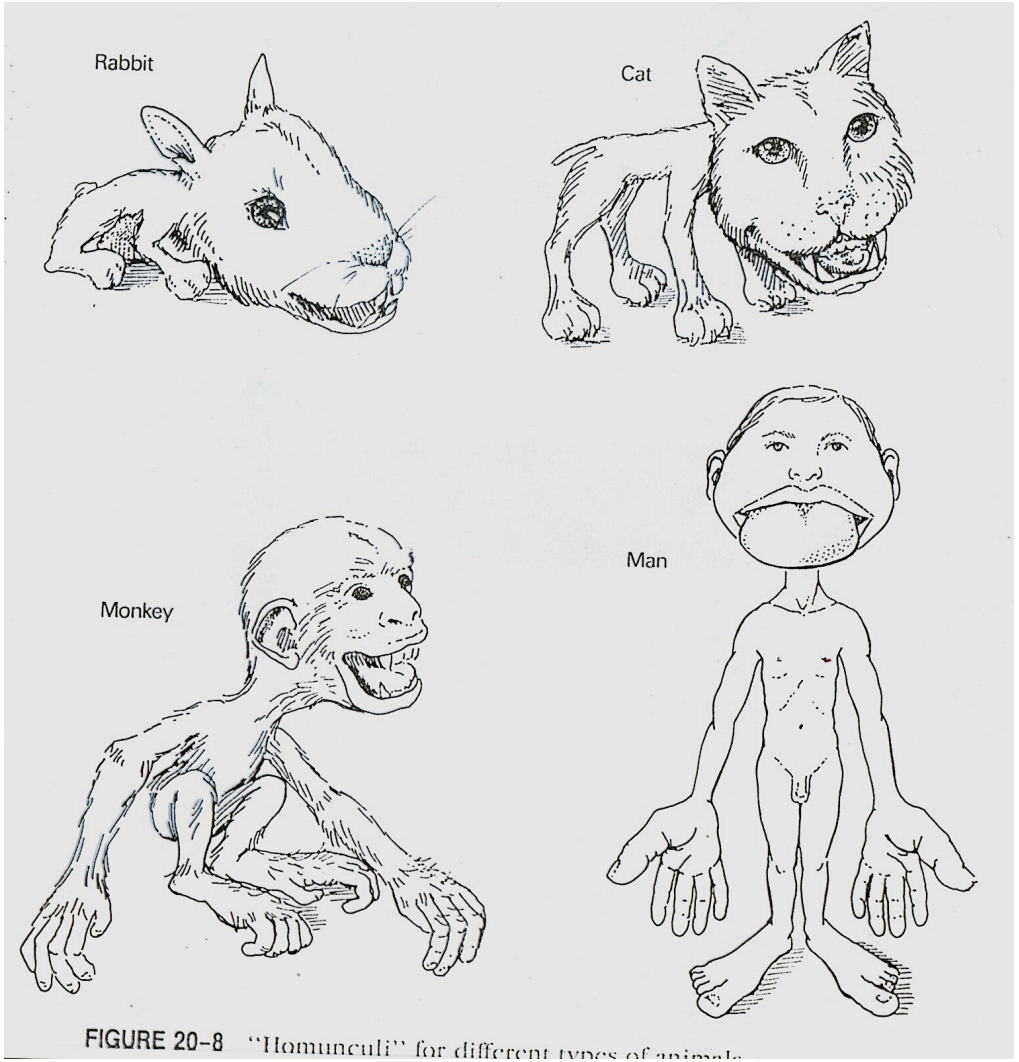
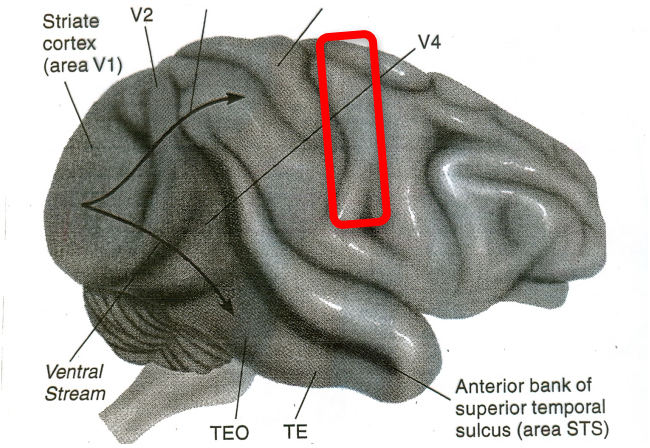


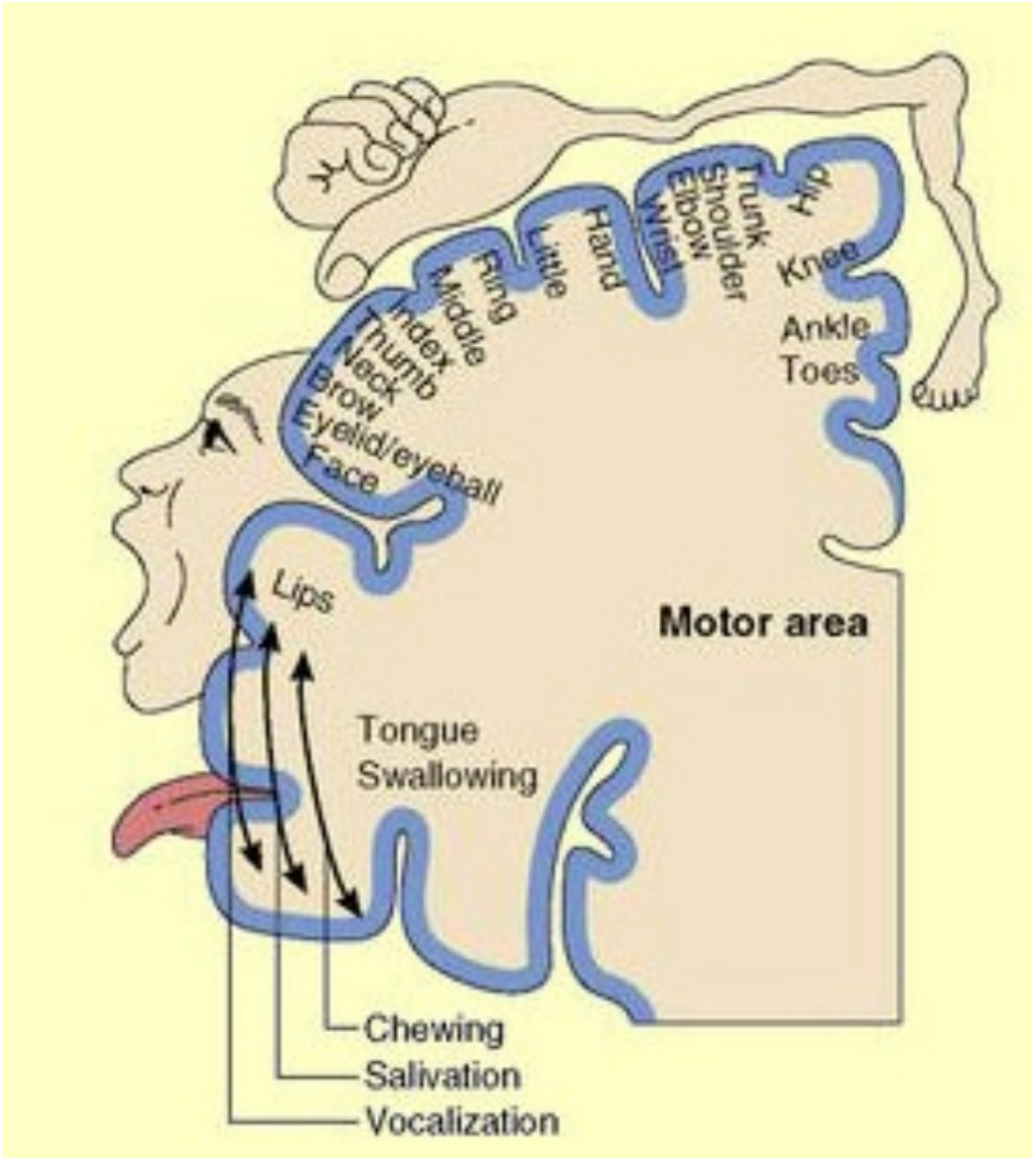
FIGURE 20–8 "Homunculi" for different types of animals

Frontal (Motor) Cortex

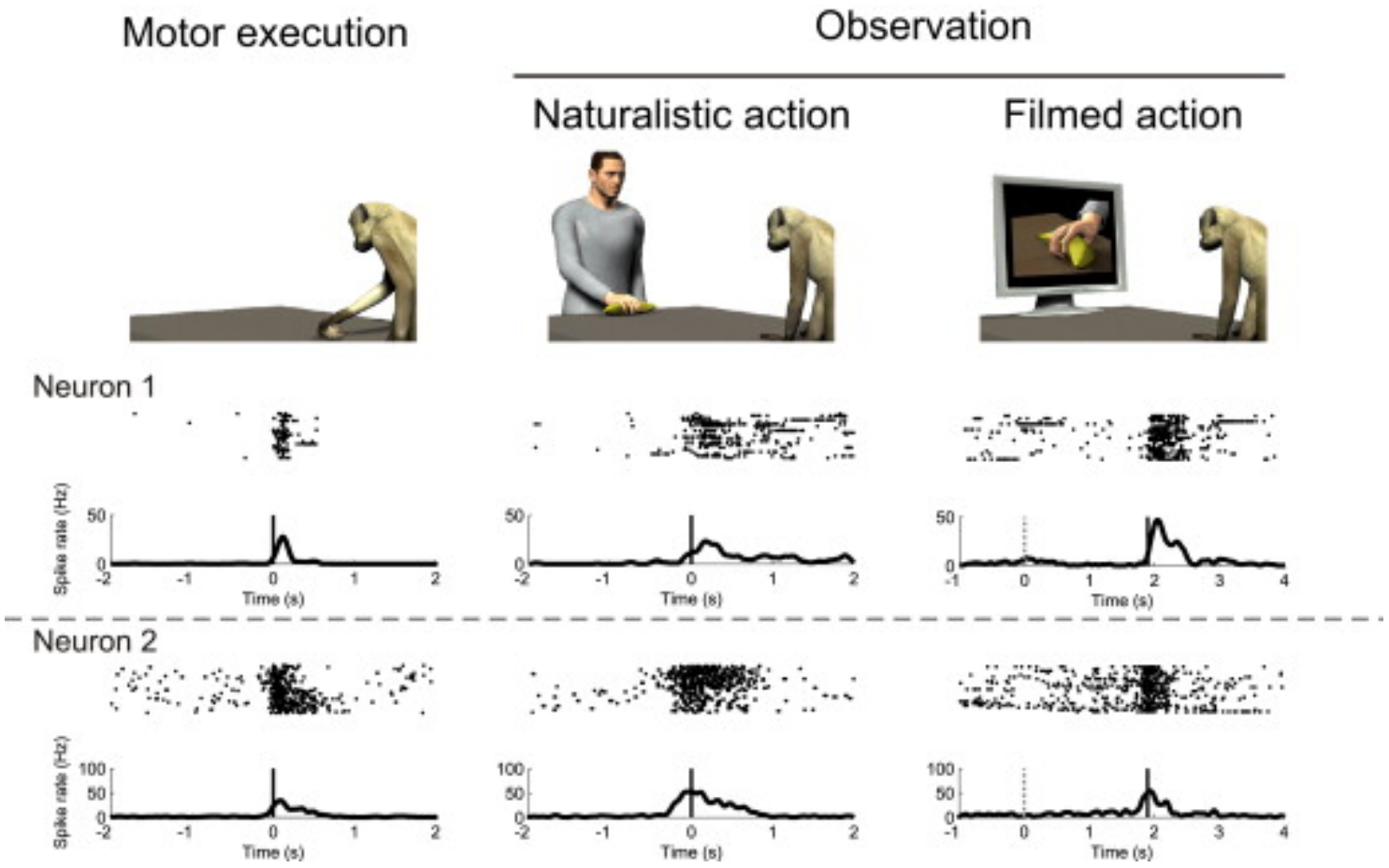


Pre-Central Gyrus

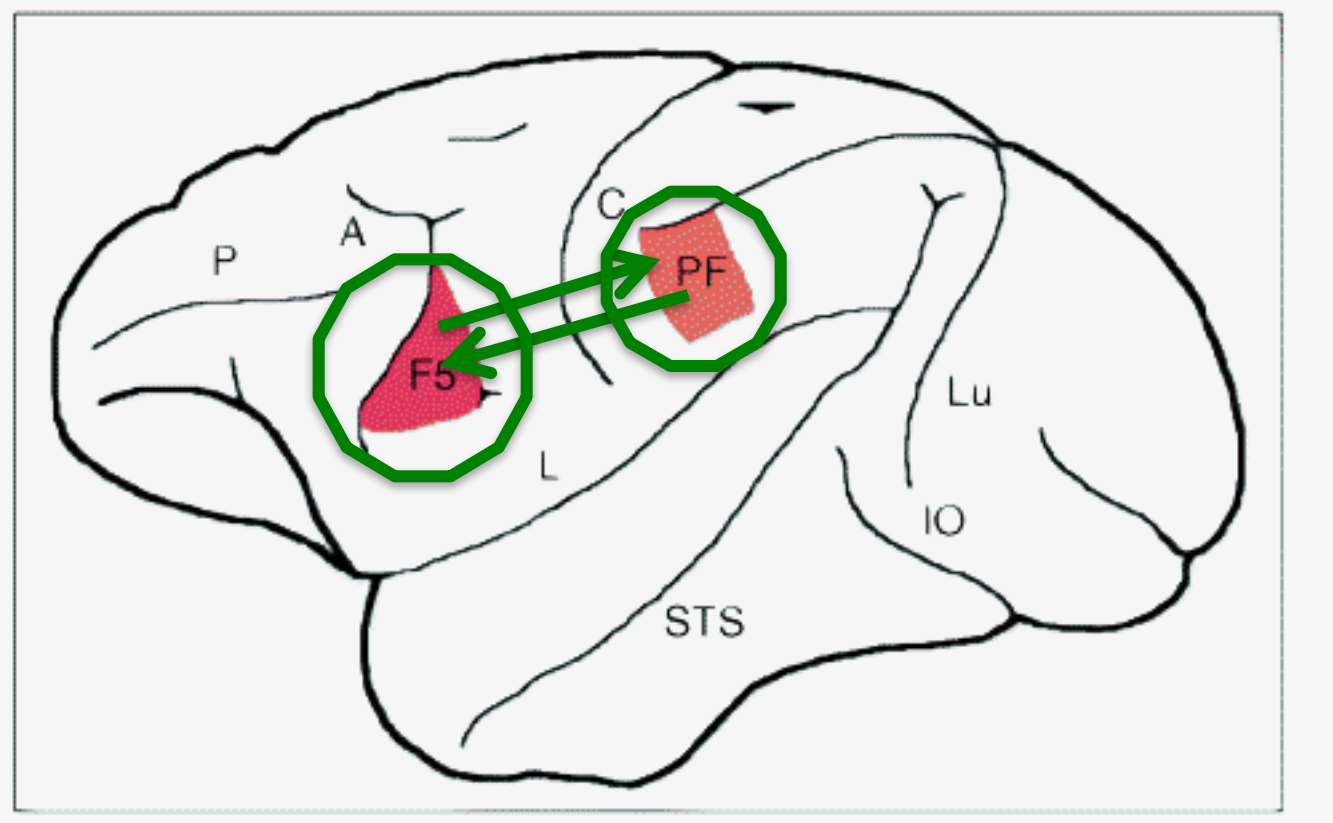
Primary Motor Cortex



Mirror Cell System



Mirror Cell System



In <u>both</u> Parietal (PF) and Premotor (F5) areas

Mirror Cell System – Observational Learning ?

Some areas mediating social cognition…

Limbic System

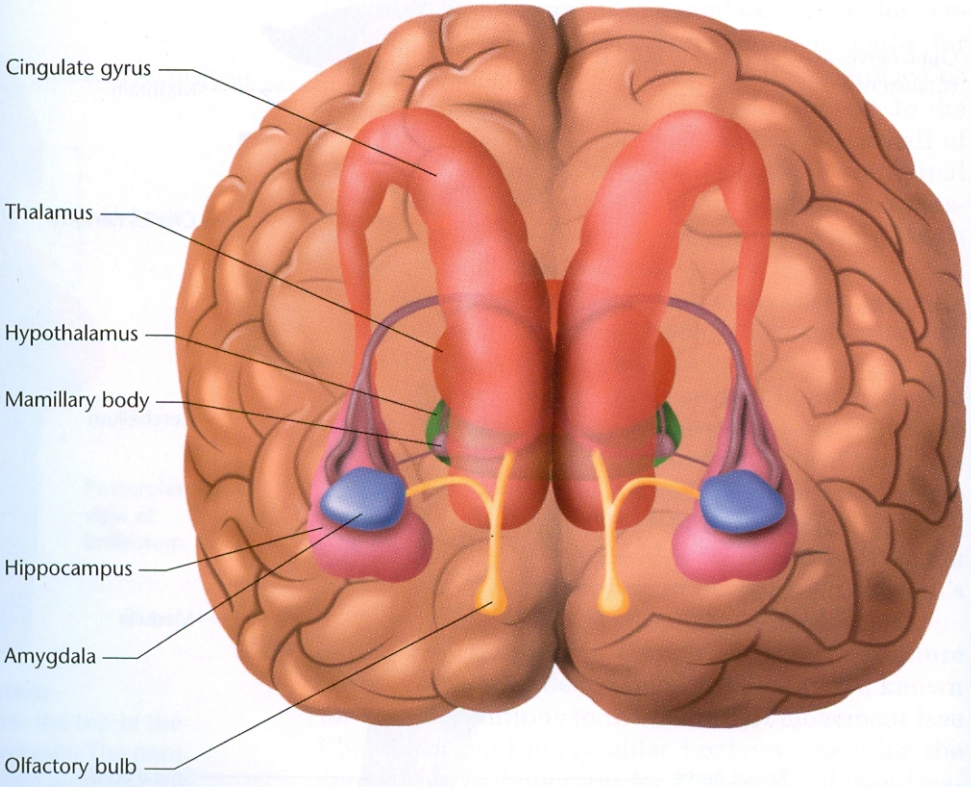
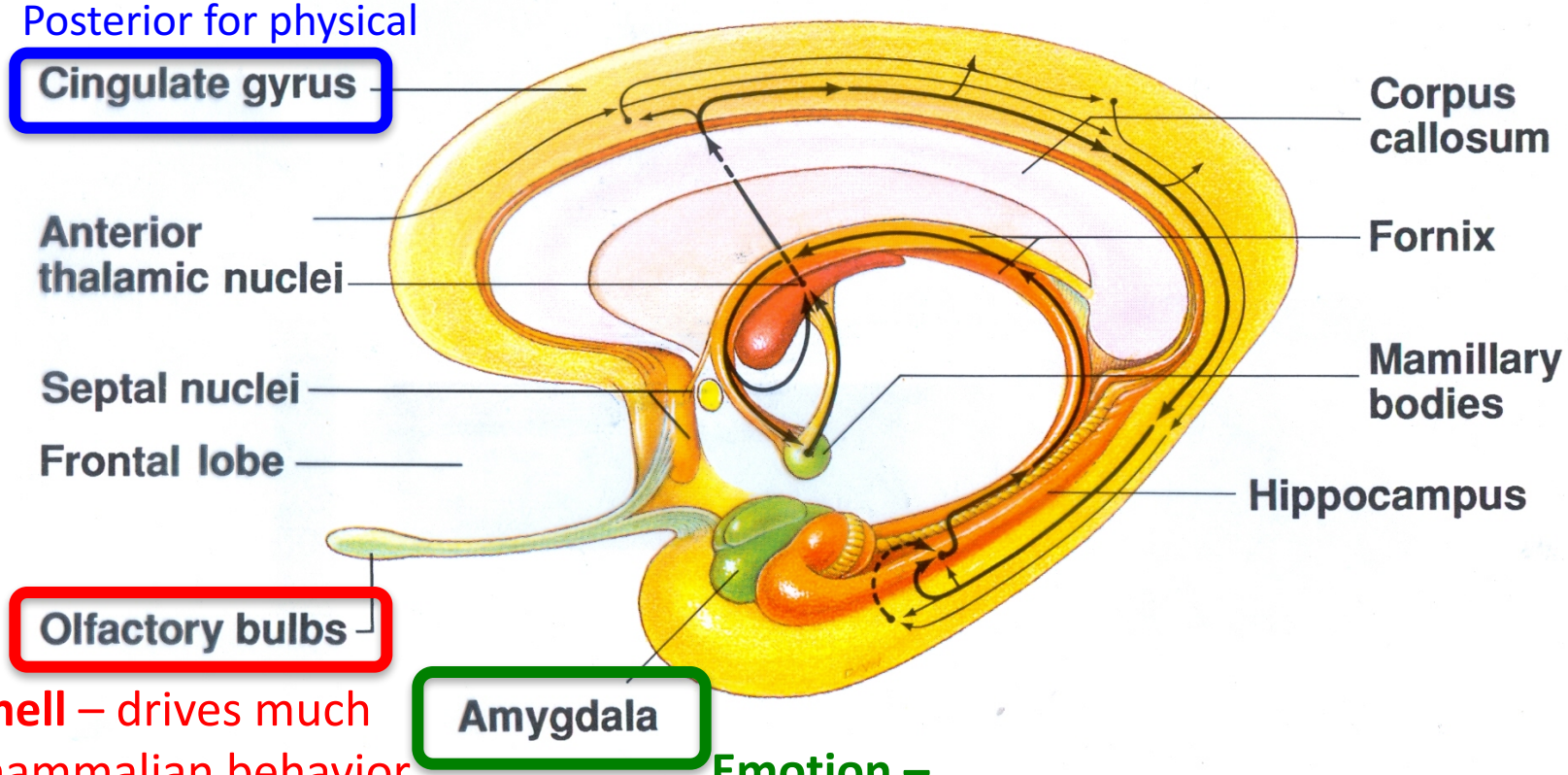


Figure 4.14 The limbic system, a set of structures that form a border (or limbus) around the brainstem

Limbic System – The "Nose Brain"

+/- Evaluator

Anterior (ACC) for social assessments,
Posterior for physical



Smell – drives much of mammalian behavior

Emotion –
Expressing & interpreting, part of ToM circuit

Some areas implicated in "Theory of Mind"

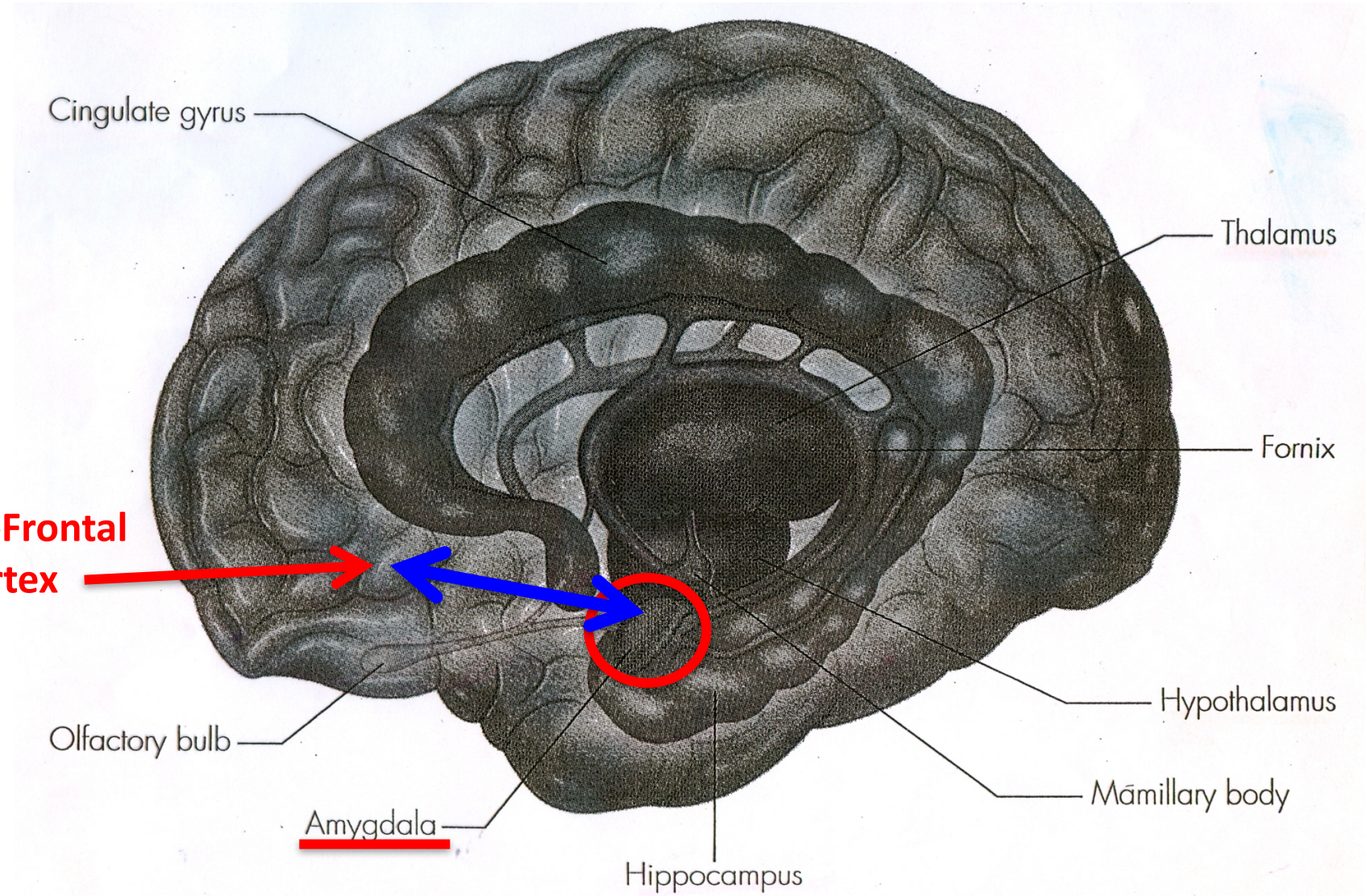
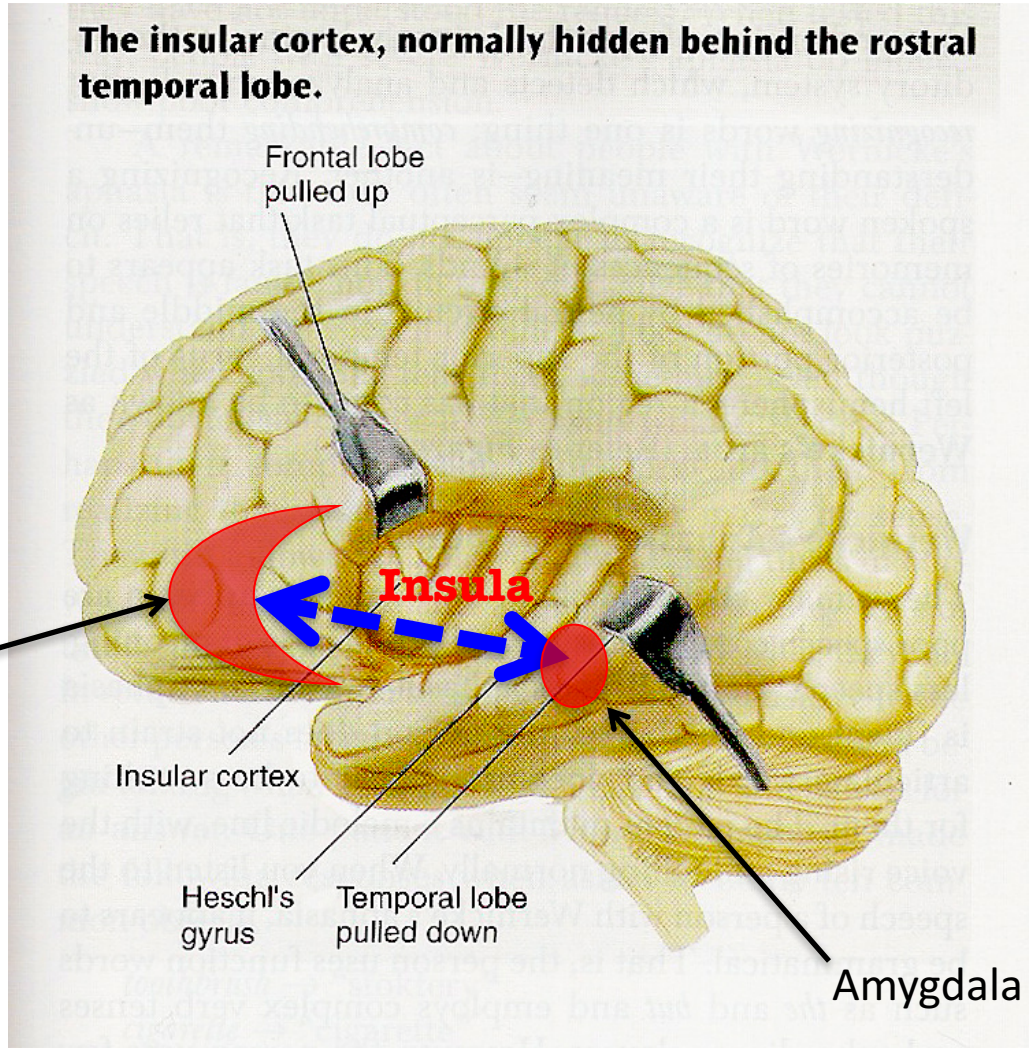


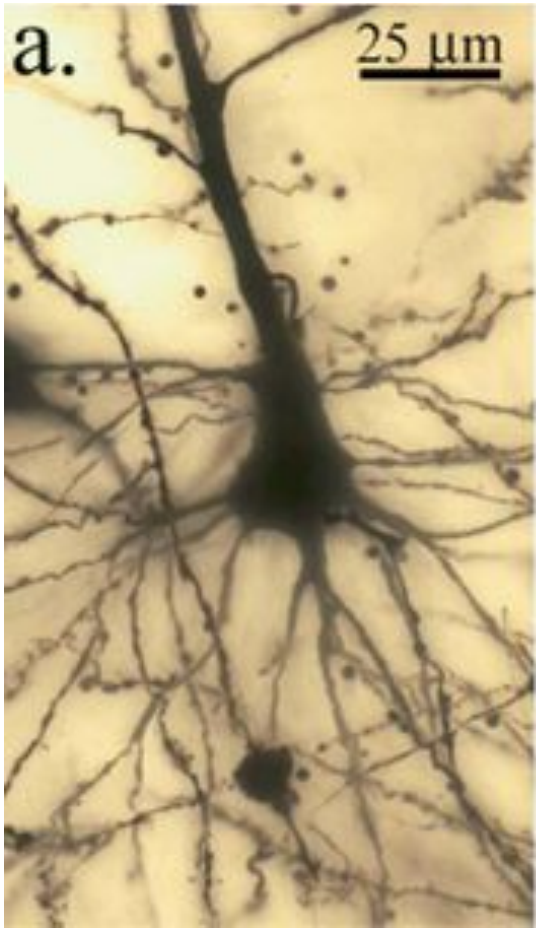
Figure 4.10 The limbic system is a set of subcortical structures that form a border (or limbus) around the brain stem

Frontal Insula



Orbito-Frontal Cortex

Von Economo Cells



Typical Pyramidal Cell

Von Economo
or “Spindle” Cell

In primates,
<u>only</u> in the
(large brained)
Apes & Humans

Von Economo Cells

Cingulate gyrus

Thalamus

Anterior Cingulate

Fornix

Frontal Insula

Hypothalamus

Olfactory bulb

Mamillary body

Amygdala

Hippocampus

Figure 4.10 The limbic system is a set of subcortical structures that form a border (or limbus) around the brain stem

Stay tuned…