

Neurocognition (see page 14-19)

Cognitive Neuropsychology - the study of the neurological basis of cognitive processing (as revealed by measures of normal brain functioning and disrupted performance due to brain damage).

Neuron (see page 15) - the basic building block of the nervous system (specialized cell for receiving and transmitting neural impulses).

Dendrites

Nucleus

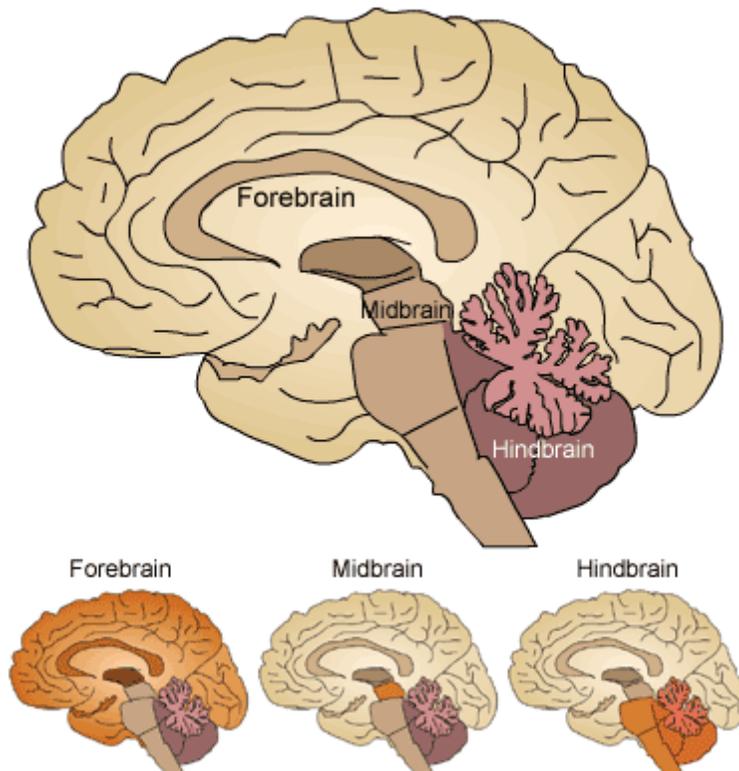
Axon (& myelin sheath)

Nervous system: the basis of our ability to perceive, and adapt to / interact with, the world. It consists of the CNS (includes the nerves in the backbone) and the Peripheral Nervous system.

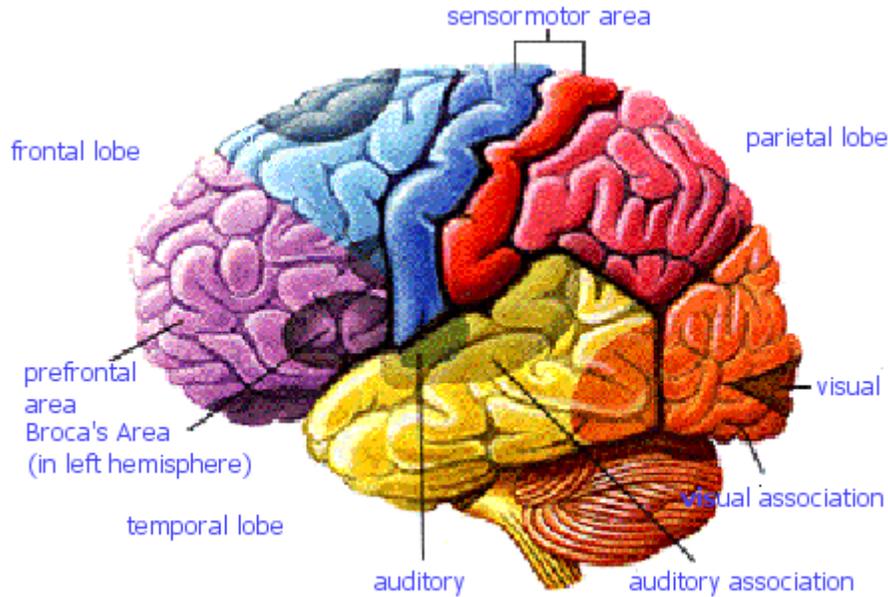
Neurotransmission takes place through the release of neurotransmitters into the synapse (synaptic cleft) between two neurons.

Brain Anatomy (Forebrain, midbrain, hindbrain)

Figure AB-7: Forebrain / Midbrain / Hindbrain



Four Lobes: Named after the bones on top of them rather than being discrete physical elements themselves. They extensively interact with one another. They are the Frontal, Parietal, Temporal, and Occipital lobes.

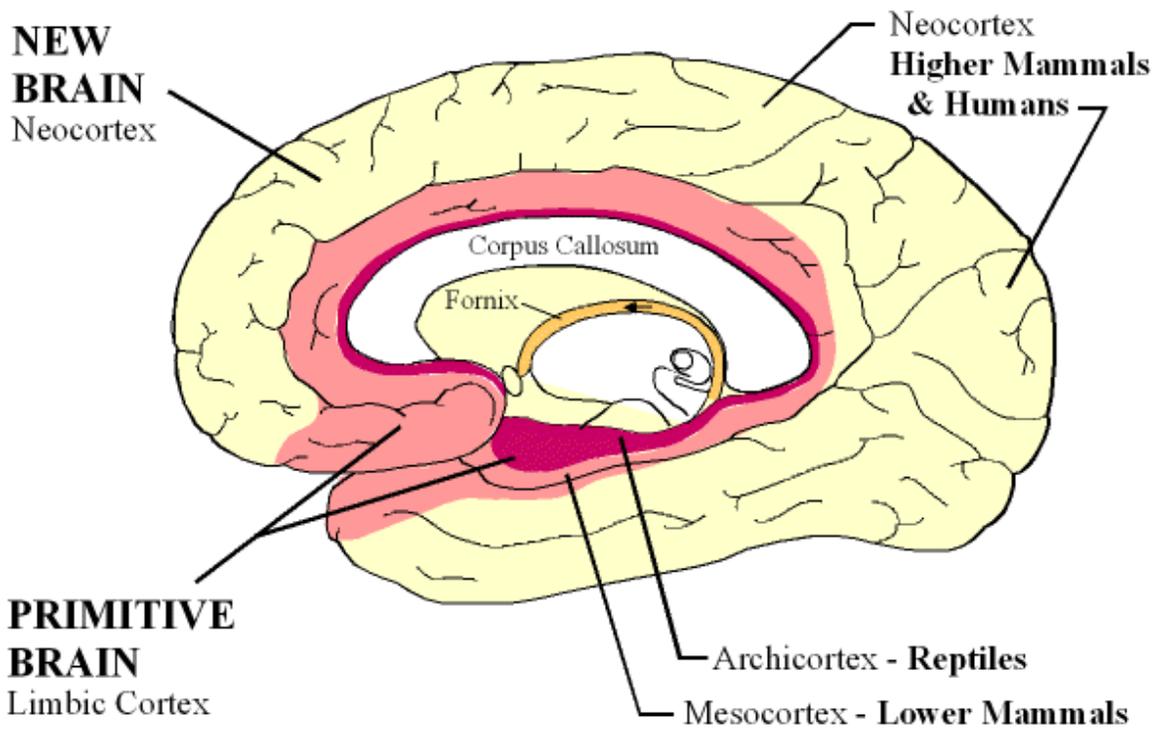


The Frontal Lobe: primary motor cortex, higher cognitive function (e.g., attention)

The Parietal lobe: primary somatosensory cortex

The Temporal lobe: auditory processing

The Occipital lobe: primary visual processing (separate areas for color, location, form, motion, ...)



Old Brain:

Brainstem, oldest in terms of evolution, most primitive of the brain structures, governs primary functions

Mid-Brain:

"New-Brain":

Neocortex / Cerebral Cortex

the top layer of the brain, responsible for higher level cognition

1-3 mm thick

Convolutions to allow more surface area within the head

Two hemispheres

Approximately 75% of the cortex is "association areas"

Particularly Important / Interesting Subcortical structures:

basal ganglia (motor system)

limbic system (emotion, motivation, control, learning, memory... can suppress instinctive responses)

Amygdala: role in emotion (esp. anger, aggression)

hypothalamus. (the "four Fs"), flee, fight, feed, mate. Also regulates emotional and stress responses.

Thalamus - virtually all messages entering the cortex come through the thalamus (i.e., the thalamus is a relay station from the sensory systems of the body into the neocortex). Divided into "NUCLEI" by sensory system. Leads to "projection areas" in the lobes governing sensory processes.

Corpus Callosum: the primary bridge between the hemispheres of the cortex. When the Corpus Callosum is cut, this produces a "split brain" patient.

Hippocampus: immediately interior of the temporal lobes; critical for storing information into memory (H.M.). Damage to this structure is thought to be primarily responsible for Korsakoff's syndrome which can develop as a result of long-term alcohol abuse. Is also thought to be responsible for tracking, location, and maintaining awareness of object relations.

Contralaterality - "opposite sides" -- the inputs from, and controls for, one side of the body are in the other side of the body.

Ipsilateral -- "same side"

Laterality -- hemispheric specialization: each hemisphere of the cortex tends to specialize in different abilities and functions, as well as processing different kinds of information. The tendency (sometimes strong tendency) for one or the other hemisphere to be primarily responsible for various processes and functions.

- "Language on the Left" (90% of the public, even 70% of left handed individuals)
- "Spatial Processing on the Right"

Neurocognition: Investigation Techniques

Lesions (deliberate [animal model, surgery] / accidental [CO₂ poisoning / Industrial injury])

Strokes – ischemic (fatty buildup breaking free) and hemorrhagic

Brain Tumors

Head Injury – closed-head and open-head

e.g., lesion of Amygdala leads to maladaptive lack of fear...

Split-Brain

Direct Stimulation (Penfield)

Direct recording

Animal models: Hubel & Weisel, 1963 + Geopolis (for work on mental rotation with monkeys)

Brain Imaging:

- fMRI/MRI - Functional NeuroMagnetic Resonance Imaging

Great spatial location, timing better with fMRI than original MRI but still not that good. Detect electrical/magnetic changes in the energy of nuclear particles within the brain that leads to tracking where metabolic activity is occurring.

- PET - positron emission tomography (inject radioactive tracers)

Can see which areas were active

Good localization

- CAT - X-ray your head

Good for picking up lesion sites (good localization), but no functional information

- EEG - Electroencephalogram (related: EKG, ERP, ... and other specific wave pattern detection) Rather crude spatial localization, great timing information

MRI + EEG gives good spatial resolution and good timing information.

Dissociations (the opposite of association) if A and B are not associated, influencing A will not affect B.

(Why are dissociations and double-dissociations useful in the study of neural functioning?)

Cognitive Disruptions:

Aphasia the disruption of language due to a brain-related disorder

Broca's aphasia (damage to Broca's area). It is characterized by disrupted speech production, disrupted syntax, but relatively unimpaired comprehension and semantics. It includes a lack of ability to produce coherent language (including spoken, written and signed forms). A Broca's aphasic can understand speech, and can form ideas to communicate, but cannot put words together to communicate those ideas. Interestingly, stuttering has also been linked to areas encompassed by Broca's area, though this disorder is not well understood or explained.

Wernicke's aphasia (damage to Wernicke's area) [p.339]

Disrupted comprehension, disrupted semantics, syntax ok

Anomia - deficits in word finding (either lexical or semantic); an impairment in the normal ability to retrieve a semantic concept and say its name. In other words, some aspect of the normally automatic semantic or lexical components of retrieval has been damaged in anomia.

Alexia - deficit in reading, recognition of printed letters or words

Agraphia - deficit in writing

Acalculia - deficit in mathematics abilities, retrieval or rule-based procedures

Agnosia - cortical perceptual-Attentional deficit in object recognition (and prosopagnosia = visual face recognition deficit) [Sack's "the man who mistook his wife for a hat" 'he failed to see the whole, seeing only details']

Apraxia - voluntary action or skilled motor movement deficit

Visual Neglect (cortical neglect) = visual information in the contralateral field is not noticed or attended (this phenomena also occurs with visual imagery - the Piazza in Milan)

Blindsight = contralateral field shows visual neglect but still has an influence

Amnesia - the loss of memory or memory abilities (well studied, quite common result of brain injury/damage). The kind of memory being tested and the type of task being administered are important because there are material-specific amnesias (e.g., explicit vs implicit [think of H.M.], p.342-343)

Retrograde Amnesia - loss of memory for events prior to brain injury (loss is backwards in time).

Anterograde Amnesia - loss of memory for events occurring AFTER THE INJURY.

Disruptions of Working Memory (p.345); double dissociation between short term and long term memory impairments are trouble for "standard model" of sensory → STM → LTM since do not need STM to get to LTM.