Tutorial 21: Cerebral Cortex

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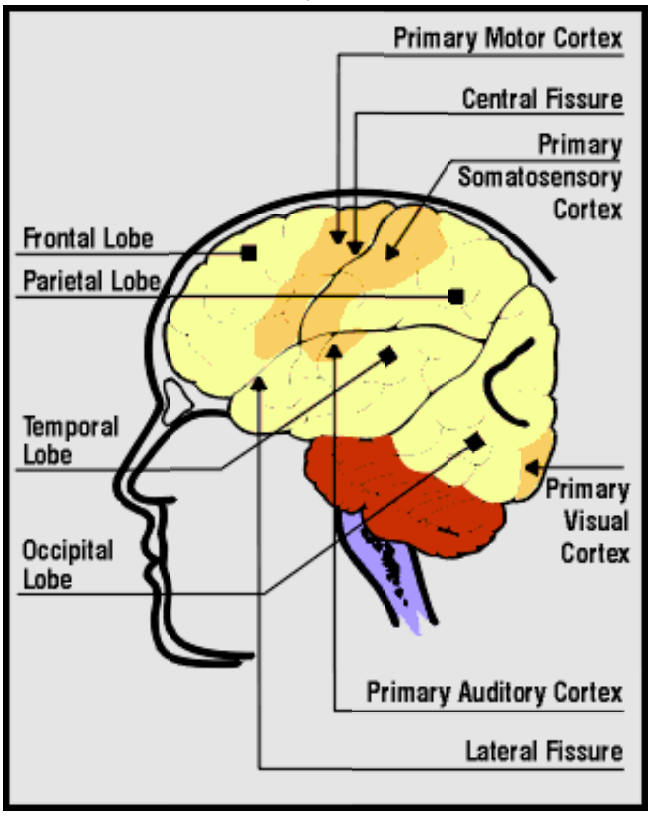

Figure 21: Cerebral Cortex

Intro | Primary Auditory Cortex | Central Fissure | Frontal Lobe | Lateral Fissure | Primary Motor Cortex | Occipital Lobe | Parietal Lobe | Primary Somatosensory Cortex | Temporal Lobe | Primary Visual Cortex

Part 1: Image-Mapped Tutorial
Part 2: Matching Self-Test
Part 3: Multiple-Choice Self-Test

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The cerebral cortex consists of gray matter (neuronal cell bodies) that form the outer, convoluted layer of the cerebrum. The convolutions or hills and valleys of the cerebral cortex evolved as a means of increasing the surface area, thereby providing additional neural control for expanding abilities. Our most complex mental activities are controlled within the approximately 1.5 square feet of surface area comprising the human cerebral cortex. These mental activities include remembering, learning, problem solving, planning, awareness, and the execution of complex responses in the world. The cerebral cortex is divided on each side or hemisphere into four separate regions based on the lobe or distinct section that it covers.

Figure 21 identifies the four lobes, important cortical landmarks, and describes the location and primary functions of several important cortical areas.

Advanced

In addition to divisions based on structure, anatomists often divide the cerebral cortex into 3 areas based on the fundamental processing (sensory, association, and motor) that distinguishes these areas. Although these processing distinctions are not absolute, they do help to organize the general sequential flow of information throughout the nervous system. Sensory information from the outside world enters the brain via the spinal cord and stops at the thalamus for processing, before this information is conveyed to the primary sensory cortical areas. Each of the primary sensory areas (as well as nuclei of the thalamus) project to the association cortical areas within the parietal and temporal lobes where cross-modal information is used for problem-solving and stored for long-term use. Once a decision is made to respond, the information is transmitted to association cortical areas within the frontal lobe where the motor activity is planned, organized, and finally executed.

Suggestions for further study

SUGGESTED READINGS:

Beardsley, T. (1997, August). The machinery of thought. *Scientific American,* 78-83.

Chalmers, D.J. (1995, December). The puzzle of conscious experience. *Scientific American,* 80-86.

Finn, R. (1991, June). Different minds, *Discover, 12 (6),* 54-58.
Wilson's Syndrome.

Goldman-Rakic, P.S. (1992, September). Working memory and mind. *Scientific American, 267(3),* 110-117.
Association areas of frontal and parietal lobes.

Horgan, J. (1993, December). Fractured functions. Does the brain have a supreme integrator ?, *Scientific American, 269(6),* 36-37.

Kennedy, J.M. (1997, January). How the blind draw. *Scientific American,* 76-81.

Kunzig, R. (1997, July). A head for numbers. *Discover, 18(7),* 108-115.
The neuropsychology of mathematics.

Kunizig, R. (1998, August). Climbing through the brain, Robert Kunzig, *Discover, 19(8),* 61-69.
Migrating neurons and brain development of cortical architecture before and after birth.

Lenhoff, H.M., Wang, P.P., Greenberg, F. & Bellugi, U. (1997, December). Williams syndrome and the brain. *Scientific American,* 68-73.

Sacks, O. (1986). *The Man Who Mistook His Wife for a Hat.* New York,N.Y.: Summit Books.
This book contains an excellent series of case studies that richly-describe the results of central damage to various regions of the cerebral cortex and underlying structures.

Sacks, O. (1995). *An Anthropologist on Mars.* New York, N.Y.:Knopf, Inc.
Seven tales of paradoxical conditions due to brain dysfunction.

Shreeve, J. (1996, October). Music of the hemispheres, *Discover, 17(10),* 90-100.
The neurology of musical expression, comprehension, and interpretation.

RELATED LINKS:

http://www.epub.org.br/cm/n02/historia/psicocirg_i.htm
(History of Psychosurgery)
Sabbitini, from *Brain and Mind,* 1997.

http://www.nimh.nih.gov/events/prfmri.htm
(fMRI Reveals Dynamics of Working Memory)
NIMH - Press Release.

http://www.sciencenews.org/sn_arc97/6_7_97/fob2.htm
(Patients Savor this Brain Disroder)
from *Science News,* 1997 - Gourmand disorder and the brain.

http://www.abc.net.au/rn/talks/8.30/helthrpt/hstories/hr080796.htm
(Synesthesia)
Radio National Radio Transcripts - *The Health Report,* July, 1996.
The simultaneous experience of multiple sensations.

http://www.gwc.maricopa.edu/class/bio201/brain/1neuro.htm
(Neuroanatomy Tutorial)
Crimando, GateWay Community College, Arizona.

http://www.vh.org/Providers/Textbooks/BrainAnatomy/BrainAnatomy.html
(The Virtual Hospital - The Human Brain)
Williams, Gluhbegovic & Jew, University of Iowa
A superb & detailed atlas of human brain dissections.

http://www.med.harvard.edu/AANLIB/home.html
(The Whole Brain Atlas - Harvard University)
Johnson & Becker, Harvard University and Massachusetts Inst. of Technology.

http://www1.biostr.washington.edu/DigitalAnatomist.html
(The Digital Anatomist Project)
University of Washington, On-line Interactive Atlas including 3-D computer graphics, MRI scans and tissue sections.