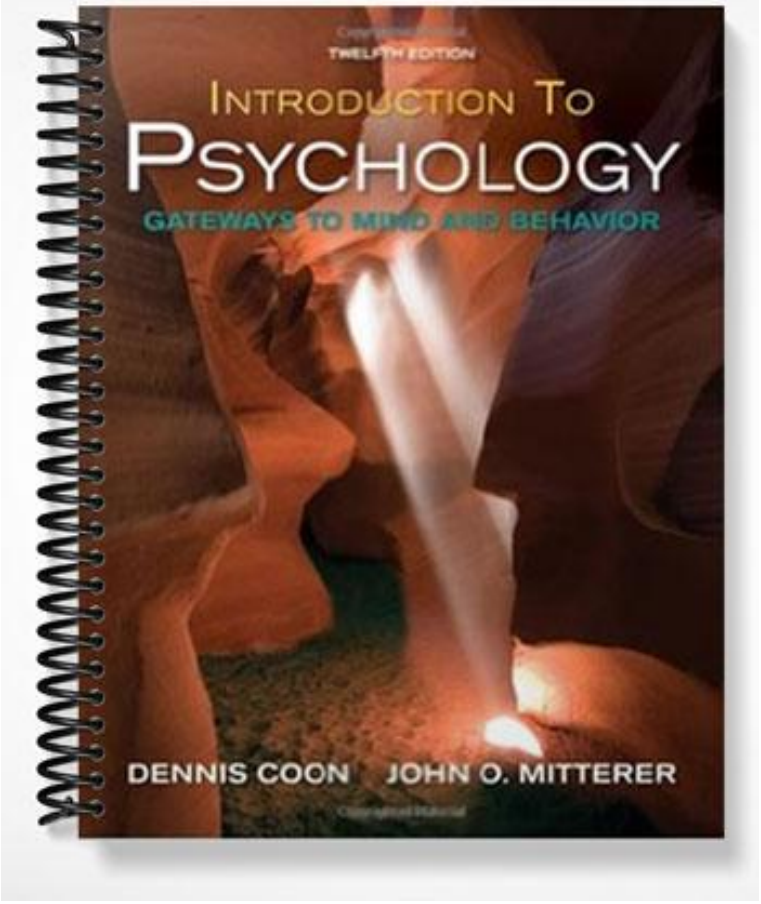
SOLUTIONS MANUAL



Chapter Two

Brain and Behavior

Discussion Topics

One-Minute Motivator 2.1: Firing of the Neuron
One-Minute Motivator 2.2: Studying Memory
One-Minute Motivator 2.3: Studying the Optic Nerve
One-Minute Motivator 2.4: Studying Facial Recognition
One-Minute Motivator 2.5: Brain and the Mind
One-Minute Motivator 2.6: Surface Areas of the Cortex
One-Minute Motivator 2.7: Child Without a Brain
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One-Minute Motivator 2.9: Hormones and Foods
One-Minute Motivator 2.10: Brain Specialization
One-Minute Motivator 2.11: Right Brain vs. Left Brain
Broadening Our Cultural Horizons 2.1: Use of Cerebral Hemispheres
Broadening Our Cultural Horizons 2.2: Cultural Attitudes Toward Transplants

Classroom Activities

Exercise 2.1: Cortical Localization and Interference
Exercise 2.2: Neurotransmitters
Exercise 2.3: Sympathetic Nervous System
Exercise 2.4: Activity of the Brain
Exercise 2.5: Left-Handers in a Right-Handed World
Exercise 2.6: Application to Other Disciplines
Exercise 2.7: Brain Dominance
Exercise 2.8: Cultural Attitudes Towards Prolonging Life

Video Suggestions

The Brain
Your Information Superhighway
The Behaving Brain
Dopamine Seduction
Language and Speech
Language Processing in the Brain
The Divided Brain
Organization and Evaluation of Brain Function
The Mind
Neurorehabilitation
Brain Anomaly and Plasticity: Hydrocephalus

Multimedia Resources

PowerLecture with JoinIn™ and ExamView® for *Introduction to Psychology: Gateways to Mind and Behavior*, 12th Edition
Websites
Digital Video Library 3.0
- Understanding Addiction
- The Cerebral Cortex (Virtual Reality)
- Electrical Stimulation of the Lateral Hypothalamus
- The Brainstem
- Hindbrain Structures
- The Thalamus
- The Limbic System
- The Longitudinal Fissure

The Corpus Callosum
The Cerebral Cortex
The Frontal Lobe
The Parietal Lobe
The Temporal Lobe
The Occipital Lobe
Main Parts of the Neuron
The Action Potential
Interference of the Action Potential
Synaptic Transmission
Interference of Synaptic Transmission

Supplemental Lecture The Brain

Handouts

Handout 2.1 Activity of the Brain
Handout 2.2 Lateral Eye Movements
Handout 2.3A Cultural Attitudes Toward Prolonging Life
Handout 2.3B Cultural Attitudes Toward Prolonging Life

Chapter Outline

Neurons—Building a "Biocomputer"
- Parts of a Neuron
- The Nerve Impulse
- Synapses and Neurotransmitters
  - Neural Regulators

The Nervous System—Wired for Action
- Neurons and Nerves
- Neural Networks
  - Peripheral Nervous System
  - Spinal Chord

Research Methods—Charting the Brain's Inner Realms
- New Images of the Living Brain
  - CT Scan
  - MRI Scan
  - PET Scan

The Cerebral Cortex—My, What a Big Brain You Have!
- Cerebrum
- Corticalization
- Cerebral Hemispheres
- Hemispheric Specialization
  - "Split Brains"
  - Right Brain/Left Brain
  - One Brain, Two Styles
- Lobes of the Cerebral Cortex
  - The Occipital Lobes
  - The Parietal Lobes
  - The Temporal Lobes
  - The Frontal Lobes
  - Association Areas

The Subcortex—At the Core of the (Brain) Matter
- The Hindbrain
  - Reticular Formation
- The Forebrain
  - The Limbic System
- The Magnificent Brain

The Endocrine System—Hormones and Behavior

Psychology in Action: Handedness—If Your Brain Is Right, What's Left?
- Hand Dominance
- Brain Dominance
- Handedness
- Advantage Left

Key Questions

- How do nerve cells operate and communicate?
- What are the functions of major parts of the nervous system?
- How are different parts of the brain identified?
- What do different parts of the brain do?
- How do the left and right hemispheres differ?
- What are the different functions of the lobes of the cerebral cortex?
- What kinds of behaviors are controlled by the subcortex?
- Does the glandular system affect behavior?
- In what ways do right- and left-handed individuals differ?

The Learning Objectives listed below are based upon the Gateway Questions that open each chapter of *Introduction to Psychology: Gateways to Mind and Behavior,* 12th edition. These Learning Objectives have been put into concrete terms to enhance the student's understanding of the material, but do not appear in the core text.

Learning Objectives

Theme: Brain activity is the source of human consciousness, intelligence, and behavior.

GQ: How do nerve cells operate and communicate?
LO 2.1 Name the basic unit that makes up the nervous system, state what it is specifically designed to do, and list and describe its four parts.
LO 2.2 Explain how a nerve impulse (*action potential*) occurs and how it is an all-or-nothing event. Include the terms *resting potential*, *threshold*, *ion channels*, and *negative after-potential*.
LO 2.3 Describe the difference between the nature of a nerve impulse and the nature of the communication between neurons. Explain how nerve impulses are carried from one neuron to another. Include an explanation of *receptor sites*; the types of *neurotransmitters*; and the functions of *neuropeptides, enkephalins,* and *endorphins*.
LO 2.4 Differentiate a *nerve* from a *neuron*. Describe the effect of *myelin* on the speed of the nerve impulse. Describe how *neurilemma* repairs neurons and explain what determines whether or not a neuron or nerve will regenerate. Include the current research techniques for alleviating brain damage.
GQ: What are the major parts of the nervous system?
LO 2.5 Chart the various subparts of the human nervous system and explain their functions.
LO 2.6 Describe the *spinal cord* and explain the mechanism of the *reflex ar*c, including the types of neurons involved.
GQ: How is the brain studied?
LO 2.7 Describe the *localization of function* strategy. Differentiate between structural and functional imaging methods.
LO 2.8 Describe the following techniques for studying the brain: *CT scan, MRI, clinical study, electrical brain stimulation, ablation, deep lesioning, microelectrode recording, EEG, PET scan* and *functional MRI*. Explain why *CT scans* and *MRIs* are different from the other techniques.
GQ: Why is the human cerebral cortex so important and what are its parts?
LO 2.9 Describe the main difference between the brains of lower and higher animals and differences between the brains of people who score high on mental tests and those who score low. Include a description of the *cerebrum* and *cerebral cortex* and an explanation of *corticalization*.
LO 2.10 Describe the two *hemispheres* of the brain, the *corpus callosum*, and the problem of *spatial neglect*; explain how and why the brain is "split" and the resulting effects; and differentiate the functions of right and left hemispheres.
LO 2.11 Describe the functions of each of the following parts of the brain as well as the

resulting effects of damage to these areas: a. *occipital lobes*; b. *parietal lobes* (include the *somatosensory area*); c. *temporal lobes*; d. *frontal lobes* (include the motor cortex); e. *association areas* (include *Broca's* and *Wernicke's areas*). Describe the causes and effects of *aphasia, agnosia* and *facial agnosia* and compare the sex differences in the hemispheric responsibility for language.
GQ: What are the major parts of the subcortex?
LO 2.12 List the three areas of the *subcortex* and explain the function of each of the following parts of the subcortex: a. *hindbrain* (*brainstem*) including: 1. the *medulla*; 2. the *pons*; 3. the *cerebellum*, and 4. the *reticular formation*; and b. *forebrain* including: 1. the *thalamus* and 2. the *hypothalamus*.
LO 2.13 Name the structures that comprise the *limbic system*; explain its overall function, the specific functions of the *amygdala* and the *hippocampus*, and the significance of "pleasure" and "aversive" areas in the limbic system; and list the six basic functions of the brain.
GQ: Does the glandular system affect behavior?
LO 2.14 Explain the purpose of the *endocrine system*; describe the action of *hormones* in the body; and describe the effects that the following glands have on the body and behavior: a. *pituitary* (include a description of *dwarfism*, *giantism*, and *acromegaly*); b. *pineal*; c. *thyroid* (include a description of *hyperthyroidism* and *hypothyroidism*); d. *adrenal medulla*; and e. *adrenal cortex* (include a description of *virilism*, *premature puberty*, and the problem of *anabolic steroids*).
GQ: In what ways do right- and left-handed individuals differ?
LO 2.15 Describe *brain dominance* and *handness*, including their relationship to speech; whether handedness is inherited; how the dominant hemisphere is determined; and the incidence, advantages, and disadvantages of being right-or left-handed.

Discussion Topics

One-Minute Motivator 2.1: ***Firing of the Neuron***

In order to conceptualize the firing of the neuron, students often need analogies to concrete objects. Possible analogies include: a radio, a telephone, a fax machine, a stereo system, the process of sending mail, etc. The analogy must be developed carefully: It must clarify, not mystify or confuse. A cap pistol can be used to demonstrate the all-or-none quality of the action potential. Since the text refers to a "domino" effect of sorts, set up a domino chain on a table.

One-Minute Motivator 2.2: ***Studying Memory***

Have students pretend that they suspect that a certain part of the brain is related to memory. How could you use clinical studies, ablation, deep lesioning, and ESB to study the structure?

One-Minute Motivator 2.3: ***Studying the Optic Nerve***

You are interested in finding out how single neurons in the optic nerve respond when the eye is exposed to light. What technique will you use?

One-Minute Motivator 2.4: ***Studying Facial Recognition***

You want to know which areas of the brain's surface are most active when a person sees a face. What methods will you use?

One-Minute Motivator 2.5: ***Brain and the Mind***

Students are usually very interested in addressing the subject of the relationship between the brain and the mind**.** You might begin a discussion of this topic by pointing out that many philosophical speculations regarding this issue have lost their relevance in light of new and innovative techniques (e.g., PET scans) for studying the human brain. The subject is, nevertheless, still very complex, and a lively class discussion can be generated by describing the following hypothetical experiment:

You are looking at a PET scan of your brain while the radiologist taking the scan is sitting with you. You are discussing the activity depicted on the screen. Assume that the PET scanner is slightly advanced over what is presently available and depicts glucose utilization immediately. (State-of-the-art scans require a 30- to 45-minute lead-time.) As you are staring at the PET scan, the radiologist points out that the most active areas seen on the screen are in the left hemisphere, particularly the language area and the visual areas toward the back of the brain. At this moment you hear some music, and almost immediately the activity pattern of the scan changes. Now there is activity in the right hemisphere as well, and you call the radiologist's attention to that change. "That's somewhere in the region of the music appreciation center," she responds. Then a few minutes later she asks, "Do you have any comments on the PET scan?" "What do you mean?" you reply, and, at this point, you notice another change. The auditory areas, as well as the frontal lobes, light up. You look toward the radiologist and see that she is smiling, and you finally realize that the PET scan is depicting your own brain activity! It is showing a shift as you change from one thinking activity to another.

Now ask the students to consider the following questions: Is this an example of their minds studying their brains, or can they adequately explain it as the brain studying itself? For more speculation on this topic see R. Restak's *The Brain*, Bantam Books, 1984.

One-Minute Motivator 2.6: ***Surface Areas of the Cortex***

To illustrate the enhanced surface areas of the cortex**,** wad up a piece of foil or aluminum-backed cloth to create a convoluted brain surface. If you don't have these materials, crumpling a sheet of paper into a small ball will suffice.

One-Minute Motivator 2.7: ***Child Without a Brain***

A national news service recently reported the case of a child born without a brain**.** According to the doctors interviewed at the time, such cases occur about once a year. In

the most recent instance, the defect was not discovered until the child was several months old. The baby, who appeared outwardly normal and healthy, began to cry excessively, and tests were performed to determine the cause. These tests revealed that the child had no brain. Doctors speculate that a cyst formed during prenatal development at the stem where the brain should have been and prevented further growth. The child survived because that portion of the brainstem which controls vital functions had already developed before the cyst formed. After students have read Chapter 3, they should be able to predict the kinds of abilities one might expect from such a child. You could ask them to describe the likelihood of this child having a personality, motivation, awareness, intelligence, etc.

One-Minute Motivator 2.8: ***Fears***

Unconscious fear produced by the amygdala seems to explain why people who survive experiences, such as a plane crash, can have debilitating fears years later. Ask students to share experiences they have that continue to "haunt them."

One-Minute Motivator 2.9: ***Hormones and Foods***

There are many articles in the media discussing the interrelationship between different foods and our hormones. For example, people are encouraged to take chromium to raise insulin, eat chocolate when our estrogen levels drop, or eat iodized salt to help our thyroid. Ask students to share some of the media "blitzes" they've heard or read about.

One-Minute Motivator 2.10: ***Brain Specialization***

Are there advantages and/or disadvantages to having our brains as specialized and lateralized as they are? Consider aspects such as plasticity, brain damage, cognitive efficiency, etc.

One-Minute Motivator: Exercise 2.11: ***Right Brain vs. Left Brain***

Right Brain/Left Brain: After students have learned that the two cerebral hemispheres differ in abilities, have them figure out in what ways are they similar and compare it to the differences.

Broadening Our Cultural Horizons 2.1: ***Use of Cerebral Hemispheres***

Ask students to give their opinions as to ways that different cultures might make greater or lesser use of the various strengths of the right and left cerebral hemispheres.

Broadening Our Cultural Horizons 2.2: ***Cultural Attitudes Toward Transplants***

Different religions have diverse attitudes concerning the rights of humans to intervene medically to save a life and also concerning the disposition of a person's body after death. Compare and contrast the following views:

a. Blood transfusions should not take place.
b. The body should not be violated after death.

c. Parts of the dead should be immediately used for transplants.
d. A person's body should be cremated at death.

Classroom Activities

Exercise 2.1: ***Cortical Localization and Interference***

This demonstration is a sure-fire illustration of cortical localization and interference. Begin by asking the entire class to simultaneously move the right hand and right foot in a clockwise direction for a few seconds. This should be quite easy for everyone. Next, ask that the right hand and left foot be moved in a clockwise direction. This is also easy. Next, have students make circular movements in opposite directions with the right hand and the left foot. This is more difficult, but most students will master it. Finally, have students attempt to move the right hand and right foot in opposite directions. This is extremely difficult for most people. After making these observations, students should be challenged to explain them. If they need a hint, ask them to think in terms of probable activity in the motor areas of the cortex.

Exercise 2.2: ***Neurotransmitters***

The power of neurotransmitters can be demonstrated using a squirt gun filled with laundry bleach. Squirt a colorful fabric; then squirt a glass or porcelain plate. The point to be made is that neurotransmitters must adhere to appropriate receptor sites before an action potential can be triggered.

Exercise 2.3: ***Sympathetic Nervous System***

Without warning, suggest that it would be helpful to know more about the interests of students. Explain, "In five minutes I will pick a student from the class and ask her/him to stand up and give a brief speech." After one student talks briefly, discuss the actions of the sympathetic nervous system in their own bodies during the past few minutes. Then guide students through a few minutes of deep breathing and relaxation to demonstrate the parasympathetic system. The transition from one to the other may be identified by asking students to indicate when they have sufficient saliva to actually swallow a cracker.

Exercise 2.4: ***Activity of the Brain***

In **Handout 2.1,** students will answer questions regarding the action of parts of the brain.

Exercise 2.5: ***Left-Handers in a Right-Handed World***

Ask left-handers to meet outside of class and make a list of all the inconveniences of living in a right-handed world**.** Ask them to share any horror stories from their childhoods, such as having their left hands tied to their backs, etc.

Exercise 2.6: ***Application to Other Disciplines***

Have students apply the information on the brain to education by asking them to develop a way to teach a child who is very verbal (left hemisphere strength) how to read vs. a child who is very visual-spatial (right hemisphere). They may need to do extra reading on the topic. The objective is to have them use synthesis (Bloom's Taxonomy), not necessarily a method that is actually being used.

Exercise 2.7: ***Brain Dominance***

An in-class activity that will demonstrate the functioning of the left and right hemispheres of the brain and which may show dominance of one hemisphere over the other involves observing lateral eye movement. A study by Schwartz, Davidson, and Maer serves as a model for this exercise. They were able to show that spontaneous lateral eye movement reflects activity in one or other of the hemispheres of the brain. Eye movement to the left seemed to indicate involvement of the right hemisphere, and movement to the right appeared to involve the left side. It has been observed that some people shift their eyes to the left more often than to the right. These are called left-movers. Others typically shift to the right and are called right-movers.

A conclusion drawn by researchers in this area is that left-movers have right hemisphere dominance and tend to be more artistic, creative, and intuitive thinkers. Right movers have left hemisphere dominance and tend to be more logical, analytical, verbal, and numerical. These conclusions are considered to be general tendencies and therefore should be viewed with a skeptical eye. More study and research is needed to support these conclusions.

Data Sheets (**Handout 2.2**)

1. Select five students to be the subjects of the demonstration. Ask them to leave the room while preparations are made.
2. Explain to the rest of the class that you will ask the subjects a list of questions. The students are to observe and record the eye movements of each subject when the questions are asked. Caution them that the eye movements may be slight and will be to the left or right. They will have to observe with care (and they will not have the benefit of slow motion or instant replays).
3. Provide each student with a copy of the record sheet, which contains the questions and a space to record the subjects' responses.
4. Admit the subjects, one at a time, and have each one stand in front of the class in full view of the students.
5. You should ask each question and give the subject time to respond. The students will record their observation for each question. You should accept whatever answer is given and move on.
6. After all subjects have been questioned, tally the number of observed left and right eye movements for each question and each subject.
7. An analysis of the results should attempt to see:
    a. which items tended to elicit a left eye shift, indicating right hemisphere activity and which elicited a shift to the right, pointing to a left hemisphere involvement.

b. if any subject had a tendency to shift more in one direction than the other, indicating a left or right hemisphere dominance.

8. The record sheet provided has a series of questions which follow a pattern. All odd-numbered items should elicit left hemisphere activity (eye shift to the right), and even-numbered items should elicit right hemisphere activity (eye shift to the left).
9. Discuss the results with the whole class, including the subjects who were observed. The class should try to see the left and right hemisphere patterns. Then they should ask the subjects about their preferences for left or right hemisphere activities to see if the eye movements do relate to hemisphere dominance.
10. Finally, ask the students to critique the exercise as a scientific endeavor. Was it scientific? Are the results valid? Reliable? Useful?

Exercise 2.8: ***Cultural Attitudes Towards Prolonging Life***

Prepare two forms outlining hypothetical situations. Put the students into small groups and give each group one of the forms to discuss and research how people of different cultural and/or religious backgrounds would respond to these situations.

FORM #1: A 25-year-old woman is dying of cancer. She has asked that "no extreme procedures be used to prolong life." She is now comatose and can be kept alive only with machines. How would you decide whether her will should be respected? (**Handout 2.3A**)

FORM #2: A 25-year-old man is dying of cancer. He has asked that "no extreme procedures be used to prolong life." He is now comatose and can be kept alive only with machines. How would you decide whether his will should be respected? (**Handout 2.3B**)

Exercise 2.9: ***Sculpting the Brain***

This activity was described at the 2008 National Institute on the Teaching of Psychology Conference by Ellen Pastorino in her presentation entitled, *Active Learning Strategies: Getting Students Engaged!* It involves having students learn the various regions of the brain by having students actually sculpt their own mini-brain.

For this activity, you will need to bring enough Play-doh or modeling clay to class for each of your students. I would suggest the Play-doh as it is softer and easier to work with. Have students spend time creating their own replica of the brain. You may want them to create their brain so that the hemispheres cut away to reveal the corpus callosum and limbic system. Once they are done you can walk around and grade each brain, having your students identify for you the various parts of their brain.

Exercise 2.10: ***Brain Map***

Have your students work in small groups to map out the brain. You can go online and find blank maps of the brain. Copy these for you students. Ask them to identify the various structures and state the functions of each. I usually make my students map the flow of information from various parts of the body into the appropriate structures of the brain.

Key Terms

Acetylcholine The neurotransmitter released by neurons to activate muscles.
Acromegaly Enlargement of the arms, hands, feet, and face caused by excess growth hormone late in the human growth period.
Action potential The nerve impulse.
Adrenal cortex The outer layer of the adrenal glands; produces hormones that affect salt intake, reactions to stress, and sexual development.
Adrenal glands Endocrine glands that arouse the body, regulate salt balance, adjust the body to stress, and affect sexual functioning.
Adrenal medulla The inner core of the adrenal glands; a source of epinephrine and norepinephrine.
Agnosia An inability to grasp the meaning of stimuli, such as words, objects, or pictures.
Amygdala A part of the limbic system associated with fear responses.
Aphasia A speech disturbance resulting from brain damage.
Association cortex All areas of the cerebral cortex that are not primarily sensory or motor in function.
Autonomic system The system of nerves carrying information to and from the internal organs and glands.
Axon Fiber that carries information away from the cell body of a neuron.
Brainstem The lowest portions of the brain, including the cerebellum, medulla, pons, and reticular formation.
Broca's area A language area related to grammar and pronunciation.
Central nervous system The brain and spinal cord.
Cerebellum A brain structure that controls posture and coordination.
Cerebral cortex The outer layer of the cerebrum.
Cerebral hemispheres The right and left halves of the cerebrum.
Cerebrum The two large hemispheres that cover the upper part of the brain.
Connector neuron A nerve cell that serves as a link between two others.
Corpus callosum The bundle of fibers connecting the cerebral hemispheres.
Corticalization An increase in the relative size of the cerebral cortex.
Cranial nerves Major nerves that leave the brain without passing through the spinal cord.
CT scan Computed tomography scan; a computer-enhanced X-ray image of the brain or body.
Dendrites Neuron fibers that receive incoming messages.
Dominant hemisphere A term usually applied to the side of a person's brain that produces language.
Effector cells Cells in muscles and glands that are capable of producing some type of response.
Electrical stimulation of the brain (ESB) Direct electrical stimulation and activation of brain tissue.
Electrode Any device (such as a wire, needle, or metal plate) used to electrically stimulate nerve tissue or to record its activity.
Electroencephalograph (EEG) A device that detects, amplifies, and records electrical activity in the brain.
Endocrine system Glands whose secretions pass directly into the bloodstream or lymph system.
Endorphins Chemicals that are similar in structure and pain-killing effect to opiate drugs such as morphine.
Enkephalins Opiate-like brain chemicals that regulate reactions to pain and stress.

Epinephrine An adrenal hormone that tends to arouse the body; epinephrine is associated with fear. (Also known as adrenaline).
fMRI scan Magnetic resonance imaging that records brain activity.
Frontal lobes A brain area associated with movement, the sense of smell, and higher mental functions.
Giantism Excessive bodily growth caused by too much growth hormone.
Growth hormone A hormone, secreted by the pituitary gland, that promotes bodily growth.
Handedness A preference for the right or left hand in most activities.
Hippocampus A part of the limbic system associated with storing memories.
Hormone A glandular secretion that affects bodily functions or behavior.
Hyperthyroidism Faster metabolism and excitability caused by an overactive thyroid gland.
Hypopituitary dwarfism Shortness and smallness caused by too little growth hormone.
Hypothalamus A small area of the brain that regulates emotional behaviors and motives.
Hypothyroidism Slower metabolism and sluggishness caused by an underactive thyroid gland.
Lateralization Differences between the two sides of the body; especially, differences in the abilities of the brain hemispheres.
Limbic system A system in the forebrain that is closely linked with emotional response.
Medulla The structure that connects the brain with the spinal cord and controls vital life functions.
Melatonin Hormone released by the pineal gland in response to daily cycles of light and dark.
Motor cortex A brain area associated with control of movement.
Motor neuron A nerve cell that carries motor commands from the CNS to muscles and glands.
MRI scan Magnetic resonance imaging; a computer-enhanced three-dimensional representation of the brain or body, based on the body's response to a magnetic field.
Myelin A fatty layer coating some axons.
Negative after-potential A drop in electrical charge below the resting potential.
Nerve A bundle of neuron fibers.
Neurogenesis The production of new brain cells
Neurological soft signs Subtle behavioral signs of brain dysfunction, including clumsiness, an awkward gait, poor hand-eye coordination, and other perceptual and motor problems.
Neuron An individual nerve cell.
Neurotransmitter Any chemical released by a neuron that alters activity in other neurons.
Norepinephrine An adrenal hormone that tends to arouse the body; norepinephrine is associated with anger. (Also known as noradrenaline.)
Occipital lobes Portion of the cerebral cortex where vision registers in the brain.
Parasympathetic branch A part of the ANS that quiets the body.
Parietal lobes Area of the brain where bodily sensations register.
Peripheral nervous system All parts of the nervous system outside the brain and spinal cord.
PET scan Positron emission tomography; a computer-generated image of brain activity, based on glucose consumption in the brain.
Pituitary gland The "master gland" whose hormones influence other endocrine glands.
Pineal gland Gland in the brain that helps regulate body rhythms and sleep cycles.
Plasticity The brain's capacity to change its structure and functions.
Pons An area on the brainstem that acts as a bridge between the medulla and other structures.
Reflex arc The simplest behavior, in which a stimulus provokes an automatic response.
Resting potential The electrical charge of a neuron at rest.

Reticular activating system (RAS) A part of the reticular formation that activates the cerebral cortex.
Reticular formation A network within the medulla and brainstem; associated with attention, alertness, and some reflexes.
Sensory neuron A nerve cell that carries information from the senses toward the CNS.
Soma The main body of a neuron or other cell.
Somatic system The system of nerves linking the spinal cord with the body and sense organs.
Somatosensory area A receiving area for bodily sensations.
"Split-brain" operation Cutting the corpus callosum.
Spinal nerves Major nerves that carry sensory and motor messages in and out of the spinal cord.
Subcortex All brain structures below the cerebral cortex.
Sympathetic branch A part of the ANS that arouses the body.
Synapse The microscopic space between two neurons, over which messages pass.
Temporal lobes Areas that include the sites where hearing registers in the brain.
Thalamus A brain structure that relays sensory information to the cerebral cortex.
Threshold The point at which a nerve impulse is triggered.
Thyroid gland Endocrine gland that helps regulate the rate of metabolism.
Wernicke's area An area related to language comprehension.

Video Suggestions

The Brain: Vol. 1, Sections #1,7,30 (Annenberg)

The Brain: Vol.1, Sections #2,12. (Annenberg)

The Brain: Vol.1, Sections #31, 32. (Annenberg)

The Brain: *Brain Anomaly and Plasticity: Hydrocephalus*, Section #7 (Annenberg, 1998, 7:02 min.)

The emphasis here is on plasticity. This video emphasizes two points. First, brain injury that occurs early in life is different from brain injury experienced after maturity. Second, hydrocephalus' individuals, although their brains are distorted, have a cortex which is essential to normal human brain function.

The Brain: *The Divided Brain***,** Section #5 (Annenberg, 6:46 min.**)**

This module will demonstrate to students the effects of having a split brain on behavior and mental processes. It should help clear up any confusion about the role of the corpus callosum in brain functioning.

The Brain: Language and Speech—Broca's and Wernicke's Areas (Annenberg, 1998, 7:44 min.)

Both Broca's area and Wernicke's area are presented in terms of their importance in language comprehension.

The Brain: Neurorehabilitation, Section #32 (Annenberg, 1998, 11:54 min.)

The important message of this program is that people can recover significantly from brain damage. For rehabilitation to be most effective, remediation should be combined with teaching compensatory strategies.

The Brain: *Organization and Evaluation of Brain Function* Section #1 (Annenberg, 7:08 min.)
This video highlights the brainstem, midbrain, limbic system, the visual projection area, and the frontal lobes.

Brain and Nervous System: Your Information Superhighway (Films for the Humanities and Sciences Inc., 2000, 25 min.)
This program explores the brain and nervous system, using the analogy of computers and the Internet.

Discovering Psychology Series: The Behaving Brain (Annenberg 1990, 30 min.)
Hosted by Dr. Phillip Zimbardo. This video provides an excellent review of basic brain structure including: the functioning of the neurons, subcortical structures, and neurotransmitters.

Dopamine Seduction: The Limbic System. (Films for the Humanities and Sciences Inc., 2000, 25 min)
This program illustrates the function of the limbic system in a subject named Greg, following the activity of his brain as he staves off danger and hunger. Extraordinary 3-D computer animation such as the release of hormones into the bloodstream and brain cells transmitting nerve impulses.

The Mind, Sections #12, 16. (Worth Publishers)

The Mind: Language Processing in the Brain (Worth, 6:19 min.)
This video shows the versatility of the PET scan as a research tool.

Multimedia Resources

PowerLecture with JoinIn™ and ExamView ® for *Introduction to Psychology: Gateways to Mind and Behavior*, Twelfth Edition.

Websites

Companion Site
www.cengage.com/psychology/coon

APA Online
http://www.apa.org/

Basic Neural Processes Tutorials
http://psych.hanover.edu/Krantz/neurotut.html

Quiz on the structure of the brain, tutorial on the physical factors involved in an action potential, and a glossary of terms relating to neural issues. By Dr. John H. Krantz, Hanover College.

Brain Images on the Web
http://www.med.harvard.edu/AANLIB/home.html

Images include normal brains, brains with cerebrovascular diseases (e.g., acute and subacute strokes, hyptertensive encephalopathy, cerebral hemorrhage), neoplastic disease (e.g., Glioma, sarcoma), degenerative disease (e.g., Alzheimer's, Huntington's, Pick's), and inflammatory or infectious disease (e.g., multiple sclerosis, AIDS dementia). The Whole Brain Atlas can also be ordered on CD-ROM.

Society for Neuroscience
http://www.sfn.org/

Digital Video Library 3.0

Understanding Addiction
The Cerebral Cortex (Virtual Reality)
Electrical Stimulation of the Lateral Hypothalamus
The Brainstem
Hindbrain Structures
The Thalamus
The Limbic System
The Longitudinal Fissure
The Corpus Callosum
The Cerebral Cortex
The Frontal Lobe
The Parietal Lobe
The Temporal Lobe
The Occipital Lobe
Main Parts of the Neuron
The Action Potential
Interference of the Action Potential
Synaptic Transmission
Interference of Synaptic Transmission

Supplemental Lecture

Students always have a difficult time learning the parts of the brain and their chief functions. Diagrams in most texts tend to appear complex and confusing because so many parts are identified and labeled. An instructor should take the time to simplify the structure, focusing on the major parts or areas of the brain. Once the students learn these, they can then add other structures and eventually see the whole thing, but first, they should see the stripped-down version, the basic model.

In this lecture the students will learn:
1. that the brain is specialized with each area having a different function;
2. that the brain is not really one organ but several "brains," all in the same location in the skull;
3. what each of the three parts or "brains" is called, where each is located, and what special tasks each performs;
4. that all of these separate parts are really interconnected and work together in a kind of network to direct behavior.

This lecture would work out best if a model of the brain were used. The model should be able to be disassembled and put together again. Otherwise a large diagram would be good; or, if that is not available, drawing on the chalkboard, showing one part at a time, can be effective.

THE BRAIN

I. Introduction
   A. Discuss the composition of the brain:
      1. type of cells
      2. number of cells (estimated)
      3. location of the brain
      4. size of brain in relation to the rest of the body
   B. Identify the three main parts or "brains" which make up what we call the brain:
      1. medulla
      2. cerebellum
      3. cerebrum
   C. Discuss each of the parts, giving location and major functions:
      1. Medulla
         a. It is located at the top of the spinal cord.
         b. It is a slightly rounded structure.
         c. It controls involuntary functions—these are the vital functions necessary for survival of the physical organism.
         d. Its functions include regulation of circulation, respiration, digestion, and reproduction.

MEDULLA

regulates —circulation

—respiration

—digestion
—reproduction

SPINAL CORD

         e. This is the most primitive part of the brain and is found in all living organisms. It is what keeps a human or animal alive.
         f. Damage to this area could cause death.

      2. Cerebellum
         a. It is located at the rear and base of the skull.
         b. It is ball-shaped and consists of a left and right lobe
         c. It controls the muscles and skeleton. It is responsible for motor coordination, balance, and fine motor movement.
         d. Humans and all higher orders of animals have a well-developed cerebellum.
         e. Damage to this area results in impairment or loss of motor functions.

CEREBELLUM

regulates motor coordination

3. Cerebrum

a. It is located at the top and front of the skull and takes up most of the space in it.
b. It is walnut-shaped and has a left and a right section or hemisphere.
c. Each hemisphere is divided into 4 parts or lobes, each of which has special functions. One function of each lobe is coordination of sensations:
    1. occipital lobe – vision
    2. temporal lobe – hearing
    3. parietal lobe – skin senses
    4. frontal lobe – olfaction and emotional control
d. The function of this complex part or "brain" is to coordinate sensations, regulate emotions, and direct thinking, learning, problem-solving, and other complex activities.

CEREBRUM

regulates —thinking
—occipital
—learning
—emotions
—sensations

e. This area is very large in humans and is smaller in other animals. Lower animals have very small cerebrums. Anthropologists have been tracing the evolution of humans from lower forms by finding skulls of various sizes leading up to the massive skull of the human. The size of the cerebrum is thought to correspond to the ability of the organism to solve problems and adapt to its environment.
f. Damage to this area could lead to a variety of problems from minor dysfunctions to major disabilities and/or death.

D. Having dissected the brain or brains, now you need to say that there is a constant flow of information to all parts so that our behavior is integrated. If time permits, you could discuss structures on the underside of the brain that do some of the interconnecting. Mention should be made of the corpus callosum, thalamus, hypothalamus, and the reticular formation.
E. As an activity students should be asked to identify all of the parts and structures discussed, either by using a model or an outline drawing such as those in this lecture. Simply reproduce the drawings without the labels and have students identify what they see.

Suggestions for Further Reading

Barich, M. & Heller, W. "Evolving Perspectives on Lateralization of Function." Current Directions in Psychological Science, 7, 1-2, 1998.

McKhann, G. and Albert, M. Keep Your Brain Young. John Wiley & Sons, Inc., New York, 2002.

Ranachandran, V. S. and Blakeslee, S. Phantoms in the Brain: Probing the Mysteries of the Human Mind. William Morrow and Company, Inc., 1998.
Sacks, O. An Anthropologist on Mars. Alfred A. Knopf, Inc., 1995.

Sacks, O. Awakenings. HarperCollins Publishers, Inc., 1990.

Sacks, O. The Man Who Mistook His Wife for a Hat and Other Clinical Tales. HarperCollins Publishers, 1985.

Scientific American: "The Hidden Mind," August, 2002. (This entire issue is devoted to the brain).

Springer, S. P. and G. Deutsch. Left Brain, Right Brain: Perspectives from Cognitive Neuroscience, 5th edition. W. H. Freeman, New York, 1998.

Handout 2.1 **Name _____**

Activity of the Brain

Answer the following short answer questions:

1. What part of the brain processes visual information?

2. What part of the brain processes what you hear?

3. What parts of the brain are involved when you hear something and look at it?

4. What parts of the brain will be "working" when you reach for something and pick it up?

5. What parts of the brain will be "working" when you hear someone ask you a question and you give the answer?

6. How could you informally evaluate someone's language skills?

Handout 2.2 **Name _____**

LATERAL EYE MOVEMENT RECORD SHEET

Record your observations on this sheet. Mark an L for left and an R for right. Remember that you are recording the subject's eye movements to HIS or HER right, not to yours. Do not do anything to distract the subject, or yourself, since the eye movement may be slight.

1. How many weeks are there in a year?
2. On what coin is John F. Kennedy pictured?
3. What is the last line of the "The Star-Spangled Banner"?
4. Without looking at me, what is the color of my shirt (tie, skirt)?
5. Define the term "psychology."
6. In England, on which side is the steering wheel of a car?
7. Why do people pay taxes?
8. Who is pictured on the front of a five-dollar bill?
9. What do the letters in "NASA" stand for?
10. About how far is it to the moon?

SUBJECT				
1	2	3	4	5

Handout 2.3 A **Name _____**

Cultural Attitudes Toward Prolonging Life

A 25-year-old woman is dying of cancer. She has asked that "no extreme procedures be used to prolong life." She is now comatose and can be kept alive only with machines. How would you decide whether her will should be respected?

Handout 2.3 B **Name _____**

Cultural Attitudes Toward Prolonging Life

A 25-year-old man is dying of cancer. He has asked that "no extreme procedures be used to prolong life." He is now comatose and can be kept alive only with machines. How would you decide whether his will should be respected?