CHAPTER 2

Biological Foundations of Behavior

"Happiness comes only when we push our brains and hearts to the farthest reaches of which we are capable." —*Leo C. Rosten*

CHAPTER PREVIEW

This chapter involves eight modules. Module 2.1 is a detailed presentation of the structure and function of neurons. Module 2.2 provides an overview of the nervous system. Module 2.3 outlines the major parts of the brain structures. Module 2.4 gives information on the methods of studying the brain. Module 2.5 is a short module on the specialization of function in the brain. Module 2.6 summarizes the endocrine system. Module 2.7 presents information on the nature and nurture issue. Finally, Module 2.8 presents a real-life application of the study of the nervous system using brain imaging.

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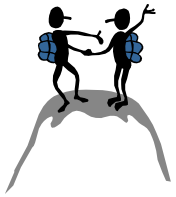

GOALS AND ACTIVITIES PLANNER

	Teacher Skills					
Student Skills	**Challenge Students**	**Variety of Teaching Methods**	**Enthusiasm and Social Skills**	**Connect with Real Life**	**Psychology Research Skills**	**Other**
Psychology Content						
Comm. Writing Speaking						
Social Skills						
Technology						
Critical Thinking						
Real-Life Application						
Other						
Other						

*Modified from K. J. Babbage, "High Impact Teaching: Overcoming Student Apathy."

- What modules will you emphasize in this chapter?
- What do you see as the big picture or take-home message?
- What ice-breaker, peak activity, lecture break(s), and wrap-up activity will you use in this chapter?
- What one topic do you want students to explore and fully engage with? How will you accomplish this?
- If you taught this class in the past, what one thing are you going to make sure to revise, add, or edit?

ICE-BREAKERS (IB)

IB 2.1 What Does the Brain Do?

Activity Type: Ice-Breaker

Class Size: This activity works well in small classes by breaking class into groups of 5 or 6 students. In large classes, the instructor should assign groups by seat location in class. This group assignment could also be done individually.

Class Time Involved: 5–10 minutes for group time; brief time to share

Materials Needed: Handout 2.1

Preparation Time: None

Student Skills: Psychology Content, Social Skills, Creative Thinking, Real-Life Application

To get students thinking about many of the things the brain and nervous system are responsible for, the instructor should take a few minutes to have students think about what we can accomplish with our brain and nervous system. In small groups, the instructor should have students come up with as many things they can think of that our brain and nervous system are responsible for controlling. Then, the instructor should have students go back and look at each action and decide if they actively control the behavior or action they listed or if the brain and nervous system does that automatically without conscious control. Usually, students generate behaviors they control such as talking, walking, and thinking. After some prompting, students will start to generate more autonomic nervous system activities such as breathing, heart rate, temperature control, and digestion.

IB 2.2 Brain Game

Activity Type: Ice-Breaker

Class Size: This activity works well in small classes by breaking the class into groups of 5 or 6 students. In large classes, the instructor should assign groups by seat location in class. This activity could also be done individually.

Class Time Involved: 5–10 minutes for group time; brief time to share

Materials Needed: Handout 2.2

Preparation Time: None

Student Skills: Psychology Content, Social Skills, Critical Thinking

As individuals or in small groups, the instructor should have students generate as many parts of the brain as they can list. The instructor should not allow students to use their text; students should complete the activity based on their previous knowledge. After each part of the brain has been listed, the instructor should have students list the primary function of the brain component. Students are usually surprised how little they actually know about one of the most important body organs. In fact, some students will erroneously list endocrine system glands as brain components. By allowing students to reflect on what they don't know, the instructor will have students develop a framework for what they will know at the end of the module. This activity can also be used as a parting-way assignment. Hopefully, students will a significantly improve their list of both brain components and brain functions.

MODULE 2.1 NEURONS: THE BODY'S WIRING

LECTURE OUTLINE

I. Neurons: The Body's Wiring
   A. Neurons transmit messages in the brain, enabling thought, sensation, perception, etc.

II. The Structure of the Neuron (**Concept Chart 2.1**, Figure 2.1)
   A. Soma—main body of the cell
   B. Axon—long cable that projects trunk-like from the soma
   C. Terminal buttons—at the ends of the axons; swellings that store and release neurotransmitters
   D. Synapse—tiny gap that separates one neuron from another
   E. Dendrites—tree-like structures that project from the soma and receive neurotransmitters
   F. Three types of neurons
      1. Sensory neurons—afferent neurons transmit information to the spinal cord and brain
      2. Motor neurons—efferent neurons convey messages from the brain and spinal cord to the muscles and glands
      3. Interneurons—associative neurons connect neurons to neurons
   G. Two types of cells
      1. In addition to neurons there are glial cells, which support neurons and form the myelin sheath
      2. Many axons are covered with a protective coating, called a myelin sheath, which speeds the transmission of neural impulses
      3. Small gaps in the myelin sheath are called nodes of Ranvier
      4. **LB 2.1**

III. How Neurons Communicate **LB 2.2**
   A. The nervous system is a massive communication network that connects billions of neurons throughout your body
   B. The neuron is electrically charged with sodium, potassium, and chloride ions
   C. Resting potential is the energy potential stored in the neuron that can be used to generate a neural impulse
   D. A neuron fires when a stimulus triggers electrochemical changes along its cell membrane that lead to a chain reaction within the cell
   E. An action potential is generated according to the all-or-none principle—it is produced only if the level of excitation is sufficient (Figure 2.2) **LB 2.3**

IV. Neurotransmitters: The Nervous System's Chemical Messengers (**Handout 2.3)**
   A. Neurons don't actually touch; they are separated by a synapse
   B. The neural impulse reaches the axon's terminal buttons and triggers the release of chemicals that either increase or decrease the likelihood that neighboring cells will fire (Figure 2.3)
   C. Neurotransmitters are either excitatory, making an action potential more likely to occur, or they are inhibitory, making an action potential less likely to occur
   D. Normal psychological functioning is dependent on neurotransmitter activity, which in turn can be affected by such factors as disease and drug abuse
   E. Antagonists block actions of neurotransmitters by occupying their receptor sites. Antagonists influence a number of psychological processes and conditions—for example, schizophrenia and Parkinson's disease
   F. Agonists enhance the function of neurotransmitters by binding to their receptor sites or mimicking their actions

G. Agonists can be influenced by a variety of drugs, such as amphetamines, alcohol, and antianxiety and antidepressant drugs

LECTURE BREAKS (LB)

LB 2.1 Head, Shoulders, Knees, and Toes: Using Music to Learn the Parts of a Neuron

Activity Type: Lecture Break

Class Size: This activity works best in small classes.

Class Time Involved: 5–10 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills, Singing

This is a risky lecture break and definitely not for all instructors. Some professors will find that this activity does not match their teaching style; however, most of us know that a song makes things very memorable. This activity explains why it is difficult to remove a song from your head. The instructor can use the music to assist students with the difficult task of visualizing a neuron and by remembering the parts of the neuron. For this activity, the instructor should have students form a large circle and explain that learning a song will help them remember the parts of the neuron.

The instructor should start by singing a popular children's song. If you don't know the tune, ask your friends, colleagues, students, children, or someone who will be able to teach you this simple tune. Start by singing the words and touching the appropriate body parts: head, shoulders, knees, and toes; knees, and toes; head, shoulders, knees, and toes; knees, and toes; and mouth, and ears, and eyes; and a nose, head, shoulders; knees, and toes; knees, and toes. Then, the instructor should speed up the song and sing it again.

After the instructor has most of the class singing the song, tell students that you are going to change the words to parts of the neuron (see word changes below). Make sure to include similar actions by wiggling your hands in the air for the dendrites, pointing to your head for the cell body, running your hands along your body for the axon, touching your toes for the buttons, going on the outside of your body for myelin sheath, and jumping along the sides of your body as the nodes of Ranvier. The instructor should do this a few times until everyone in the class knows the order of the neuron and parts. At first, some students will find this silly, but it is not uncommon to have students leave the room singing the "neuron song."

Head, shoulders,
Knees and toes; knees and toes
Head, shoulders,
Knees and toes; knees and toes
And mouth, and ears, and eyes, and a nose
Head, shoulders,
Knees and toes; knees and toes!

Dendrites, cell body,
Axon, buttons; axon, buttons
Dendrites, cell body,
Axon, buttons; axon, buttons
And myelin sheath and nodes of Ranvier
Dendrites, cell body,
Axon, buttons; axon, buttons!

LB 2.2 The World's Largest Neuron

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: Two tennis balls

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills

The instructor should get the class into two long lines. In smaller classes (e.g., 30 students or less), the instructor should use the entire class and separate them into two equal lines. In larger classes, the instructor may want to have 30 people perform for the rest of the class. If the class has an odd number of students, have a "helper" stand next at the start of one of the student lines. Explain that the first person in line represents the dendrite, the second person the soma or cell body, the next 10 or so students are axons, and the last person is the terminal button.

Then, hand a tennis ball to both "dendrites" and say, "Go," or have the helper hand a ball to each dendrite. Have students pass the tennis ball as fast as they can to the student who represents the terminal button. If a person drops the tennis ball, the instructor can explain the body (they represent) has been drinking too much alcohol or using drugs and has messed up their neuron functioning. The instructor should repeat this activity several times and ask students what happens with practice (a stopwatch can time each of the neural "firings"). As students repeat this exercise, they typically get faster and better, which is just what happens with real neurons. After students have fired a number of times, take one neuron or one line of students and have every other person in the axon become a node of Ranvier. In this line of neural firing, the nodes can jump their tennis ball from node to node over the myelinated axon student. The instructor should repeat the firing process several times; students will quickly see why the nodes of Ranvier increase the speed of transmission.

LB 2.3 Linking the Action Potential to Diet

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Real-Life Application

Students often find the action potential very confusing. The instructor may want to spend some time explaining that the three most important ions in the action potential are potassium, chloride, and sodium. The instructor should start by stating that during the resting potential, inside the neuron, there is a great deal of potassium; while outside the neuron there is more chloride and sodium. The instructor should ask students what chloride and sodium make together; most students know they make salt. By talking about the salty nature of the body, students will understand from where ions come. This activity can also lead into a quick discussion of the importance of a healthy diet for proper neuron functioning. If a person has too much salt in his or her diet, this imbalance could result in improper neuron functioning. Finally, the instructor should ask students if they have ever experienced a nighttime leg muscle cramp (their muscles suddenly tighten, creating pain in their legs). Most students will understand this painful experience. The instructor should ask students what they heard is a common remedy for this pain; most students will respond that people often suggest eating bananas. Eating

bananas helps increase potassium. If the instructor takes something as abstract as the action potential and then making it more concrete, by relating it to diet and food, this will help students remember the information.

MODULE 2.2 THE NERVOUS SYSTEM: YOUR BODY'S INFORMATION SUPERHIGHWAY

LECTURE OUTLINE

I. The Nervous System
   A. An intricate network of neurons that are organized in a communication network consisting of the central and peripheral nervous system (Figure 2.4)

II. The Central Nervous System: Your Body's Master Control Unit
   A. Central nervous system (CNS) consists of the brain and spinal cord
   B. Regulates everything in the body
   C. The brain consists of three major parts: the hindbrain, midbrain, and forebrain
   D. Conducts information between the brain and the peripheral nervous system
   E. Spinal cord is encased in a protective bony column called the spine
   F. Spinal reflexes are innate, automatic responses controlled at the level of the spinal cord that allow you to respond quickly to particular stimuli (refer to Figure 2.5)

III. The Peripheral Nervous System: Your Body's Link to the Outside World (**Concept Chart 2.2**)
   A. Peripheral nervous system (PNS) connects the central nervous system to other parts of the body
   B. Somatic nervous system is the part of the PNS that controls voluntary movements
   C. Autonomic nervous system is the part of the PNS that automatically controls such involuntary bodily processes as heartbeat, respiration, and digestion
   D. Refer to IB 2.1 if not uses for an ice-breaker activity (can be used now)
   E. The autonomic nervous system is divided into two branches that have largely opposite effects
      1. The sympathetic nervous system—the body's alarm system that heightens states of arousal
      2. The parasympathetic nervous system—tones down bodily arousal and helps replenish body resources
      3. **LB 2.4, LB 2.5**

LECTURE BREAKS (LB)

LB 2.4 What Part of the Nervous System Is Responsible for This?

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: Handout 2.1

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills

If the instructor used IB 2.1, he/she can have students return to their answers. The instructor can have students complete this activity individually or in small groups. The instructor should have students go through their lists and write what part of the nervous system (central, peripheral, autonomic, somatic, parasympathetic, or sympathetic) is most commonly used for each behavior. In addition, or as an alternative, the instructor should use Handout 2.1 and have students generate a list of behaviors and activities to determine if students can generate specific examples for different parts of the nervous system. The instructor should tell students some behaviors involve both types of nervous system responses. For example, breathing can be a somatic-controlled behavior or it can be an autonomic nervous system response.

LB 2.5 Parasympathetic or Sympathetic?

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: Handout 2.4

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills

Frequently, students have a difficult time distinguishing between the two branches of the autonomic system. The instructor should remind students that the sympathetic division is the alarm or the fight-or-flight action that uses energy; the parasympathetic system conserves, reserves, and restores energy. The instructor should tell students when they are "stressed," this is a sympathetic function.

The instructor should have students complete Handout 2.4. This may help students deal with the difficulty in understanding sympathetic versus parasympathetic behaviors. This assignment could be done as a take-home worksheet to be completed before the lecture. Alternatively, the assignment could be completed individually or in small groups during class. Answers to Handout 2.4: Skin has goose bumps (S); Skin is relaxed (P); Palms are dry (P); Palms are sweaty (S); Lungs are dilated and rapid breathing occurs (S); Lungs are constricted and breathing is relaxed (P); Heart rate decreases (P); Heart rate increases (S); Blood is sent to muscles (S); Blood is sent to internal organs (P); Adrenal gland activity increases (S); Adrenal gland activity decreases (P); Digestion is stimulated (P); Digestion is inhibited (S); Mouth is dry (S); and Salivation in the mouth (P).

MODULE 2.3 THE BRAIN: YOUR CROWNING GLORY LECTURE OUTLINE

I. The Major Parts of the Brain (**Concept Chart 2.3**)
   A. Hindbrain—the lowest part of the brain where the spinal cord enters the skull
      1. Medulla—controls vital bodily processes such as heart rate, breathing, and reflexes like swallowing, coughing, and sneezing
      2. Pons—helps regulate states of wakefulness and sleep
      3. Cerebellum—controls balance and coordination of basic body movements
   B. Midbrain—relays messages between the hindbrain and the forebrain

1. Reticular formation—regulates states of attention, alertness, and arousal

C. Forebrain—controls higher mental functions such as thinking, problem-solving, use of language, planning, and memory
   1. Thalamus—relay station near the middle of the brain
   2. Basal ganglia—cluster of nerve cells that play a key role in voluntary movement
   3. Hypothalamus—regulates hunger, thirst, body temperature, reproductive processes, emotional states, aggressive behavior, and response to stress
   4. Limbic system—plays an important role in the regulation of memory and emotions; consists of the amygdala, hippocampus, thalamus, and hypothalamus

II. The Cerebral Cortex: The Brain's Thinking, Calculating, Organizing, and Creative Center
   A. The cerebrum is divided into two hemispheres and covered in a layer of gray matter, the cerebral cortex
   B. Cerebral cortex is 1/8-inch thick, yet accounts for 80% of brain's total mass
   C. The corpus callosum is a bundle of nerve fibers that connects the two hemispheres of the brain, allowing them to share information
   D. Each hemisphere is divided into four lobes (Figure 2.8, Table 2.1)
      1. Occipital lobes—process visual information
      2. Parietal lobes—process touch, pressure, pain, and temperature; contain the somatosensory cortex (Figures 2.9 and 2.10)
      3. Frontal lobes—solve problems, make decisions, process emotional states, weigh evidence, and carry out coordinated action; contain the motor cortex
      4. Temporal lobes—process sensory information from the ears
   E. Association areas found in each lobe are responsible for putting sensory information together to form meaningful perceptions of the world
   F. **LB 2.6, LB 2.7**

LECTURE BREAKS (LB)

LB 2.6 What Can the Specific Parts of the Brain Do?

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: Handout 2.1

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills

If the instructor used IB 2.1, he/she can have students return to their answers. The instructor can assign this activity as an individual or small-group task. The instructor should have students go through their lists and write which part of the brain is most commonly used for each behavior.

In addition, or as an alternative, the instructor can use Handout 2.1 and have students generate a list of behaviors and activities to determine if students can correctly identify the correct parts of the brain that are responsible for the behaviors or actions they listed.

LB 2.7 Build a Magazine Brain

Activity Type: Lecture Break

Class Size: This activity works best in small classes.

Class Time Involved: 20–30 minutes

Materials Needed: Textbook to refer to Concept Chart 2.3, magazines, construction paper, markers, scissors, glue, etc.

Preparation Time: Time to gather supplies

Student Skills: Psychology Content, Critical Thinking, Social Skills

This is a successful lecture break to help students understand and memorize the parts of the brain, the location of the brain sections, and the function of the brain. This assignment could be completed individually, with completed student projects shared with the class. The assignment could also be completed individually during class. Students who have completed this activity in small groups of five or six students, have found the greatest success. In smaller classes, the instructor should bring enough scissors, markers, construction paper, glue, and magazines for the entire class (at least three old magazines for each group). The instructor may have a collection of magazines; he/she may also collect outdated magazines from the campus library or a doctor's office. However, ask students to bring their own scissors, markers, glue, and old magazines. Refer to the Time-Saver tip about collecting a stock pile of materials, such as these, to help with hands-on "craft projects."

The instructor should tell students to refer to Concept Chart 2.3. First, draw a large picture of a brain; label each part of the brain listed in Concept Chart 2.3. Then, students should find a picture from a magazine that represents the function of each section of the brain and paste that picture into the appropriate location. For example, a student might find a picture of Rodin's *The Thinker* to represent the frontal lobe or a picture of an eye or pair of glasses for the occipital lobe. A variety of interesting pictures can be used to represent the hypothalamus. This activity allows students a hands-on opportunity to label the brain and learn brain function. This project helps students learn, understand, clarify, and memorize complex information.

MODULE 2.4 METHODS OF STUDYING THE BRAIN

LECTURE OUTLINE

I. Recording and Imaging Techniques
   A. Modern technology provides ways of studying the structure and function of the brain without the need for invasive techniques (**Concept Chart 2.4**)
   B. EEG—electroencephalograph is an instrument that records electrical activity in the brain (Figure 2.11)
   C. CT scan—computed tomography scan is an imaging technique in which a computer measures the reflection of a narrow X-ray beam from various angles as it passes through the brain and other bodily structures (Figure 2.12)
   D. PET scan—positron emission tomography provides a computerized image of the brain and other organs at work (Figure 2.13)
   E. MRI—magnetic resonance imaging provides a detailed image of the soft matter of the brain or other body parts (Figure 2.14)
      1. Functional MRI allows for study of brain in action assessing function and structure
   F. **LB 2.8**

II. Experimental Methods

A. Lesioning—destroying part of the brain in experimental animals to observe the effects **LB 2.9**
B. Electrical recording—electrodes are implanted and records of electrical changes are gathered
C. Electrical stimulation—a mild electric current is passed through parts of the brain to observe the effects

LECTURE BREAKS (LB)

LB 2.8 Methods of Studying the Brain Field Trip

Activity Type: Lecture Break

Class Size: This activity works best in small classes.

Class Time Involved: 2 hours plus travel time

Materials Needed: A willing field trip location and transportation

Preparation Time: Time to find field trip location

Student Skills: Psychology Content, Social Skills, Real-Life Application

Although this activity is not a possibility for large classes, a field trip to a local hospital or clinic is a fantastic experience for students to see first-hand the brain scans discussed in this chapter. Rather than take the entire class, the instructor could offer students extra credit and conduct this field trip as a psychology club event. The activity will work best if someone has a professional contact at a hospital or clinic. The instructor should allow for plenty of time to arrive, park, and get to the hospital or clinic. Finally, the instructor should brief students on appropriate behavior in a hospital. When the field trip is over, the instructor should make sure students sign a thank you card for hospital or clinic staff.

LB 2.9 Animal Research Debate

Activity Type: Lecture Break

Class Size: This activity works well with all class sizes.

Class Time Involved: 50 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Communication Verbal Skills

When the instructor discusses the section on lesioning, the issue of animal rights often emerges. This is an excellent time to teach students about appropriate rules in academic discourse, topic research, and argument presentation. In smaller classes, it is possible to have the entire class involved in the debate. In larger classes, some students could volunteer to participate and receive extra credit. The instructor could have four debates throughout the semester, so that each student can participate in at least one. The instructor should emphasize that in a well-prepared debate, there is no "winning" side, but rather full discussion of both sides of the issue.

The instructor should divide the class into two groups (pro animal research versus con animal research) and tell students them to present the following: a clear thesis statement, an outline of their arguments, research to support each of their arguments, a clear conclusion statement, and rebuttals. Debate teams

can decide who will be responsible for each of these debate elements, or the instructor can assign debate roles. There are a variety of ways to conduct a debate, but the following format works well:

Pro team presents its argument (10 minutes)

Con team presents its argument (10 minutes)

Pro team rebuttals (5 minutes)

Con team rebuttals (5 minutes)

Questions from the class (10 minutes)

MODULE 2.5 THE DIVIDED BRAIN: SPECIALIZATION OF FUNCTION

LECTURE OUTLINE

I. The Brain at Work: Lateralization and Integration (**Concept Chart 2.5**, **LB 2.10**)
   A. In most people, the left hemisphere is specialized for use of language and logical analyses
   B. The right hemisphere, in contrast, is specialized for spatial processing and other nonverbal tasks
   C. Broca's area—essential to speech production
   D. Wernicke's area—essential to ability to understand language

II. Handedness (Table 2.2, **LB 2.11)**
   A. Runs in families
   B. Not sure of causes, but could be genetics and social factors

III. See *Exploring Psychology*—Research on Split-Brain Patients **LB 2.12, LB 2.13**

IV. Brain Damage and Psychological Functioning
   A. Phineas Gage, victim of accident in 1848, demonstrated effects of head trauma on personality and behavior (Figure 2.17)
   B. Head trauma

V. Brain Plasticity
   A. Ability of brain to adapt and reorganize following trauma or surgery
   B. Particularly "plastic" prior to age 13

LECTURE BREAKS (LB)

LB 2.10 Left-Brain/Right-Brain Survey

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: Handout 2.5

Preparation Time: None

Student Skills: Psychology Content, Real-Life Application

Most students enjoy reading split-brain patient research. To help them explore this issue, the instructor should have students complete a survey to test for left- or right-brain dominance. There are many surveys available, but a quick, easy-to-score survey will be most effective. The activity could be completed as a take-home class activity or in class. The instructor may also have students discuss possible careers they wish to consider based on their brain hemisphere preference. In scoring, the instructor should indicate to students that more choices selected from the "a" column hints at greater left-brain dominance; the "b" column, indicates greater right-brain dominance.

LB 2.11 Left Handedness

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Real-Life Application

This module includes a review of factors that affect expression of right or left handedness. The instructor should begin the activity by having students share their own personal knowledge about beliefs relating to left-handedness. Students may not be aware of the longstanding superstitions and myths about left-handedness; the instructor may need to add background information to the discussion (online information can be found at www.anythingleft-handed.co.uk). After the class discusses social reactions relating to handedness, the instructor should broaden the discussion to include stigmas relating to other variations in human behavior. Students should make a list of characteristics or traits that are likely to be met with negative reactions by others. The instructor should ask students the following questions: Why might we stigmatize those who are different than us? Should the fact that many of these variations are caused by genetic factors affect our level of stigmatization?

LB 2.12 Can You Pat Your Head and Rub Your Tummy? Left-Brain/Right-Brain Activity

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking

After discussing split-brain research, the instructor should reiterate that the right hemisphere controls the left hand and the left hemisphere controls the right hand. The instructor should stand in the front of the classroom and make sure his/her feet and hands are free to move. The instructor should tell all students to put down their pens and pencils and move their right hand in a circular clockwise direction. As students move their right hand, the instructor should ask which hemisphere is primarily in control. Most of the students will say the left hemisphere. Then, the instructor should ask students to get their right foot moving in a clockwise direction. Usually, there will be a little laughter. The instructor should tell students they are making their brains work a little bit harder. Then, the instructor should have

students stop moving their right foot and have them move their right hand in a clockwise direction and their left foot in a clockwise direction. The instructor should ask students why it is harder for most people, now they are using both sides of their brain. Most students will think this behavior is very difficult, but it is surprisingly easy. Finally, the instructor should tell students to continue to move their right hand in a clockwise direction and then move their right foot in a counterclockwise direction. For most people, this action is nearly impossible. The instructor should discuss why this activity is so difficult to accomplish.

LB 2.13 Exploring Psychology—Split-Brain Patients

Activity Type: Lecture Break

Class Size: This activity works well with all class sizes.

Class Time Involved: 10 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking

These written assignments will be developed in conjunction with the *Exploring Psychology* sections of each chapter. These assignments could be assigned to students as individual activities in a paper format or as a discussion board. In addition, these questions could be used for small-group discussion in class:

1. Describe a typical split-brain patient.
2. After reviewing the research of Sperry and Gazzaniga, draw a picture of the process identified in the blindfold study. Make sure to identify how split-brain patients process key stimuli.
3. Examine Figure 2.16. How might the findings demonstrated in the perception study impact the daily life of split-brain patients?
4. Why do you think the findings in split-brain patient research and perception are an important issue? What is the most important implication for this research in terms of brain functioning?
5. Split-brain patients maintain their intellectual abilities and personality. How can this be? What can we conclude about human experience based on this split-brain research on intelligence and personality?
6. If your child were a severe epileptic, would you consider surgery to sever the corpus callosum? List the issues you would consider when making your decision.

MODULE 2.6 THE ENDOCRINE SYSTEM: THE BODY'S OTHER COMMUNICATION SYSTEM

LECTURE OUTLINE

I. **LB 2.14**
II. Endocrine Glands: The Body's Pumping Stations (**Concept Chart 2.6**)

A. Distributed throughout the body, help coordinate many bodily functions (Figure 2.19)
B. Hormones are released by endocrine glands directly into your bloodstream and travel to specific receptor sites on target organs and tissues
C. In concert with the nervous system, the endocrine system helps the body maintain a state of equilibrium, or homeostasis
D. Hypothalamus uses releasing hormones to influence pituitary gland functioning
E. The pituitary gland is often called the "master gland" because it helps regulate so many other endocrine glands
F. The pineal gland releases melatonin, a hormone that helps regulate the sleep-wake cycle
G. The adrenal glands produce cortical steroids, which promote muscle development, and the stress hormones epinephrine and norepinephrine
H. The gonads are the sex glands, and they produce hormones
    1. Ovaries in women produce the female sex hormones estrogen and progesterone
    2. Testes in men produce the male sex hormone testosterone

III. Hormones and Behavior (**LB 2.15)**
A. Hormones affect a number of mood states and behaviors
B. Testosterone and aggression
C. Thyroid gland hormone and metabolism, anxiety, and irritability
D. Premenstrual syndrome

LECTURE BREAKS (LB)

LB 2.14 Hormones!

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 5–10 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Social Skills, Critical Thinking

Before beginning the section on the endocrine system, the instructor should get students thinking about hormones. Many students will have stereotypic ideas about hormones. This can be a good teaching moment. Ask students to get into small groups and answer the following:

- What would happen to a woman if you started giving her large doses of testosterone?
- What would happen to a man if you started giving him large doses of estrogen?
- If there were no negative consequences to taking testosterone or estrogen, why would a person want to increase their intake of these hormones?

After getting their initial ideas—and misconceptions—the discussion of the endocrine system should be more interesting and relevant to students.

LB 2.15 Biobehavioral Aspects of the Endocrine System

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: Student groups work together on the project outside of class and then present their findings in class

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Social Skills, Critical Thinking, Real-Life Applications

Frequently, students consider the endocrine system to be completely separate from the neurological system. This activity will allow students to understand the close relationship between brain centers and the endocrine system. The instructor should have student groups focus on one endocrine disorder. Examples of endocrine disorders may include thyroid disorders (hypothyroid, hyperthyroid), adrenal disorders, and pancreatic disorders (Type I diabetes). Student groups should outline the brain-body connection in the normal functioning of these endocrine systems (What part of the brain directs the release of the endocrine hormones? How does it know when to stop releasing the hormone? etc.). Additionally, student groups should briefly describe what goes wrong in the development of these disorders and the psychological repercussions of the disorders. For example, patients with thyroid disorders have an increased risk of depression. In addition, psychological states such as stress can influence most of these disorders. Students will find resources on the Internet about the characteristics and repercussions of these disorders. After students complete their research, the instructor should have students present their findings to the class. By completing this activity, students will learn the connection between the brain, psychological states, and the endocrine system.

MODULE 2.7 GENES AND BEHAVIOR: A CASE OF NATURE *AND* NURTURE

LECTURE OUTLINE

I. **LB 2.16**

II. Genes and Behavior: A Case of Nature *and* Nurture

- A. The genetic instructions are encoded in the organism's genes
  1. Genes are the basic units of heredity passed along from parent to offspring
  2. Genes are composed of the complex, double-stranded spiraling molecule called deoxyribonucleic acid (DNA)
  3. Genes are linked together on long strands called chromosomes that reside in the cell nucleus
- B. Genetic influences on behavior
  1. Nature-nurture problem one of oldest debates in psychology
  2. Heredity influences many psychological traits and disorders
  3. Whether the genotype becomes expressed in the organism's observable traits, or phenotype, depends on a complex interaction of genes and other factors
  4. Genetic factors create predispositions that increase the likelihood that certain behaviors, abilities, or personality traits will emerge, but whether they do emerge depends largely on environmental influences and individual experiences
- C. Kinship Studies: Untangling the Roles of Heredity and Environment (**Concept Chart 2.7**)
  1. Familial association studies look at how similar closely related people are compared to more distantly related individuals

2. Twin studies compare similarities between monozygotic or identical twins and dizygotic or fraternal twins
3. Adoption studies compare adopted children with their adoptive parents and biological parents

LECTURE BREAKS (LB)

LB 2.16 Nature versus Nurture

Activity Type: Lecture Break

Class Size: This activity works with all class sizes.

Class Time Involved: 10–15 minutes

Materials Needed: Handout 2.6

Preparation Time: None

Student Skills: Psychology Content, Social Skills, Critical Thinking

Students have many intuitive ideas about the nature versus nurture debate. To introduce this section, the instructor should use Handout 2.6 in a variety of ways. The instructor can administer the survey individually and have students complete it. The instructor can also have students get into small groups and have them discuss several developmental issues before rating whether the issues are more nature or nurture in origin. Alternatively, in a smaller class (30 or less), the instructor can write the numbers 1 (nature/genetics) 2, 3, 4, & 5 (both nature and nurture) and 6, 7, 8, 9, & 10 (nurture/environment) on the board. The instructor should have students move toward the position they believe is correct (nature only, nurture only, or nature & nurture) as the different behaviors are read. This incorporation of a movement activity will be memorable for kinesthetic learners.

MODULE 2.8 APPLICATION: LOOKING UNDER THE HOOD: SCANNING THE HUMAN BRAIN

LECTURE OUTLINE

I. Cognitive Neuroscience
   A. Cutting-edge applications of brain imaging called cognitive neuroscience have led to exciting research in each of the following areas: memory and cognition (Figure 2.20); personality traits (Figure 2.21); personnel selection; consumer decision-making (Figure 2.2); lie detection; and diagnosis of psychological disorders

II. **LB 2.17**

LECTURE BREAKS (LB)

LB 2.17 It's the Real Thing—Guest Speaker

Activity Type: Lecture Break

Class Size: This activity works well with all class sizes.

Class Time Involved: 50 minutes

Materials Needed: Guest speaker

Preparation Time: Time to find guest speaker

Student Skills: Psychology Content, Real-Life Application

If it is not feasible to take a field trip to see actual brain scans discussed earlier in this chapter, the instructor should invite a medical professional who has brain-imaging experience to address the class. The instructor should contact a local clinic or hospital to find someone with experience in performing at least one of these scans and ask the guest speaker if he/she will bring copies of neuroimaging scans on a computer disk or printout. During the speaker's presentation, the instructor should ask him/her how the field has changed and the common applications for scans. Chapter 1, LB 1.6, has more information on successful guest speakers.

PARTING WAYS (PW)

PW 2.1 Concept Chart Parting Ways

Activity Type: Parting Way

Class Size: This activity works well with all class sizes.

Class Time Involved: 10 minutes

Materials Needed: Textbook

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking

To provide chapter closure, the instructor should direct students to the following concept charts and ask if they have questions or need clarification:

Concept Chart 2.1: Gives an excellent summary of the parts of the neuron

Concept Chart 2.2: Gives an excellent summary of the peripheral nervous system

Concept Chart 2.3: Gives an excellent summary of the parts of the brain

Concept Chart 2.6: Gives an excellent overview of the endocrine system

PW 2.2 Critical & Creative Thinking

Activity Type: Parting Way

Class Size: This activity works well with all class sizes.

Class Time Involved: 10 minutes

Materials Needed: Textbook, page 83, *Thinking Critically about Psychology* exercise

Preparation Time: None

Student Skills: Psychology Content, Writing Skills, Critical Thinking, Social Skills

Throughout the textbook, instructors will find a variety of critical thinking activities. This activity could have students work individually on the assignment in class or outside of class as a writing assignment. If the instructor uses a course journal in the course, this activity could be assigned as a writing assignment. If a virtual discussion board is being utilized, the instructor could use this activity as a discussion starter. Finally, this activity could be completed in small groups, with answers shared in class.

PW 2.3 Brain Game (Again)

Activity Type: Parting Way

Class Size: This activity works well with all class sizes.

Class Time Involved: 10–15 minutes

Materials Needed: Handout 2.2

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills

If the instructor had students complete IB 2.2, he/she may reassign this activity at the completion of the brain unit to assess improvement. Or the activity could be completed for the first time, if it was not used as an ice-breaker. In individual or small groups, the instructor could have students generate as many parts of the brain as they can list. The instructor should not allow students to use their textbook. The instructor should tell students to complete the activity based on their chapter knowledge. After each part of the brain, the instructor should have students list the primary function of each section of the brain.

The activity may also be assigned as a competition. For example, the group that lists the most parts of the brain and correct brain functions will receive two extra-credit points on the upcoming exam. This incentive will increase group cooperation.

PW 2.4 Preposterous Question: Build the Best Brain You Can

Activity Type: Parting Way

Class Size: This activity works well with all class sizes.

Class Time Involved: 10–15 minutes

Materials Needed: None

Preparation Time: None

Student Skills: Psychology Content, Critical Thinking, Social Skills

As a culminating activity, the instructor may want students to review the parts and functions of the brain. The instructor should propose the following preposterous hypothesis: Pretend you will survive, but you can only pick five brain structures that will work completely effectively. If you don't select certain brain structures, they will not function quickly or very effectively. Which five areas would you select? What areas would not be in your top five and why? Students can complete this assignment

individually or in small groups. This creative assignment allows students the chance to review information and also to compare brain structures.

Please see the discussion board, writing, and/or web evaluation assignments for more possible parting-way activities for this chapter.

PORTFOLIO PROJECTS: PUTTING THE PIECES TOGETHER

PSYCHOLOGICAL FAMILY TREE

Ask students to identify one personality characteristic/trait or mental health condition to investigate in their own family. They will need to contact parents, grandparents, and other family members to gather information. Each student will create a chart depicting whether specific members of the family (siblings, parents, grandparents, aunts, uncles, and so on) have the trait or characteristic. After creating the chart, have students briefly summarize life events that may have impacted the expression of the trait for each family member. Finally, the instructor should have students reflect on how nature (genetics) and nurture (environment) have played a role in the expression of the trait or mental health condition.

Students get very interested in pursuing this assignment. After completing their family tree, many students decide to do more intensive family research. This portfolio assignment is meaningful for students, because it encourages family discussion about psychological issues.

ELECTRONIC DISCUSSION BOARD, JOURNAL ASSIGNMENT, OR WRITING ASSIGNMENT TOPIC

QUESTION: What information in this chapter about brain structure and brain functioning did you find most surprising? Why did you find this information surprising? Although many functions of the brain were presented, along with the associated brain area primarily in control of this function, some functions do not have one clear area of the brain that is responsible for their functioning. What are some of the functions of the brain that do not seem to have one primary area of responsibility? Finally, how do you think the information presented can assist you personally or professionally? Why?

BLOG PROMPT

What role does genetics play in human behaviors? Are criminals just "born that way" or does their environment contribute? If you had to pick between nature and nurture to explain violent criminal behavior, which would you choose? Why?

TEACHER TECHNOLOGY ADD-ON—USING WEB LINKS

In each chapter, we present a possible technology component to incorporate into your course. Some of these you may already be using; others you may not think fit your particular teaching style. We hope

you find some of these ideas may enhance your current teaching style and ultimately increase student learning.

In Chapter 2, numerous diagrams or pictures are particularly useful to help students visualize parts of the brain. In other chapters, pictures or diagrams will also be useful. There are pictures of the brain and brain structures in the textbook. Additional pictures, at different angles, with labeled structures are helpful to students. In addition, as the instructor lectures and students take notes, it is useful to present a variety of webpage links via PowerPoint presentations. Students who are not comfortable drawing diagrams will appreciate this. The instructor may also provide valuable links in their syllabus.

If the instructor uses a course webpage, built with FrontPage or a course management system such as BlackBoard or WebCT, he/she can post brain structure links there. Some links are interactive; students can select different parts of the brain to explore in more depth. One significant problem with web links is that they move or may not exist. Therefore, the instructor should select web links from reliable sources. One reliable webpage repository is Project Merlot (http://www.merlot.org/). This project, sponsored by a variety of colleges, has peer-reviewed web links. This project allows students to go to one webpage and surf for a variety of useful links. For example, by searching for "brain" on the Merlot site, we found this very useful brain atlas site with excellent pictures of the brain:

http://www.med.harvard.edu/AANLIB/home.html.

Web Evaluation Assignment

The instructor should randomly assign each student a part of the brain and have them complete the web evaluation sheet on their brain structure (see Handout 1.10). In addition to teaching students technological skills, this assignment is also an excellent way for the instructor to find interesting resources. Alternatively, the instructor could assign students to research different neurological disorders.

TIME-SAVER

In this chapter, one of the lecture breaks involved creating a brain poster by using magazine cutouts of brain functions, markers, glue, and scissors. These hands-on activities that require kinesthetic activity give students the chance to work in groups, create a project, and think about the content and material presented in class. These activities generally create excitement in the classroom and are especially beneficial for students who are kinesthetic learners. It is amazing how willing students are to brainstorm and answer questions when given a piece of poster board and different colored markers. However, it takes time for the instructor to gather magazines, markers, tape, glue, and the associated craft items. We believe the benefit of hands-on creative projects is worth the extra effort.

ASSESSMENT ISN'T A DIRTY WORD!

Chapter 2: STUDENT ASSESSMENT

1. What were the teaching methods, activities, or content that you found most important in this chapter? Why?

2. What aspects of the chapter did you have the most difficulty understanding? For example, many students have difficulty remembering the different structures of the brain. What did you do to assist your learning when the information is difficult? Explain.
3. What is the instructor doing to help facilitate your learning of this chapter information?
4. What could the instructor do to increase your learning and appreciation of this chapter information?
5. What are you doing to help facilitate your learning of this chapter information?
6. What could you do to increase your learning and appreciation of this chapter information?
7. What current examples, television shows, music, or movies, would be relevant to the chapter?
8. Please add additional comments (on back of page):

Chapter 2: INSTRUCTOR ASSESSMENT

1. What aspects of the chapter do you think students found most important and engaging?
2. What aspects of the chapter do you think students had the most difficulty understanding?
3. While teaching this chapter, what activities, discussions, or lectures worked particularly well to help students learn and appreciate the material?
4. What things could you change to help students learn and appreciate the material more?
5. What current examples, television shows, music, or movies would be relevant to the chapter?
6. List the important things you want to remember to do the next time you teach this chapter (on back of page):

Handout 2.1 What Does the Brain Do? (IB 2.1, LB 2.4, LB 2.6)

In the space below, list as many behaviors or actions with which the brain and the nervous system are involved. Try to generate as many behaviors or actions as you can.

Behaviors or Actions	*	**

*, ** Please leave these columns empty for now; you may use these columns for later activities.

Handout 2.2 What Are the Parts of the Brain? (IB 2.2, PW 2.3)

List as many parts of the brain as you can. After each part of the brain, list the primary function of that part of the brain.

Brain Area	**Associated Function**

Handout 2.3 Functions of Key Neurotransmitters

Neurotransmitter	Functions
Acetylcholine (ACh)	Regulation of muscle contractions of skeletal muscles; regulation of heart beat; involved in formation of new memories
Dopamine	Regulation of muscle contractions, pleasurable sensations, and mental processes involved in learning and memory
Glutamate	Excitatory effects on nervous system arousal
GABA (gamma-aminobutyric acid)	Calming effects on central nervous system arousal
Norepinephrine	Regulation of mood states, learning, and memory
Serotonin	Regulation of moods, feelings of satiety, and sleep
Endorphins	Inhibition or blocking or pain; regulation of pleasurable sensations

Handout 2.4 Parasympathetic or Sympathetic? (LB 2.5)

For the following body functions, indicate which function is primarily controlled by the sympathetic branch of the body and which is primarily controlled by parasympathetic behavior.

Next to each behavior or action, put an "S" for sympathetic and "P" for parasympathetic:

1. Skin has goose bumps.

   Skin is relaxed.

2. Palms are dry.

   Palms are sweaty.

3. Lungs are dilated and rapid breathing occurs.

   Lungs are constricted and breathing is relaxed.

4. Heart rate decreases.

   Heart rate increases.

5. Blood is sent to muscles.

   Blood is sent to internal organs.

6. Adrenal gland activity increases.

   Adrenal gland activity decreases.

7. Digestion is stimulated.

   Digestion is inhibited (can cause you to feel like you have a knot in your stomach).

8. Mouth is dry.

   Saliva is in the mouth.

Handout 2.5 Left-Brain/Right-Brain Survey (LB 2.10)

For each pair, please select the item that is most appealing to you.

1.	a) Writing a letter	b) Drawing a picture
2.	a) Being a movie critic	b) Creating a new toy
3.	a) Playing a logical game	b) Playing an instrument
4.	a) Reviewing a book	b) Building something
5.	a) Writing a play	b) Visualizing a play
6.	a) Learning computer programming	b) Puttering in the yard
7.	a) Analyzing a budget	b) Re-arranging an office or room
8.	a) Planning a trip	b) Going on a trip with no plans
9.	a) Learning a dance step by talking	b) Learning a dance step by watching

Modified from Wagner, R. F., and Wells, K. A. (1985). A refined neurobehavioral inventory of hemispheric preference. *Journal of Clinical Psychology, 41,* 672–673.

Handout 2.6 Nature versus Nurture (LB 2.16)

For each of the following items, select the number that most represents your belief about what primarily controls this aspect of an individual. Use the following scale:

1	2	3	4	5	6	7	8	9	10
nature/genetics				both					nurture/environment

1. Height

2. Eye color

3. Weight

4. Aggression/anger/temper

5. Happiness

6. Intelligence

7. Personality

8. Skin color

9. Extraversion/social skills