**Depression—More Than Just Sad**

**Lesson Overview**

Students reveal their preconceptions about depression, then they visit G2C Online to learn about symptoms of the disorder, genes, and neurotransmitters associated with it, and challenges involved in diagnosis and treatment.

**Description of Activity**

In Part 1 of Depression—More Than Just Sad, students indicate whether they think statements about depression in an anticipation guide are true or false to expose their preconceptions. (Most of the statements are common myths about the mood disorder.) After completing anticipation guides, they explore G2C Online to find out if their preconceptions are correct or not. Finding information that reinforces or contradicts their answers, students record correct responses on their anticipation guides and note appropriate information about the concept.

In Part 2A, students work in expert cooperative learning groups to develop answers to questions about depression at one level of organization (genes/biochemicals and cells/brain anatomy/ cognition/ environment). In Part 2B, they share their information in jigsaw groups in a round robin so everyone can learn across all levels.

Parts 1 and 2 can be completed independently of each other.

**Goals and Objectives**

Students will be able to:

- Differentiate between depression and bad mood or sadness.
- Give a reason why depression is often considered the “common cold of mental illness.”
- Explain why the identical twin of an individual with depression is likely, but not guaranteed, to develop the disorder.
- Provide evidence that several neurotransmitters may be involved in producing depression.
- Locate brain structures affected in patients with depression.
- Characterize the thinking and behavior of people with depression.
- Tell how a supportive environment can lessen the effects of depression and decrease the likelihood of a person becoming depressed.
- Relate information about depression at one level of organization to information at other levels.
- Speculate on the directions of future research.

**Assumptions of Prior Knowledge**

Students should have a basic knowledge of principles of genetics and understanding of the biological basis of behavior.

© 2008-2012, Cold Spring Harbor Laboratory. All rights reserved.
Common Misconceptions

Students often think:
- Depression is no different from getting the “blues” – and this is just a normal part of life.
- People who have been diagnosed with depression are depressed all the time.
- Depressed people are generally more aware that they are depressed than people who are close to them.
- “Once depressed, always depressed.”
- Depression is not a medical condition.
- Most people with major depression commit suicide.
- Most people involved in horrendous events, such as 9/11 or serious accidents or crimes, will become depressed.
- Talking about depression only makes it worse.
- Depression is a normal part of getting old.

Implementing the Lesson

Time Allotment:
Part 1: 1 x 50-minute class
Part 2: 1 or 2 x 50-minute class

Before Class

Become familiar with Genes to Cognition Online (www.g2conline.org). If necessary, reserve computers for the lesson.

Photocopy student worksheets:
Part 1: Feeling Down
Part 2A: Depression—Breaking It Down
Part 2B: Depression—More Than Just Sad

For Part 2A, determine which students will be in each of the five expert groups:
1. Genes
2. Biochemicals/Cells
3. Brain anatomy
4. Cognition
5. Environment

Each expert group will answer questions dealing with their aspect of depression by searching atoms of the Depression area of the G2C Online that deal with their assigned concepts.

Determine the jigsaw round robin groups. Reconfigure groups so that one member of each expert group gets together with a member of each of the other groups, to form new five-member groups. Thus, each new group has one member each from groups 1, 2, 3, 4, and 5.
During Class

Use student worksheet, *Part 1: Feeling Down*, to introduce students to the topic of depression. Uncover their preconceptions by administering the anticipation guide activity. Once students have indicated their responses, demonstrate, if necessary, how to explore *G2C Online* to gather information about depression. Tell students to find out if their responses are supported or refuted on the website, and indicate the information that leads to their assessment of their answers in the G2C Information column of their *Anticipation Guides*. You may choose to go over answers with the class.

Assign students to expert groups, and then use student worksheet, *Part 2A: Depression—Breaking It Down*, to guide student research about different aspects of depression. After gathering information, all of the members of each expert group should discuss their answers and edit their notes to create their best agreed-upon answers.

Once the groups have agreed upon their answers, students should move to their assigned jigsaw groups. Using the worksheet, *Part 2B: Depression—More than Just Sad*, students share information in a *round robin*. If time permits, the class can discuss how understanding interactions among the different levels leads to a better understanding of depression and speculate on the directions of future research.

To do Part 2 in one class period, eliminate the jigsaw groups, and have expert groups report out while other members of the class fill in student worksheet *Part 2B*.

**Recommendations for evaluation:**

Collect student handouts and evaluate the responses.

Have students use the *DNALC Simple Mapper* to construct a concept map including the following terms: depression, serotonin, norepinephrine, SSRIs, ECT, amygdala, HTR2A, serotonin transporter, hypothalamic pituitary adrenal axis, pessimism.

**Suggestions for Extended Learning**

Create a brochure about depression for the general public using information from *G2C Online*. See the *DNA Interactive* website (www.dnai.org), *Teacher Guide: A Tour and Genetic Disorder Brochure, Student Worksheet* for the directions for creating the brochure. A scoring guide is also included.

View the PBS television program *Out of the Shadows*. Do you think that depression is adequately portrayed in the program? Why or why not?

View a popular film that features a character who is depressed. Note the behaviors of the character and treatment by other characters. Determine if you think the depiction is accurate.
Glossary

Adrenal glands: The adrenal glands are endocrine glands located atop the kidneys. The outer layer or cortex produces steroid hormones, such as cortisol which is a stress hormone. The core or medulla secretes adrenaline (epinephrine) and noradrenaline (norepinephrine) which prepare the body for “fight or flight” like the sympathetic nervous system.

Cingulate gyrus: The cingulate gyrus is an important part of the limbic system that helps regulate emotions and pain. It is thought to directly drive the body’s conscious response to unpleasant experiences. In addition, it is involved in fear and the prediction (and avoidance) of negative consequences.

Depression: Depression is a mood disorder characterized by intense sadness and disturbances in such psychological and physical processes as sleep, appetite, ability to concentrate, energy level, interest, and experiencing pleasure that impairs the person’s normal ability to function in daily life.

ECT: Electroconvulsive therapy (ECT) is a treatment for depression and (less commonly) bipolar disorder and schizophrenia. It involves the delivery of an electrical current through the brain while the patient is under anesthetic.

fMRI: Functional magnetic resonance imaging (fMRI) is a neuroimaging technique that takes snapshots of the brain to produce 3-D images of brain activity. Unlike standard MRI procedure, fMRI allows researchers to examine specific structures as they respond to various stimuli.

HPA Axis: The hypothalamic pituitary adrenal (HPA) axis is the system that controls the stress response. The hormone cortisol is intrinsic to this system.

Hypothalamus: The hypothalamus is a brain region that regulates a wide range of behavioral and physiological activities. It controls many autonomic functions such as hunger, thirst, body temperature, and sexual activity. To do this, the hypothalamus integrates information from many different parts of the brain and is responsive to a variety of stimuli including light (it regulates circadian rhythms), odors (e.g. pheromones), stress, and arousal (hypothalamic neurons release oxytocin directly into the bloodstream).

Limbic system: The limbic system is a group of brain structures including the amygdala, hippocampus, and hypothalamus that are involved in processing and regulating emotions, memory, sexual arousal, and response to stress.

Norepinephrine: Norepinephrine (also known as noradrenaline or noradrenaline) is a hormone and neurotransmitter that originates in the locus ceruleus (locus ceruloeus) region of the brain. It is released as part of the body’s response to stress and affects arousal and attention.

Pituitary gland: The pituitary gland is a small bulb at the base of the brain that
releases hormones such as corticotropins (ACTH) and endorphins. It is part of the endocrine system.

**Selective serotonin reuptake inhibitors (SSRIs):** Selective serotonin reuptake inhibitors are a type of antidepressant medication. SSRIs are thought to work by increasing the availability of serotonin to postsynaptic serotonin receptors.

**Resources**

*TV Program/DVD*

http://www.shoppbs.org/product/index.jsp?productId=3097517

*Book*

American Psychology Association
National Standards for High School Psychology

Standard Area IA: Introduction and Research Methods

Content Standard IA-3: Research strategies used by psychologists to explore behavior and mental processes

Standard Area VA: Psychological Disorders

Content Standard VA-1: Characteristics and origins of abnormal behavior

1.1: Distinguish the common characteristics of abnormal behavior.
1.2: Cite examples of abnormal behavior.
1.4: Describe major explanations for the origins of abnormality.

Content Standard VA-2: Methods used in exploring abnormal behavior

2.1: Identify the purpose of different research methods.
2.2: Characterize the advantages and limitations of different research methods for studying abnormal behavior.

Content Standard VA-3: Major categories of abnormal behavior

3.1: Discuss major categories of abnormal behavior.
3.2: Explore the challenges associated with accurate diagnosis.

Content Standard VA-4: Impact of mental disorders

4.1: Consider factors that influence vulnerability to abnormal behavior.
4.2: Discuss the stigma associated with abnormal behavior.
National Science Education Standards

Content Standard A: Science as Inquiry

- Identify questions and concepts that guide scientific investigations
- Formulate and revise scientific explanations and models using logic and evidence
- Recognize and analyze alternative explanations and models

Content Standard C: Life Science

The Behavior of Organisms

- Multicellular animals have nervous systems that generate behavior. In sense organs, specialized cells detect light, sound, and specific chemicals and enable animals to monitor what is going on in the world around them. Behavioral biology has implications for humans, as it provides links to psychology, sociology, and anthropology.

Content Standard G: History and Nature of Science

Nature of scientific knowledge

- Scientific explanations must meet certain criteria. First and foremost, they must be consistent with experimental and observational evidence about nature, and must make accurate predictions, when appropriate, about systems being studied.
- Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available.

Historical Perspectives

- Usually, changes in science occur as small modifications in extant knowledge. The daily work of science and engineering results in incremental advances in our understanding of the world and our ability to meet human needs and aspirations. Much can be learned about the internal workings of science and the nature of science from study of individual scientists, their daily work, and their efforts to advance scientific knowledge in their area of study.


**Answer Key**

*Part 1: Feeling Down*

Depending on the information a student gathers, answers will vary. The G2C information listed represents just some possible answers.

<table>
<thead>
<tr>
<th>Anticipation Guide: Statements About Depression</th>
<th>True</th>
<th>False</th>
<th>G2C Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depression is no different from getting the “blues,” and this is just a normal part of life.</td>
<td></td>
<td>X</td>
<td>Depression is outside the bounds of normal fluctuations of mood.</td>
</tr>
<tr>
<td>2. People who have been diagnosed with depression are depressed all of the time.</td>
<td>X</td>
<td></td>
<td>Depression lasts for at least two weeks, but may subside thereafter.</td>
</tr>
<tr>
<td>3. Depressed people are generally less aware that they are depressed than people who are close to them.</td>
<td>X</td>
<td></td>
<td>Some depressed people are not even aware of their own low mood.</td>
</tr>
<tr>
<td>4. Once a person has become clinically depressed, that person will always be depressed.</td>
<td>X</td>
<td></td>
<td>Once a person has a depressive episode, there’s a 50% chance he/she will have another.</td>
</tr>
<tr>
<td>5. Depression is a medical condition.</td>
<td>X</td>
<td></td>
<td>Depression affects physical processes such as appetite, sleep, and energy.</td>
</tr>
<tr>
<td>6. Most people with major depression commit suicide.</td>
<td>X</td>
<td></td>
<td>About 6% of depressed people commit suicide.</td>
</tr>
<tr>
<td>7. Most people involved in horrendous events, such as 9/11 or serious accidents or crimes, will become depressed.</td>
<td>X</td>
<td></td>
<td>The majority of people involved in horrendous events do not become clinically depressed, although many people do.</td>
</tr>
<tr>
<td>8. Talking about depression only makes it worse.</td>
<td>X</td>
<td></td>
<td>One type of treatment for depression is a “talk therapy.”</td>
</tr>
<tr>
<td>9. Depression is not a normal part of getting old.</td>
<td>X</td>
<td></td>
<td>Depression is not typical of healthy aging. It often accompanies illness such as Alzheimer’s.</td>
</tr>
</tbody>
</table>
Part 2a: Depression—Breaking It Down

Because G2C Online contains so much information, answers will vary widely. Some possible answers follow.

Expert Group: Genes

1. What evidence is there that different genes may be involved in causing depression? Give examples of some of these genes.

Because close family members of depressed individuals are more likely to become depressed than the average person, and identical twins have a concordance rate of 60-70%, scientists hypothesized that there is a hereditary component to depression. Genetic research has pointed to candidate genes for the disorder. Candidate genes include: “The serotonin transporter protein (5-HTT/SLC6A4) transports the neurotransmitter serotonin from synapses to presynaptic neurons. The serotonin transporter seems to be an important component in the physiological response to cocaine and amphetamines. It is expressed in the central and peripheral nervous systems. The 5-HTT gene has long (L) and short (S) variants, which are identifiable by the insertion or deletion of 44 base pairs close to the beginning of the gene’s transcription site. A study by Caspi and colleagues (2003) found that individuals with the shorter variant allele were more likely to become depressed following environmental stress. Additionally, Kaufman and colleagues (2006) found a three-way interaction between the presence of the allele, a BDNF polymorphism, and stress.”

“Brain-derived neurotrophic factor (BDNF) is mainly expressed in the central nervous system, particularly in the cortex, hippocampus, and forebrain. Neurotrophic factors promote the survival of neurons by preventing associated signals that initiate programmed cell death. Govindarajan and colleagues (2006) found that transgenic mice who overexpressed BDNF showed anxious behavior and had abnormalities in amygdala neurons that were similar to mice that experienced chronic stress. By contrast, mice who overexpressed BDNF showed decreased depressive-like behavior and healthy hippocampus activity that mimicked the effect of antidepressives. In 2003, a paper by Egan and colleagues identified a single nucleotide polymorphism in humans that causes an amino acid substitution from valine to methionine at codon 66 (V66M). The presence of this polymorphism was associated with depression under stressful circumstances. However, two large-scale studies in 2005 and 2006 failed to replicate this finding. There is some evidence that the V66M polymorphism may be a genetic cause for bipolar disorder.”

2. Explain why the identical twin of an individual with depression is likely, but not guaranteed, to develop the disorder.

Although genetic factors increase the risk of depression, heredity is not always a controlling factor. “The identical twin of a person with depression has only about a 60-70% lifetime risk.” Drugs, abuse, chronic medical illnesses and even some medicines increase the risk of depression.
Expert Group: **Biochemicals and Cells**

1. How is the noradrenaline (norepinephrine) system related to depression?

   *Stress causes the release of adrenal hormones such as cortisol which affects secretion and use of other adrenal hormones/signal molecules such as norepinephrine. Comparatively low levels of norepinephrine are associated with depression.*

2. Why are SSRIs used to treat depression?

   *Depression is associated with too little available serotonin in synapses. SSRIs prevent the reuptake of serotonin by presynaptic neurons which increases the availability of serotonin to postsynaptic neurons.*

Expert Group: **Brain Anatomy**

1. How might the brain of someone who has had numerous bouts of depression differ from the brain of someone who has never been depressed?

   *Because neurotransmitters are out of balance, parts of the brain function differently, and even the size of regions may change. In some studies, the hippocampus and amygdala were found to be smaller in people who had numerous bouts of depression.*

2. Which parts of the brain are most closely associated with depression? What are their functions?

   *The hypothalamus, which is involved in control of appetite for food and the sex drive, and the amygdala, which is involved in emotions such as fear, are associated with depression. Changes in the brain during a bout with depression are similar to changes resulting from intense, prolonged stress. Blood flow to the prefrontal cortex that controls judgement and executive functions is diminished.*

Expert Group: **Cognition**

1. Characterize the behaviors typical of people experiencing an episode of major depressive disorder.

   *People experiencing an episode of major depressive disorder typically seem sad and lack both energy and motivation. They have difficulty concentrating, have difficulty sleeping, lack interest in accomplishing normal daily tasks, and lack appetites for food and sex.*

2. “Pessimism is a hallmark of depression.” What does this mean?

   *This means that a defining characteristic of someone who is depressed is his/her tendency to expect the worst, to view the future as bleak.*
Expert Group: Environment

1. Explain the relationships among stress, HPA (the hypothalamic pituitary adrenal axis), and depression.

The HPA axis, or the hypothalamic-pituitary-adrenal axis, controls the stress response. People with depression have elevated rates of the stress hormone cortisol, which is produced by the adrenal gland (part of the HPA axis). Scientists are studying whether the increase of cortisol in response to stress causes depression, or if depression leads to increases in cortisol. It would appear right now the answer probably is some of each. Scientists are testing medications to block that increase in cortisol as a potential treatment for depression.

2. Provide evidence that depression probably results from the interaction of heredity and the environment.

Depression appears to be a complex disorder with many factors that increase its probability for a particular person. When one family member has had a depressive episode, other family members are more likely than the average person to have a depressive episode, but the probability is far from 100%. Even the concordance rate for identical twins is only about 60-70%. Factors that seem to increase the probability for a depressive episode include:

- Physical, sexual, or emotional abuse
- Medications such as beta-blockers for high blood pressure or pain relievers such as codeine
- Substance abuse
- Conflict with or alienation from close family members or friends
- Death of a loved one
- Major life changes such as birth of a child, divorce, retirement, moving or loss of income
- Social isolation
- Major physical or mental illness

**Part 2B: Depression—More Than Just Sad**

Students will fill-in the chart with their answers/information from Part 2a.