Lesson Overview

Students learn about symptoms of autism and difficulties inherent in diagnosing people with autistic spectrum disorders. By making observations of children with autistic spectrum disorders, learning about a family’s concerns, interpreting facial expressions, and hypothesizing about the causes of autism, students can empathize with individuals on the autistic spectrum and their families.

Description of Activity

*A Failure to Communicate* engages students with a case study and the constellation of symptoms associated with autism. In Part 1, students learn about a family where one twin has been diagnosed with autism and consider the possibility that his brother may also be on the autistic spectrum.

In Part 2, students explore twin studies that compare concordance rates among identical (monozygotic) and fraternal (dizygotic) twins.

Difficulties interpreting basic facial expressions are a common symptom for individuals with autism. In Part 3, students identify basic facial expressions using *Dissect-A-Face* (#866). They then explore *Reading Faces* (#867), where they are challenged to identify more difficult-to-discern facial expressions.

In Part 4, students access an interview with Mark Haddon, author of *The Curious Incident of the Dog in the Night-Time*, and design a quasi-experiment to test a hypothesis about autism.

All four parts of this lesson may be conducted sequentially, interchanged, or completed independently of each other.

Background

Autism is a spectrum disorder, which means there are different levels and forms of autism. It is difficult to define exactly what constitutes autistic behavior, and the threshold between “normal” and “autistic” is often not clear. The Diagnostic and Statistical Manual of Mental disorders (DSM) focuses on 3 primary symptoms of autism – social difficulties, communication difficulties, and repetitive behaviors. One of the social difficulties is an inability to interpret facial expressions. By using the *Reading Faces* tool, students can explore their own ability to read facial expressions. Individuals will differ in how well they perform on this tool, just as autistic individuals differ in where they fall on the autistic spectrum.

Research from twin studies provides compelling evidence that autism is a highly genetic disorder. A study by Bailey and Colleagues (1995) found that if an identical (monozygotic) twin had autism, there was a 60% likelihood that the other twin also had autism. For non-identical (dizygotic) this figure dropped to 0%. The search for
genes for autism has been difficult however, and there is no one single gene that has been definitively linked to the disorder. Instead, it seems that a number of interacting genes are involved in the disorder. Students can use the Chromosome Map of Disorders and Processes (#471) to explore some of the prominent genes associated with autism.

**Goals and Objectives**

Students will be able to:
- describe behaviors they observe
- analyze criteria used to diagnose autism
- empathize with individuals with autistic disorders and their families
- apply research on autism with respect to twin studies
- interpret facial expressions
- design a quasi-experiment to support a hypothesis
- explore genes associated with autism

**Assumptions of Prior Knowledge**

Students should have a basic understanding of the scientific concepts of an introductory or general biology course, or of an introductory psychology course at the secondary or post-secondary levels.

**Common Misconceptions**

Students often think:
- If one twin is autistic, then the other twin must also be autistic.
- There is only one form of autism.
- Mothers of autistic children rarely interact with their children.
- Autism can be cured.
- Most autistic children have an area of brilliance (savantism).

**Implementing the Lesson**

**Time Allotment**

Parts 1 and 2: 1 x 50-minute class  
Part 3: 1 x 50-minute class  
Part 4: 1 x 50-minute class

**Before Class**

Become familiar with Genes to Cognition Online (www.g2conline.org). Photocopy student worksheets:

*The Case Study*
- Part 1: A Failure to Communicate
- Part 2: Like Two Peas in a Pod?
- Part 3: Identifying Facial Expressions
- Part 4: The Hidden Face of Autism
During Class

Use student worksheet, *The Case Study*, to introduce students to James in this progressive disclosure case study. Using student worksheet *Part 1: A Failure to Communicate*, students observe a video clip of James, analyze differences in the DSM-IV and the ADI diagnostic criteria for autism, and consider the impact of autism on other family members.

Use student worksheet, *Part 2: Like Two Peas in a Pod?*, to guide students through the data analysis of a research study on twins and autism. Students answer questions comparing the incidence of autism among monozygotic and dizygotic twins and determine whether James’s twin brother John is likely to be autistic. Students will also research candidate genes for autism.

Using student worksheet, *Part 3: Identifying Facial Expressions*, students characterize simple facial expressions, construct mixed expressions using drag and drop features, and attempt to identify difficult-to-discern facial expressions to experience some of the challenges autistic individuals face.

Using student worksheet, *Part 4: The Hidden Face of Autism*, students observe an interview with Mark Haddon, author of a novel about a boy with autism. Students are asked to hypothesize about a given statement and to design a quasi-experimental protocol in order to test their hypothesis.

**Recommendations for Evaluation:**

Have students use the *DNALC Simple Mapper* to construct individual concept maps including the following terms: autism, autistic spectrum disorders, dizygotic twins, monozygotic twins, Asperger syndrome, case study, controlled experiment, quasi-experiment, and DSM-IV.

Use the *G2C Online Item Bank* to construct an evaluation based on this lesson.

**Suggestions for Extended Learning**


Create a brochure about autism for the general public using information from *G2C Online*.

Find examples on the Internet site regarding autism that address the following levels of organization: genes, biochemicals, cells, brain anatomy, cognitive behavior, and environment.
Glossary

**ADI:** ADI is an acronym for Autism Diagnostic Interview, a clinical diagnostic instrument for assessing autism in children and adults.

**Asperger’s disorder (AS):** Asperger’s disorder is an early onset developmental disorder on the autistic spectrum characterized by major difficulties in social interaction, and restricted and unusual patterns of interest and behavior.

**Autism:** Autism (or autistic disorder) is an early onset developmental disorder characterized by markedly abnormal or impaired development in social interaction and communication, and a markedly restricted repertoire of activity and interests.

**Autistic spectrum disorder:** Autistic spectrum disorder is the name given to the different forms and levels of what had been under the *umbrella* of autism, such as autistic disorder, Rett’s disorder, and Asperger’s disorder.

**Concordance rate:** Concordance rate refers to the number or percentage of members in a study group that share a common trait, e.g. the proportion of identical twins where both twins have autism.

**Dizygotic twins:** Dizygotic twins are fraternal twins, individuals that develop from two different eggs fertilized by two different sperms.

**DSM-IV-TR:** DSM-IV-TR (also known as DSM-IV) is an acronym for Diagnostic and Statistical Manual of Mental Disorders (4th Edition, Text Revised) published by the American Psychiatric Association. This widely used manual for mental health professionals classifies psychological disorders.

**Monozygotic twins:** Monozygotic twins are identical twins; genetically identical siblings who share 100% of their genes because they developed from a single fertilized egg.

**Quasi-experiment:** A quasi-experiment is a research method similar to a controlled experiment, but in which random assignment to groups is not possible. It can provide strong evidence suggesting cause and effect relationships.

**Pediatrician:** A pediatrician is a medical doctor who specializes in the diagnosis and treatment of children.

**Psychiatrist:** A psychiatrist is a medical doctor and only mental health professional who can prescribe medication or perform surgery in all of the states of the U.S.

**Psychologist:** A psychologist is a scientist who studies behavior and mental processes, generally has earned Ph.D. or Psy.D., and may be a clinician or researcher or both.
Resources

Video/DVD


Book


Articles


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.
Answer Key

Part 1: A Failure to Communicate

1. What behaviors does James display that are not typical of little boys with whom you're familiar?

   He engages in repetitive behaviors such as shaking his head and flapping his hands. He totally ignores the person he’s with and focuses only on the toys.

2. How do the diagnostic criteria of DSM-IV for autism compare with the ADI?

   They are very similar. Both describe qualitative impairment in social interaction, communication, and restricted repetitive and stereotyped patterns of behavior, interests, and activities that arise in early childhood as symptoms of autism. They differ in the specificity with which they describe symptoms. Examples of these will vary.

3. What aspects of James’s behavior, as described by his parents, seem to fit the DSM-IV diagnostic criteria of autism?

   James displayed impairment in social interaction when he didn’t look at his mother when he was breastfeeding, didn’t look at his parents when they talked to him, and didn’t respond to the sound of their voices. James doesn’t interact with other children and takes their toys.
   James displayed qualitative impairment in communication. He spoke few words and could not be understood.
   James displayed restricted repetitive and stereotyped patterns of behavior, interests and activities “in his own world,” such as banging toys against a table leg.

4. Why might James’s parents be concerned that John will develop autistic disorder?

   James and John are twins. Some disorders are more common in twins than in the general public.

5. What kinds of stress do you think are experienced by James’s family?

   Answers will vary. They may include time taken from other endeavors and each other resulting from additional care for James, inappropriate behaviors and negative reactions from James, monetary expenditures for specialists, negative reactions by others towards James and other members of the family, etc.
Part 2: Like Two Peas in a Pod?

1. Are James and his twin brother, John, monozygotic or dizygotic? How do you know?

   Dizygotic. Because James and John seemed to have different kinds of personalities and didn’t look alike from birth, and identical twins occur so much less frequently than fraternal twins, they are most probably fraternal or dizygotic.

2. Based on your own knowledge of biology, compare the genetic make-up of monozygotic twins with the genetic make-up of dizygotic twins.

<table>
<thead>
<tr>
<th>Monozygotic twins</th>
<th>Dizygotic twins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop from one fertilized egg containing 23 chromosomes from the mother and 23 from the father</td>
<td>Develop from two fertilized eggs, each of which contains 23 chromosomes from the mother and 23 from the father</td>
</tr>
<tr>
<td>Have the same genes as each other</td>
<td>Share about half of the same genes</td>
</tr>
</tbody>
</table>

3. Read all three screens of Autism and Twin Studies 1 (#869). Then, answer the following questions:

   a. If the reported samples on screen 2 represented all pairs of same-sex twins, and at least one twin is autistic, what would be a valid statement about the incidence of autism in males versus females?

      No difference between the concordance rate in males and females is indicated.

   b. The data table on screen 3, Concordance rates for autism among monozygotic and dizygotic twins, displays the percentage of monozygotic pairs or dizygotic pairs in which both individuals have been diagnosed with autism. How does the concordance rate for monozygotic twins differ from the concordance rate for dizygotic twins?

      The concordance rate for monozygotic twins is 60%, and the concordance rate for dizygotic twins is 0.

   c. Based on the diagnostic criteria for autism, a psychiatrist screened both James and John. James met the criteria for individuals with autism. John did not. If James and John had been included in this study by Bailey et al. (1995), where would their data have been entered?

      Their data would have been entered in the first box of the second column.

4. Next, access Autism Candidate Genes (#471) displaying a map of human chromosomes and the location of genes that have been associated with autism.

   a. Which chromosomes appear to have genes associated with autism?
Chromosomes 7, 12, 15, 17, 20, 22, and X all appear to have genes that are associated with autism.

b. Why do you think it is difficult to determine which genes are associated with autism?

Answers will vary. They may include the inability to perform controlled experiments on humans, the difficulty finding model organisms that closely approximate human behavior, the difficulty separating the results of heredity and environment on a particular behavior, the small number of families with a substantial number of individuals with autism who are also willing to participate in medical research over an extended period, etc.

c. How does the difference in concordance rate of autism in monozygotic twins, compared with dizygotic twins, support the hypothesis that autism has a genetic component?

When twins grow up in the same environment, the extent to which behaviors of monozygotic twins are behaviorally more similar than dizygotic twins reveals the contribution of heredity to behavior since monozygotic twins share the same genetic make-up, and dizygotic twins don’t.

5. Summarize: How is diagnosing autism different from diagnosing a broken (fractured) arm?

Although both autism and a broken arm can be childhood disorders that affect the ability to function normally, a broken arm can be examined and diagnosed relatively easily. A fracture rarely develops gradually, is usually accompanied by obvious pain, and can usually be seen with an x-ray. Autism, on the other hand, has a variety of symptoms that may appear over an extended period of time. No definitive test pinpoints autism.
Part 3: Identifying Facial Expressions

1. How might reading facial expressions be adaptive? (Remember: An adaptation is a structure or behavior that increases the organism’s chances of survival).

*Human beings are social animals who need to avoid danger and meet their biological needs. We need to recognize expressions so that we can, for example, stay away from someone who is angry, avoid a situation that produces fear or unhappiness, or engage in situations that evoke happiness. As we mature, we can interpret expressions in order to interact appropriately with friends, relatives, teachers, co-workers, employers, potential mates, or even strangers to maximize our chances of success in all aspects of our lives.*

2. How can misreading facial expressions lead to interpersonal problems? Give an example.

*Answers will vary greatly. Accept any reasonable answer.*

3. Describe how:

   a. the happy expression differs from the sad expression

      *In the happy expression, the corners of the mouth are raised, cheeks are raised, and eyebrows are relaxed; whereas in the sad expression, the corners of the lips are turned down, inner corners of the eyelids are raised, and the inner corners of the eyebrows are raised.*

   b. the angry expression differs from the fear expression

      *In the angry expression, the inner corners of the eyebrows are lowered, eyebrows are drawn together with vertical wrinkles between them, both eyelids are tense, and lips are pressed together; whereas in the fear expression, eyebrows are raised with inner corners drawn together, eyes are wide open with lower lids tense, and lips are usually tense but open.*

   c. Characterize the facial expression for surprise. In your characterization, describe the shape and positions of the eyebrows, eyes, jaw, and mouth. If you prefer, sketch your characterization of surprise.

      *Eyebrows raised and curved
      Eyes wide open
      Eyelids apart
      Jaw dropped
      Lips parted*
4. By dragging and dropping upper and lower parts of the face, create mixtures of expressions and suggest a real-life situation that might evoke each.

Some suggestions include:

<table>
<thead>
<tr>
<th>Upper</th>
<th>Lower</th>
<th>Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sad</td>
<td>Happy</td>
<td>You are leaving for college</td>
</tr>
<tr>
<td>Angry</td>
<td>Happy</td>
<td>Your coach is scolding you</td>
</tr>
<tr>
<td>Surprised</td>
<td>Happy</td>
<td>You won a prize</td>
</tr>
<tr>
<td>Angry</td>
<td>Disgusted</td>
<td>You have to clean bird waste off your windshield</td>
</tr>
</tbody>
</table>

5. Next, access Reading Faces. Generally, people can easily identify the six Dissect-a-Face expressions, but many people find it difficult to identify less basic expressions. People with autism find identifying emotions very challenging. Try identifying all emotions shown in the Reading Faces activity.

Students can observe up to 20 faces showing emotions.

a. How many did you observe? Answers can vary: 0-20

b. How many did you identify correctly (with your first “guess”)?
   Answers can vary: 0-20

c. Most people identify at least a few of the facial expressions incorrectly. If you identified some incorrectly, how do you think this helps you understand people with autism better?

   It can be frustrating when you can’t identify expressions right. Some students may say any of the following:
   - I started to get angry when I didn’t get the expression right.
   - I didn’t know what the expression was.
   - I didn’t know what the person was supposed to be saying.
   - I felt stupid.
Part 4: The Hidden Face of Autism

“There is this rather sort of joking wisdom... that autism and Asperger’s syndrome are just an extreme form of maleness.” Generate a hypothesis to test this assertion.

1. Generate a hypothesis to test this assertion.

   Answers will vary. Examples may include:
   - Males are less able to read emotion than females.
   - Males are less socially responsive than females.
   - Males are more comfortable doing mathematical calculations than females.
   - Males are more concerned with details than females.

2. Develop a protocol to test your hypothesis.

   The procedure will depend upon the hypothesis generated.

3. Would it be possible to perform a controlled experiment to test your hypothesis? Why or why not?

   A controlled experiment could NOT be performed because random assignment to the experimental and control condition is not possible. Any individual participating in the study cannot be assigned to be a male or female; that has already been determined. Research designs that are similar to controlled experiments, but in which participants are not randomly assigned are called quasi-experiments. Because of confounding variables (preexisting differences between the experimental and control groups), quasi-experiments cannot establish cause and effect relationships. Such research studies can point in the direction of cause and effect relationships.
Autism Item Bank – Answer Sheet

Correct answers are in italics.

1. One of the best ways to distinguish how much genetic and environmental factors affect behavior is to compare children who have
   e. The same genes but different environments

2. A population frequently studied to best assess the relative effects of nature (genetics) vs. nurture (environment) is
   a. Identical twins

3. Which of the following is typically cited as a characteristic of autistic children?
   c. Severely impaired interpersonal communication

4. DSM-IV is most helpful for
   c. Classifying psychological disorders

Please circle True or False after the following statements

5. If a twin is autistic, then the other twin must also be autistic. (False)
6. All autistic people have an area of brilliance (savantism). (False)
7. Autism has a genetic basis. (True)

Please respond to the following statements in the space provided.

8. Discuss whether nonverbal expressions of emotion are universally understood, and describe the effects of facial expressions on emotions.

   Answers will vary. Gestures seem to vary among cultures, but facial expressions appear to be more universal. Basic facial expressions of emotions such as happiness, sadness, surprise, disgust, fear, and anger seem to be universally understood. Some scientists have found that “faking” facial expressions can increase our likelihood of experiencing that emotion. We often respond to an emotional expression with empathy.

9. Biological research has generated knowledge used to diagnose genetic disorders in humans. Explain how a specific genetic disorder can be diagnosed. Your answer must include at least:

   • The name of a genetic disorder that can be diagnosed
• The name or description of a technique used to diagnose the disorder
• A description of one characteristic of the disorder

Answers will vary.
With respect to autism, observation of a group of behaviors delineated in DSM IV is generally used to diagnose the disorder. One characteristic of the disorder is repetitive behavior such as arm flapping.