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to the Classroom

The Brain, Habits and Food Decisions in Anorexia Nervosa

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The Brain, Habits and Food Decisions in Anorexia Nervosa

Students use experimental data and brain scans to model the interaction between the brain and food choices in anorexia nervosa patients.

Suggested duration

- 2 x 45 min class periods

Essential questions

- Why do anorexia nervosa patients make maladaptive food choices?
- What is the relationship between brain activity and food choices?
- How can we do a better job of treating anorexia nervosa?

Objectives

All students will...

- Develop a model, based on evidence, to illustrate the interactions between the brain and the digestive system in anorexia nervosa patients

Materials

- Projector
- Large blank paper
- Markers

Supplementary materials

- [Stuck in a Rut: The Neurobiology of Anorexia Nervosa slides](#)
- [Student sheet](#)

Based on

The Stavros Niarchos Brain Insight Lecture, “Stuck in a Rut: The Neurobiology Behind Anorexia Nervosa’s Stubborn Grip.” By Joanna Steinglass, MD

<https://www.youtube.com/watch?v=6wj7ybXpsUc>




Instructional Activities

Class 1

1. Do Now: Multi-item Meal Task and Figure Analysis Template | ⌚ 10min

 Use Student Sheet

 Use *Stuck in a Rut: The Neurobiology of Anorexia Nervosa* slides

- Describe the “Multi Item Meal Task” to the students.
- This is the test that was used to generate the data in the graph that students will analyze next. Describe how a person is asked to make choices in the test.

Important: *Don't ask students to take the test themselves - just describe it.*

 Show students slide 4


- Students use the four questions as a framework to analyze the graphs on “Figure Analysis Template 1” comparing the choices made in this task between controls and anorexia nervosa patients.

2. Tabletop Twitter | ⌚ 25min

 Use student sheet (*Tabletop Twitter protocol*)


 Show students slide 5

- Introduce students to the Tabletop Twitter protocol and instruct them to respond at least once to each of the prompts about anorexia nervosa.
- Note: students aren't actually tweeting! Use blank paper and markers to create a tabletop version.

 Show students the video clip: “Basics of anorexia nervosa” (slide 6) from **3:50 - 11:30**

- Have the students take notes on the lecture clip.
- After watching the video, students can respond again to the prompts, or reply to other “tweets” as a means of correcting or refining thinking.

3. Making Predictions 1: Food Choice Task | ⌚ 10min

 Use slides 8-12

- The “Food Choice Task” is another tool used by doctors and scientists to study decision making in anorexia nervosa patients. In this task, participants are asked to choose between a reference food on the left, and a variable food on the right, and to rate the degree of their preference.
- Describe the task to the students.

Important: *Don't ask students to take the test themselves - just describe it.*

- After describing the food choice task, ask students to predict what trend they would expect to see if this task were given to anorexia nervosa patients and healthy controls. Their predictions should be based on what they have learned about anorexia nervosa so far.
- After the students have made predictions, reveal the actual data (slide 14) so that students can see if it matches their predictions.



Class 2

1. Making Predictions 2: Brain Activity During Food Choice Task | ⌚ 10-15min


 *Use Stuck in a Rut: The Neurobiology of Anorexia Nervosa slides*

 *Show students slide 15*

Explain

- There is a difference between goal-oriented behavior and behavior that has become habit, and those different behaviors are controlled by different areas of the brain.
- fMRI is a technique that indirectly measures brain activity by measuring the changes in blood flow and oxygen use.

 *Use student sheet*

 *Use slides 16-17*

- Ask students to color in blank brains to predict results of fMRI performed on anorexia nervosa patients and healthy controls while undergoing Food Choice Task. Students should color the blank fMRI brains to make predictions based on what they have learned about areas of the brain involved in goal-directed and habitual behavior.
- Give students guidance where needed to help find those brain areas.
- After students have made predictions, reveal the actual data so that students can see if it matches their predictions.
- Discuss the predictions together as a class.

2. Making Predictions 3: Treating Anorexia Nervosa | ⌚ 10-15min

- Explain in general terms the difference between psychotherapy and REACH therapy.

- Ask students to use blank axes to predict the effectiveness of the two types of therapy on anorexia nervosa patients based on what they have learned so far. Then, reveal actual data so that students can see if it matches their predictions.

3. Wrap-Up and Assessment | ⌚ 15-20min

- Ask students to develop a model to illustrate the interactions between brain and eating behavior in healthy controls and anorexia nervosa patients.

TYPES OF ASSESSMENTS:

Student-created models can be used as an assessment of students' understanding.



Resources for Students

FIRST LEVEL	Reading - Nutrients in Food	https://healthy-kids.com.au/food-nutrition/nutrients-in-food/
	Reading - Eating Disorders	https://kidshealth.org/en/teens/eat-disorder.html
MEDIUM LEVEL	Reading - What are Eating Disorders?	https://www.nationaleatingdisorders.org/what-are-eating-disorders
	Reading - Anorexia nervosa	https://www.nationaleatingdisorders.org/learn/by-eating-disorder/anorexia
	Reading - What is fMRI	http://fmri.ucsd.edu/Research/whatisfmri.html
ADVANCED LEVEL	Scientific American article: Disrupting the Habits of Anorexia	https://www.scientificamerican.com/article/disrupting-the-habits-of-anorexia/?redirect=1
	Scientific American blog post: The Genetics of Eating Disorders	https://blogs.scientificamerican.com/observations/the-genetics-of-eating-disorders/
	Scientific American article: Brain Differences Help Explain Eating Disorders	https://www.scientificamerican.com/article/brain-differences-help-explain-eating-disorders/



Resources for Educators

Background Reading	
Nature article: Neural Mechanisms Supporting Maladaptive Food Choices in Anorexia Nervosa	https://www.nature.com/articles/nn.4136
Eating Disorder Organizations	
A full list of resources can be found here: https://www.eatingdisorderhope.com/information/resources-for-anorexia-bulimia-and-binge-eating-disorder	
AED - Academy for Eating Disorders	http://www.aedweb.org/
Alliance for Eating Disorder Awareness	http://www.eatingdisorderinfo.org/
ANAD - National Association of Anorexia Nervosa & Related Disorders	http://www.anad.org/
BEDA - Binge Eating Disorder Association	http://www.bedaonline.com/
EDC - Eating Disorders Coalition	http://www.eatingdisorderscoalition.org/
FOR-U - Focus on Recovery United, Inc.	http://www.focusonrecovery.org/site/
N.A.M.E.D. – The National Association for Males with Eating Disorders	http://www.namedinc.org/
NEDA - National Eating Disorder Association	https://www.nationaleatingdisorders.org/
NIS - NORMAL In Schools	http://www.normalinschools.org/



Standards

NEXT GENERATION SCIENCE STANDARDS (NGSS)	Practice 2. Developing and Using Models
CONTENT SPECIFIC CURRICULUM STANDARDS	HS-LS1-2



Vocabulary

Anorexia nervosa

An eating disorder characterized by three criteria:

- 1) maintaining an unhealthily low calorie intake and weight;
 - 2) intense fear of gaining weight;
 - 3) disturbance in body image.
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Carbohydrate

Nutrients that are mainly composed of carbon, hydrogen, and oxygen, such as sugars, starches, and fiber. Carbohydrates are mainly used by the body for energy.

Dorsal striatum

An area of the brain that is associated with habitual behavior and other functions.

Fat

Nutrients that are mainly composed of glycerol and fatty acids. The body uses fats for energy and also to build healthy cells.

Functional magnetic resonance imaging (fMRI)

A brain scanning technique that measures brain activity by measuring oxygen rich blood flow in different areas of the brain.

Goal-directed behavior

Behavior that is intentionally planned to meet a goal or reward.

Habitual behavior

Behavior that is not directly tied to a reward, but is engaged in out of habit.

Prefrontal cortex

An area of the brain comprising the cortex that covers part of the frontal lobe of the brain. The prefrontal cortex is involved in planning, decision making, and many other functions.

Protein

Nutrients that are mainly composed of amino acids. The body breaks down proteins and uses the amino acids to build its own essential proteins.



Sources

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Acknowledgements

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