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BRAIN
STEM

Bringing
Neuroscience
to the Classroom

Obsessive-Compulsive Disorder

Supported by:

ΙΣΝ SNF ΙΔΡΥΜΑ ΣΤΑΥΡΟΣ ΝΙΑΡΧΟΣ
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Obsessive-Compulsive Disorder

Students explore how scientists use model organisms to learn about human behaviors and disorders such as obsessive-compulsive disorder (OCD).

Suggested duration

- 1 x 45 min class period
- Lesson best used during second day in OCD unit or any day in a unit on scientific processes.

Essential questions

- Predicting scientific data: How do scientists use model organisms to learn about human behaviors and disease?

Objectives

All students will...

- Be able to predict and justify data.
- Draw conclusions based on data about OCD circuitry.
- Differentiate between obsessions and compulsions.
- Collaborate and come to consensus about data predictions.
- Analyze data and make conclusions about its importance to human health.

Materials

- Projector
- Smartphones or Chromebooks for [Socrative](#)
- Whiteboards
- Markers

Supplementary materials

- [OCD slides](#)
- Data sets
- Primary journal article:

[Repeated Cortico-Striatal Stimulation Generates Persistent OCD-Like Behavior. Science 1234-1239](#)

- [Student sheet](#)

Based on

The Stavros Niarchos Brain Insight Lecture, “Hope in the Face of Fear: Using Neuroscience to Transform Treatments for Anxiety and OCD.” By Helen Blair Simpson, MD, PhD

<https://www.youtube.com/watch?v=dQ5Tma9r6cl>



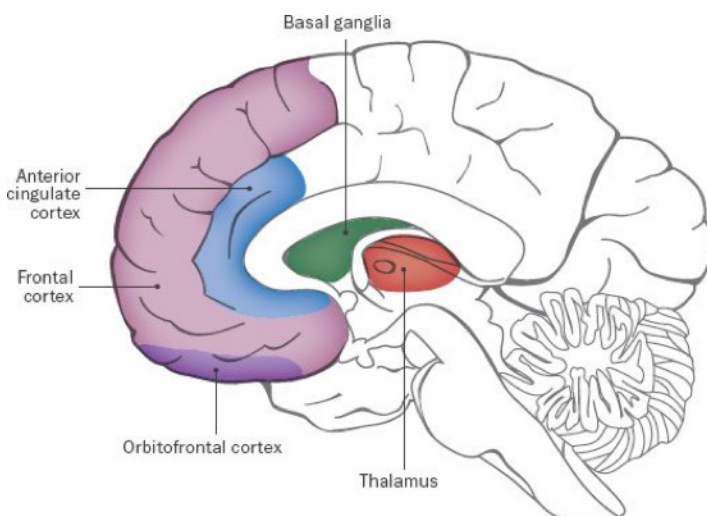
Background Information

Prior knowledge needed

- General brain anatomy.
- Major neural circuits and how they are modulated and connected
- Possible symptoms of obsessive-compulsive disorder (OCD).

Background information from [International OCD Foundation](#)

- While we still do not know the exact cause or causes of OCD, research suggests that differences in the brain and genes of those affected may play a role.
- Research suggests that OCD involves problems in communication between the front part of the brain and deeper structures of the brain. These brain structures use a neurotransmitter (basically, a chemical messenger) called serotonin.
- Pictures of the brain at work also show that, in some people, the brain circuits involved in OCD become more normal with either medications that affect serotonin levels (serotonin reuptake inhibitors, or SRIs) or cognitive behavior therapy (CBT).



Instructional Activities

1. Do Now/Introduction | ⌚ 10min

📄 Use student sheet

🖥️ Show students slide 2

- Check that students are familiar with how to log in to [Socrative](#) and respond in their pairs (<https://b.socrative.com/login/student/>)
- Students complete Bell Ringer activity (quick introductory activity that can be done right at the start of class) in groups on their student sheet and then digitally enter their best answer into Socrative:
 - What do you know about OCD? Give examples, explain what you think a day in the shoes of a patient would look like, etc.
 - How do you know what you know about OCD?
 - What additional information do you think you need to help treat patients with OCD?
- Teacher circulates and encourages students to complete their handouts.

🎥 If students need help identifying OCD behaviors, show them the video clip, "Obsessive-Compulsive Disorder." from National Geographic.

<http://www.natgeotv.com/int/taboo/videos/obsessive-compulsive-disorder>

- Have students identify and list OCD obsessions and compulsions from the video.
- As groups try to identify new information they could use to diagnose or treat at the cellular level, ask students, "What would happen if we removed one neuron from a circuit? How could this or a variation of this be used to diagnose or treat OCD?"



2. Mini-lesson | ⌚ 30min

Part 1 (5min)

- Review Bell Ringer with student groups by reviewing responses to what students think they know by calling on student volunteers or calling on students who have written responses teacher has previewed.
- Show Socrative screen to review ideas of more information students would like. Press students as to why they want this information.

Part 2 (10min)

 Use student sheet

 Show students slide 4

- Explain that students are previewing an Abstract of a Scientific Journal Article (which some people read last to prevent themselves from being swayed or unfocused, but for our purposes, it gives a nice overview) and they will answer questions to help guide them through.
- Guided Practice/ “We Do”: groups complete the questions about the abstract on the student sheet.
- Encourage students to share out any questions they have.
- Answer student questions from abstract aloud as called upon or assigned to respond. Ask students questions for clarification.
- Try to come to a consensus on possible experiment results.

Part 3 (15min)

 Use student sheet

 Use slides 5-10

- Circulate and help student pairs digest abstract and answer questions (see student sheet). Stress that they should focus on QMDC questions (Question, Methods, Data, Conclusions).
- Digging deeper/scaffolding questions to ask student groups:
 - Which circuits did not originally produce repetitive behaviors?
 - What did scientists change in order to observe mouse grooming?
 - How long did the increased grooming last after stimulation ended?
 - What are possible methods by which chronic fluoxetine could work to decrease OCD behaviors? (Think down to the neural circuitry, neurons and synaptic level as possibilities).
- Review answers with class. Call on volunteers and student groups assigned to specific questions. Allow students to ask any additional clarifying questions.
- Introduce methods and results sections. Review how the experiments were done, show slides with images of techniques, ask student how they think the apparatuses worked, and ask students to predict data on their student sheet.
- Circulate while students work on student sheet questions. Ask students why they expect a difference between control mice and those with stimulation to supposed OCD neural circuit.
- Prompt students to write their answers on whiteboards, and share their graphs and their explanations of the trend lines they drew.



3. Closing | ⌚ 5min

 Show students slide 11

- Ask student groups: What does this data tell us about OCD? If you were the scientists, what would you do next?
- Have students share out answers.

EXTENSION/HOMEWORK

 Have students watch this video:

<http://ed.ted.com/lessons/debunking-the-myths-of-ocd-natascha-m-santos>

Ask students to write answers and ideas to the following prompts:

- Conducting in vivo exposures in behavior therapy can often be difficult for those with OCD. Can you think of some of the barriers to treatment? Are there other ways that individuals can face their fears?
- What role can family members play in the progression of OCD symptoms? What role can they play in the treatment of individuals with OCD?
- In what ways does OCD affect school-aged youth? How can you incorporate treatment into daily life if you had a friend with OCD?

EXTENSION/EXTRA CREDIT

- Ask students to write a scenario about an individual with true OCD where the reader would have to identify the compulsions and obsessions.

EXTENSION

- Give students an index card with a compulsion they must complete by the end of class (wash their hands 5 times, write something on the board 10 times by the end of class, etc). Have them reflect at the end of class about how the compulsion interfered with their ability to focus in class and how this could impact someone who truly had OCD in how they carry out their daily lives.

TYPES OF ASSESSMENTS:

Student-created brain diagrams can be used as an assessment of students' understanding of brain anatomy and associated neurological functions.

For differentiation

- Use video clip to supplement Bell Ringer.
- Groups/pairings are intentionally heterogeneous groupings so that students can assist one another in the discovery process.

Feedback opportunities

- Directly to students during Bell Ringer.
- During group work predicting data
- Online to homework responses.



Standards

NEXT GENERATION SCIENCE <u>STANDARDS</u> (NGSS)	HS-LS1-2
	CC Systems & System Models HS-LS1-2
	Sci Engine HS-LS1-3
CONTENT SPECIFIC CURRICULUM <u>STANDARDS</u>	Standard 1: Key Ideas 1,2,3
	Standard 4: Key Idea 5
COMMON CORE STATE <u>STANDARDS</u>	Math Standard S-ID 1,2,7,9
	S-IC 1,2, 5
	English Standards R.H. 9-10.1-3, 7-9
	RST.9-10.1-2, 6-8
	WHST9.10.1



Vocabulary

Obsessive-compulsive disorder (OCD)

A common, chronic and long-lasting disorder in which a person has uncontrollable, reoccurring thoughts (obsessions) and behaviors (compulsions) that he or she feels the urge to repeat over and over.

Obsessions

Uncontrollable, reoccurring thoughts.

Compulsions

Uncontrollable behaviors that the patient has an urge to repeat.

Serotonin

A chemical produced in the body and the brain, also called 5-hydroxytryptamine.

Serotonin reuptake inhibitors (SRIs)

A class of drugs that are typically used as antidepressants in the treatment of major depressive disorder and anxiety disorders.

Cognitive behavior therapy (CBT)

A common type of talk therapy.

Ventromedial orbitofrontal cortex (OFC)

An area in the lower (ventral) region of the prefrontal cortex.

Hyperactivity

Abnormally high levels of activity.

Optogenetics

A method in which neurons are made light-sensitive in order to artificially increase or decrease their activity.



Sources

The Stavros Niarchos Brain Insight Lecture: Using Neuroscience to Transform Treatments for Anxiety and OCD.” By Helen Blair Simpson, MD, PhD

<https://www.youtube.com/watch?v=dQ5Tma9r6cl>

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