Lesson plan for the Brain Biopsychology unit

This plan addresses the following content standards from the National Standards for High School Psychology Curricula:

Students are able to (performance standards):

- Differentiate between the structures and functions of the various parts of the central nervous system
- Describe lateralization of brain functions
- Discuss the mechanisms and the importance of plasticity of the nervous system
- Describe advances made in neuroscience

DAY ONE of a two-day introduction to the brain

Intro with current events

Students will have taken notes on brain parts and functions from assigned pages in their textbook. The class is introduced with a PowerPoint slide that features brain-related stories that are currently in the news. The objective is to introduce students to modern research topics, to make connections to current events and the real world, and to help them begin to have conversations about the role of the brain in our everyday lives. Here is an example of the slide from 2016, which references football and CTE, lead in drinking water, and how solitary isolation affects the brain.



Review of brain parts and functions from notes

Students will have read and taken notes about brain parts and functions from their textbook in their homework the previous night. We will take a few moments now for general clarification if they have questions and to clear up any misconceptions they may have about brain functions.

Brain mnemonics from Michael Britt

I like to use cognitive techniques throughout the course, so to aid students in recalling so many various brain parts and functions I use the Brain Mnemonics packet created by Michael Britt of <u>www.thepsychfiles.com</u>. I pair students together and give them 10-15 minutes to use the mnemonics, followed by a brief oral review that I lead based on the mnemonics. We also talk at the end about what makes these mnemonics so powerful (Britt uses humor and vivid imagery, which make for very effective mnemonics).

Phineas Gage - from a story of loss to one of reinvention

For years I have used the video clip of the recreation of Phineas Gage's accident from the TV series The Brain, and I still continue to use it with some caveats. The video (found at

https://www.learner.org/resources/series142.html, episode 25) does a great job of portraying the accident, but leaves students with the impression that "Gage was no longer Gage." I then share with them more of the story that was revealed by psychology Malcolm Macmillan in his 2000 book *An Odd Kind of Fame: Stories of Phineas Gage*. (More information on Macmillan's site here:

https://www.uakron.edu/gage/) In the interest of time, I show them the following two slides that update the story of Gage's life in the 12 years that elapse between his accident and his death. I then discuss with the students how the story of Phineas Gage can be reframed not as a story of loss – where Gage is a victim of his damaged brain – to a story of reinvention – where because of his brain's plasticity Gage is able to learn new skills, live in another country, speak another language, and generally live a decent life until this death.

The new scoop on **Phineas Gage**

- 1. He resumes work on the family farm within four months of the accident, and seeks his old job as foreman within another four.
- 2. He adapts within two or three years to the vocation of "exhibiting," possibly managing his appearances, advertising, and travel independently, and probably re-learning lost social skills.
- 3. He works for Currier during 1851-1852, where he possibly learns stagecoach driving and builds on his social re-learning.
- 4. He is settled and reliable enough in his behavior for an employer to take him to Chile as a coach driver.



The new scoop on **Phineas Gage**

- 5. He works in Chile for 7 years in a highly structured occupation (possibly for just one employer) where he adapts to the language and customs, and uses the complex psychological and cognitive-motor skills required by his job.
- 6. Eventually his mental faculties are such that a doctor who had known him well sees "no impairment whatever" in them.
- 7. He is "anxious to work" after recovering from illness in San Francisco, and finds farm employment.
- 8. He continues to work even after his first seizure. Only now does he become unsettled and dissatisfied with a succession of employers.





As an alternative assignment, I will assign this excellent article from Sam Kean on Phineas Gage for students who want more information:

http://www.slate.com/articles/health and science/science/2014/05/phineas gage neuroscience case t rue_story_of_famous_frontal_lobe_patient.html

Brain Valentines

Because of the way my one semester course is organized, the biopsychology unit happens around Valentine's Day. As a way to celebrate the day and to serve as an exit ticket, I have students randomly draw a brain part, and then create a Valentine's card (of some sort) that shows they understand their part's function. Students tend to have fun with this! The brief directions are below, followed by some examples.

Brain Valentines

1) Your task is to create a valentine for a part of the BRAIN we have studied.

2) It has to be an actual physical thing – not a digital valentine. You're welcome to use the computer to make it, but it must be printed out and handed in.

3) It has to be in the style of a valentine card. (Feel free to search for images online to inspire you, but your valentine **must** be your own creation.)

4) It has to incorporate the brain part correctly – if you were to use the hippocampus, for example, you should be using the idea of "memory" in your valentine.

5) It should "look like a valentine" – turning in a solid black rectangle, or some pencil scribbled on lined notebook paper, won't cut it. (Be creative and/or funny and/or sweet and/or corny and/or romantic!)



Optional homework assignment: brain hats

Because my AP Psychology class is one semester, and this unit is covered in February, we almost always miss at least a day or two during this unit. For the past several years, then, I have given students a printed brain hat during the first part of the unit and encourage them to take them home, draw on them, color them, and in a sense use them as a "cheat sheet" on the upcoming test. If we do lose a day or two, then the students are allowed to use their brain hat on the test, but only if it's colorful and it is worn in class prior to the test. Below is an image from a few years ago of students in one class wearing their hats during the test, yet never take it off to use it as a cheat sheet – "Hey, Mr. Jones, I didn't even use it!" they say, and I smile.



DAY TWO of a two-day introduction to the brain

"Cupid's Disease"

We begin the second day with any questions they may have about the brain, then go into a reading of the story "Cupid's Disease" from *The Man Who Mistook His Wife For a Hat* by Dr. Oliver Sacks. This is a fascinating story for my students because it violates their expectations about older people and sexual activity, and they are intrigued by the idea that a long dormant virus can cause these feelings. It leads to a nice discussion for me about how the connections between our bodies and our brains. "Cupid's Disease" can also be retrieved from here: <u>https://cnaenglish.wikispaces.com/file/view/Cupid's+Disease.pdf</u>

"The mysterious workings of the adolescent brain"

http://www.ted.com/talks/sarah jayne blakemore the mysterious workings of the adolescent brain

Because I have the one semester, I often choose activities that can reach into more than one unit, and this TED Talk by psychologist Sarah-Jayne Blakemore does this brilliantly. As a working researcher, Blakemore gives a great talk about her lab's work and the way they try to determine how adults and adolescents think differently. But she also explains the development of the concept of adolescence, the malleability of the teenage brain, and the notion that this period should be seen as one "for education and social development," and not as a time to stigmatize teens for poor behavior. One assignment I've used with this video (as an quiz grade, with students using notes they took during the video) is below:

AP Psych "The mysterious workings of the adolescent brain" - TED Talk by Sarah-Jayne Blakemore

1) According to Blakemore we have a much better sense of what brains are like in the last decade or so because of advances in brain imaging technology. What type of brain imaging technology did she specifically refer to?

2) Dr. Blakemore focused primarily on one specific part of the brain. Draw a small image of a brain, and then shade in the part that she's talking about. Be sure to name it. (Hint: the word **lobe** is not in the answer.)

3) She says the part (in #2) is involved in "a whole rang of cognitive functions," and then she lists nine examples. List any two of the nine examples she provides.

4) Dr. Blakemore describes how the volume of gray matter in the brain "increases during childhood [and] peaks in early adolescence." After that, she said, "there's a significant decline in gray matter volume in prefrontal cortex." What is the name for this "elimination of unwanted synapses"?

5) What sport did she talk about when she showed a photo of player and fans reactions during a game? The next few questions are about the "shelves" experiment. Blakemore's team had two different versions of this experiment: in one you were to follow the instructions of the director (who was behind the shelves) and in the other there was no director. In the latter group the participants were just told to ignore objects with the dark gray background.

6) What was the experimental group and control group in this experiment?

7) What was the independent variable? 8) What was the dependent variable?



"Between late childhood and mid-adolescence, there's an improvement, in other words a reduction of errors, in both of these trials, in both of these conditions. But it's when you compare the last two groups, the mid-adolescent group and the adult group where things get really interesting, because there, there is no continued improvement in the no-director condition. In other words, everything you need to do in order to remember the rule and apply it seems to be fully developed by midadolescence, whereas in contrast, if you look at the last two gray bars, there's still a significant improvement in the director condition between mid-adolescence and adulthood; and what this means is ... ____"

9) Can you explain (in one sentence) what she means about what adolescents are still not quite good at?

10) She told a story about a friend who had daughters. When they were young he would do something and it would improve their behavior, but when they became adolescents, the same thing "became a threat." What was the dad doing?

- 11) Name the author she quoted who described adolescent behavior in "The Winter's Tale."
- 12) What area of the brain goes in the blanks below? (Yes, it's two words.)

"So the _______ is right deep inside the brain, and it's involved in things like emotion processing and reward processing. It gives you the rewarding feeling out of doing fun things, including taking risks. It gives you the kick out of taking risks. And this region, the regions within the ______, have been found to be hypersensitive to the rewarding feeling of risk-taking in adolescents compared with adults ...

13) "And that's still the case for many, many teenagers around the world today. Forty percent of teenagers don't have access to secondary ______. And yet, this is a period of life where the brain is particularly adaptable and malleable. It's a fantastic opportunity for learning and creativity." What goes in the blank?

14) "So what's sometimes seen as the problem with adolescents — heightened risk-taking, poor impulse control, selfconsciousness — shouldn't be stigmatized. It actually reflects changes in the brain that provide an excellent opportunity for education and social development." What does she mean here by <u>stigmatized?</u>

"Mr. Split Brainy"

Students often struggle with understanding what a split-brain patient can say or touch (with a specific hand), so at this time students go in pairs to the activity "Mr. Split Brainy." Created by the Nobel organization (in honor of Roger Sperry's 1981 Nobel Prize), this is a fun and creative way to get students to think through the possible outcomes for a split-brain patient. While some students may prefer to do this independently, I prefer having them do this assignment in pairs so they can talk through the questions that arise as they play the activity. The URL is:

http://www.nobelprize.org/educational/medicine/split-brain/

TED-ED Brain Videos/jigsaw

If time permits, I assign students to watch one of four TED-ED videos about the brain (below). Each TED-ED video is between 4-5 minutes, is creatively depicted, and contains both multiple choice and short answer questions. Students in each group watch the video, take notes, and select two of the multiple-choice questions they feel are the best. Students then rotate groups, so that each group contains members of two videos (A/B and C/D the first time, then A/C B/D, finally A/D B/C). By using the jigsaw method, each student is responsible for sharing complete information about the full video they watched, and they get to learn about three others they didn't watch. The eight multiple choice questions can then be reviewed (individually, in groups, or as a class) to check for understanding.

* A) What percentage of your brain do you use? - Richard E. Cytowic <u>http://ed.ted.com/lessons/what-percentage-of-your-brain-do-you-use-richard-e-cytowic</u>
* B) What happens when you remove the hippocampus? <u>http://ed.ted.com/lessons/what-happens-when-you-remove-the-hippocampus-sam-kean</u>
* C) How sugar affects the brain <u>http://ed.ted.com/lessons/how-sugar-affects-the-brain-nicole-avena</u>
* D) How stress affects your brain <u>http://ed.ted.com/lessons/how-stress-affects-vour-brain-madhumita-murgia</u>

End of day two video: Beautiful 3-D Brain Scans Show Every Synapse

I show this five minute video at the end of the brain unit for two reasons. First, I like for my students to be awed by the technology that allows us to see more details about the interior of the brain. But second, I love these comments by Harvard's Jeff Licthman about how much we know about the brain. He says "Understanding that everything we needed to know about the brain is one mile long, how far have we walked?" I stop here and have my students turn to their neighbor and each make a guess. I then resume the video, and Licthman gives the answer: "I think about three inches." I then have the students talk to their neighbor again about this claim, and then we have a brief discussion as a whole class. What are some things we feel like we know, and what are the areas where we don't know as much? We then continue the video and see how these researchers are exploring the brain and using technology to reveal the structure and function of the brain. The video is found here:

http://video.nationalgeographic.com/video/magazine/ngm-3d-brain

The Zombie Menu Project

I created this simple project several years ago and still like to use it with my students because - zombies! The simple directions are posted below:

Restaurant for zombies (new!)

For this option you will need to design a menu for a restaurant for zombies. As you know, zombies are fond of eating brains, and your goal is to create seven mouth-watering brain dishes for them to enjoy. Your menu must be in printed form when it is submitted, but you can either design it digitally or by hand.

You will need to show a page from your restaurant's menu that shows the seven dishes. The name of your restaurant should be prominent on the menu page and the name of the restaurant must be creative – think of a name that would be attractive to zombies. Each of your seven dishes must reflect a different part of the brain and be creatively named: why, for example, does Outback call its chicken dish Alice Springs Chicken?

Be sure the name matches the function of the brain part as well. Each of the seven dishes must include something about the function of that part, and will need to be described in an attractive way so that a zombie will look forward to the dish – that is, don't just mention that you are serving pituitary lobe, but perhaps "grilled pituitary that grows in your plate over a bed of sautéed jasmine rice." You need to have pictures of three of the dishes as well.

Rubric	Spot on!	Somewhat	Um, no.
Is the name creative and	(3)	(2-1)	(0)
appropriate for a zombie			
brain restaurant? (3)			
Do the dish names and	(20-18)	(17-14)	(13-0)
descriptions reflect that you			
know the function of each of			
the seven brain parts? (28)			
Do the three dishes that are	(20-18)	(17-14)	(13-0)
pictured depict the dishes			
well? (12)			
Is your zombie menu	(7)	(6-4)	(3-0)
colorful and neat? (7)			



Philly Cheese Medulla: Shaved \$8.99 medulla seasoned with brain juice and cautéed 'Bhilly other' with arilled

and sautéed 'Philly-style' with grilled onions then topped with a rich cheese sauce. Served on a toasted roll will have your heart racing.

Grilled Jalapeno-Lime \$10.79 Amygdala: A hearty portion of grilled chipotle-lime amygdala and salsa tossed with lime-juice. Served on a mix of grilled zucchini, tomatoes, onions & red peppers with steamed white rice will have you fearing the next bite.

