**Advanced Methods in Neuroscience: Instructor Guide**

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| \***Theme**: | Neuroscience research techniques used in the lab |
| \***Objective**(s):*(What key learning do you want students to come away with?)*  | Understand some of the fundamental experimental techniques neuroscientists use in the lab to study the brain.  |

 **LESSON OUTLINE:**

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| **1. Introduction:***Plan a script of what you will say to start.**- What will this be about? Why’s it interesting?* *(Hook)* | Introduce yourself and what you do in the lab!Q: What do you guys know about the brain? What is it made of? How does it work? What are action potentials? |

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| **2. Building Background:***List questions you can use to immediately engage your audience and prepare their thinking for your activity.**-What prior knowledge might they have about/related to your topic?* *-What prior knowledge (background) do they need for your activity?* | Q: What does the brain do?A: The brain and the nervous system that it controls is responsible for many things—controlling subconscious things like breathing, walking, reflexes, and complex parts of human existence like emotions, language, and memory. Q:How can it do those things?A: By taking in information from our surrounding! The rain takes information, processes it, which allows you to behave or react. You perceive head and pull back your hand. You listen to someone talking, and you talk back. Generally, things come in and you put something out into the world or inside yourself (like a memory or internal decisions). BUT THE BIG QUSTION TODAY IS:**How can we study the role of the brain? How do we know what the brain does?!** |

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| **3. Lesson & Activity:***Outline the key components of your lesson.***Plan/Note**:- key ideas/ vocabulary- scaffolds - images/media- extension questions\*Consider how to best deliver your content! \*Plan interactive components that encourage active thinking in your students. | **Old Techniques in Neuroscience*** **Lesioning**: Go over Flouren’s pioneering work in lesioning rabbits and pigeons. Showed that different parts of the brain have different functions through localized lesioning—which is called localisationism.
* **Broca**: Neurologist with patients that has site specific lesions and behavioral deficit. They could understand language spoken to them, but would not produce speech themselves.
* **Golgi Staining: seeing the neuron.** If we looked at your brain right now, we wouldn’t be able to see any specific cells. Just a big hunk of matter. So, Golgi developed a technique where we could stain individual cells. This work went on to win a Nobel Prize.

**New Techniques in Neuroscience*** **Immunohistochemistry:** selectively stain specific proteins and cell types.
* **Electrophysiology:** Recordings of the electric language transmitted from one neuron to another through action potentials! We can see when cells are active during behavior.
* **Optogenetics** : We can manipulate the cells of the brain, making them active or inactive. Look at the role of specific populations of neurons in various behaviors.
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| **4. Wrap Up:***- Review key ideas**- Share takeaways and final thoughts**- Discuss connections to other questions and ideas. Extensions.**- Ask: Who could you teach what you learned here today?**- Ask/Suggest: What can I do to learn more?* | There is always new techniques evolving! There is live imaging of entire regions. With this we can look at populations of cells, not just single ones. Also, full tissue clearing allows for a complete 3D rendering of cells in the brain.  |

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| **MATERIALS NEEDED: *\*\*(please list all items and quantities necessary for preparation)*** |
| Powerpoint presentation, Brain Bank.  |

\*\*attach any printouts to end of document here

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| **Other Notes**  |
| Let students look at the brain bank after the lecture. Answer questions! |

**Extra Resources: If time permits, also have students do the “Action potential skit” activity.**