**ACTIVITY TITLE: Brain Bank**

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| \***Theme**: | Brain Anatomy |
| \***Objective**(s):  *(What key learning do you want students to come away with?)* | The objective is to show students what an actual brain looks like- its size, weight, structure, and explain what the brain is made up of in addition to how a human brain compares to other animal brains. |

**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)* | [Point to human brain] This is a real human brain that was donated to science for educational purposes. It has been plastinated using the technique that you might have seen in the Bodies Exhibit—all of the water is gone and the fats were turned into a plastic material to harden and preserve it. This three-pound organ is responsible for everything that makes you “you”: your behavior, your personalities, your memories, and your hopes for the future. Do you have any questions about the brain? |  |

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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?* | You can see there are a lot of folds and grooves in the human brain. These folds and grooves, called sulci and gyri, increase the surface area of the brain of the outer layer of the brain, the cerebral cortex. In a human brain, the cortex flattened out would be the size of a pizza, but the folding allows it to fit in our skulls. All that surface area is important because a lot of our most complex thoughts and behaviors come from the cortex.  It’s common to split up the brain into lobes, which you can see color-coded on this plastic brain and also in this picture. Can you see the lobes on the real brain? The brain can be split up into these lobes simply based on the shape of the brain, but they also have different broad functions that can be attributed to them. You can see that one the first brain picture, and in the second picture you can see the parts of the brain that are responsible for our five senses. |

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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. | The activity is allowing people to touch the brain with a glove on, and engaging in a discussion about the human brain and animal brains. Below are a few standard questions and answers to share with the students. More questions and talking points can be found at the end of the guide.  Q: Why can we study animal brains to understand how the human brain works?  A: The basic building block of the brain (neuron) is found in both kinds of brains. Remarkably, a lot of the structures and functions are the same in animal and human brains. These similarities allow us to study animal brains and better understand how human brains work (both healthy and diseased).  Q: How many brain cells are in the human brain?  A: Estimated to be ~ 80-100 billion  Q: Why does the human brain have folds?  A: More surface area! The entire brain surface unfolded would be the size of a large pizza.  Q: What is different about animal brains and human brains?  A: Size, folds in cortex, olfactory bulb size, etc.  \*good time to show the different animal brains, compare their anatomy and discuss why it might be useful, for example, for a rodent to have a large relative olfactory bulb. |

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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?* | Let’s look back at the human brain that was donated to us. Basically everything you do is because of your brain. What you see, how you move, what you think, how you feel. This is all done by your brain. And now you know what your brain actually looks like!  Can you name the different lobes and what they are responsible for?  If you were interested in studying vision, which part of the brain would you study?  We talked about similarities and differences between the human brain and some animal brains. Why might you want to study an animal brain? |

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| **MATERIALS NEEDED: *\*\*(please list all items and quantities necessary for preparation)*** |
| The brain bank (includes human, sheep, rat, mouse brains), brain block (fish, frog, snake, pigeon, rabbit), box of gloves, plastic brain model, (only volunteers can pick up the human brain, visitors can touch with a glove) |

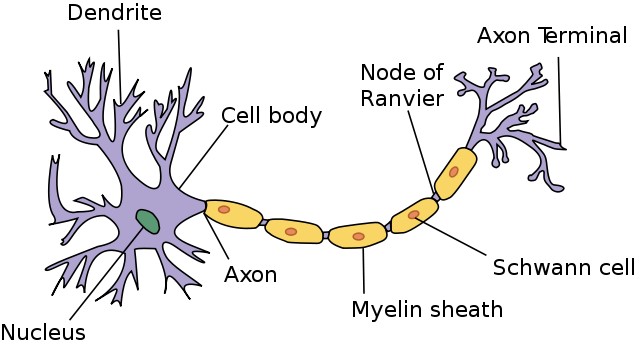
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| **Other Talking Points and Questions:** |
| **What similarities and differences do you see between these brains?**  Similar: oblong shape, link to spinal cord, brain stem, cerebellum  Different: size, presence/absence of cerebral cortex or amount of folds in the cortex  **Are bigger brains better?**  Depends on how you define better. Animals evolve to fit perfectly in their environment. A bigger brain might be too metabolically costly for an organism to survive in its environment, so in that case a smaller brain is better. Bigger brains allow organisms to do more complex behavior – to learn and remember where food is, to raise young, to live with other members of the same species, and all of these things can promote survival.  **What is the knob on the front of the rodent brains?**  Notice the white protuberance on the rat and mouse brains—it’s called the olfactory bulb and it sits right above the nose. We have an olfactory bulb (actually two – one on each side), but ours is small compared to the size of our brain. In a rat or mouse, the olfactory bulb is quite large compared to the size of the brain. Why do you think that is? (various answers could be true. The point is that rodents and certain other mammals rely on smells to interpret their environment. Vision is not particularly detailed in a rat or mouse compared to humans, which makes sense since rats and mice spend much of their life in the dark where vision isn’t helpful.)  **Mouse brains at different ages**  Show how brain grows as animals grow. Even when brains reach full size, they are still changing internally. In humans, the brain reaches full size at about age 8 but the internal architecture isn’t mature until over 20 years of age. Furthermore, we continue to make some new neurons into old age, showing that it’s never too late to learn new things.  **Why do we use animals for medical research?**  Even though brains come in a variety of sizes from brains even smaller than what you can see here (for example, in a fruit fly) to even larger than a human brain (elephant, blue whale), the basic building block—the neuron—of the brain remains remarkably similar. Studying how neurons work in other brains can tell us fundamental things about how our own brains work, and ultimately this knowledge can lead to brain diseases and disorders.  **Comparative brain block**  This set of brains can be used to point out how eyes vary some in size but the brains vary widely. Get people to think about the significance of this (possible answer: bigger eyes don’t confer an evolutionary advantage, but bigger brains can). The brain block is useful for showing how the basic parts of the brain—spinal cord, brain stem, cerebellum, cortex—can be observed in different species.  **The Plastinated Brains**  This human brain was donated to science and is on loan to the American Museum of Natural History from the University of Toledo Plastination Laboratory. The brain has been plastinated, a process of replacing the water and fat with silicone. This brain is slightly smaller and more rigid than when it was in the body. A brain in the body is soft enough to cut with a butter knife.  We don’t know anything about the person who donated this brain to science, and we can’t tell from looking at the brain whether it came from a man or a woman. Based on the size, we surmise it came from an adult. Based on the appearance of the folds of the brain (the gyri), we surmise the person was not of extremely advanced age nor had advanced Alzheimer’s disease, both processes that result in a thinning of the folds of the brain.  Details on organ plastination: The body is embalmed using formaldehyde and the organ of interest is dissected out. The organ is then placed in a bath of acetone, which forces out all of the water in the tissue. The dehydrated organ is then placed in a bath of liquid silicon in a vacuum chamber. Under low pressure and at a low temperature, the acetone slowly boils off and is replaced by the silicone. The entire process takes over two months for a human brain. |

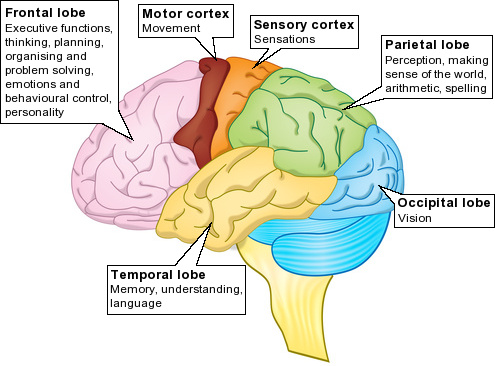
**NOTES:**

Print out these anatomy images for your own use and further explanations!

Neuron:



The lobes of the brain:



Labeling the senses:

