Brain Bank:

What you have: Human, sheep, rat, mouse, brain block (fish, frog, snake, pigeon, rabbit)

Talking points

Human brain

Note, only volunteers are allowed to pick up the human brains. Visitors may put on a glove and touch the brain, but do not let them pick it up. These specimen are very delicate and would shatter if dropped. Please remember to wear gloves at all times when holding the brain. It may be a little smelly, but the biggest danger is actually the oils of your skin damaging this precious artifact.

For someone just walking up and ready to listen, try to give 2-3 interesting facts and then end with an open ended question to let the viewer direct the conversation. For example:

"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?"

In describing what the brain looks like:

"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. Do you have any questions?"

- By the numbers
    - Weight: 3 lbs
    - # neurons: 80 billion
    - Estimated length of all myelinated axons in an adult brain: 176,000 km (enough to wrap 4.5 times around the equator!)
- Comparisons with other animals
    - not the biggest brain (smaller than elephant, blue whale, and dolphin)
    - larger than other primate brains
    - organization very similar to other primates, but more folding of the cortex and bigger PFC (although the "bigger PFC" evidence is sometimes contested)
- External surface of brain:
    - Cortical folds (if you unfolded all the gyri, you would get a "sheet" of brain about the size of a large pizza)
    - PFC indentations over eyes – pointing these out help orient the viewer
    - Lateral fissure: two parts of cortex are not connected
    - Cerebellum: balance, coordination, learning (but also higher cognitive functions like language). The medial parts of the cerebellum control the medial parts of the body (e.g. balance and trunk muscles) while the lateral parts control distal parts of the body (e.g. precise finger movements)
    - Brain stem: basic functions of the nervous system like digestion, heart rate, breathing, eye reflexes
    - In the case of major damage to the brain stem and spinal cord, even a fraction of an inch makes a difference in terms of paralysis and other effects on bodily function
    - Optic chiasm: neurons from the eye traveling to the brain. Just like the right side of the brain controls the movement of the left side of the body (and vice versa), the right side of the brain processes the visual

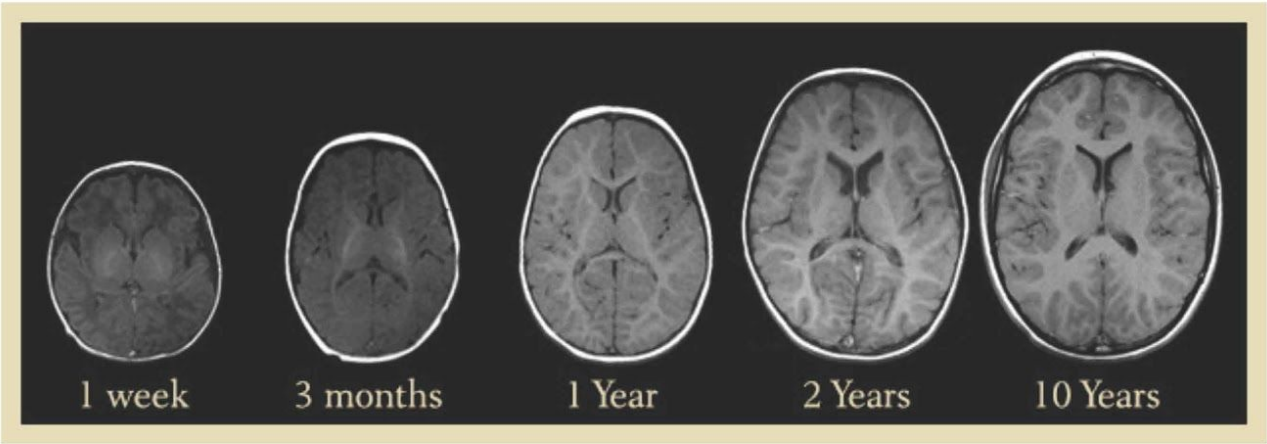
information from the left side of the body (and vice versa).
    - Occipital lobe: The concept of “seeing stars” after being hit on the head comes from the fact that the occipital lobe hitting the back of the skull will cause the neurons to randomly fire just because of pressure. So little spots of light or dark appear in the visual field
    - The neurons of the cortex communicate extensively with each other and with neurons in the internal regions of the brain. We have a mature brain in terms of # of neurons by the time we are a toddler. But as we grow up, the connections between these neurons extend and mature. Connections aren’t fully realized until early adulthood. In particular, connections between the PFC and the striatum (motor regulation) are still developing during adolescence. Some scientists think that’s why teenagers are still learning to control their impulses.
- What you can see in a hemisected brain:
    - Notice how cortex folds in on itself – not cut
    - Corpus callosum
    - Different textures and colors apparent on cut surface according to how much white matter/gray matter and orientation of cells
    - See cavern of lateral ventricle. Ventricles hold the fluid that bathes and protects the brain. Brain floats in cerebral spinal fluid. If it didn’t float, its own weight would crush the cells on the bottom of the brain
    - CSF and other layers of brain protection aren’t perfect: concussions can happen when the brain bumps against the skull.
- The Developing Brain and Fruit Comparison.

  Two ways to approach this section: 1) Ask visitors to guess how much our brain weighs at 1 week, 1 year, and 10 years old. Give them the fruits to hold to compare. 2) Give the visitors the fruit to hold and ask at what age they expect our brains to weigh that much. Reveal that our brains weigh as much as an apple

at 1 week, a grapefruit at 1 year, and by the time we are 10 and above, our brains are the weight of a small cantaloupe.

- 1 week = medium apple = .8 lbs
- 1 year = small grapefruit = 2.1 lbs
- 10+ years = medium cantaloupe = 3.1 lbs

Human Brain Growth



Size Compared to Adult Brain

1 week	3 months	10 Years
25 %	60%	99%

Average Weight

1 week	3 months	10 Years
370 grams (0.8 lb) medium apple	960 grams (2.1 lb) small grapefruit	1400 grams (3.1 lb) medium cantaloupe

Developmental Events

Animal Brains:

For someone just walking up and ready to listen, try to give 2-3 interesting facts and then end with an open ended question to let the viewer direct the conversation.

Review the points below and feel free to add your own. Think about how you would like to begin the conversation according to your own research and interests.

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.