



## Neuroanatomy

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**Objectives:**

- Learn about basic neuroanatomy including:
  - organization of the lobes of the brain and their functions
  - sulci and gyri
- Compare and contrast neuroanatomical features of different species to gain a sense of scale and learn about how the brains of different species are adapted for certain functions

**Materials and Supplies Needed:**

Item	Quantity	Notes (Vendor, price, purpose, etc.)
Preserved sheep brains	4	Carolina Biological Supply - Carolina's Perfect Solution (nontoxic) Item # 228703 \$12/ea
Gloves	Several boxes	Various sizes (S, M, L, XL) ~\$20/box - various vendors including VWR, carolina biological supply
Bench paper or absorbent pads		For clean working surface
Hand sanitizer	1	~\$5/bottle Walgreens, CVS
Preserved brains of various species (e.g., mouse, rat, rabbit, pig, dog, cat, monkey)		These are borrowed from labs and other scientists so use what is available. These are <b>for-show only</b> . Participants are absolutely not allowed to handle these since they need to be returned and are often in formaldehyde. Handle with care.
Index cards		Have one labeled with each species of brain for matching game
Trash bag	1	For disposing gloves

**Background Information / Activity Explanation:**

The brain is the most complex organ in the body. The brain serves as the center of the nervous system and is responsible for controlling pretty much every aspect of the human body. The shape and size of the brains of different species vary greatly, and identifying common features is often difficult. Nevertheless, there are a number of anatomical features of the brain that apply across a wide range of species. Some features are common to almost the entire range of animal species; others distinguish "advanced" brains from more primitive ones, or distinguish vertebrates from invertebrates. The simplest way to gain information about brain anatomy is by visual inspection. We will aim to highlight these points through 2 activities: 1) Hands-on examination of preserved sheep brains and 2) Comparative neuroanatomy

**Procedures:**

1. Hands-on examination of preserved sheep brains  
 Obtain several sheep brains that are preserved in a nontoxic fixative so that the guests can handle them. These can be purchased at a reasonable price from Carolina Biological Supply. It is recommended to have several whole brains and several brains that have been sectioned

coronally and sagittally. Before the activity begins, instruct participants on the proper way of putting on and removing gloves.

Wearing gloves, let participants touch and pick up the sheep brains. Describe the major neuroanatomical features and the functions associated with each.

Some key features to point out:

- Hemispheres
- sulci and gyri - explain the sulci and gyri allow greater surface area of the brain
- cerebellum - describe importance in smooth movements + motor learning
- lobes - frontal, parietal, occipital, temporal - describe general functions associated with each lobe
- optic chiasm - for visual processing
- corpus callosum - allows the two hemispheres to communicate
- ventricles - contains cerebrospinal fluid that bring nutrients + clears waste
- hippocampus - important for memory

Once finished, have participants remove gloves properly. Dispose used gloves in appropriate waste container. Provide hand sanitizer or soap/water to let participants wash their hands afterward.

## 2. Comparative Neuroanatomy

From various research labs and partners, borrow preserved brains from different species of animals (e.g., mouse, rat, rabbit, pig, cat, dog, monkey, and human) that are placed inside jars filled with fixative. Since these are borrowed, need to be returned, and are often preserved in a toxic fixative, participants are not allowed to handle/touch them/take them out of the jar. **These are for-show only.**

For this activity, a "matching game" will be played first to have participants guess which animal the brains were obtained from. For each brain, prepare an index card indicating the species of animal. Line up the various brains in random order. Ask participants to guess which species the brains were obtained from by placing the index cards in front of the jars. After guessing, either confirm or correct participants on their guesses. Then, compare and contrast the various brains as you explain key features and functions.

Some key points to make:

- Some brains appear smooth cortex while others are "wrinkly." Explain the wrinkles are called sulci and gyri which increases the surface of the brain i.e., you can pack more brain tissue into the skull by letting the brain fold up on itself. More brain = more "brain power." More "advanced" organisms (e.g. humans) have more sulci and gyri compared to more "primitive" organisms (e.g. mouse) that have smooth brains.
- Rodent brains have a very prominent olfactory bulb, while humans have a relatively small olfactory bulb. Explain that rodents rely heavily on their sense of smell, so they have more of their brain dedicated to this important scent.

- Every brain has a cerebellum and brain stem. Explain their functions and how every species, regardless of their perceived "complexity" require these two basic structures for moving (cerebellum) and controlling bodily functions like respiration and arousal, (brain stem - also needed for transduction as it connects with spinal cord and nerves).
- The size of the brain doesn't necessarily correlated with how "advanced" the species is. Elephants, whales, and dolphins have larger brains than humans but humans are perceived as being more "advanced." A better measure for "advancedness" is the brain-to-body mass ratio.

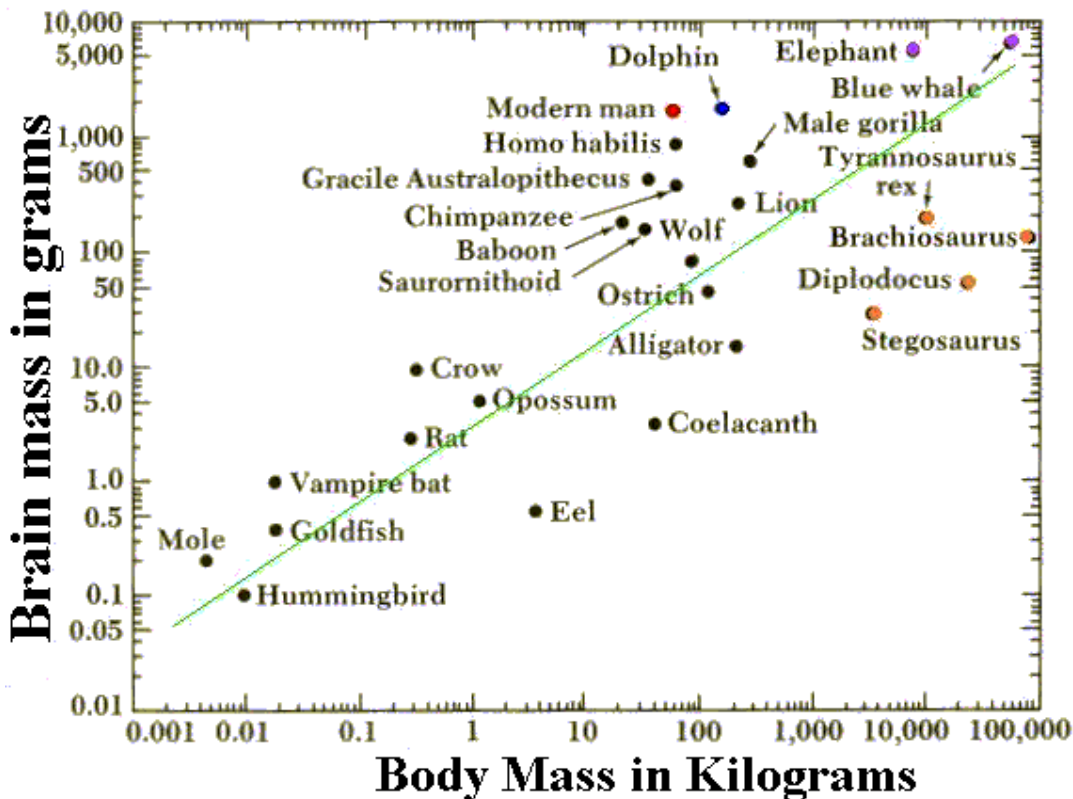
**Additional Information (advice, spiel, links, figures, etc.)**

For the comparative neuroanatomy activity, see if brains (e.g., mouse, rat) can be donated by certain labs for you to keep. Otherwise, borrow and make clear they will be handled with the best care and returned promptly after the event.

It is not recommended to visit a local butcher to obtain carcasses of various species (pig, cow) to remove their brains unless you are trained to perform and use and have access to appropriate tools, supplies, and personal protective equipment. **Removing the brain from cow carcasses are NOT recommended due to the risk of contracting prion diseases.**

Can have printouts of brains of various other species (appended to end)

Brain-to-body mass ratio:



Further away from the green line in the positive brain mass direction may be better indicative of "advancedness"

Brains of various species

