I have in my hands the most complex structure known to mankind, the human brain.

Isn't it cool? It's just so amazing - especially when you think of all that it does.

Our brains define how we see, feel, taste, smell, and hear. They define our personalities. They allow us to go from crying to laughing - sometimes in a blink of an eye. It's our brains that keep us breathing. Our brains do so much.

Now, medicine and science have come a long way in helping us understand the brain and how it works. But I'd be remiss if I didn't acknowledge that there's a lot more that we don't know that we have to understand. And for a scientist like me, that's what's so exciting.

For this lesson, I want to help you understand some basics about the brain.

Why?

Two reasons really. First - knowing about the brain is cool. Trust me. It'll give you some serious cred at the next party if you start throwing out terms like pre-frontal cortex, temporal lobe and hippocampus - especially hippocampus.

Second, and perhaps most importantly, a basic understanding of the anatomy of the brain and its core functions is foundational for the rest of the course.

So, let’s take a quick tour of the brain. As we go, I’m going to give you the primary function for each area, but it’s important to realize that the brain is actually interconnected with a lot of shared responsibilities across brain areas.

That said - let’s look at things from the top. The brain is divided into two hemispheres. The left and the right. If you really want to impress your friends, remember that this crevice right here is called the superior sagittal sulcus - a fancy way to say “that line down the middle.”

While we’ve all heard it, it’s an oversimplification to say that the right side controls creativity and the left side controls logical thought, but the different sides do manage different tasks for us. What we do know is that the right hemisphere controls the left side of our body and the left hemisphere controls the right.

Starting with the very front, this is the frontal lobe. At the very front of the frontal lobe is an area called the prefrontal cortex - important for things like working memory, decision making and the seat of our personality. Towards the back of the frontal lobe is a critical strip of cortex. I’m going to turn the brain around right here, located approximately right here, this is primary motor cortex - critical for allowing us to move all different parts of our body.
This next lobe right around here is called the parietal lobe - important for visual spatial function, trying to figure out the organization of different objects in a scene for example. This is called the occipital lobe, critical for visual processing, in fact what’s called primary visual cortex is located right here. If you have damage to your primary visual cortex on both sides you become blind, even if your eyes work perfectly.

Now we’re going to flip over here, to this very, very lobed structure right here called the cerebellum. The cerebellum is critical for motor control, but fine motor control. It helps in fine motor movements that you might use to play the violin.

Now I’m going to flip over a little bit more. If you see this little stem here, this is the end of the spinal cord and right above the spinal cord is an area called the medulla oblongata. This area is critical because it helps control our essential functions like breathing and heart rate.

This is called the temporal lobe. And there’s two key structures that I want to highlight within the temporal lobe. It’s not on the outer surface of the temporal lobe but both of them are located deep in the temporal lobe. The first is the hippocampus. Hippocampus means seahorse, and actually if you dissect out the hippocampus in the human it really does look a lot like a seahorse.

The hippocampus is critical for our ability to form and retain new long term memories for facts and events. If you have damage to the hippocampus on both sides you become amnesic. You can remember the things from your past - your childhood, your parents, your family - but you are no longer able to form any new long-term memories.

The last structure that I want to highlight in the temporal lobe is called the amygdala. It actually sits just in front of the hippocampus. The amygdala means almond, and it’s approximately an almond shape. And it’s critical for our ability to process certain emotions, particularly fear. And lastly, a critical role of the amygdala is to help stimulate and strengthen memories, particularly emotional memories that the hippocampus is critical for laying down.

Okay - so that was a super quick tour of the brain. And a pretty basic one at that. We didn’t get into neurons or synapses or neurotransmitters any of that, but we’ll get back to that soon. What I really wanted you to do in this lesson was to understand some of the major structures of the brain and be able to describe what they do - important stuff as we learn about how the brain works and what we can do to make it work better.