

Dr Tiffany Rodgers Complete

The brain is the most complex organ in the human body. Well, it has many different functions that help ensure our survival. One of these is to help code things in our environment as either good for us or bad. The reward pathway of the brain helps to do this by rewarding us for interacting with things that are good for us. The reward pathway is located deep within the brain near a collection of structures called the limbic system. The limbic system is composed of several structures mostly dealing with emotion or memory. The picture here shows a few of these areas. The hypothalamus is a sort of CEO of hormone production. The hypothalamus prompts the production of hormones that control hunger, metabolism, and homeostasis or keeping the body at a consistent internal state when it comes to things like body temperature. Other areas like the hippocampus, which controls memory function and the amygdala, which controls certain types of emotion are also included in the limbic system. If we zoom in to see the cells that make up all of our brain structures, including the limbic system, we can see that they have round cell bodies with several small branches called dendrites and then a long branch called an axon. These cells are called neurons. Neurons use dendrites and axons to send and receive chemical messages. The tips of the axon send out chemical messages and the dendrites of nearby cells receive those messages. It's similar to how people communicate with each. We use our mouths to speak and our ears to receive those messages. Our voices usually convey the message between one person's mouth and another person's ears. In the case of neurons, they use chemicals to talk between each other. Neurons can use many different types of chemicals, but one of these is particularly important for the reward pathway. The reward pathway is considered a dopamine pathway, because dopamine is the primary chemical used to communicate between these cells. Many different names are used to describe the reward pathway, but one of the more common names is the Mesolimbic pathway. Let's break this name down for just a moment. "Meso" refers to where the pathway begins. "Meso" comes from the Greek word "mesos", meaning middle. This term is used, because the pathway begins in an area of the brain called the midbrain. More particularly the pathway starts in a specific group of cells within the midbrain. These cells are called the Ventral Tegmental Area. The pathway name ends in the word "limbic". This is because the pathway ends in multiple different structures within the limbic system, including the Hippocampus and the Amygdala that we saw before. This figure adds an area that is particularly important for understanding reward in the brain, the Nucleus Accumbens. So, the cells of the mesolimbic or reward, start in the Ventral Tegmental Area and end in the Nucleus Accumbens. Remember that this pathway is a dopamine pathway. Which means that whenever becomes active, dopamine is released in the Nucleus Accumbens. Scientists can measure how much dopamine is released to determine how motivating something might be. So, things in our environment that can activate this pathway, causing dopamine release, will likely be things that we like and likely be things that we are motivated to pursue. So, what kind of things can activate this reward pathway? Basically, anything that we like. Food, particularly salty fatty or sugary foods, physical touch, sex, music, winning games or competitions, playing video games, getting money. These are all rewarding. Things like food and sex are called natural rewards, because we don't have to learn to be motivated for them. Things like money are called learned rewards, because our environment teaches us that it is rewarding. Some of these are really necessary for our survival. We need to

want to eat, reproduce, and even compete in certain circumstances. In our modern world, we also need to earn money to survive, but you could also quickly see how too much motivation for any of these could be harmful. In the same way, drug of abuse can cause the reward pathway to produce too much dopamine and our motivations driven by this pathway are overtaken by the pursuit of these drugs. Drugs of abuse actually do release much more dopamine than any of our natural or learned rewards. Drugs of abuse have a particular advantage in activating the reward pathway. Remember that the neurons and the reward pathway are talking via chemicals. Drugs of abuse have chemical structures that allow them to get in on this conversation directly. Even more they can communicate with the pathway more directly than natural rewards. For example, imagine that you've just eaten a slice of pizza, signals from your mouth have to be sent up to your brain to tell the brain that you've just eaten something tasty. However, when you consume a drug, it can reach the brain much more quickly, but not having to wait on these internal signals. So, while the reward pathway is important for motivation and for deciding what things the environment, we like it, can also easily be hijacked creating excessive motivation for behaviors, like eating, winning, or sex or for certain chemicals like drugs of abuse.