Sensory 4

[00:00:00.31] I'm going to conclude this lecture on sensory systems with a little bit about other senses that don't come up so much in neural engineering, but they're still interesting. First, smell. There are cells in the back of the nose that have receptors that bind to specific part of smell molecules, called odorants, which are floating through the air. These cells are called olfactory sensory neurons, and they're located in the olfactory epithelium. Each neuron has only one type of receptor. So depending on what combination of neurons is activated, it gives the structure of the molecule that you're smelling.

[00:00:41.90] The olfactory sensory neurons are notable because they regenerate approximately every 30 days. It's one of the only regular instances of adult neurogenises, or the birth of new neurons when you are fully grown. The information from the olfactory sensory neurons then travels through the base of the skull, and then from there, to the brain. Smell does not have any kind of organization in space or any other dimension that vision, and hearing, and touch do. There's not really a good conceptual way to organize smells. What would you put near each other? So it just is organized by what features of molecules there are and it's all clustered together.

[00:01:32.17] Taste is similar to smell in that each taste molecule, called a tasteant, binds to a combination of taste receptors. But each taste cell has multiple types of receptors, and we don't fully understand yet how the combination of taste cells that are activated translates to a specific taste experience. Groups of taste cells cluster in taste pores, shown here. There are many taste pores per taste bud. It's important, also, to remember that flavor is mostly determined by smell. Also, the taste zones on your tongue are totally wrong. That doesn't exist at all. You have taste receptors for all the different types of taste scattered throughout your tongue and into your throat.

[00:02:17.51] The vomernasal sense detects pheromones. Humans don't have the vomernasal or organ, but we're unusual for lacking it. Almost all vertebrates have one. It detects pheromones, which are chemicals that are released into the environment for the purpose of communicating with other animals from the same species. Those pheromones are detected through an opening in the roof of the mouth.

[00:02:40.15] The animals shown in these pictures are collecting pheromones in the air. They can also be distributed through markings in territory. This face position is called the flehman response, and it helps collect these molecules and bring them in to be detected by the vomeronasal organ. This is also what snakes are doing when they stick their tongue out. They're smelling and they're also looking for pheromones.

[00:03:06.17] Finally, a small number of animals have the ability to detect electricity or magnetic fields. There are two different types of electroreception-- passive electroreception is from animals that just pick up ambient electricity in their environment. Active electroreception is animals that generate their own electric field and pick up disturbances in it that they created. This is found exclusively in aquatic animals, because electricity travels well through water, but not very well through air.

[00:03:39.66] Disturbances in the electrical field indicate non-conducting, solid objects, such as rocks, so you can see that in the diagram on the left side that this electrical field is disturbed by the presence of a rock. But, it's not disturbed by conductive obstacles, such as grass. Animals can also detect other organisms that disrupt the electrical field or might be generating their own electrical field as well. Electroreception is found in aquatic animals that live in environments that have poor visibility, so they wouldn't be able to see each other or obstacles very well. And chemical signals and sounds aren't very useful in water, because they're too hard to localize.

[00:04:23.04] Magnetoreception is found in animals that migrate long distances, such as birds and turtles. A small shard of ferrous or magnetic metal usually is found in a chamber in their upper beak and an orients to the Earth's magnetic field. It works just like a compass. And the animal detects the angle of that shard of metal, and it tells them which way north is. Animals that migrate very far distances, like pole to pole or over oceans, are traveling too far for visible landmarks to be useful, so they need orientation to the entire planet.