

Frequently Asked Questions

- Why do some smells hurt?

Some odors, like ammonia, actually hurt when we smell them. These odors are typically hazardous to our health so our bodies have installed an extra set of receptors in addition to the receptors in the nose associated with the "trigeminal" system in the face to feel pain in the presence of these odors. Most odors just activate the olfactory receptors. Some odors activate or stimulate both the olfactory (odor) receptors and the trigeminal (pain) receptors.

- Why does my nose water when I am eating hot or spicy food?

When your nose senses too much of one thing, like a hot chile or other spicy flavor, additional mucus is generated in the nose so that the olfactory receptors are not over-stimulated and lose their sensitivity. More mucus dilutes the odor, preventing too much odor from reaching the receptors themselves.

- Why does a dog smell more and better than a human?

The dog has 200 million receptors in its nose, at least 10-100 times what we do.

- Why can't I taste my dinner when I have a cold?

Half of what we think of as taste is smell. The brain combines information from the nose and tongue to perceive taste. With the olfactory receptors disabled during a cold, half the information is no longer available and our food tastes bland.

- Why is does a smoke detector have an auditory alarm?

When we are asleep, our auditory (hearing) systems are more sensitive than smell or vision and are thus an auditory alarm is more likely to wake us up than another sensory stimulus.

- How does the metal-oxide sensor in a smoke alarm detect an odor

Oxygen reacts with the surface of the sensor and steals electrons from the sensor, decreasing its conductivity and increasing its resistance to electrical current. When a chemical appears in the environment that interacts with the oxygen, the oxygen leaves the surface of the sensor but reinjects electrons into the sensor material before it leaves. When the sensor responds then, its conductivity is increasing and it conducts or allows more current to pass through it. We measure this current as a voltage (current is very hard to measure) through another resistor called a load resistor. A chemical reaction occurs on the metal-oxide sensor surface (just like when our mouths start heating up from sucking on a red hot jawbreaker) which increases the conductivity (ability to conduct current) of the sensor. The increase in conductivity is electronically sent to the "brain" of a circuit which interprets what type of odor is present.

- What are other applications of the artificial sensors in this demonstration?

These sensors can be used to detect breath alcohol, natural gas leaks, propane gas leaks (a real issue in countries like Japan), carbon monoxide, seafood freshness, and similar molecules. Carbon monoxide and natural gas are of special concern because the human nose cannot smell them, yet they are harmful (even fatal) to humans.

- What can cause the electronic nose not to smell?

Yes, an artificial nose can be sick just like the human nose! Neither type of nose smells very well when "stuff" is poked nor poured into it. The artificial nose needs a proper voltage, or temperature in biological terms, in order to properly smell. When this voltage is either too high or too low, the sensor does not work well. This is analogous to the human body under fever or hyperthermia.