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Researchers unlock new secret to how smells are detected

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Researchers seeking to unravel the most ancient yet least understood of the five senses – smell – have discovered a previously unknown step in how odors are detected and processed by the brain.

The four year study, focusing on how mice respond to odors, showed that smells are picked up by the olfactory bulb – the first stop on the way to the brain – then sent to the olfactory cortex for further analysis.

But scientists discovered something else – a dialogue between the bulb and the cortex conducted by rapidly firing nerve cells.

"It was originally thought that the olfactory bulb filtered and the olfactory cortex made decisions on whether something is, for example, edible," said lead researcher Diego Restrepo, professor of Cell and Developmental Biology and co-director of the University of Colorado School of Medicine Center for NeuroScience. "Our study says it's not quite like that. You process information on reward in the olfactory bulb, send it to the cortex and there is a dialogue between the two. Then the brain will act."

The study was published March 24 in the science journal *Neuron*.

Restrepo, an expert on the science of taste and smell, said the discovery expands our understanding of how the olfactory system filters and categorizes the thousands of odors that bombard the brain daily.

"We know very little about olfaction and we tend to think that it is not very important in humans compared to the other creatures," he said. "But much of what goes on is subtle and we are only beginning to understand it."

For example, scientists recently found that when men sniffed the odorless tears of women, their levels of testosterone dropped. And for years it's been known that humans, like animals, secrete pheromones that may subconsciously help them choose a mate.

But unlike hearing, taste, sight and touch – smell is the only sense not processed exclusively through the thalamus in the brain, Restrepo said. So the exact path odors take to the brain and how they can trigger often vivid reactions is still not fully understood. The new research suggests that perhaps part of the answer lies within the dialogue between olfactory bulb and cortex.

In describing their work, the researchers noted that "olfaction is a primitive sensory system connected to the brain in a fundamentally different way from other systems."

"Decision-making in olfaction is challenging with a large number of input dimensions and hundreds of olfactory receptors," they wrote. "We show that information about what odors predict is integrated into the earliest stages of neural encoding compared to other senses."

Provided by University of Colorado Denver