The brain is more adept at using the nose than previously realized

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Brains are able to adjust automatically to the demands of distinguishing between small differences in smell, new research at the University of Chicago shows.

The research, which was conducted on rats, suggests that the human brain may be more adept at distinguishing smells than previously thought. The work comes from studies in the laboratory of Leslie Kay, Assistant Professor in Psychology at the University, who is looking at the ways animals perceive sensory stimuli by focusing on the neural basis of olfactory perception and how context and experience influence it.

The research demonstrates the importance of smell as a means for people to gather information from their environment. Smell is often an undervalued sense because people are more aware of the visual aspects of their perceptions, the researchers said.

Those visual distractions lead people to ignore their ability to detect smells, something the brain is apparently well equipped to do, according to Kay and Jennifer Beshel, a graduate student at the University, who presented results of her dissertation research in the talk, "Olfactory bulb gamma oscillations are dynamically altered to adjust to task demands," at the annual meeting of the Association for Chemoreception Sciences in Sarasota, Florida.

The olfactory bulb is the portion of the brain that processes scent information. Previous studies have looked at the how the olfactory bulb

works in regulating smell and also examined behavior related to smell in mammals and other animals. "This is the first study to look at the ways in which mammals respond to challenges of distinguishing smells by studying actual activity in the olfactory bulb while varying the difficulty of the discrimination," Kay said.

For the study, the researchers attached electrodes to the brains of four rats and trained them to distinguish different odors. The electrodes followed the oscillations of the cells in the olfactory bulbs. The oscillations act as a means to carry complex information between cells, Beshel explained.

Their research showed that the rats used the oscillations selectively. When smells were quite distinct, they used more irregular activity, and the oscillations became more regular when the smells were similar. Other researchers had shown that activated regions of the olfactory bulb overlap when smells are similar but are distinct when the smells are different. Beshel and Kay speculate that the oscillations help the rats to separate the overlapping patterns.

The findings may provide some clues about how rats are able to survive, despite repeated attempts to poison them.

In other work presented at the conference, Kay, in collaboration with another University of Chicago Psychology graduate student, Emily Wyatt, and Christiane Linster and Nathalie Mondairon from Cornell University, showed that rats' ability to distinguish scents increases if they are exposed to a new odor for one hour per day for less than two weeks. The improvement comes from an increase in the number of responsive small inhibitory neurons in the olfactory bulb, which leads to improved cooperation and increased oscillations among the cells in the olfactory bulb. This work was presented in a talk at the conference, "Olfactory bulb odor response dynamics enhanced by odor enrichment."

The research underway in Kay's laboratory provides a basis for further study on the way animals use smell.

Now that the scholars know that animals use these oscillations selectively for difficult discriminations and that exposure to scents over many days can improve smell, they can look at how the process occurs and how animals increase the presence of the oscillations in a situation-specific manner. Other parts of the brain likely contribute to this effect and need to be studied, the researchers said.

Source: University of Chicago