What rat breath can teach us about food preference, sense of smell and taste

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(Medical Xpress) -- Would your favorite dinner taste the same if you could not smell it? Does a sense of smell require a sense of taste? Katz, an associate professor of psychology and neuroscience, set out to find some answers.

Donald B. Katz sits in his modest office as his colleague makes a cappuccino. The small machine gurgles and churns and the smell of fresh brewed coffee wafts through the door.

Would it taste the same if you could not smell it? Does a sense of smell require a sense of taste? Katz and colleagues are trying to find answers to such questions with help from the breath of rats.

In research published in the journal Nature Neuroscience, Katz and his team set out to see if taste is influenced by a sense of smell and what happens to taste preference when a sense of smell is lost.

“Rats learn what food that they like from smelling the breath of other rats,” says Katz, an associate professor of psychology and neuroscience. “He will essentially say, ‘Hey – Fred ate that and lived to tell the tale’ so later, when that rat is offered a choice, he will gravitate toward the food that he smelled on the other rat’s breath.”

This is true despite very bitter tastes, such as raw cocoa, which rats generally do not care for. “And they will even make rat yummy faces to show that they’re enjoying the experience,” says Katz, who has come to

understand facial nuances.

The research was comprised of a training session and a testing session. Essentially one rat is left smelling the breath of another rat that had just finished eating. The “sniffer” was then tested alone to see which pot of food he preferred. As soon as the sniffer was made anosmic, or unable to smell, he no longer learned the task.

Once Katz and colleagues proved that smell was the driving force in food choice, they set out to see if that would remain the influencing factor if the rats had no sense of taste.

Katz compares his research to the common cold: A stuffy nose throws tastes systems out of whack, leaving food tasting bland. This, says Katz, is because the taste and smell systems work together.

The problem, he says, is that the opposite natural experiment never occurs: “It’s never the case were there’s a three to four day period when someone’s tongue isn’t working,” says Katz.

Katz and colleagues temporarily disabled the primary taste cortex in the rat’s brain while the animal was in the task, or training session. They found that when taste was eliminated, the rats could no longer learn the task, proving that the taste system must be intact order to smell the odors.

In addition they learned that the experiment had a state-dependent effect, meaning that if something is learned in one state, it’s only remembered if the testing occurs while in the same state, so if the taste system is knocked out while the animal is in the midst of smelling the other rat’s breath, he will still show that he’s learned to prefer that taste — but only if the taste cortex is disabled while he’s sampling the tastes and trying to decide what he likes.

Knocking out the taste cortex turned out to have a bigger impact on the sense of smell than the sense of taste, the researchers found. Something that smells like roses when the taste cortex is intact can smell like something entirely different when the taste cortex is knocked out, explains Katz.

Does the study have a practical application?

“To be honest, I’ve never thought about it,” says Katz. “I think it’s dangerous, and vey bad for science, to be thinking about applications and translations prior to having a whole bunch of information about how basic things work.”

Katz says that arguably the single most important biomedical breakthrough of the 20th century was the Magnetic Resonance Imaging machine (MRI), which is now widely used to look at everything from blood vessels to bones to cancers, but which was not originally developed with the idea that it was going to help the human race.

“It was invented by a bunch of geeky polyester pants-wearing physicists who were sitting around spending all of their time thinking about spin – and not spin the way we think about it” but quantum mechanical property, says Katz. “They weren’t thinking about practical applications.”

The MRI became what it is today after many people had their hands on it, says Katz, sharing data and techniques.

Katz says that in order to make basic scientific research work it has to percolate.
He cautions that turning scientists into industrial workers who are asked to bring home a particular result and not encouraged to dig deeper into newly discovered applications, short-circuits good science.

"Science works by slowly wending its way toward solutions," says Katz.

More information: State dependence of olfactory perception as a function of taste cortical inactivation, Yaihara Fortis-Santiago, Benjamin A Rodwin, Selin Neseliler, Caitlin E Piette & Donald B Katz, *Nature Neuroscience* 13, 158–159 (2010) doi:10.1038/nn.2463

Abstract

As anyone who has suffered through a head cold knows, food eaten when the olfactory system is impaired tastes 'wrong', an experience that leads many to conclude that taste stimuli are processed normally only when the olfactory system is unimpaired. Evidence that the taste system influences olfactory perception, however, has been vanishingly rare. We found just such an influence; if taste cortex was inactivated when an odor was first presented, later presentations were properly appreciated only if taste cortex was again inactivated.

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