

When Odors Warn: What Does the Nose Know?

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The nose is a confusing tool, especially when the mouth is involved. Durian fruit is a delicacy in Asian countries, where people say that it "smells like hell, and tastes like heaven." Kim chi has a strong odor, too, yet many people find it equally satisfying.

So can one's nose be trusted to detect whether food is good or bad?

"It's a learned response to know whether food is spoiled," said Dr. Alan Hirsch, director of the Smell & Taste Treatment and Research Foundation. "Does cheese smell so bad because it's spoiled or is that the way cheese is supposed to smell?"

Food authority Harold McGee concurs, writing in his book "On Food and Cooking" that, "our attitude toward smells and tastes is molded by social custom, opportunity, and often private associations with pleasant or painful moments. Even our disgust at rotting food, which would have a protective advantage, appears to be learned at some point in childhood -- how or why remains mysterious -- and is not shared by our mammalian relatives."

Three or four percent of our genes, Hirsch notes, are related to smell. The amount is indicative of the importance of smell to the evolution of our species.

"We had to be able to smell if food was bad or not. Otherwise we would get sick and die from it," said Hirsch.

Smell is one of the senses that people who source their food from Dumpsters and call themselves Freegans rely on when deciding what might make a meal and what is truly waste.

That may sound extreme, but prior to the 1998 implementation of the Hazard Analysis and Critical Control Point system, U.S. Department of Agriculture officials used the "poke and sniff" method in slaughterhouses to investigate the meat being handled.

The senses can discern some obvious signs of decay.

"Food spoilage organisms including yeasts, molds and bacteria can give off odors warning you that they are present. While food spoilage organisms are not harmful to consume, they do change the quality of the food in such a way that makes it very unappetizing," said Carol Schlitt of Safe & Savory Solutions. Off flavors or colors, slimy coatings and fuzzy mold can warn of more dangerous bacteria that you can't see, taste or smell.

But our senses are not equipped to detect pathogenic bacteria, hence the abandonment of the "poke and sniff" method. These changes to the USDA's meat monitoring practices followed E. coli outbreaks in the early 1990s, yet a fail-safe system is not in place. Thus USDA inspected meat was traced to a March salmonella outbreak found in sausage served at a fundraising breakfast in Thurmont, Maryland. The salmonella was undetectable to those who cooked, served or ate the contaminated food.

That's not to say we should disregard the input we receive from our noses. People who have lost their sense of smell face a higher risk of food poisoning, often requiring hospitalization. Beyond safety measures, the nose is vital to our experience of taste. Ninety percent of our sense of taste is smell.

"It's retronasal smell," explained Dr. Hirsch. "Smells come in through the mouth go to the back of the throat and the top of the nose. This retronasal smell is what people call taste."

The nose's receptor cells transmit information directly to the olfactory bulb, which is part of the brain's limbic system. The limbic system processes emotions, and explains the deep connection between memories and scents. The proximity might also explain the strong feelings provoked by odorous foods. Limburger cheese or lutefisk could dissolve otherwise solid marriages.

In the case of fermented foods, how can you tell if powerful odors mean danger? This question occurs to people who are experimenting with fermenting foods at home, a habit that is becoming popular as more people explore home food production. Many learn the process through the tutelage of fermentation expert Sandor Katz, who teaches and has written books on the topic.

"There's fresh food and there's rotten food, but in between there is food which has been preserved," said Katz. "In the case of fermentation that preservation involves some of the same kinds of biomolecules that appear when something is rotting."

Fermented foods exist along a continuum, Katz explained. Many fermented foods that are fine at some stage of their development, may become unappealing, if the process of fermentation is left uninterrupted.

"Bacteria exist in succession," he said. "So sometimes in a later succession you could get more putrefying bacteria rather than acidifying bacteria. There is a large amount of cultural subjectivity, cultural relativism that exists in terms of what people deem appropriate to put in their mouths."

That subjectivity is part and parcel with acculturation to certain foods, such as fish aged for months in pits in the Arctic. While people who have grown up eating this food develop the microbes in their digestive tract to tolerate it, outsiders may grow ill from eating it. Does that mean the food is poisonous? Not quite.

The process of fermenting vegetables involves using salt to facilitate the production of lactic acid. Salted cabbage produces its own brine, while other vegetables, such as cucumbers, are placed in a brine solution. The acidification functions as a safety mechanism. The lactic acid bacteria acidify the vegetables and their environment, making it impossible for other bacteria to survive.

Katz said that because of this, fermented vegetables are safer than raw vegetables. Fred Breidt, of the USDA's Food Science Research Unit at North Carolina State University, has studied this issue and recently published a paper on the survival of *E. coli* 0157 in cucumber fermentation brines.

"The presence of live growing cells of lactic acid bacteria, which are the ones that ferment pickles and cheese and a lot of things, actually in competition cause *E. coli* to die off rather quickly, because they produce things other than just the acid, that's in the fermented foods," said Breidt. "Lactic acid bacteria are highly efficient killers of other bacteria, and they do a marvelous job. This is why vegetable fermentations

pretty much always works. It's been working for thousands of years. It's one of the oldest technologies known to man and it always works, and the reason is these lactic acid bacteria are very good at what they do, and we take advantage of that as a technology."

Breidt's paper was number 373 produced at the research station, which has been studying fermentation and acidifying vegetables since the 1930s. All of their published research is available at <http://ncsu.edu/foodscience/USDAARS/html/Fflbiblio1.htm>.

There are no known cases of people getting ill from properly fermented products, said Breidt. The risk of people making themselves ill from home fermenting vegetables is pretty low. He advised people to get a recipe from their extension office or from a book in the public library.

Still, a book or even a how to video won't tell you when to be in doubt of your homemade sauerkraut.

"If you have putrefying bacteria developing rather than acidifying bacteria, you can smell that, it smells horrible. But if you have botulism in your canned string beans there's no way to taste that," Katz said. "I would never say don't trust your nose, because anyone who gets involved in the arts of fermentation, up to a degree, has to trust their nose -- because you can smell when it's going to the right direction and when it's going in the wrong direction."