

## Dairy Manure Odor Perception and Management Series

### Part 2: The human sense of smell

Understanding the physiology of human smell can help a farmer to better consider odor issues, off-farm impacts, including neighbor complaints and potential solutions.

The human nose has around 400 types of scent receptors, and scientists estimate 1 trillion different odors could be detected<sup>[1]</sup>. The sensitivity of these receptors varies from person to person; therefore, a highly offensive smell to one individual may not bother another at all. Humans are highly capable of connecting odors to perceptions and memories. A trigger of an olfactory receptor may evoke a strong reaction from the individual because of something they connect that particular smell to. What does this all mean for a dairy farmer? It means that an odorous substance like manure is likely to bother at least a portion of people that live near to or pass by their farmstead or fields.

#### The human sense of smell

*“More than 75 odorous compounds, in varying proportions, have been identified in livestock manures<sup>[1]</sup>”*

The sense of smell in humans is the most mysterious of the five senses, and the most complicated to quantify; the ability to perceive an odor also varies widely from person to person, making it very challenging to measure and quantify odor releases from farm sources.

The five basic properties of odors that can be quantified are: 1) intensity, 2) degree of offensiveness, 3) character (see next sentence), 4) frequency, and 5) duration; quantification of these properties can help in comparing and describing odors<sup>[1]</sup>. The seven basic categories of odor character that humans can identify are: 1) ethereal, 2) camphoraceous, 3) musky, 4) floral, 5) minty, 6) pungent, and 7) putrid. However, in

human studies, more than 50 odorous substances have stood out independently, meaning the characterization of odors is very person specific and not an exact science<sup>[1]</sup>.

The major parts of the human olfactory (sense of smell) system are shown in Figure 1.

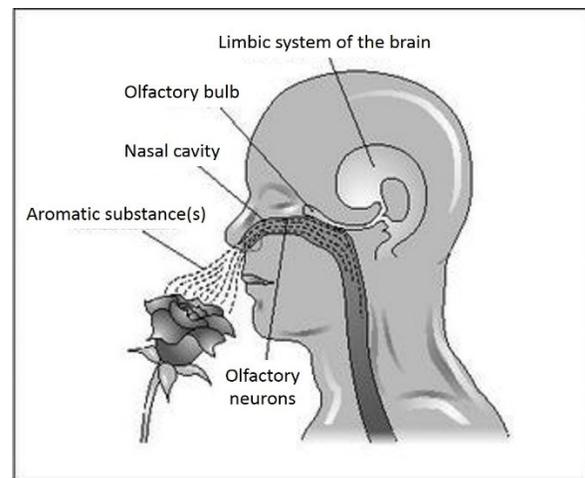


Figure 1. Diagram of the human olfactory system<sup>[3]</sup>

Odor perception can vary up to 1,000 fold between the least- and most-sensitive individuals. How to effectively manage odors is highly complicated by the subjective nature of describing the type and intensity of odor combined with other factors that affect a person’s response to an odor including the effect and experience from any previous exposures, and any perspectives or biases that were created at that time<sup>[1]</sup>.

Odor adaptation occurs when a person becomes accustomed to an odor. Furthermore, odor fatigue occurs when the person is completely adapted to an odor, because of prolonged and repeated exposure, to the point that the person no longer even detects the odor. Observation

has shown that working on a farm can lead to the acclimatization of farm workers to farm odors. Interestingly, odors of high intensity cause a person to become adapted even faster than to odors of lower intensity, according to odor research performed at Iowa State<sup>[4]</sup>.

*“There are certain odorous compounds that actually desensitize a person’s olfactory system, for example, hydrogen sulfide and ammonia, two of the prominent odors in dairy manure.”*

*“Long-term exposure to these compounds causes damage to the olfactory system, resulting in a decrease in the ability to detect odors. This further complicates the farmer and farm workers to be able to detect the presence of these and other odorous compounds in manure and on the farm.”*

### Farm impacts

In general, four things determine whether an odor will be a nuisance: frequency, intensity, duration, and offensiveness. If an odor is of low offensiveness but it is perceived with some regular frequency, it might be as bothersome as a highly offensive smell that is only apparent for a short while, for example. In any case, there are several factors on and around a farm that can impact the odor intensity and method of dispersal, a few examples being wind, temperature and geography.

The issue of odor fatigue and olfactory system damage for those present on the farm every day, makes it difficult to pinpoint the presence, strength and dispersal of manure-based odors. Those outside the farm business more easily take note of, and are generally much more bothered by, the odors that are emitted. This makes the pursuit to deal with neighbor odor complaints a difficult task, even when the farm’s intent is collaborative.

### FACT SHEET SERIES

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- [2] Marsh, L. Trenton S. An Evaluation of Alternative Approaches to Reduce Odors from Intensive Swine Operations – Interim Report. State of Virginia Dept. of Environmental Quality. 2001.
- [3] <https://senseofsmellproject.weebly.com/anatomy-of-smell.html>
- [4] The Science of Smell; Part 1. Iowa State. 2004.