Podcast Interview: Noam Sobel

I’m your host Prashant Nair, and welcome again to Science Sessions. Among the different senses that make humans sentient, the sense of smell is perhaps the most enigmatic. Most of us with a normal sense of smell tend to perceive and describe most odors more or less similarly, but some odors appear redolent to some people while being elusive to others. The question of whether each of us has a subtly distinct sense of smell has long fascinated philosophers and neuroscientists, but an empirical answer largely remains elusive. So what determines whether or not a person is likely to perceive an odor? Proteins called olfactory receptors – of which there are more than 400 subtypes in the olfactory epithelium lining the nose – play an important part in sensing smell, and subsets of these receptors are specialized to detect different odors. And because almost one-third of the DNA encoding these olfactory receptors is thought to be unique to each person, it might be possible to derive a human fingerprint of olfactory perception. That’s just what Weizmann Institute neuroscientist Noam Sobel and his team demonstrated in a recent PNAS paper. I spoke to Sobel at a recent meeting of the American Association for the Advancement of Science in San Jose, California.

Sobel: So given the fact that each one of us expresses a slightly different subset of such receptor subtypes, then you would imagine, or you could assume, that each one of us has a slightly different olfactory repertoire. Because each of us has a slightly unique olfactory receptor subtype genome, therefore each of us should have slightly unique olfactory perception.

PNAS: But that says Sobel is an assumption, and although there are well-established tests of human olfactory function, there isn’t a sensitive tool to parse subtle individual differences in the sense of smell. So Sobel and his colleagues asked 89 volunteers, who were around 26 years old, to rate how similar pairs of 28 odors were using descriptive phrases like “very lemony” or “very masculine.” Using the pairwise similarity judgments, the team derived olfactory fingerprints.

Sobel: From these values we generate a matrix, and this matrix is your fingerprint. So your fingerprint is the entire set of pairwise similarities. One of the important take-home messages here about deriving these fingerprints is in terms of descriptors, it doesn’t really matter which descriptors we use as long as we use a reasonable number of descriptors. So these fingerprints are really descriptor-independent. We can choose a rather utterly arbitrary set of descriptors, let’s say, how much this odor smells like an airplane, and you probably have your own world of what an airplane smells like, and I have my own idea of what an airplane smells like, and they’re probably very different. But that doesn’t matter because if you rate odor A as smelling airplane let’s say 10 out of a 100, and you rate odor B smelling airplane 11 out of 100, and you rate odor C as 70 out of a 100 in its “airplaneness,” okay? Then for me you said odor A and B are similar and C is different, and that’s all I need to know to build your fingerprint.

PNAS: That certainly reiterates the Bard’s famous take on roses smelling sweet by any other name. So what did the olfactory fingerprints reveal?

Sobel: If you take the average description of an odor, that’s a pretty good guess or estimate for what you or I will say about that odor. That said, once you take advantage of the very, very high specificity that the fingerprint provides us with, because this is a very,
very sensitive test, once you use the fingerprint, we find that indeed each person is unique in their sense of smell once you use a sufficient number of odorants.

**PNAS:** The genes encoding olfactory receptors are linked to other genes, such as those that encode a group of proteins called human leukocyte antigens, or HLA. The HLA proteins confer immunological identity and therefore influence traits like compatibility for organ transplantation. So Sobel team’s surmised that if the olfactory fingerprint reflects an individual’s olfactory receptor DNA, it might also carry an imprint of linked genes, such as the HLA genes. So the team set out to determine whether people who were well-matched in HLA genes also had similar olfactory fingerprints. Lavi Secundo, a researcher in Sobel’s team and first author of the PNAS paper, described the team’s findings by phone from Israel.

**Secundo:** First thing we find is that people who are similar on their olfactory perception also have a tendency to be more closer in their HLA makeup. So it can be used as a prescreening criteria for organ donation and transplantation.

**PNAS:** The team estimates that olfactory fingerprint matching could theoretically obviate the need for almost 30% of HLA matching tests, which typically require blood draws. But, Sobel cautions, the findings on HLA are preliminary and show a modest link, and it’s unlikely that a smell test would replace HLA tests in clinics anytime soon. Yet the olfactory fingerprint, he adds, might have other applications. Previous studies have tied changes in olfactory perception to neurodegenerative diseases like Parkinson’s disease, so Sobel speculates that olfactory fingerprints might serve as a conceivable biomarker for such diseases. Also, he says, olfactory fingerprints might have other commercial uses, such as tailoring personal choices of perfumes and determining compatibility between romantic partners. You can find more podcasts at pnas.org