# HUBER THE NOSE.

**Perception of Odoriferous Compounds**

## Our Practical Findings

During the past 65 years, our Analytical Department has established a library presently consisting of more than 4000 chemical substances, i. e. comprising most of the currently-known odoriferous compounds.

Our perfumers and flavorists go through a regular daily training of their noses: A computer-generated random selection of 12 odiferous compounds, in the form of 2% ethanolic solutions, is chosen from among a group of 1000 regularly used by our company.[1] They are numbered 1 - 12, and the compounds must be identified correctly, and also the odor must be described with up to five characteristics, such as "woody, floral, earthy, berry, green" etc., and, if possible, also naming a specific term or verbal label, such as "similar to linalol", etc.

While the scores[2] may differ depending upon the materials randomly-selected by the computer, the personal daily condition of the expert, the time of day (earlier in the day usually leads to better results than later in the afternoon), it is interesting to note that the odor characteristics given do not vary by much. As a matter of fact, our method of training has led to a very refined description of most odors which we can also use in other ways, such as using the descriptors as aids when looking to add a special effect to a specific composition.

Therefore, it seems that (at least within a sociological or cultural area or population) the description of smells follows common lines and does not differ very much among individuals. For example, for most nose experts, 1-octen-3-ol smells "fatty, aldehydic, mushroom and lavender-like"; cis-jasmone is best described as "spicy, celery, and dry".

From practical experience gleaned throughout many years, we are tempted to conclude that most people are able to communicate in the world of flavors and fragrances using descriptors rather concordantly. It does require a certain degree of training to use one's nose or one's vocabulary, but experts can communicate quite well even from a very early stage of col-laboration.[3]

In the last decades, there have been efforts to categorize scent descriptions, trying to group odors according to their odor descriptors[4] or by fragrance mapping[5].

## Human Olfactory Receptor Variability

In humans, some 1000 genes (about 3% of the total genome) are reserved for the sense of smell. Surprisingly, only 350 – 400 seem to be active.[6] This decrease in functional receptors in humans is not yet understood. Nevertheless, the fact that trained humans can distinguish up to 10,000 different odors is an astonishing accomplishment unequalled in the animal world.

Even more surprising are the results of a recent study from the Monell Center by Mainland *et al.*[7] indicating significant functional variability in the above-mentioned human olfactory receptor pool. Any two human individuals may have differences of up to 30% in their olfactory genome, i.e., up to 125 of their 400 active genes may vary. Since even small variations of a specific receptor may have a great influence on the perception of the odorant, there must be significant differences in how fragrances and flavors are perceived individually.

Differences in odor perception in men or women seem to be undisputed.[8] Many of these may date back to the emergence of mankind, or mammals, or even further back in the development of life on earth.

## Odour Thresholds and Anosmia

The relative intensity of individual odorants is a subject that confronts those inolved in the creation of flavors and fragrances daily. The actual measurement of varying intensities has largely been restricted to the determination of "threshold values of detection". This is the value determined by panelists at which the odor or flavor of a "pure" smelling compound can be detected. The measurement of threshold values depends on a number of factors:

(a) the experimental methodology;
(b) the screening of the panelists for specific anosmia;[9]
(c) the experience of the panelists;
(d) the purity of the odorant chemical;
(e) the gender and age of the panel;
(f) the media and concentration in which the odorant is evaluated.

It is generally accepted that women are more sensitive to odors than men. This seems to be confirmed statistically by The National Geographic Smell Survey, conducted in late 1986.[10] The age of the respondents also appears to play a major role in acuity, with definite decreases occurring after the age of 50.

General anosmia to all odors is relatively rare (0.2%). However, there are specific anosmias to individual odiferous compounds that are widespread. In particular, 47% of respondents were found to be anosmic to the "urinous" odor of 5-α-androst-16-en-3-one showed and 36 % were anosmic to the "malty" odor of isobutyraldehyde, and 12% were anosmic to the nature-identical musk, omega-cyclopentadecanolide (also known as Thibetolide or Exaltolide). A more complete review of this appeared in 1991 in Perfumer & Flavorist.[11]

## References


1 From among more than 4000 odorant compounds existing worldwide a flavor and fragrance company uses about 1000 regularly. The oher 3000 are either olfactorily very similar to other compounds already used in the company's pool, or have been forbidden due to ecologic, economic or other reasons, or are very rare or difficult to come by.

2 One point for a full hit, ½ point for a close hit (member of a group with very similar odor characteristics), i.e. a maximum score 12 (out of 12).

3 Of course, what the individual senses when smelling a certain substance is something quite different . The olfactory nerve system leads directly to the limbic system in the brain, the center of feelings and emotions. Since these are very unique there must be differences in the translation of smelling impulses. Furthermore, the philosophical question also arises: Who really knows what another person experiences when s/he describes an odour as , e.g."dusty"?

4 Castro BC, Ramanathan A, Chennubhotla CS: Categorical Dimensions of Human Odor Descriptor Space Revealed by Non-Negative Matrix Factorization. *PLOS One* (2013):8(9); e73289 pp. 1 - 16

5 Donna L: Fragrance Perception. Is everthing relative? Recent research presentssa leap towards a consensus in fragrance mapping. *Perfumer & Flavorist* (2009):34, pp. 26 - 35

6 10 Gilad Y, Man O, Pääbo S, Lancet D: Human specific loss of olfactory receptor genes. *Proc Natl Acad Sci U S A* (2003): 100(6), pp. 3324 - 3327

7 Mainland JD, Keller A, Li YR, Zhou T, Trimmer C, Snyder LL, Moberly AH, Adipietro KA, Liu WL, Zhuang H, Zhan S, Lee SS, Lin A, Matsunami H: The missense of smell: functional variability in the human odorant receptor repertoire. *Nature Neuroscience* (2013) doi:10.1038/nn.3598, and (2014):17(1), pp.114 - 120

8 Several studies at the Monell Centre (Philadelphia). See also *Perfumer & Flavorist* (2009):34

9 Anosmia is the medical term that refers to one's inability to smell a certain odor.

10 Wysocki CJ, Gilbert AN: National Geographic Smell Survey. *Ann NYAad Sci:* (1989):561, pp. 12 - 28

11 Leffingwell JC, Leffingwell D: GRAS Flavor Chemicals - Detection Thresholds. *Perfumer & Flavorist* (1991):16(1), pp. 1 - 19