

Glossary of Olfactory Terms

A

accessory olfactory system: present in many vertebrates, this sensory system responds to *pheromones*. It is distinct from the olfactory system proper, containing a separate set of receptor neurons in the nose, located in a pair of structures known as the *vomeronasal organ* (also known as *Jacobson's organ*). It is controversial whether humans have such a system.

androstenone: a steroid component present in the fat of sexually mature male boars. It is sensed by 35% of people as having a foul, urinous, sweaty-type odor, by 15% as having a mild pleasant odor and by 50% as having no odor at all (see also *specific anosmia*).

anosmia: an olfactory disorder characterized by the complete absence of any olfactory sensation (see also *partial anosmia*; *specific anosmia*).

B

basal cells: cells of the olfactory epithelium that differentiate and divide to form new *olfactory receptor neurons*. Basal cells are located at the top of the *olfactory epithelium*, close to the *cribriform plate*.

Bowman's glands: see *olfactory glands*.

C

cacosmia: an olfactory disorder in which a normal, pleasant odor is perceived as foul or putrefactive. For example, in one form of cacosmia, a subject smells rotting meat when no such odor is present.

chemical sense: a sense modality in which chemical substances attach themselves to the receptors on the sensory cells (also known as *chemoreception*). Olfaction (including the *accessory olfactory system*) and gustation are chemical senses.

chemoreception: see *chemical sense*.

chemosensory: relating to perception by a chemical sense.

cribriform plate: the light and spongy bone that separates the nasal cavity from the brain (also known as the *ethmoid bone*).

D

dysosmia: a general term for any olfactory disorder that is characterized by a distorted olfactory sensation—i.e. an illusory or hallucinatory olfactory experience. Any disorder characterized by a lack of olfactory sensation in the presence of an odor stimulus does not fall into this category (see also *phantosmia*, *parosmia*, *cacosmia* and *heterosmia*).

E

ethmoid bone: see *cribiform plate*.

eucalyptol: a colorless liquid that has a fresh camphor-like odor. Research suggests that 33% have a *specific anosmia* to eucalyptol.

G

gas chromatography: a method of separating the volatile chemicals of odors into their component parts.

glomeruli: structures within the olfactory bulb within which the axons of the olfactory receptor neurons and the dendrites of the *mitral cells* meet.

H

heterosmia: an olfactory disorder in which all odorants smell alike.

hyperosmia: an olfactory disorder characterized by an abnormal super-sensitivity to odors.

hyposmia: an olfactory disorder characterized by a decreased sensitivity to odors.

I

isovaleric acid: a natural fatty acid found in a wide variety of plants and essential oils. Specific anosmia to isovaleric acid is known as the 'sweaty odor anosmia' given its characteristic sweaty odor. Research suggests that 3% of people are anosmic to isovaleric acid—a relatively small percentage compared to those to *isobutyraldehyde* and *androstenone*. It, however, was the first reported form of specific anosmia.

isobutyraldehyde: a colorless, flammable, liquid with a characteristic malty odor. Research suggests that 36% of people are anosmic to isobutyraldehyde.

J

Jacobson's organ: see *vomerinasal organ*.

L

limbic system: consists of three structures in the brain: the olfactory cortex, the amygdala, and the hippocampus. The amygdala is thought to govern fear, emotion and mood. The hippocampus is responsible for memory storage. The close proximity of these structures is thought to explain why olfactory sensations can evoke vivid memories and emotional responses.

M

mitral cells: the output neurons of the olfactory bulb that receive input from the *olfactory receptor neurons*.

N

nasal cavity: the inside of the nose.

nasal conchae: three bony plates that project into each nostril. They function like turbines, churning the inhaled air as it passes through the nostrils. As it swirls around, the air is warmed and filtered by the mucosa covering the inside of the *nasal cavity*.

O

odor: a chemical substance that has the capacity to stimulate the olfactory neurons or, more generally, the sense of smell. Most odorants consist of mixtures of different types of molecules (also known as an *odorant*).

odorant: see *odor*.

odorant binding proteins: proteins of the olfactory receptor neurons that recognize and bind odorant molecules, stimulating the cell to transmit signals to the olfactory bulb.

olfactometer: a device that is used to measure *olfactory detection thresholds* and *olfactory recognition thresholds*. The olfactometer dilutes a selected concentration of an odorant sample with odorless air. Subjects then inhale the dilution and report whether they detect and/or whether they recognize the odorant sample.

olfactory agnosia: an olfactory disorder characterized by a loss of the ability to recognize odors despite being able to detect them. Those who suffer from olfactory agnosia are unable to classify or contrast odors.

olfactory axon: the fiberlike extension of the *olfactory receptor neuron* that transmits receptor signals to the olfactory bulb. Axons expressing the same receptor type join in sets of fiber bundles through which these signals are transmitted. At the olfactory bulb, these signals are interpreted at the *glomeruli* and further signals are transmitted to the olfactory centers of the brain (see also *limbic system*).

olfactory bulbs: two pea-sized brain structures just above the nose in which axons from neurons that express the same odor receptor converge in associated *glomeruli*.

olfactory cilia: hair-like fibers on the end of the *olfactory receptor neuron* that are immersed in the olfactory mucosa and that contain the odor binding sites. Each olfactory receptor neuron is topped with an average of 10 cilia.

olfactory detection threshold: the lowest concentration of an odorant required for detection against an odorless background.

- olfactory epithelium:** two patches of tissue, each about the size of a dime, lying approximately 7cm within each nostril. Each patch contains three types of cells—*olfactory receptor neurons*, *sustentacular cells* and *basal cells*—and the *olfactory glands* that produce the *olfactory mucosa*.
- olfactory fatigue:** refers to the loss of olfactory sensation after exposure to a certain odorant. For example, consider how the smell of coffee ‘hits’ you when you walk into a café but fades, even disappears, as you sit.
- olfactory glands:** glands of the olfactory epithelium which produce the mucus that bathes and protects the olfactory receptor sites (also known as *Bowman’s glands*).
- olfactory mucosa:** a thin layer of mucus that bathes the olfactory epithelium, protecting the *olfactory cilia* and the *olfactory receptor neurons* located within.
- olfactory nerve:** refers to the entire collection of axon bundles originating from *olfactory receptor neurons* expressing the same *olfactory receptor protein*. These bundles project through the *cribriform plate* and converge in the *glomeruli* of the *olfactory bulb* (see also *olfactory axon*).
- olfactory receptor neuron:** cell of the olfactory epithelium that contains the odor binding sites, or receptor sites. There are about 50 million receptor neurons in the human olfactory epithelium. Each olfactory receptor neuron expresses one type of odor receptor. These neurons are unique in that they are the only neurons that regenerate.
- olfactory recognition threshold:** the lowest concentration of an odorant required for its identification. The recognition threshold of an odorant is typically higher than its detection threshold (see *olfactory detection threshold*).

P

- parosmia:** an olfactory disorder characterized by a distorted perception of an odor stimulus, i.e. an illusory perception of the odor stimulus (also known as *troposmia*; see also *cacosmia*, *heterosmia*).
- partial anosmia:** an olfactory disorder characterized by the inability to perceive some, but not all, odorants.
- phantosmia:** an olfactory disorder characterized by the prevalence of olfactory hallucinations—i.e., undergoing olfactory sensations (usually unpleasant ones) in the absence of an associated odorant.
- pheromones:** a chemical produced by an organism that acts as a signal to other members of the same species. These chemical stimuli carry information about the sender such as gender, reproductive status and kinship.
- proboscis:** the external part of the nose.

R

retronasal olfaction: refers to the stimulation of the olfactory receptor neurons by molecules that originate in our mouths. When we chew, molecules are released from food. Some of these molecules travel up the *retronasal pathway* to the olfactory epithelium where they stimulate olfactory receptor neurons.

retronasal pathway: a passage at the back of the mouth that connects the mouth to the nose.

rhinencephalon: refers to the whole of: the olfactory nerves and bulbs, their connections to various parts of the brain, and the *limbic system*.

S

specific anosmia: an olfactory disorder characterized by the inability to perceive a specific odorant. Specific anosmias to *androstenone* and *isobutyraldehyde* are some of the most common.

sustentacular cells: cells of the olfactory epithelium which support the *olfactory receptor neurons*.

T

trigeminal nerve: the largest of the cranial nerves, it is responsible for sensation in the face. Some trigeminal nerve endings extend into the nasal cavity. Trigeminal nerve stimulation typically results in sensations of irritation but there is increasing interest in how stimulation of the trigeminal nerve endings located in the nasal cavity might contribute to perceived olfactory quality.

troposmia: see *parosmia*.

turbinate bones: see *nasal conchae*.

V

vomer nasal organ: in some animals, an auxiliary olfactory sense organ utilized in the sensing of pheromones (also known as *Jacobson's organ*; see also *accessory olfactory system*).