

Olfactory Nomenclature: An Orchestrated Effort to Clarify Terms and Definitions of Dysosmia, Anosmia, Hyposmia, Normosmia, Hyperosmia, Olfactory Intolerance, Parosmia, and Phantosmia/Olfactory Hallucination

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Keywords

Olfaction · Definition · Anosmia · Hyposmia · Parosmia ·
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Abstract

Background: Definitions are essential for effective communication and discourse, particularly in science. They allow the shared understanding of a thought or idea, generalization of knowledge, and comparison across scientific investigation. The current terms describing olfactory dysfunction are vague and overlapping. **Summary:** As a group of clinical olfactory researchers, we propose the standardization of the terms “dysosmia,” “anosmia,” “hyposmia,” “normosmia,” “hyperosmia,” “olfactory intolerance,” “parosmia,” and “phantosmia” (or “olfactory hallucination”) in olfaction-related communication, with specific definitions in this text. **Key Messages:** The words included in this paper were determined as those which are most frequently used in the context of olfactory function and dysfunction, in both clinical and research settings. Despite widespread use in publications, however, there still exists some disagreement in the literature regarding the definitions of terms related to olfaction. Multiple overlapping and imprecise terms that are currently in use are confusing and hinder clarity and universal understanding of these concepts. There is a pressing need to have a unified agreement on the definitions of these olfactory terms by researchers working in the field of chemosensory sciences. With the increased interest in olfaction, precise use of these terms will improve the ability to integrate and advance knowledge in this field.

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Introduction

Definitions provide a foundation for understanding concepts. They allow for the shared understanding of a thought or idea and serve as a means to generalize knowledge. Definitions, especially in science, are essential for effective communication and discourse and are crucial to the scientific endeavor. Without a clear understanding of what an examined phenomenon is, or is not, scientific investigation grasps at clouds.

In the words of Cubelli and Salla (2017), “the meaning of a noun should allow all speakers of the same language to think and represent the same object in the same way” [1]. A literature search on PubMed showed

that thousands of publications mentioned terms related to olfaction that are included in this paper (Fig. 1). However, despite widespread use of these terms in publications, there still exists some disagreement regarding the definitions of these terms [2, 3], where, for example, “dysosmia” can mean quantitative and qualitative olfactory dysfunction [2, 4] but was also previously synonymous with “parosmia” [5]. In the same way, “cacosmia” has been used to mean both what we now term “parosmia” and “phantosmia” [2, 4]. Some authors have used “troposmia” for the symptom now defined as “parosmia” [2] while “hyperosmia” refers to a quantitatively heightened olfactory function but is often only subjectively reported and not confirmed with olfactory testing [5, 6]. Similarly, “microsmia” has been used as a synonym for hyposmia [7]. These multiple overlapping and imprecise terms are confusing and hinder clarity and universal understanding of these concepts. An unambiguous universal description is beneficial for clear identification and classification of olfactory phenomena.

A simple online search of seven terms included in this article revealed that several of them (usually hyposmia, normosmia, and phantosmia) were not included in standard dictionaries (e.g., Oxford [8], Merriam-Webster [9], Cambridge [10], Collins [11]) and some of the publicly available definitions were vague and imprecise. That is, anosmia and hyposmia were both defined as impairment of the sense of smell [12, 13]. Also, parosmia was defined as a “disorder of the sense of smell, especially as involving the perception of a non-existent odour” [14] – which may be confused with phantosmia or as “any disorder of the sense of smell” [15] – which may be confused to mean as either quantitative or qualitative olfactory dysfunction. In addition, hyperosmia was described as an “abnormally acute of the sense of smell” [16, 17] – where the use of the word “acute” refers to intensity and does not refer to its clinical meaning denoting temporality or time.

This article aimed to provide clear, unambiguous definitions to nine of the most commonly used olfaction-related terms, i.e., dysosmia, anosmia, hyposmia, normosmia, hyperosmia, olfactory intolerance, parosmia, and phantosmia (also termed olfactory hallucination). This is to allow writers and readers of olfaction-related literature to have a common understanding of what is meant when these words are used. To reduce miscommunication, we propose that these definitions be used in future scientific communication about olfaction.

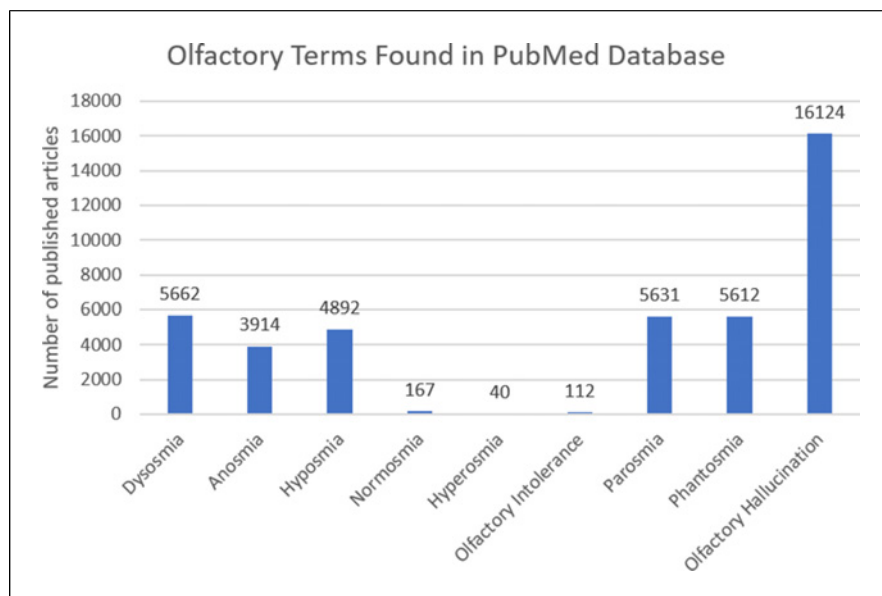


Fig. 1. Olfactory terms in the PubMed database (as of January 2023).

Dysosmia

Dysosmia comes from Greek “dys-” meaning “bad,” “osme” which means “smell,” and “-ia” which is a usual termination for Greek terms of pathology [18]. It has previously been described to be related to qualitative olfactory dysfunction [6, 19, 20], and it has been used as a synonym to “parosmia” [5, 21, 22]. However, “dysosmia” has also been used to describe only a quantitative olfactory loss [2, 23–25].

To avoid confusion, we propose that “dysosmia” be used as an umbrella term to describe the presence of quantitative and/or qualitative olfactory dysfunction [6, 26–31]. However, more specific terms listed below are recommended to better describe specific olfactory dysfunctions.

Anosmia

Anosmia is derived from the Greek “an-” meaning “without or not,” “osme” which means “smell,” and “-ia” which is a usual termination for Greek terms of pathology [32]. It has been in use since the early 19th century [33]. In the strictest meaning, it refers to the complete absence of the olfactory sense [34], but we extend it to a state where vague smell sensations may be present but are not enough to be useful in daily life, for tasks such as detecting dangers or appreciating foods or pleasant odors. Previously, some investigators, including some of the authors, have used the term “functional anosmia” for this present

but unusable olfactory function. But because “functional” is often used in medicine to refer to physical symptoms in the absence of a known physical cause (often unexplained or psychosomatic) [35], we suggest the term “anosmia” as an umbrella term for cases where the assessment of the sense of smell shows no usable olfactory function. Olfactory tests show scores below the lower limit for hyposmia.

Assessment of olfaction using validated, standardized psychophysical olfactory tests, for example, “Sniffin’ Sticks” [36] or the University of Pennsylvania Smell Identification Test (SIT-40) [37] may demonstrate anosmia (although they cannot rule out the presence of vague olfactory sensations which are not usable in daily life). However, various tests may use different numerical cut-offs to define anosmia (see [31, 32]); hence, the diagnosis of “anosmia” depends to some degree on the test used [38]. In addition, psychophysical olfactory tests are typically based on multiple forced choice principles which means that even completely anosmic people obtain a score that overlaps with scores obtained by individuals with strongly decreased but not completely absent olfactory function [3]. In this sense, the term “anosmia” may be used to refer to both. More definitive support for the diagnosis of anosmia can be derived from test results based on reflective changes of breathing patterns when sensing an odor [39], electrophysiological, EEG-related tests [40–42], or structural brain imaging, for example, suggesting the absence of olfactory bulbs [43, 44].

The term “anosmia” has been related to various etiologies, including sinonasal, post-viral, post-traumatic,

idiopathic, congenital, or neuropsychologic disorders [3]. It may be permanent or reversible depending on the cause [7]. When paired with particular adjectives, the term “anosmia” may take on different meanings. In particular, “specific anosmia” (sometimes “partial anosmia”) refers to the absence of smell perception for a particular odorous molecule or group of odorous molecules with an otherwise normal olfactory function and is thought to be a normal physiological trait [45].

Hyposmia

Hyposmia is derived from the Greek prefix “hypo-” meaning “under or beneath” [46]. It is used to describe olfactory dysfunction and refers to a quantitatively reduced ability to detect and identify the presence of certain odors. The word may be used to subjectively describe this reduction in olfactory function but is often used in the context of psychophysical testing (i.e., “Sniffin’ Sticks,” SIT-40, etc.). The distinction between “hyposmia” and “normosmia” is based on the performance of a sample of normal individuals from a particular age group in a particular olfactory test that has been generalized to a larger population. In the case of the “Sniffin’ Sticks” and the SIT-40, the 10th percentile of the distribution of the test scores of this group was chosen to define the border between hyposmia and normosmia. If this definition would be changed to 5%, then more individuals would reach the normosmic range when being tested. Hence, the definition of hyposmia is arbitrary to some degree.

To separate “hyposmia” and “anosmia,” the distribution of scores obtained in patients with anosmia is often used. In the case of the “Sniffin’ Sticks,” a composite score is used, consisting of the sum of scores for odor threshold (T), discrimination (D), and identification (I). The maximum TDI score possible for people with anosmia is 16 [47] and this is, therefore, the lower limit for “hyposmia” [48]. In SIT-40 [49], however, the term “microsmia” was described as a “condition of lessened smell function” that specifically relates to scores on this test only. “Microsmia” is further subdivided into “severe,” “moderate,” and “mild.” However, this subdivision is heuristic, and the word “microsmia” does not distinguish from “partial anosmia” and “hyposmia” as “. . . individuals on the borderlines may change boundaries, reflecting test-retest variation” [49]. Despite the slightly arbitrary boundary, the distinction between decreased and extremely little or no olfactory function is useful in clinical and research applications.

The current quantitative assessment of hyposmia is based on comparison with a group of young (21–30 years), healthy individuals who typically have the best olfactory function measurements of any age group. If the test scores were compared to those from the 71–80 year age group, the scores for the hyposmic category would be different because, in general, older people score lower on smell tests. The question arises whether, in individual testing, would an age-related categorization be more appropriate? The answer to that is not straightforward. On one hand, age-related categories can be helpful in counseling patients that their scores are normal for their age range, and as such, they can avoid the need to have unnecessary medical workup done based only on a test score. On the other hand, it is not helpful when people are labeled as having age-related normosmia when their relatively low function does not allow them, for example, to identify and subsequently avoid rotten milk. Much of how an age-related olfactory test result is handled depends on (1) the subjective complaint of the individual and (2) the clinical context in which the test results are interpreted.

Like anosmia, the term “hyposmia” has been related to various etiologies [3] and may be a sign of altered olfactory processing, although not to a degree of severity that is observed in anosmia. It may also be reversible or permanent depending on the cause [7] but has been attributed to similar causes identified for “anosmia.” However, it is worth noting that transient hyposmia may occur due to accelerated or prolonged olfactory adaptation and may be observed in chronic exposure to certain workplace chemicals [50]. In addition, hyposmia has been regarded as a frequent non-motor symptom related to Parkinson’s disease and may even predate motor symptoms by years [51, 52].

Normosmia

Normosmia comes from the Latin word “norma” meaning “standard or pattern of practice or behavior” [53]. It is used to describe normal olfactory function and refers to the absence of any olfactory-related complaints in terms of quantitative olfactory function. Accordingly, it may be that patients with olfactory dysfunction in the form of parosmia (see below) score in the normosmic range.

In terms of psychophysical testing, values of ≥ 30 in SIT-40 and ≥ 30.75 in the composite TDI score for “Sniffin’ Sticks” correspond to normal smell function. Similar to how the cut-offs for “hyposmia” were determined in the “Sniffin’ Sticks,” “normosmia” also relied on the scores of a particular group of young and healthy individuals (21–30 years) to determine what is normal (composite TDI score: 10th percentile = 30.75).

Hyperosmia

Hyperosmia comes from the Greek prefix “hyper-” meaning “over or beyond” [54]. It describes a quantitative increase in olfactory function, corresponding to an exceptionally high score in a psychophysical olfactory test (e.g., above the 90th percentile). Hyperosmia is not considered to be a type of olfactory dysfunction, and we propose that this term be used only in relation to results of psychophysical olfactory tests.

In contrast, the term “olfactory intolerance” is proposed to describe a qualitative olfactory dysfunction where individuals who do not experience odor distortions complain of a subjectively enhanced sense of smell and are intolerant to everyday odors. This condition is rare [5, 45], but it has been reported in certain conditions such as migraines, pregnancy, epilepsy, and Addison’s disease [6]. The term “hyperosmia” was previously used to describe this phenomenon. However, since the subjectively enhanced sense of smell is not consistently confirmed by psychophysical olfactory measures [6, 55] and does not equate to increased olfactory performance, we propose that the term “olfactory intolerance” be used for this particular phenomenon instead of “hyperosmia” for clarity.

Parosmia

Parosmia comes from the Greek prefix “para-” meaning “beside.” The word has been in use as early as the 19th century [14, 56] but has gained popularity with the increased frequency of this phenomenon due to the COVID-19 pandemic. It has been used as a synonym for “dysosmia” [5, 22] (see also above), while historically “parosmia” was used to mean “any disorder of the sense of smell” [15]. Its present use refers to a symptom of qualitative olfactory dysfunction where distorted odor perception occurs in the presence of an odor. Odors are often perceived as unpleasant [57] (described as, e.g., “smoke,” “feces,” “chemical,” “vomit”). Some molecules are more likely than others to produce parosmic sensations [58].

Parosmia is determined based on an individual’s self-report and may be challenging to assess. A grading system that includes frequency of occurrence, intensity, and social effects has been used to quantify the severity of parosmia [59]. In addition, a 4-item questionnaire [60] and a test based on the ratings of odors ([44], but also see [45]) have been proposed. Currently, there is no validated test or psychophysical measure that is widely recognized and utilized to test for parosmia. In certain cases, parosmia may improve with obstruction of airflow through the nasal

cavity. The distorted odor perception is usually unpleasant but may occasionally be pleasant (also “euosmia”) [61].

Parosmia is often associated with post-infectious olfactory dysfunction but may also be observed in sinonasal, post-traumatic, or idiopathic olfactory dysfunction [3] and has been reported in the literature as an isolated phenomenon after general anesthesia [62]. It often coincides with either a quantitative olfactory dysfunction (typically hyposmia) [63] or with phantosmia, but it may also occur independently. The exact mechanism of parosmia remains unclear, but it has been proposed to involve problems with odor coding affecting both the peripheral and central olfactory systems [64].

Parosmia is also believed to be associated with olfactory system repair and may be seen as a sign of recovery in some cases [64]. There is still some debate in the clinical olfaction community as to whether parosmia is a positive prognostic sign.

Phantosmia (Also Termed Olfactory Hallucination)

Phantosmia comes from the Latin word “phantasma” meaning “hallucination or illusion” [65]. It refers to the perception of an odor, often unpleasant (i.e., burned, rotten, fecal, or chemical [2, 25]) in the absence of an odor stimulus [2, 3]. Distinguishing the presence or absence of an odor stimulus may depend on the perception of other individuals in the same environment (i.e., whether they perceive the same odor the patient does or otherwise).

However, to describe a symptom as “phantosmia,” it is necessary to exclude an endogenous odor source from the nose or sinuses (e.g., mucopurulent discharge from sinuses, fungal ball, foreign bodies, tumor, etc.). There is no consensus whether there is need for a term that describes individuals who complain about an unpleasant odor in the nose with the eventual discovery of an endogenous odor source in the nasal cavity, paranasal sinuses, or oral cavity. Nevertheless, it is important to do a complete and thorough ear, nose, and throat physical examination (including nasal endoscopy, also computed tomography scan or magnetic resonance imaging in selected cases) to help rule out endogenous odor sources and better understand olfactory complaints.

Cacosmia is a general term previously used to mean a “negatively perceived olfactory distortion” but was also used as a term for either parosmia, phantosmia, or both [2, 4]. Due to the confusion potentially brought about by these different meanings, we propose that the terms “phantosmia” and/or “parosmia” be used instead of “cacosmia.” However, should one decide to use the word

Table 1. Summary of common olfactory term definitions

Olfactory term	Definition	Related terms
Dysosmia ¹	Olfactory dysfunction, in general (quantitative or qualitative)	Quantitative olfactory dysfunction Qualitative olfactory dysfunction
Anosmia	Quantitatively reduced olfactory function to the extent that the sense of smell is not useful in daily life	Functional anosmia
Hyposmia	Quantitatively reduced olfactory function	Microsmia
Normosmia	Quantitatively normal olfactory function	
Hyperosmia	Quantitative increase in olfactory function, corresponding to an exceptionally high score in a psychophysical olfactory test (e.g., above the 90th percentile)	
Olfactory intolerance	Qualitative olfactory dysfunction where individuals, without odor distortions, complain of a subjectively enhanced perception of odors and are intolerant of everyday odors	
Parosmia ¹	Distorted perception of an odor in the presence of an odor stimulus	Euosmia
Phantosmia or olfactory hallucination	Odor perception in the absence of an odor stimulus	

¹For clarity, “parosmia” and “dysosmia” are *not* regarded as synonymous.

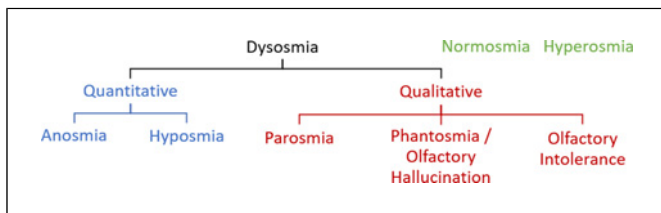


Fig. 2. Concept diagram of olfactory terms.

“cacosmia,” it is important to clearly describe what meaning the word holds for its use.

Leopold (2002) also made a distinction that sensations in patients with “phantosmia” last longer than a few seconds, while those in “olfactory hallucination” last only a few seconds [2]. Given that this phenomenon is difficult to measure, temporality may not be a relevant distinction that is required for this term. Therefore, we propose that the terms “phantosmia” and “olfactory hallucination” be regarded as synonymous. Phantosmia is a term that is generally familiar to otorhinolaryngologists; however, the term “olfactory hallucination” has been noted to appear more frequently in the neurologic literature and might have been associated with psychiatric disorders. Since the

exact pathophysiology is unclear, we deliberately propose to make the parallelism between phantosmia and olfactory hallucination to improve communication further and increase the awareness of progress in the various fields related to olfaction.

Henkin (1971) also previously used phantosmia as “a term describing the intermittent or persistent odor... perceived when no apparent odor is inhaled.” However, there exists a phenomenon regarded as “odor-induced phantosmia” or “smell lock” where one starts with the perception of odor from an apparent odor source, but the odor lingers and continues even when the odor source is no longer present. Hence, this circumstance still fits the criteria of phantosmia but may have initially started out from the perception of an odor. Along the same avenue of phenomena, some patients report “nasal breathing-related phantosmia” where odor perception occurs in the absence of an apparent odor source only when breathing through the nose but is eliminated once airflow through the nose is restricted (i.e., by pinching or occluding the nostrils).

Phantosmia is often associated with post-infectious and post-traumatic olfactory dysfunction but may also be observed in neuropsychiatric, sinonasal, and idiopathic olfactory dysfunction [3]. Like parosmia, it often coincides

with either a quantitative olfactory dysfunction (often anosmia) [63] or with parosmia, but it may also occur independently in individuals with normosmia. Similar to parosmia, determination of the presence of phantosmia is dependent on self-report as there is currently no validated test or psychophysical measure available to test for phantosmia. Still, specific questions have been proposed to identify the presence of phantosmia [60]. The exact mechanism of phantosmia remains unknown but is believed to involve an abnormality anywhere along the olfactory pathway. However, phantosmia may be a symptom of a deafferentation syndrome and, therefore, indicates poor prognosis in some cases [25, 64, 66].

Measured versus Subjective

In the literature, the determination of olfactory function can be “measured” or “subjective.” “Measured” usually denotes a numerical value from a validated, often psychophysical, olfactory test that quantifies olfactory function. It is often associated with terms related to quantitative olfactory dysfunction (i.e., “anosmia,” “hyposmia,” and “normosmia”). The word “subjective” refers to an individual’s self-reported olfactory function (i.e., poor-same-better or bad-equivocal-good). Qualitative olfactory dysfunction (i.e., parosmia, phantosmia) is often regarded as “subjective,” given that validated psychophysical tests are currently not available to evaluate these conditions. However, the word “subjective” may also be added to quantitative terms (i.e., anosmia, hyposmia, or normosmia) to mean self-reported olfactory function or dysfunction that is not confirmed by psychophysical olfactory testing. An exception to this is the term “olfactory intolerance” which we propose instead of “subjective hyperosmia.” This is to avoid confusion, given that “hyperosmia” is not considered as a pathologic state, while “olfactory intolerance” is. Although some patients may show congruence of measured and subjective olfactory function, some continue having subjective complaints in the setting of normal olfactory test scores and vice versa. Despite measured olfactory function often being the basis for management of patients with olfactory complaints, subjective olfactory function may sometimes better reflect quality of life. A clear distinction between “measured” and “subjective” olfactory function is important to consider, especially when they are not congruent, to enable clinicians to provide more holistic counseling and patient care.

A summary of the definitions of the abovementioned olfactory terms can be found in Table 1, and a concept

diagram of these terms can be found in Figure 2. This paper serves as a starting point in the efforts toward common understanding and use of the aforementioned olfactory terms. Future studies may re-evaluate for possible changes in the way these words are used in scientific publications years from now.

Conclusion

In conclusion, we propose the standardization of the use of the terms “dysosmia,” “anosmia,” “hyposmia,” “normosmia,” “hyperosmia,” “olfactory intolerance,” “parosmia,” and “phantosmia” or “olfactory hallucination” in olfaction-related communication. Further specification as “measured” or “subjective,” when referring to olfactory function, is helpful in the clinical setting. Precise use of these terms will enhance scientific communication in a field that is set to grow further.

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Conflict of Interest Statement

A.K.H., B.N.L., A.A., A.W.F., S.G., E.H.H., C.H., I.K., M.L., A.M., P.P.M., T.M., J.M.P., S.C.P., J.V., A.W.L., and K.L.W. have no conflicts of interest to declare. C.P.: the author is a trustee of Fifth Sense and holds grants with the National Institute of Health Research, the Engineering and Physical Sciences Research Council, the Rosetrees Trust, ENT UK, and the Royal College of Surgeons. He has received personal fees from GSK, Sanofi, Stryker, and Olympus. T.H.: since 2019, T.H. did research together with and received funding from Sony, Stuttgart, Germany; Smell and Taste Lab, Geneva, Switzerland; Takasago, Paris, France; AspUraclip, Berlin, Germany; Baia Foods, Madrid, Spain; Burghart, Holms, Germany; and Primavera, Oy-Mittelberg, Germany.

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Author Contributions

A.K.H.: conceptualization, writing, review, and editing. B.N.L.: conceptualization, review, and editing. A.A., A.W.F., S.G., E.H.H., C.H., I.K., M.L., A.M., P.P.M., T.M., C.P., J.M.P., S.C.P., J.V., A.W.L., and K.L.W.: review and editing. T.H.: conceptualization, supervision, review, and editing.

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