



Editorial: An Integrated Model of the Olfactory System Through Phylogenetic, Evolutionary, and Clinical Aspects: From Invertebrates to Humans, Through Sensory, Perceptual, and Cognitive Olfactometry Studies

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Editorial on the Research Topic

An Integrated Model of the Olfactory System Through Phylogenetic, Evolutionary, and Clinical Aspects: From Invertebrates to Humans, Through Sensory, Perceptual, and Cognitive Olfactometry Studies

The olfactory areas, among the brain structures, were the first to develop in primitive animals, and much of the brain developed around this original olfactory core. A part of the brain that originally served olfactory functions later evolved into the basal pathways that control emotions and the memory system, and other aspects of behavior. In some species, there still are functional transpositions, where the sense of smell has been replaced by brain functions related to spatial localization, cognitive maps, and aspects of social dominance.

The olfactory sense plays a critical role in various aspects of life in living organisms, according to an evolutionary line. Interestingly, recent studies have shown that the olfactory system can also be considered an active sensor of signals from endogenous activations (e.g., hormones and nutrients), therefore capable of simultaneously gathering and processing exogenous and endogenous information.

In this Research Topic, we invited researchers who study the olfactory system at different levels, including a comparative, evolutionary, and neuro-olfactometry perspective: from marine organisms, insects, vertebrates, mammals, up to humans.

We develop aspects related to the interaction of odors with the olfactory receptors, to the transduction of the olfactory signal, integration of olfactory information at a central level, to sensation, perception, emotion, and olfactory cognition, to the common pathways between olfaction and memory, to behavioral responses, to the genetic-physiological-environmental-social-psychological factors that can modulate the olfactory perception, to the connection between stress and smell, to the relationship between smell and eating disorders, metabolic disorders, to

olfactory biomarkers in neurodegenerative diseases, depression, and anxiety, to the various anosmic syndromes related to head injuries and various other pathologies.

This Research Topic includes eight papers covering the above mentioned aspects.

In a cross-sectional study Sollai and Crnjar, evaluating the impact of physical, cognitive, and social activity on the olfactory function in Elderly Subjects, found a positive relationship between high levels of physical activity and olfactory function. In particular, elderly people can benefit from a more active lifestyle by increasing non-exercise physical activities.

In another study on comparative aspects of aging Marín-Pardo and Giménez-Llort, referring to the paradigm of olfactory loss as a biomarker of neurodegenerative disease, provided distinct contextual, sex, and genotype olfactory signatures useful to explore olfactory function in aging (healthy and AD).

A review study by Damon et al. focused on the role of olfaction in the multisensory processing of faces, explaining how olfaction may influence the perception of transient face properties, in relation to competing frameworks of emotions.

Fantin et al. investigated the discriminatory potential of the Vividness of Olfactory Imagery Questionnaire (VOIQ), suggesting that daily olfactory stimulation is fundamental for maintaining the ability to create a vivid olfactory image.

The next paper by Su et al. examines clinical implications of psychophysical olfactory testing which has been widely used to evaluate the ability to smell due to its validated utility and feasibility in the clinic.

Regarding the dysfunction, the concept of olfactory training was investigated through a systematic review by Yuan et al., that identifies studies assessing olfactory symptomatological changes in patients with postviral olfactory dysfunction.

Switching back to animal models, Solari et al. investigated the chemical sensitivity of the sea urchin *Paracentrotus lividus* in response to sugars and the blue-green algae *Spirulina*. They highlight that understanding chemical sensitivity to potential food-related compounds may improve the efficiency and reduce the costs of dietary substrates for the optimization of intensive rearing strategies.

The study of Crava et al. on the functional characterization of the chemosensory receptors in the buccal apparatus of the oligophagous *Papilio hospiton* specie, represents the first attempt to connect the neuronal activity with their

molecular bases to unravel diet specialization between closely related species.

This Research Topic has dealt with the important theme of chemoreception from an evolutionary, physiological, and cognitive approach. Most contributions focus on olfactory communication and contribute to improving our knowledge of the role of the olfactory system in the life of living organisms. Based on what is reported in these studies and reviews, we can conclude that the research in the olfactory and chemosensory fields is wide-ranging and is developing in a methodologically more precise and structured way, and this chemoreceptive contribution can lead to breakthroughs and new visions in various research fields. In particular, both the psychophysical olfactory tests and their clinical relevance, and the importance of olfactory training for studying the olfactory function and trying to intervene in case of dysfunction were summarized. This aspect is very important if we consider that, as highlighted by the original articles published in this Research Topic, knowing the olfactory function can help to develop protocols that improve the quality of life of individuals, can allow for the early identification of neurodegenerative processes, improve processes cognitively, understand the molecular basis for a specialized diet and develop breeding protocols for species of economic interest.

AUTHOR CONTRIBUTIONS

GS and SI wrote the manuscript. GS, AD, and SI revised the manuscript. All authors have read and approved the final manuscript.

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