

ORAL PRESENTATION

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Is CYBERNOSE® an instrument for measuring odor space?

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All human senses, other than smell, can be readily represented by definable physical surrogates. Our sense of hot and cold approximates temperature as measured by a thermometer; touch equates to pressure; balance measures orientation and acceleration; vision integrates measures of the wavelengths and intensities of a portion of the electromagnetic spectrum with the four dimensions of space and time; hearing fundamentally equates to the amplitude and frequency of vibrations. Taste, apart from our bitter sense, measures the concentrations of acids, salts, a few amino acids and a number of sugars.

Our sense of smell is different. There is no instrument that can measure the fundamental properties that our noses respond to - indeed we don't really know what those properties are. Whilst there is some loose relation between sensory perception of smells and chemical structures, this only seems to apply to closely connected chemical species and breaks down once we move beyond that.

In principle we could objectively define an odor space, to sit alongside the human or animal percept, that could be measured with a set of odorant receptors, precisely definable as strings of amino acids expressed under standard conditions. Such odorant receptors would define the dimensions of odorant space. Of course, currently, there are many practical obstacles to employing biological odorant receptors for this purpose. One of the difficulties is the existence of many millions of different odorant receptor sequences belonging to at least four molecular families and distributed among millions of different metazoan species. We could define a human receptor-based odor space or a dog or a fly or nematode worm receptor-based odor space. They would differ, in some respects profoundly. Nevertheless, solving the aforementioned practical problems would not only support many practical applications but also allow us to reproducibly define the dimensions of

odor space and make "smell" an objective measurable property.

Our approach to this is through machine olfaction. Currently we are working with off-the shelf electronic noses as well as developing our own bioelectronic nose, the CYBERNOSE® instrument. In the former case, we looked to biology, specifically to published data on *Drosophila* olfaction, to guide our understanding of how solid state sensors encode odor space [1]. The take home message appears to be that the inadequacies of current solid state sensors prevent them being very useful for characterising and defining odor space, as proposed by Shurmer & Whitehouse (1993). On the other hand, we believe that development of the CYBERNOSE® instrument, which incorporates odorant biosensors, offers a viable approach to characterise defined, standardised odor spaces, based on but not limited to what is available to the nematode worm *Caenorhabditis elegans*.

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