



Contribution ID: 6

Type: **Talk**

Considerations on structure-odour activity relationships in humans

Friday, October 6, 2017 11:00 AM (20 minutes)

Odor potency and odor character are obviously tightly linked to chemical structure. Numerous studies have shown that specific structural features such as thio groups or aromatic moieties bare a high potential of causing extremely low odor thresholds, and, accordingly, of inducing potent smells. Likewise, specific groups appear to be commonly associated with specific smell character such as ester functions being predominantly associated with fruity impressions, or terpene structures eliciting balsamic or herbal smells.

However, when investigating specific substance groups with regards to their smell impact on individuals, one is astonished to find at times enormous variance in odor threshold levels, and also quite variable smell descriptions reported by different subjects. On first sight one might be tempted to assume that such differences in smell description are primarily related to linguistic issues rather than real differences in smell perceptions. Nevertheless, such questions can be resolved when asking panellists not only to rate their smell impressions for a specific substance but additionally relate the perceived smell to that of other substances; using this approach it is possible to elaborate which substances are perceived by the same person as being similar in smell. Based on such considerations, our group recently performed a number of systematic investigations on structure-odor activity relationships, starting with the synthesis of structurally related odorants belonging to different substance groups, namely odorants theoretically deriving from fatty acid oxidation, terpene-related compounds as well as phenol-, cresol- and guaiacol-derivatives (1-8). Our group further decodes odorants that occur as artefacts in products of a modern world, namely odorous contaminants in any types of pigments, paints, glues and adhesives, polymers and plastics, to name but a few. Based on this comprehensive substance library, we undertake to characterise the smell sensitivity of individuals to specific compounds, and how these are perceived. This not only helps us to decode naturally occurring, yet unknown odorants, but to also form a broader understanding of smell perception in human individuals.

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Session Classification: Olfactory receptors, chemical structure and animal models