The SENSOMICS approach: A useful tool to unravel the genuine aroma blueprint of foods and to elucidate the generation of key odorants during food processing

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Cultural familiarity, gender or age as well as food borne factors, such as cost or convenience undoubtedly do influence food choice by the consumer. However, numerous consumer surveys confirm that the main drivers of food acceptance are aroma and taste which are, thus, the main determinants of the differences in the flavor signatures of any given type of food. Now what makes a food smell and taste good? It is well established today that during food consumption, a certain set of volatile constituents induces a pattern of neural activity in the olfactory bulb located in the nasal cavity, while preferentially non-volatile constituents interact with the gustatory receptors in the oral cavity. Although both perceptions are closely linked, this talk will be mainly focused on olfaction. The complex neural patterns generated at the odorant receptor sites are finally “translated” by our brain into a simple perception telling us, for example, the aroma quality of roasted nuts. However, since the overall aroma of e.g., filberts is significantly influenced, for example by the variety and/or the roasting conditions, and, also, because off-notes may be formed due to improper technological conditions in food production, there is a clear need to understand the aroma signature of a given food on the molecular level. In the past decades, the Sensomics concept was developed by our group aimed at decoding the aroma signature of foods, i.e., the exact quantitative ratio of food aroma compounds in the headspace above the food. As part of the concept, the analytical data are finally confirmed by re-engineering the respective food aroma on the basis of quantitative data displaying the natural concentrations in the food itself.
Using roasted peanuts and hazelnuts as examples, concepts how to characterize complex aromas by breaking down the overall aroma sensation into single, “molecular” odor responses will be presented, followed by approaches how to re-engineer the natural aroma by so-called recombination experiments. Further, it will be illustrated, how this knowledge can be used to study flavor formation during roasting of hazelnuts (filberts) in order to adjust the chemistry to the overall liking of the roasted material. Finally, using the case of off-flavors, it will be shown, how close odorant concentrations may determine liking and disliking of the same food.