Human odorant receptor for characteristic petrol note of Riesling wines identified

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Climate change does not stop at grapevines. Too much sun means that the bouquet of German Riesling wines becomes dominated by a petrol note (some) customers do not appreciate. A research team from the Leibniz Institute for Food Systems Biology at the Technical University of Munich has identified the human odorant receptor responsible for the perception of this special aroma. Their paper is published in the *Journal of Agricultural and Food Chemistry*.

The grapevine (Vitis vinifera) is one of the most economically important fruit plants, with Riesling being one of the classic grape varieties. The bouquet of this white wine is characterized by floral, fruity and honey-like nuances, accompanied by a more or less pronounced petrol note.

The latter is due to an odorant with the chemical name 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN). Low and moderate concentrations of this odorant contribute to the complexity of the wine bouquet. However, wines with higher levels are often rejected by local consumers.

Increased sun exposure intensifies the petrol note

Compared to German Riesling, Riesling wines from South Africa or Australia generally have significantly higher concentrations of the aroma compound. The reason for this appears to be the higher UV exposure of the grapes in the southern hemisphere, which leads to increased carotenoid production in the plants. Like pigments in human skin, these natural colorants serve as sun protection, but at the same time are molecular precursors of the odorant TDN.

Studies have determined an odor detection threshold of TDN between approx. 2 and 20 micrograms per liter. Its odor quality is reminiscent of

petroleum and kerosene. A human odorant receptor for this compound, however, was previously unknown. As the research team led by Dietmar Krautwurst has now shown for the first time, it is the odorant receptor OR8H1.

Receptor with a specific recognition profile

The team identified the odorant receptor using bidirectional receptor screenings. Using a cellular test system, they examined which of a total of 766 human odorant receptor variants react to the petroleum note. The OR8H1 receptor was the only one to respond to physiologically significant concentrations of the kerosene-like odorant. The team then investigated whether the identified receptor also reacted to other food-relevant odorants. Of the 180 substances tested, only seven, predominantly aromatic compounds, were able to significantly activate the receptor.

"The recognition spectrum of receptor OR8H1 is therefore very specific. Moreover, it complements the spectrum of another odorant receptor that recognizes a very broad range of food-relevant odorants," reports first author Franziska Haag.

Principal investigator Dietmar Krautwurst adds, "Our new findings help us to better understand the molecular mechanisms that contribute to our perception of foods as distinguishable odor objects, for example the complex bouquet of a wine."

The researchers assume that a deeper understanding of the molecular background of odorant perception will lead to the development of new sensor technologies for food aromas in the long term. These could then be used for quality control purposes of not only the petrol note in wines, but also the occurrence of (off) flavors in other foods.

About 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN)

The TDN concentration in wine increases during bottle aging due to the conversion of carotenoid precursors contained in the grapes or must. The amount of precursors depends on viticultural practices such as defoliation of the grapes, soil fertilization, irrigation and the selection of grape clones.

Apart from this, higher temperatures and intense sunlight help to increase the formation of the odorous substance that smells of petrol. The yeast strains and the choice of bottle closures also influence the concentration of odorants in the wine. Storage conditions, especially elevated temperatures, have been shown to accelerate the formation of TDN.

The typical content of TDN in European Riesling wines is usually between 1 and 50 micrograms per liter, while in Australian wines it can reach up to 250 micrograms per liter and more.

More information: Franziska Haag et al, Petrol Note in Riesling – 1,1,6-Trimethyl-1,2-dihydronaphthalene (TDN) Selectively Activates Human Odorant Receptor OR8H1, *Journal of Agricultural and Food Chemistry* (2024). DOI: 10.1021/acs.jafc.3c08230

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