On the scent of a wine's bouquet

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As the grapes ripen, more and more aroma compounds accumulate in their skin. Credit: Johanna Frotscher/Hochschule Geisenheim

The majority of wines are produced from around 20 different types of grape, all of which have their own typical aroma. This is due to the terpenes, a diverse category of chemical substances including cholesterol and estrogen. Scientists from Technische Universität München (TUM), the Hochschule Geisenheim and the Universität Bonn have now

identified two enzymes that determine the terpene content – and thus the aroma intensity – of grapes. The findings could play an important role in the future development of grape varieties.

From Chardonnay to Sauvignon, Dornfelder to Merlot, every grape variety has its own distinctive aromatic profile. The reason why a white wine has either fruity or flowery notes or a red has flavors of nutmeg or berries is all down to the composition of the terpenes. These compounds accumulate as the grape ripens, especially in the skin. The number of terpenes formed depends on external factors, for example the soil conditions or hours of sunshine.

But the terpenes only contribute to the aroma if they are in a free state, as Professor Wilfried Schwab from the Biotechnology of Natural Products program explains: "Terpenes are biochemically altered in the metabolism of plants – usually through the attachment of sugars, or glycosylation. In this attached form, however, the terpenes are no longer aroma-active." In Riesling grapes, for example, only 20 percent of the terpenes occur in a free state.

Cultivation of new grape varieties – more aroma with fewer enzymes

The research team headed by Schwab investigated the biochemical principles of terpene glycosylation. They identified two related enzymes that transfer the sugar groups to various terpenes. "What we have discovered here is a fundamental mechanism that could be relevant for the cultivation of new grape varieties or the improvement of existing ones," claims Schwab.

Growers could then specifically select vines with a genetic profile that will likely have a high proportion of free terpenes – and which will

therefore be particularly aromatic. "A key role is played here by the sugar-transferring enzymes," comments Schwab. "If the plant produces few enzymes, then the level of activity will be low. As a result, the aroma-active terpenes will accumulate in the grape." As soon as the genetic profiles of current grape varieties have been determined, the new findings can be transferred directly to practice.

Since terpenes also play an important role in the cosmetics industry, it is possible that additional applications will be found here. One example is the creation of aroma activated at the touch of a button. Sugar-cleaving enzymes could then be used to control the release of aromas, which could for example prolong the effect of deodorants.

More information: Activity-Based Profiling of a Physiologic Aglycone Library Reveals Sugar Acceptor Promiscuity of Family 1 UDP-Glucosyltransferases from Grape1, Friedericke Bönisch, Johanna Frotscher, Sarah Stanitzek, Ernst Rühl, Matthias Wüst, Oliver Bitz, and Wilfried Schwab, *Plant Physiology*, DOI: 10.1104/pp.114.242578

A UDP-Glucose:Monoterpenol Glucosyltransferase Adds to the Chemical Diversity of the Grapevine Metabolome, Friedericke Bönisch, Johanna Frotscher, Sarah Stanitzek, Ernst Rühl, Matthias Wüst, Oliver Bitz, and Wilfried Schwab, *Plant Physiology*, DOI: 10.1104/pp.113.232470

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