

# In vino veritas: Promiscuous yeast hook up in wine-making vats

February 27 2012

---

Humans aren't the only species that like to get busy with a glass of bubbly, according to researchers at the Stanford University School of Medicine. Turns out, the common baker's yeast has indulged in a frenzy of amorous frolicking in the fermentation vats of winemakers for hundreds, possibly thousands, of years, with interesting results.

The unexpected [promiscuity](#) has made the [lineage](#) of many commercial and wild [yeast](#) strains difficult to trace. But there are also indications that such willy-nilly sharing of genetic information is precisely what gives that hint of passion fruit to your favorite glass of [chardonnay](#), or that round, plummy flavor to your most-recent quaff of zinfandel.

"The strain of yeast used in fermentation definitely affects the flavor of the wine," said Gavin Sherlock, PhD, an associate professor of genetics who personally taste-tested several vintages specially produced by his Gallo collaborators as part of the research, "and we thought that these strains would fall into a nice evolutionary-tree-like structure with a [common ancestor](#)."

Instead they found chaos. The yeast, which normally reproduce asexually, had partnered multiple times not just with one other — mingling strains — but even with members of different species of yeast.

"We were surprised to see how much mating has occurred," said senior research associate Barbara Dunn, PhD. "It makes it much harder to follow the trail backward through history."

It's not clear whether the crossbreeding the researchers observed was deliberately fostered by ambitious winemakers or bakers, or if it happened by chance.

Sherlock is the senior author of the research, which will be published online Feb. 27 in *Genome Research*. Dunn is the first author of the study. The work was done in collaboration with, and funded by, the E. & J. Gallo Winery. A special wine-production line was used for the study to be sure that all other variables, such as grape type and temperature, were eliminated.

Baker's yeast is sometimes referred to as the world's first domesticated organism. Although the entire genome of one reference strain was sequenced in the early 1990s, there has been little additional study of intraspecies genomic variation, or the "pan-genome."

"The total gene pool for this species is not well-characterized," said Sherlock. "But there have been indications that the reference sequence generated in the '90s doesn't accurately reflect the totality of the *cerevisiae* genome. Comparing the genomes of many strains will help us understand how they are related."

Previously, Sherlock and Dunn conducted a similar study of the types of yeast used to brew beer. In that study, they found that a pairing of two species of yeast, one of which had been used for thousands of years to make ale, had occurred more than once and resulted in a more cold-tolerant hybrid responsible for today's lager. Unfortunately in the new study, the wily wine yeast strains were less accommodating.

Like other organisms, yeast — most of which belong to the genus *Saccharomyces* — are classified into groups by species indicated by their scientific names. The common baker's yeast, *Saccharomyces cerevisiae*, for example, is a different species than *S. paradoxus* or *S.*

mikatae. Within each species are subgroups called strains that share [genetic information](#), somewhat like extended family members.

Many of these yeast strains and species have been used by humans for several millennia. Early humans relied on airborne wild yeast to help their bread to rise and grain to ferment.

Eventually they began to reuse portions of dough from baking or the sludge left behind after fermentation to ensure the success of their next effort. As they did so, they were unconsciously selecting for particular yeast strains. Now, several industrial applications — including commercial wine making, beer brewing, baking and even the production of fuel ethanol — all rely on their own particular species and strains.

The reason the extent of mating was surprising is that most yeast, at least during industrial processes, reproduce primarily by asexual budding — pinching off one identical daughter cell after first duplicating the parent's genetic material. Occasionally they go through sexual reproduction and form spores that can mate with another spore of the same species and then continue to bud asexually.

"It's not known how often yeast mates in the wild," said Sherlock, "but it's thought to be relatively rare. That's why we thought that the yeast strains we studied would be relatively pure lineages, and that we could easily deduce evolutionary relationships among them."

The researchers used a technique called array-comparative genomic hybridization to analyze the genomes of 83 strains of yeast. The technique identifies variations in copy number among different yeast samples and can be used to deduce evolutionary relationships as an alternative to sequencing the entire genome. Sixty-nine of the strains studied by the researchers are used in commercial wine making; the remaining 14 are used either in other industrial applications or occur

naturally in the wild.

They found a surprising genetic mish-mash. Several strains harbored bits and pieces of DNA from other cerevisiae strains or even other *Saccharomyces* species — proof positive of past co-mingling. And more than one strain sported the same bits of DNA as another, suggesting that a particular gene or genes offered an evolutionary leg up.

"It suggests that there might be something advantageous to winemakers about that DNA," said Sherlock. "One gene is known to reduce haziness in white wines, while another affects the amount of foam produced during fermentation."

The researchers plan to continue their experiments on how yeast strains affect wine flavor and other characteristics. But they also plan to conduct whole-genome sequencing of many of their samples to nail down once and for all who is related to whom, and to figure out exactly what's been going on in those wine barrels.

"Historically, winemakers were just happy to see that fermentation was taking place," said Sherlock. "But it seems that all the sloshing about that occurs during the process may have facilitated some very interesting couplings."

Provided by Stanford University Medical Center

Citation: In vino veritas: Promiscuous yeast hook up in wine-making vats (2012, February 27) retrieved 21 June 2024 from <https://phys.org/news/2012-02-vino-veritas-promiscuous-yeast-wine-making.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.