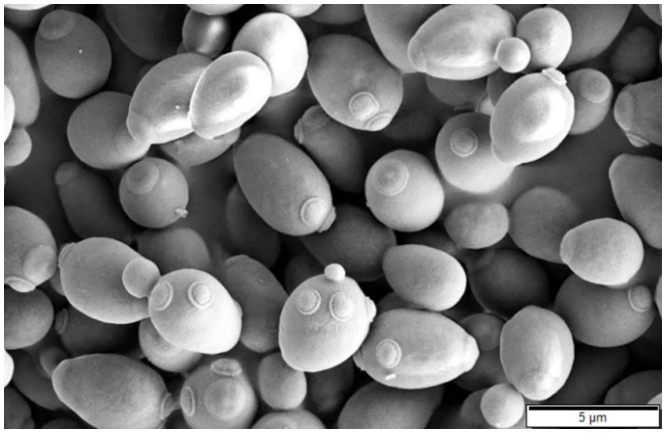
Understanding probiotic yeast

30 August 2019



Saccharomyces cerevisiae, SEM image. Credit: Mogana Das Murtey and Patchamuthu Ramasamy/CC BY-SA 3.0

Researchers led by Prof. Johan Thevelein (VIB-KU Leuven Center for Microbiology) have discovered that *Saccharomyces boulardii*, a yeast with probiotic properties, produces uniquely excessive amounts of acetic acid, the main component of vinegar. They were also able to find the genetic basis for this trait, which allowed them to modify the acetic acid production of the yeast. If this unique *S. boulardii* trait can be further validated to have a probiotic effect in animal models, these results could provide the first genetic basis for S.boulardii's unique probiotic potency. The study is published in *Genome Research*.

A tale of mysterious yeast

In 1923, the French scientist Henri Boulard isolated a mysterious yeast strain from lychees in South East Asia. This yeast turned out to have unexpected and potent probiotic properties. This yeast, called *Saccharomyces boulardii*, has since been commercialized for treatment of diarrhea and other intestinal diseases. It is now sold in pharmacies all over the world under a wide range of trade names.

Recent whole-genome DNA sequence analysis showed that *S. boulardii* is closely related to the much better-known *Saccharomyces cerevisiae*, the yeast species of which different varieties are commonly used in baking, beer brewing, wine making, bioethanol production, etc. The DNA sequence of these two yeasts is actually so similar that*S. boulardii*is no longer considered as a separate species but as a variety of *S. cerevisiae*. Why this *S. boulardii* yeast has been so successful as probiotic, as opposed to the common*S. cerevisiae*yeasts, has remained a complete mystery.

The vinegar mutations

The team led by Prof. Johan Thevelein (VIB-KU Leuven) found that the production of acetic acid, the main ingredient of vinegar, is a distinguishable feature of *Saccharomyces boulardii*. Acetic acid is a well-known preservative and strongly inhibits the growth of all microorganisms. But how does *S.boulardii* produce such large amounts of acetic acid?

Time for a genetic investigation, as Prof. Thevelein explains: "We were able to find two unique mutations in S.boulardii that are responsible for the production of acetic acid. These mutations can act as a genetic 'fingerprint' that allows us to distinguish between these two types of yeast and allow the isolation and identification of new *S. boulardii* strains from nature."

Based on this knowledge, the researchers were able to implement CRISPR/Cas genome editing to abolish acetic acid production completely as well as switch high into very high acetic acid producers and vice versa. These modified yeast strains can now be used to test the importance of the acetic acid production for the probiotic power of *S.boulardii* in laboratory animals, which, in turn, may pave the path towards improved treatments for intestinal diseases.

More information: Benjamin Offei et al. Unique

genetic basis of the distinct antibiotic potency of high acetic acid production in the probiotic yeast Saccharomyces cerevisiae var. boulardii, *Genome Research* (2019). DOI: 10.1101/gr.243147.118. genome.cshlp.org/content/early … .full.pdf+html?rss=1

Provided by VIB (the Flanders Institute for Biotechnology)