Methanol Metabolism of Yeasts Defined

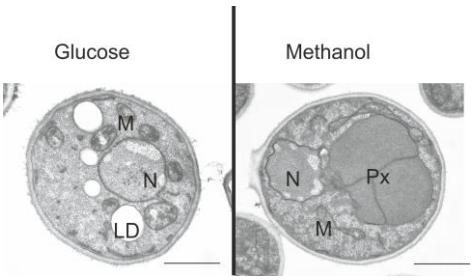
Duplicate copies of genes safeguard survival of the biotech yeast *Pichia pastoris* in environments where only methanol is present as feed. A recently elucidated metabolism is similar to that used by plants for the utilisation of carbon dioxide.

Yeast has been used by mankind for longer time than any other microorganism. Bread, beer, wine – all of these could not be produced without *Saccharomyces cerevisiae* (baker's yeast) and other yeast species. Over the last decades yeast has become indispensable for industrial biotechnology as a reliable cell factory. Valuable products ranging from enzymes to active pharmaceutical ingredients are industrially produced using yeast, mostly by a species called *Pichia pastoris* that is particularly productive. Because of its long and varied use, yeast is one of the best studied organisms. Besides its industrial application *Pichia pastoris* is also used by scientists as a model organism for studying cell structures.

The group of Brigitte Gasser and Diethard Mattanovich at the BOKU Department of Biotechnology and the Austrian Centre of Industrial Biotechnology (acib) has elucidated a new pathway that makes the yeast *Pichia pastoris* unique. The new pathway explains the utilization of methanol as "feed". Yeasts such as *Pichia pastoris* belong to the rare kind of microorganisms that are able to utilize this simple alcohol as nutrient, such as in in the sap of trees, where methanol is present.

The BOKU team, in cooperation with the BOKU Department of Chemistry and TU Graz, showed that the formation of carbon-carbon bonds and the following chemical rearrangements to suitable molecules follow a metabolic pathway which resembles CO_2 in plants. The localization in specialized organelles (peroxisomes in yeasts) is another resemblance to the plant pathway.

Just as little was known about the genetic encoding of this metabolism. All genes for methanol manipulation are duplicated, as the BOKU team has discovered. The genes have an additional genetic information so that the appropriate reactions are located to the peroxisome, and they are active only when methanol is present as a nutrient source.



Electronmicroscopy of *Pichia pastoris* cells: normal yeast cells grown on glucose on the left. Clearly visible peroxisomes (Px), the organelles responsible for assimilation of methanol into cellular biomass on the right.

Reference:

Rußmayer et al. Systems-level organization of yeast methylotrophic lifestyle. *BMC Biology* 2015, **13**:80.

About acib

The Austrian Centre of Industrial Biotechnology (ACIB) is an international research centre for industrial biotechnology with locations in Vienna, Graz, Innsbruck, Tulln, Hamburg and Bielefeld (D), Pavia (I), Barcelona (E) and Rzeszow (P). acib sees itself as a scientific and industrial network of 130+ partners, including Biomin, Biocrates, Boehringer Ingelheim RCV, Lonza, Sandoz, VTU Technology.

At acib, 200+ employees work on more than 70 research projects with the final goal to replace conventional industrial processes and products by more environmentally friendly and more economical approaches.

acib is owned by the University of Natural Resources and Life Sciences, Graz University of Technology, the Universities of Innsbruck and Graz and the Styrian Joanneum Research. acib is financed by industrial and public contributions. The latter come from the Austrian Research Promotion Agency of the Republic of Austria (FFG), the Standortagentur Tirol, the Styrian Business Promotion Agency (SFG), the province of Lower Austria and the Economic Development Agency of Vienna.

www.acib.at

Contacts

Dr. Brigitte Gasser, BOKU/acib, 01 47654 6813, brigitte.gasser@boku.ac.at
Prof. Diethard Mattanovich, BOKU/acib, 01 47654 6569, diethard.mattanovich@boku.ac.at
DI Thomas Stanzer MA, public relations/acib GmbH, 0316 873 9312, thomas.stanzer@acib.at