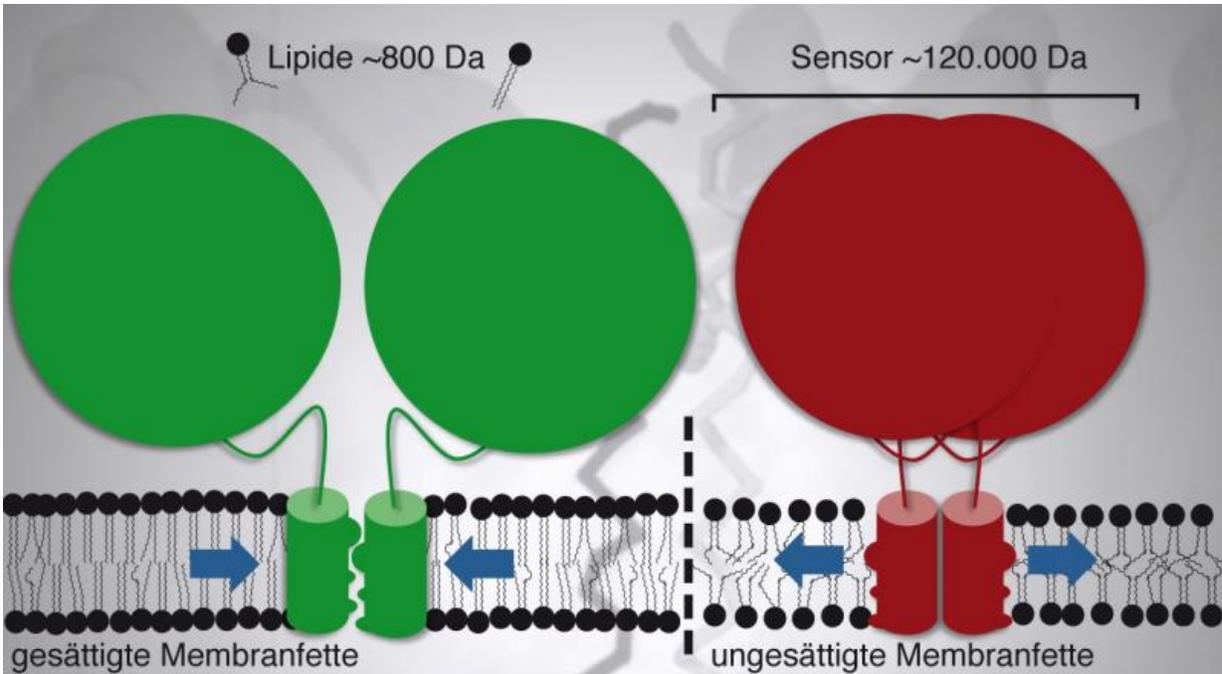


How yeast cells regulate their fat balance

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Not only humans but also each of their body cells must watch their fat balance. Fats perform highly specialised functions, especially in the cell membrane. A research group at the Buchmann Institute for Molecular Life Sciences (BMLS) of Goethe University in Frankfurt, together with colleagues at the Max Planck Institute of Biophysics, has now discovered how yeast cells measure the availability of saturated and unsaturated fatty acids in foodstuffs and adapt their production of membrane lipids

to it. This opens up new possibilities to understand the production and distribution of fatty acids and cholesterol in our body cells and make them controllable in future, report the researchers in the latest issue of the *Molecular Cell* journal.

A glance in the supermarket refrigerator shows: Low fat, less fat and no fat are en vogue. Yet fats are essential for cell survival as they form the basic structure for the biological membranes which separate cells from the environment and form functional units inside them. In this way, opposing reactions, such as the formation of energy stores and consumption of fat, can be organised in one and the same cell.

"Membrane lipids have a large number of vital cellular functions. They impact on signal transmission from cell to cell, but also affect intracellular communication," explains Professor Robert Ernst, whose research group at the BMLS has been on the trail of fats' hidden functions for years. "Hormone-producing cells are particularly susceptible to perturbed fatty acid metabolism and often have difficulties in regulating their membrane lipid composition. A malfunction of fatty acid regulation can, however, lead to cell death and – depending on the type of cell – trigger diseases such as diabetes."

First observations that living organisms such as bacteria can actively control their fatty acid production were already made decades ago. Yet until recently researchers puzzled over how higher organisms, for example fungi such as baker's yeast, measure and regulate the ratio of saturated and [unsaturated fatty acids](#) in their [membrane lipids](#). Thanks to funding from the German Research Foundation and the Max Planck Society, the working groups headed by Robert Ernst at Goethe University Frankfurt and Gerhard Hummer at the Max Planck Institute of Biophysics have been able to investigate this fundamentally important question.

In order to describe the mechanism of a membrane sensor which measures the degree of lipid saturation in the yeast cell, the researchers used genetic and biochemical methods and simulated the motions and underlying forces of membrane lipids over a period of a few milliseconds by means of extensive molecular dynamic simulations.

These efforts revealed that the sensing mechanism is based on two cylinder-shaped structures which are positioned next to each other in biological membranes. They both exhibit a rough and a smooth surface respectively and rotate around each other. "It's like a finger in cookie dough that checks how much butter has been added," explains Robert Ernst. As saturated fats cannot be accommodated by the rough surface of the helix while unsaturated fats can, the fat sensor's structure changes depending on the membrane environments. Intriguingly, this conformational change can control the downstream production of unsaturated fatty acids.

"This finding paves the way for many more studies", predicts Robert Ernst. "With our knowledge of this delicate mechanism in yeast we can now focus on finding new sensors in different organelles and species which monitor and control the production of unsaturated [fatty acids](#) and cholesterol in our body." In view of the far-reaching potential of these findings, an international conference will be staged in the near future. The organisers, including researchers from Frankfurt, expect that many cellular functions of membrane lipids will be revisited from a new perspective and that it will be possible to support hormone-producing cells in a more targeted manner.

Provided by Goethe University Frankfurt am Main

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