

## The SMALTIS'tory – episode #11

### Talk and Cheese

Once upon a time was cheese, a high place of communication between fungi and bacteria.

Attracted by the smell of French cheeses, a team from Tufts University recently published work on how, in Camembert, Roquefort and other festivities, bacteria use compounds produced by fungi and adapt their behavior.

Let's go back to the starting point. While fungi grow on the cheese rind, they secrete enzymes that lead to the formation of various substances such as acids, alcohols, aldehydes, amines, sulfur compounds... It is among these substances that we find volatile organic compounds (VOCs).

These molecules intrigued the researchers at Tufts University. The latter then set up a model allowing them to analyse the effect of VOCs produced by the five main fungi found in cheese, namely *Galactomyces geotrichum*, *Debaryomyces hansenii*, *Penicillium sp.*, *Scopulariopsis sp.*, and *Fusarium domesticum*, on phylogenetically different bacteria.

Their work showed that the *Vibrio casei* proteobacterium responded most strongly to VOCs, with a very significant and rapid increase in growth. These effects are not transitory, as they are maintained after one week of incubation. The fungal VOCs therefore cause a change in the diversity of the cheese microbiota, with the appearance of the *Vibrio* genus dominating.

Let's take the analysis a step further to understand the underlying genetic changes. Analysis of the metatranscriptomics profile of *Vibrio* revealed a change in the expression of 159 genes, including activation of the glyoxylate shunt, a short circuit in the Krebs cycle. This allows bacteria to use simple compounds such as acetate or other fatty acids as carbon sources when more complex sources such as glucose are not available. Since cheese is limited in nutrients for many species, this metabolic shunt is the presumed mechanism by which *Vibrio* use fungal VOCs to proliferate rapidly. These metabolic changes could also change the way bacteria produce secondary molecules that affect the taste of cheese.

Fungal VOCs are therefore a means of indirect communication between fungi and bacteria, allowing the latter to thrive, and ultimately play a significant role in the taste qualities of cheese.

A better understanding of the interactions within cheese microbiomes could help producers manipulate these elements to improve the quality and variety of flavors.

A perspective that whets the appetite!

