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# BACK TO THE FUTURE: DESIGNING THE MICROBIAL TERROIR OF FRENCH AND SWISS CHEESES SINCE THE 70s

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**In the 1970s, European cheesemakers and scientists faced a decline in the microbial diversity of raw milk dairy products, primarily attributed to “the progress in hygiene”**

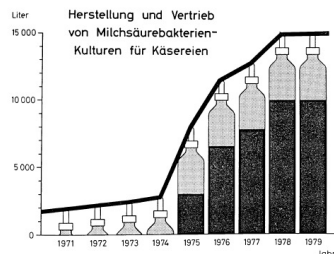


**1968-1970**, Swiss federal dairy research station Liebefeld-Bern (now Agroscope). Excerpt of the Activity Report:

« The types of bacteria generally present in milk on delivery and their proportions have a certain influence on the quality of the milk and the products made from it. **The development of hygiene in milk production and processing has created completely new conditions in this respect. [...]**

The ever-increasing demand from cheesemakers for pure strains or pure mixed cultures to improve or even replace their own cultures **is due to a change in the composition of the dairy flora as a result of measures to improve quality.** » (translated from German)

Increasing demand by Swiss cheese dairies for the ferments produced by the Liebefeld dairy research station (now Agroscope) (Source: Activity report 1968-1970)

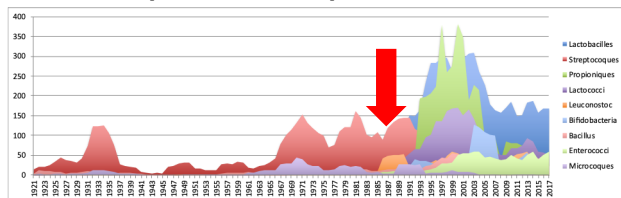


**1979**, Institut Technique du Gruyère (I.T.G, now Actalia). Excerpt of a meeting of the scientific and technical committee:

« An English researcher took advantage of a trip to Franche-Comté to take milk samples. **He considered that there were only 5 or 6 strains of Streptococcus lactis and Str. cremoris used in his region because of the progress in hygiene and mechanisation [...]. The Committee therefore requests that [the technicians] of the I.T.G. [...] build up a stock of strains\*** »

\* (translated from French)

## Studies on the microbial diversity of milk and dairy products developed in the 80s



Textual analysis of the journal *Le Lait-Dairy Science & Technology* (1921-2017). Occurrence of taxa of technological interest mentioned in the articles (5-year moving average). There was significant diversification of the taxa studied from the end of the 1980s until the mid-2000s.

## National and European biotechnology programs also developed in the 80s

Simultaneously, during the 80s, national and European programs encouraging the development of biotechnology emerged to support the European industry. **They supported the creation of microbial banks and research on food micro-organisms** for a wide range of fermented foods. As highlighted by a research director from the National Institute of Agricultural Research (INRA):

“It has become clear in recent years that the industry is finding it increasingly difficult to use natural flora and wants to replace it with selected flora. We therefore need to encourage the marketing of high-performance sourdoughs.”\*

P. Dupuy, avril 1984. Stratégie du secteur agro-alimentaire face aux biotechnologies. Note, 7 p.

## Techniques of dairy microbes' conservation differed between countries. They reflect different conceptions of the terroir



The Dairy Research Station Liebefeld-Bern continued to advance raw mixed cultures, comprising a blend of unselected strains, occasionally lacking characterization. Each cheesemaker is required to incubate the culture in order to produce their customized, ready-to-use culture.



In this case, the most crucial factor is the expertise of the cheesemaker. As stated in an interview with a scientist in 2018. **“From a single starter, the cheesemaker can derive a hundred distinct starters [...] and craft their own unique cheese”\***. Terroir is defined at the level of the cheese dairy.



I.T.G (Actalia) leveraged a technology initially designed for evaluating commercial strains to formulate a ready-to-use blend of carefully selected strains tailored specifically for DPO cheeses

In this case, microbes are inherently regarded as an integral component of terroir. As per the DPO specificity guidelines from 1996, **“The strains must respect the specificity of the [cheese] flora”\***. Terroir is delineated on a regional scale.



1996: ferments retailing  
1996: 1<sup>st</sup> ready-to-use mix of « wild strains »  
2009: 2<sup>d</sup> ready-to-use mix of « wild strains »

## How can comparative history inform the present?

Cheesemakers and scientists began observing a reduction in dairy microbial diversity as far back as the 1970s. Analysing the solutions they proposed during that period sheds light on the ongoing discussion about microbial conservation, expanding the range of potential approaches. In an era marked by the proliferation of gene banks, the questions of ‘why in-situ conservation wasn’t developed?’ or whether certain techniques tend to favour the use of clonal populations in cheese production, continue to be relevant.

