Veille citoyenne d'information sur les OGM et les semences

« Animal proteins » without animals

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Publié le 10/07/2025, modifié le 09/03/2026

Milk proteins without cows, fish without fish, meat without animals and even egg proteins without eggs or chickens: welcome to the realm of "*precision fermentation*" for our future food. Three start-ups in the sector have obtained approval for their milk-free milk proteins from the US health authorities, enabling them to sell them to food manufacturers.The industry and certain institutions are presenting these innovations as a step forward in reducing the carbon impact of livestock farming and meeting the food needs of human populations. Above all, it is a promising market: these "*advances*" are already attracting investors.

These non-animal proteins are produced by genetically modified micro-organisms. For several decades, such micro-organisms (bacteria, yeast and filamentous fungi) have been used in confined environments (in bioreactors) to produce molecules of industrial interest. These concern the medical sector (production of human insulin or vaccine proteins by genetically modified bacteria) and the agri-food sector (production of enzymes, mainly, but also vitamins and food additives)[i]. It used to be called "*moleculture*"; nowadays it's called "*precision fermentation*". But beyond this semantic change, which makes sense, another difference needs to be highlighted in this case: we are talking about nutrients[ii], sources of energy and molecules that make up organisms.

Are these non-animal proteins, substitutes for animal proteins, and the processes used to produce them, sufficiently well researched to guarantee their safety?
This is an important question at a time when, in Europe, the deregulation of GMOs is likely to affect GM micro-organisms[iii].

"*Precision fermentation*": how does it work?

At Wageningen University in the Netherlands, the yeast *Pichia pastoris*, a close relative of baker's yeast, has been genetically modified to produce these proteins. For casein, for example, a DNA fragment coding for casein is integrated into the yeast genome. This is transgenesis[iv]. It should be noted that the vocabulary used by the Académie des technologies is different: it speaks of "*rewriting the genome of micro-organisms*"[v]. An euphemism...

In a bioreactor, the yeasts are fed sugars and nitrogenous substances (supposed to replace the grass grazed by the cow). They then develop and produce casein proteins, which are isolated and separated from the rest of the medium. "*This stage is important to avoid ending up with genetically modified yeast residues in the feed*", explains Etske Bijl, a researcher at Wageningen University. The powder obtained is mixed with water, vegetable fat and salt. Finally, the '*cocktail*' is poured into moulds and placed in the fridge for an hour to obtain the so-called '*cheese*'[vi].

The Israeli start-up that has just obtained FDA (Food and Drug Administration) approval in the United States for its whey proteins claims: "*These proteins are identical to cow's milk proteins in that they have the same taste, texture, functionality and nutritional value, while being hormone-free* "[vii].

This technique has also been developed to obtain other milk proteins, such as lacto-globulins, hen egg white proteins (ovalbumin) or myoglobin, a vertebrate muscle protein.

In fact, the term "*fermentation*" is a misnomer. The micro-organisms genetically reprogrammed to produce these proteins are yeasts and micro-algae that breathe. They are grown aerobically. The error stems from the fact that bioreactors are also called fermenters[viii].

Furthermore, "*precision fermentation*" should not be confused with "*biomass fermentation*", which is based on micro-organisms (filamentous fungi, micro-algae or bacteria that are ultimately edible), but which are not genetically modified to produce animal proteins.

Will these "*animal proteins*" soon be marketed in Europe?

In the European Union, start-ups are lining up to manufacture and produce these animal proteins without animals. In France, Standing Ovation, Bon Vivant (now Verley) and Nutropy are investing in this field.

But in Europe, these start-ups are coming up against two stumbling blocks.
The first is GMO legislation, which governs the marketing of products obtained from GMOs, which are transgenic micro-organisms. The deregulation of GMMs (genetically modified micro-organisms) in Europe is currently only proposed for algae. However, the European Parliament has called for this to be extended to other GMMs. If this deregulation becomes effective one day, it could give these micro-organisms non-GMO status, reshuffling the cards.
The second stumbling block is the *Novel Foods* framework. Under this framework, the European Commission only authorises a novel food[ix] if it "*presents no risk to health, taking into account the scientific data available*" and if "*the intended use of the food does not result in a nutritional imbalance*"[x].

The French Academy of Technology also deplores this regulation: "*The regulatory hurdle in Europe is the "*novel foods*" framework, which requires a high level of proof at a high cost, takes a long time and is therefore a brake on the market. The "*Ferment of the Future*" project has positioned itself to improve fermentation technologies for food purposes without having to apply for "*novel foods*" authorisation*"[xi].

As a result, start-ups are turning to the American market and selling their products outside Europe, under cover of a "*status*" called "*Fat*": "*generally recognised as safe*"[xii].

Do these proteins present any health risks?

Are the proteins produced by GMMs really purified? This is a recurring question for this type of technique, and examples have shown that contamination is possible and can be a source of allergies, some with serious consequences. For example, batches of vitamins have been marketed while the GMMs that produced them were still present[xiii].

Are the structures and properties of these animal proteins produced by micro-organisms really the same as those of animal proteins? Some people are asking questions. "*Many questions remain, whether about the digestibility of these products or their effects on health, and regulators need to*

be certain of their safety", says Karen Polizzi, Professor of Biotechnology at Imperial College London (UK) and Co-Director of the National Alternative Protein Innovation Centre (Napic)[xiv].

What can we say, too, about these isolated ersatz animal proteins used as nutrients when the real proteins are in a complex animal food, such as milk, meat or eggs?
Biotechnology, nourished by a restrictive vision of the genome and living organisms, approaches food with the same vision. They forget the complexity of whole foods and the slow evolution of organisms' physiology. A natural nutrient is not isolated. It is part of a complex, evolving whole that scientists call the "*matrix*" and which the industry ignores: the assimilation and tolerance of nutrients such as casein, for example, will not be the same isolated from milk or in milk. The calcium in milk, another nutrient, will not be the same as that in almonds... Failure to take these new scientific factors into account can only have an adverse effect on the health of those who eat preparations based on these animal protein substitutes.

There are also more philosophical problems. Admittedly, we need to review and reflect on a diet that is more respectful of animals, and our relationship with animals needs to be rethought. But should we rush headlong into unnatural biotechnologies, which consume a lot of energy because they are produced in bioreactors and depend on complex computer networks, when these same technologies claim to be environmentally friendly?

When will the living being be considered as something other than a machine, and a machine that can be controlled?

i Eric Meunier, "Des usines de production bien discrètes", *Inf'OGM, le journal*, n°174, January-March 2024.

ii A nutrient is an organic or mineral molecule contained in food that can be assimilated by the body.

iii "Micro-organismes OGM, l'offensive cachée", *Inf'OGM, le journal*, n°174, January-March 2024. Eric Meunier, "The European Commission's proposal to deregulate GMOs does cover some GMO micro-organisms", *Inf'OGM*, 19 March 2025.

iv "Agroalimentaire : du lait et de la viande sans vache", *Sciences et avenir*, 3 May 2025.

v Académie des technologies, "L'avenir des protéines alternatives", 21 July 2023.

vi "Agroalimentaire : du lait et de la viande sans vache", *Sciences et avenir*, 3 May 2025.

vii Sharon Wrobel, "FDA authorises Imagindairy to produce non-animal milk proteins", *The Times of Israel*, 5 January 2024.

viii Yves Le Loir, "Les fermentations : des savoir-faire traditionnels et empiriques aux procédés maitrisés, porteurs d'innovations", Inrae, Lamballe, France, February 2024.

ix A food is said to be new if it was not consumed in any significant way before May 1997 (source: Anses).

x Anses, "What are novel foods and food ingredients?", 22 January 2013.

xi "Agri-food: milk and meat without cows", *Sciences et avenir*, 3 May 2025.

[xii] Amelie Dereuder, "Fermentation de précision: Bon Vivant change de nom et s'attaque au marché américain", *Process alimentaire*, 12 May 2025.

[xiii] As an example of contamination:
Eric Meunier, "Vitamine B2: contamination en cours par une bactérie transgénique", *Inf'OGM*, 7 December 2018.

[xiv] "Agroalimentaire : du lait et de la viande sans vache", *Sciences et avenir*, 3 May 2025.

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