

# Precision Fermentation

## The Basics

### PRECISION FERMENTATION IS JUST LIKE BREWING BEER, BUT FOR PROTEIN AND FAT

Precision Fermentation is a refined form of brewing that uses microorganisms to make ingredients we currently get from animals or plants. Here's how to do it:

1. Choose a specific microorganism such as a yeast or bacteria.
2. Genetically programme the microorganism with the DNA sequence for the ingredient you want to create – such as the proteins found in cow's milk: casein and whey.
3. Put the microorganisms in a fermentation tank with some simple nutrients and sugars.
4. Ferment! (Just like beer)
5. Harvest perfect food grade ingredients that are biologically identical to those you'd get from an animal and mix them up into sellable products (like milk, or cream, or cheese...)

### PRECISION FERMENTATION IS A TRIED AND TESTED GLOBAL SUCCESS

In the first half of the 20th century, insulin – used to treat diabetics – was harvested from the pancreases of cows and pigs. This process required an awe inspiring 50,000 slaughtered animals to produce just 1 kg of the hormone!

But in the late 1970s a company called Grenetech found a way of creating human insulin using precision fermentation. Being cheaper and better in quality it quickly captured the market. Today PF insulin accounts for 99% of insulin demand worldwide, saving millions of lives – both of diabetic humans and of cows and pigs! A similar story happened with rennet, a crucial ingredient in cheese.



INSULIN



RENNET

99% of global demand now supplied by PF<sup>1</sup>

80% of global demand now supplied by PF<sup>2</sup>

## PRECISION FERMENTATION MILK, GROUND BEEF, EGG WHITES AND CREAM ARE ALREADY ON THE MARKET

In just the last decade, Precision Fermentation innovators have made the next crucial leap, into commercialising PF versions of familiar kitchen ingredients.

*Precision fermentation products already on the market and available to buy today:*

<p><b>MILK</b> ✓ <b>PERFECT DAY DAIRY</b></p>  <p>Perfect Day is a Californian company producing animal free versions of the two crucial proteins in milk: casein and whey. You can buy milk made from this through the USA under the Bored Cow brand.</p>	<p><b>GROUND BEEF</b> ✓ <b>IMPOSSIBLE</b></p>  <p>Impossible Foods make 'burgers that bleed' using a Precision Fermentation product called Heme. Heme is the molecule that makes meat taste like meat. Widely available in the USA it has recently been cleared for market in the UK</p>
<p><b>EGG WHITES</b> ✓ <b>THE EVERY COMPANY</b></p>	<p><b>CREAM</b> ✓ <b>BRAVE ROBOT</b></p>

<sup>1</sup> Kasia J. Lipska, Joseph S. Ross and Holly K. Van Houten, 2014. *Use and Out-of-Pocket Costs of Insulin for Type 2 Diabetes Mellitus From 2000 Through 2010*. Journal of the American Medical Association (JAMA), volume 311, issue 22, pp. 2331-2333. <https://doi.org/10.1001/jama.2014.6316>

<sup>2</sup> Jeanne Yacoubou, 21 August 2012. *Microbial Rennets and Fermentation Produced Chymosin (FPC): How Vegetarian Are They?* The Vegetarian Resource Group (VRG).



The Every Company (formerly Clara Foods) has used PF to crack the codes to create identical egg whites – just without chickens. In March 2023 they launched their first PF enabled macarons with leading French pastry chef Chantal Guillon.



Brave Robot makes a range of ice cream flavours using animal free milk proteins created by Perfect Day. Already available in the USA, it has plans to expand internationally.

## CHEESE, STEAK, FISH AND ALMOST EVERY ANIMAL PRODUCT YOU CAN IMAGINE CAN NOW BE PRODUCED WITH PRECISION FERMENTATION

*Precision fermentation products very nearly on the market:*

**STEAK** ✓  
**MEATI**



Meati from Boulder, Colorado are making precision fermentation enabled meats out of mycelium.

**CHEESE** ✓  
**FORMO**



Formo is a start up from Berlin using precision fermented milk proteins to make a range of cheeses that melt, stretch and cook just like 'real' cheese.

**PROTEIN POWDERS** ✓  
**SOLEIN**

**And so, so much more...**

Companies around the world have now cracked the vast majority of animal proteins in the lab



Solein by Solar Foods in Finland is making a complete protein powder with a microorganism that metabolises air itself. Initial life cycle assessments suggest this could be the most environmentally friendly protein ever produced.

meaning everything from PF butter and sausage meat or PF fish fingers and chicken nuggets are now technically feasible. Just as PF insulin quickly did away with animal insulin, with the right government support, PF could transform the global food system.

## PRECISION FERMENTATION PRODUCTS ARE EPICALLY BETTER FOR THE ENVIRONMENT

**On every metric of environmental impact, precision fermentation is an order of magnitude better than animal derived products.**

**90% less land use<sup>3</sup>**

**91% less GHG emissions<sup>4</sup>**

**96% less water consumption<sup>5</sup>**

**72% less greenhouse gases<sup>6</sup>**

Numbers based on life cycle analysis of PF milk and egg whites.

[END]

---

<sup>3</sup> <https://www.nature.com/articles/s43016-021-00418-2>

<sup>4</sup>

[https://m4f6w9b2.rocketcdn.me/app/uploads/2022/01/Comparative-Perfect-Day-Whey-LCA-report-prepared-by-WSP\\_20AUG2021\\_Non-Confidential-1.pdf](https://m4f6w9b2.rocketcdn.me/app/uploads/2022/01/Comparative-Perfect-Day-Whey-LCA-report-prepared-by-WSP_20AUG2021_Non-Confidential-1.pdf)

<sup>5</sup>

[https://m4f6w9b2.rocketcdn.me/app/uploads/2022/01/Comparative-Perfect-Day-Whey-LCA-report-prepared-by-WSP\\_20AUG2021\\_Non-Confidential-1.pdf](https://m4f6w9b2.rocketcdn.me/app/uploads/2022/01/Comparative-Perfect-Day-Whey-LCA-report-prepared-by-WSP_20AUG2021_Non-Confidential-1.pdf)

<sup>6</sup> <https://www.nature.com/articles/s43016-021-00418-2>