

Producing milk from yeast that looks and tastes like cow's milk

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Prof. Tamir Tuller and Dr. Eyal Iffergan. Credit: Tel Aviv University

Might a new technological development of researchers from Tel Aviv

University soon revolutionize the dairy products we consume? The initiators of the development believe that in the not-too-distant future we will be able to buy dairy products in the supermarket that are identical in taste and color to the ordinary dairy products that we consume today, but with one small difference: the dairy products will be produced from yeast rather than from cow.

Behind this development is Professor Tamir Tuller from the Biomedical Engineering Department of the Iby and Aladar Fleischman Faculty of Engineering at Tel Aviv University. Together with foodtech entrepreneur Dr. Eyal Iffergan, Tuller established the startup company Imagindairy, which attempts to do the as-yet impossible: produce cow's milk from yeast.

In recent years, increased awareness of the damage caused by the dairy industry to the environment and human health, and the ethical dilemmas of animal husbandry, [biotechnology companies](#) worldwide have been searching for milk substitutes. Professor Tuller explains that the goal of Imagindairy is to produce milk with all the important nutritional values of animal milk, and with the same taste, aroma, and texture that we are all familiar with, but without the suffering that cows endure, and without damage to the environment. Imagindairy's milk and cheese products will actually be much healthier than milk that comes from animals, since it will not contain cholesterol, lactose, or somatic cells.

"Our startup also includes food engineers and food experts from the Strauss Company," Professor Tuller says. "Currently, they are trying to take [milk proteins](#) from yeast and produce cheese from them. This is a long process of improvement—of productivity, taste, and, of course, of the price. This product is not a milk substitute like almond or soymilk. We plan to produce [dairy products](#) that will be identical to products that come from animals by introducing the yeast genome the [genes](#) that code for milk development in cows"

Imaginedairy has been working with Tel Aviv University via Ramot, the university's technology transfer company, "The groundbreaking technology of Professor Tuller could revolutionize the dairy industry as we know it," said Keren Primor Cohen, the CEO of Ramot.

For about a decade, Professor Tuller's laboratory at Tel Aviv University has specialized in the modeling and engineering of gene expression using biophysical simulations, computational modeling of molecular evolution, and machine learning. Among other things, these models are used to make the production of heterologous proteins (proteins coded by genes that come from another organism) more efficient and thus cheaper. Professor Tuller's technology has been successfully used in the past to produce vaccines, antibodies, biosensors, and green energy using various organisms such as yeast, bacteria, micro-algae, and even viruses. Professor Tuller and his colleagues are now on the way to conquering a new objective: cow's milk.

Professor Tuller says: "The genome of every living creature contains genes that encode the recipe for making chains of amino acids that make up proteins. However, it also contains information that encodes the complicated process that is known as 'gene expression'—the timing and pace of the creation of the proteins. Gene expression is the process of turning information stored in "inanimate" DNA into proteins that are the 'essence of life' and are a major ingredient in every living thing that we know, from human beings to the coronavirus to cow's milk. For many years, biotechnology companies have been harnessing the gene expression process in order to produce desirable proteins affordably. They do this by taking a gene from one living organism and implanting it in the genome of another organism that will serve as a 'factory' for producing the [protein](#) that is encoded in that gene. This technology has been used for many years to produce medications, vaccines, and energy, and it is also used in the food industry."

Professor Tuller adds: "Theoretically, we can reach a situation in which we can't tell the difference between cow's milk that comes from a cow and cow's milk that comes from yeast. But in order for that to happen in an economical way, we must turn the yeast cells into efficient factories that produce milk proteins—not a simple challenge to solve. Even though we know what the genes that encode the proteins for cow's milk are, those genes are written in the 'language' of cow cells, and need to be rewritten in the 'language' of yeast. This will make the production of the milk proteins possible in an appropriate, affordable, and efficient way in the yeast cell 'factory.'

With the help of models that we developed in the laboratory, we believe that within a fairly short time, we will succeed in making yeast produce milk proteins in an efficient way that will enable affordable, high-quality industrial-scale, production.

There have already been attempts to produce milk from microflora, but the price of producing milk in this way was a far cry from being affordable. I believe that we are on the right path, and within a fairly short time, we will be able to prepare in our own homes, toast with yellow cheese that was made from [yeast](#) and not from cow's [milk](#), without having paid any more for it."

Provided by Tel-Aviv University

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