

No-Freezer Ice Cream

The scientific explanation

Ice cream is an emulsion - a combination of two liquids that do not normally mix together, such as oil and water, so that one of them (in this case, oil) is dispersed throughout the other liquid (water) in tiny droplets that do not sink.

In ice cream, the oil from the cream and the water do mix! This happens because of another ingredient in the mixture, which connects the oil droplets and the water. This ingredient is dairy protein, such as casein. Proteins act as stabilizers for the emulsion, allowing the oil droplets to remain dispersed in the water, instead of coalescing and floating to the top.

Another ingredient in ice cream is air. Ice cream is whipped as it freezes - a process that inserts air into the mixture. Air makes up as much as 50% of the total ice cream volume. Freezing adds an additional important ingredient - ice. In order to keep ice cream's texture soft and fluffy, rather than too firm to bite into, we need very small ice crystals. The rapid and continuous shaking motion, which integrates whipping and freezing, ensures, together with the sugar, that the ice crystals formed are small enough to produce a pleasant sensation in the mouth. But is sugar only a sweetening agent? It also has a role in reducing the amount of ice, because it helps to lower water's freezing point.

At the end of the process, we have small ice crystals in a sugar-rich, syrup-like liquid that does not freeze, alongside air bubbles and oil droplets. The result: Soft, melt-in-your-mouth ice cream.