Feature

Chemistry in a Cone

If that scoop of ice cream doesn't melt, isn't cold, and tastes like an everything bagel, is it still ice cream?

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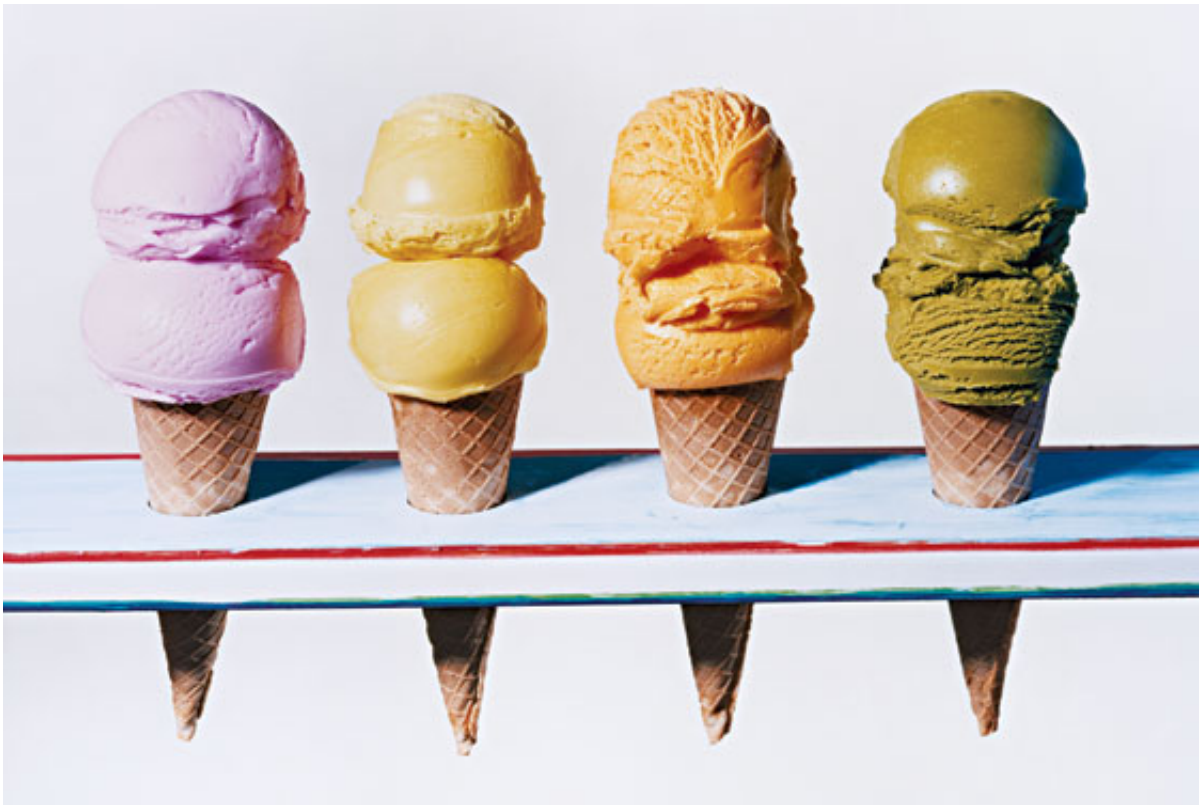


In June, the Cold Stone Creamery chain introduced a new ice cream that doesn't melt. The dripless ice cream comes in two flavors, Butterscotch Velvet and Chocolate-y Goodness. It takes a second to process this. Melting ice cream is an immutable truth of summer, a symbol of the fleeting nature of the season itself. How did

they do away with one of the frozen treat's most fundamental properties? Welcome to the weird science of ice cream.

Ice cream is like Play-Doh for scientists—it practically begs to be manipulated. Its chemistry is an intricate mix of solid, liquid, and gas, and fiddling with one thing affects another. If you play with protein, you're going to be messing with fat globules, and if you tick off the fat globules, you're going to hear about it from the air bubbles. The fact that all of this interplay occurs in a frozen environment is the clincher: A basic bowl of organic vanilla is one of the most complex foods we eat. And it's becoming even more so, because in laboratories, restaurants, and home kitchens, ice cream is being reinvented at the molecular level.

The Texture

An arctic fish might hold the keys to a silky smooth scoop.

Ice crystals are like the cancer cells of ice cream. Retarding their growth is the holy grail. To get the smoothest ice cream, you want the smallest ice crystals. But every time a pint sits on a kitchen counter or a loading dock, the ice crystals get big, and the ice cream gets crunchy. (This is generally agreed to be a loss of quality, though food writer Harold McGee has argued in the *Times* that perhaps there's nothing wrong with a granitalike texture.)

Richard Hartel, the scientist who co-wrote the book on ice cream (*Ice Cream,* sixth edition), is a food-engineering professor at the University of Wisconsin, Madison, who studies ice crystals. His current approach involves reexamining an age-old process: how exactly ice crystals form in a typical commercial freezer. Hartel and one of his grad students have jury-rigged a microscope, a digital camera, and a refrigerated glove box. "It's really ugly, but pretty effective," Hartel explained. Though it's too soon to predict the outcome of the experiment—the early photographs have a blurry quality, like ultrasound for ice cream—the work may eventually change how freezers are made. It could be possible to reengineer them so that they produce small crystals, and smooth ice cream, right from the start.

But the solution may ultimately be found in nature's own freezer case. One recent breakthrough involves a fish called the ocean pout, which lives in the Arctic and resembles an eel. A protein that prevents the ocean pout from freezing to death in icy waters turns out also to inhibit the growth of ice crystals in ice cream. Breyer's has been using a synthetic version of the fish's protein in some of its low-fat varieties. The company also found that it improved taste (thereby inviting cracks about "van-eel-a").

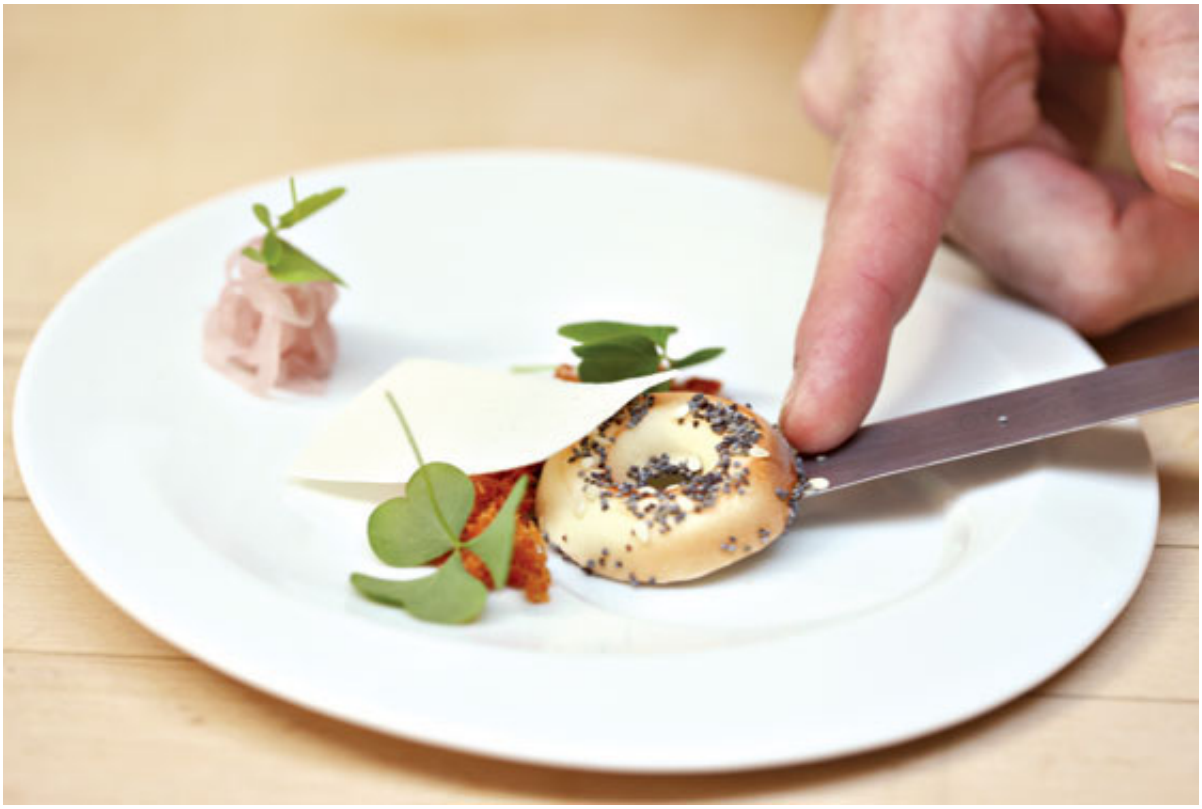
The Temperature

Cold is not the only option.

When I called Cold Stone Creamery to ask how their no-melt ice cream works, the explanation turned out to be simple. Someone at Cold Stone came up with an idea for an ice cream that would have the texture of Jell-O pudding. The modified food starch that sets instant pudding caused the resulting blend to gel rather than liquefy. The guy who created the flavor discovered this when he accidentally left a bowl of it out on the counter. A classic example of scientific serendipity. But there's a whole world of molecular gastronomes out there performing intentional experiments with temperature and ice cream.

Alex Talbot, an experimental chef, recently moved to Bucks County, but before that he lived in Queens, and before that he was running the kitchen at a boutique hotel in Pagosa Springs, Colorado, which is where he was when he set out to create a dessert that resembled ice cream in every single way but one: He wanted it to be hot. "To do this in the hot state—that was the quest," Talbot told me. On Ideas in Food, the blog he writes with his wife, Aki Kamozawa, Talbot posted a recipe for hot vanilla ice cream. All of the ingredients were easily found, as long as you had a good connection at Dow Chemical.

The recipe calls for familiar basics like yogurt and cream cheese, specialty ingredients like a pinch of sea salt and a scraped bourbon vanilla bean, and then the kicker, 11.55 grams of Methocel food gum SGA150, which forms a gel when heated. Talbot begins by adding Methocel to his unfrozen ice-cream base; then he dips an ice-cream scoop into the base, moves the scoop to a pot of boiling water, and, as the ice cream begins to set, gently releases the scoop, creating what amounts to ice-cream dumplings—little balls of "hot" ice cream. When the ice cream is removed from the water, it is unpleasantly firm—just as regular ice cream is when you first take it out of the freezer. Which means that, weirdly, hot ice cream actually has to melt a little before you can eat it. "We had to add that to the technique of the recipe," Talbot says. "It was common sense for us to let it temper, but it wasn't common sense for everyone."



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Now that they've mastered the technique, readers love the recipe. They've posted primers on the many kinds of Methocel available from Dow, and offered reassurance that you've ingested this compound if you've ever swallowed a coated pill or eaten a Burger King onion ring. Talbot continues to get e-mails from amateur chefs who've come up with their own riffs on it, or from people who are wondering where to buy Methocel. (Try Willpowder.net, a general store for molecular gastronomists.)

Talbot likes serving the ice cream to friends without telling them it's hot. One oblivious friend sat there enjoying vanilla ice cream with chocolate sauce and peppermint crisps. Finally, "We asked him, "Do you notice anything?'" Talbot says. "And he was like, "Holy shit! It's hot!'" If this trick seems too clever, consider that unadulterated ice cream is also a mind game. All that smoothness? The whole point is to make you forget you're eating ice.

Taste

Have a scoop of filthy Guinness.

These days, a savory ice cream is nothing to get too excited about. To push the flavor profile, you've got to get pretty creative. A woman in Bangkok is making cigarette ice cream. Momofuku Milk Bar in the East Village has offered soft-serve that approximates Lucky Charms. And for the past two years, an artist named Miwa Koizumi has been roaming the streets of Manhattan with homemade ice cream in the tastes of various neighborhoods. The Wall Street, for example, is said to taste like a "filthy Guinness" from a "shitty fake Irish bar." You can now eat an entire brunch made of ice cream: At the Fat Duck outside London, waitresses carry flasks of liquid nitrogen and whip up bacon-and-egg ice cream at your table, and at WD-50 on the Lower East Side, bagel ice cream arrives on your plate looking exactly like an everything bagel—seeds and all.

The humble bagel posed a technical challenge. Many savory ice creams have "singular" flavor profiles; the goal with the bagel was to encapsulate something more complex. To create it, everything bagels are bought and toasted—"rather dark," says WD-50's pastry chef, Alex Stupak. Then they're crushed into pieces, soaked in hot milk, and strained. The ice cream is made from the bagel-flavored milk. "You have the flavor of poppy seeds, sesame seeds, and onions all built into it," says Stupak.

The pastry chef's latest invention is something he calls inflated ice cream. A small scoop is blown up like a balloon, torn apart to showcase its aerated interior, and presented on a large plate looking like a pale yellow sponge. Eating it is "almost like breathing in cotton candy," says Stupak, who achieves the funhouse effect by manipulating the percentage of air in the ice cream. The process involves a Cryovac machine—the Cuisinart of molecular gastronomy—and other secret steps Stupak is guarding.

Health

Lowering fat by spreading out the molecules.

The number of ice-cream scientists is surprisingly small, maybe 100 in the world. And at the top of the list is Douglas Goff, a dairy-science professor at the University of Guelph, in Ontario, who has written reams of papers on ice cream for peer-reviewed journals and had a hand in nearly every major recent ice-cream development. His lab is like the Google of ice cream, a playland workplace for brainy innovators. One of his latest ideas is an ice cream you buy from the refrigerator instead of the freezer case. When you get home, you put it in your own freezer, and it turns into regular ice cream all by itself—no need for churning.

Much of the time, Goff has more practical preoccupations—like health. Diabetics want low-sugar ice cream, and most everyone wants to enjoy ice cream that's low-fat. "Ten years ago, the quality of low-fat ice cream was pretty poor," says Goff. "I always told people to eat half as much of full-fat ice cream." But there have been

breakthroughs since then. A few years back, a Swiss scientist discovered you could make low-fat ice cream taste creamier if you ran it through a snack-puff machine. Ice cream made this way is now identified with phrases such as double-churned, slow-churned, and creamery churned. And NYU chemistry professor Kent Kirshenbaum recently conducted an experiment to determine what gave a traditional Turkish ice cream called dondurma its taffylike texture. The answer turned out to be a polysaccharide called glucomannan, a soluble fiber which has been shown to reduce cholesterol. Kirshenbaum posits that glucomannans could be useful in making low-fat ice creams.

The latest research focuses on redistributing fat molecules throughout ice cream. One method Goff has studied is called high-pressure homogenization, which shrinks fat globules but spreads them out, ensuring that each bite still tastes creamy. The technique works, but it is expensive and has not been adopted commercially yet.

The reason it's so difficult to make ice cream healthy is that the chemical structure itself girds against dismantlement. "You can take the sugar out of Coke," says Goff. "That's easy. But you can't take sugar out of ice cream, because of the structural role it plays. It's the same thing with fat."

It's kind of satisfying to know that, in the end, ice cream will not be completely compromised. We can inflate it, or weigh it down with pudding; we can infuse it with bagels, or with the proteins of fish. But ice cream has its own DNA for decadence. Think of it as an evolutionary mechanism. It insures that no matter what else it becomes, ice cream will forever be an indulgence.

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