CENTENARIAN

Updating the science of the *PopSci* archives

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hold the ice

• Putting aside snacks best served frigid—ice cream, anyone?—fresh food generally beats stuff from the icebox. Still, with surges in megastores, online shopping, and specialized diets, we're downing more frozen shrimp, pizzas, meals, and ingredients than ever. In 2020, US freezer aisle sales grew 20 percent, and forecasters predict more momentum over the next five years.

Despite our appetite for Tater Tots, extreme cold takes its toll: Ice creates crystals that rupture cell walls, leaking nutrients and flavor and ruining texture. The slower the chill sets in, the larger the crystals and the worse the outcome. Such was the case before the 1920s, when biologist Clarence Birdseye (yes, the same as Birds Eye) offered up a technique inspired by the Inuit of Labrador. On an expedition, he had seen fish freeze solid in the −40°F air in minutes—and stay so fresh the critters would sometimes squirm before cooking.

Birdseye's various techniques to mimic those intense lows, logged in the September 1930 issue of *Popular Science*, included spraying metal conveyors with the refrigerant calcium chloride at −45°F and stowing food in freezers with dry ice cooled to −109°F. The methods, which froze morsels 14 times faster than ice alone, worked equally well on meats, vegetables, and berries. In time, Birdseye amassed 168 frozen food patents, and his setups remain the gold standard.

But, like everything, they're imperfect. So-called isobaric freezing, which chills ingredients at constant pressure, is energy intensive. A new approach developed by UC Berkeley and the US Department of Agriculture called isochoric freezing promises to elevate food quality to near fresh while tapping far less energy than Birdseye's ways. The secret, explains mechanical engineer Matthew Powell-Palm, is never *freezing* food at all. If you submerge vittles in a metal container filled with water, seal it, and hold it at temps around 23°F, "This wonderful new variety of ice-water behavior emerges." Ice forms inside the walls, expanding inward and increasing the pressure. Higher pressure drives down the freezing point, so the innermost H_2O—and the food—stay very cold but never truly freeze.

"The grand thermodynamic premise of food freezing has not been revisited for almost a century," says Powell-Palm, noting that its time may be up—for the good of the planet. A totally isochoric food supply chain could have the carbon impact equivalent of taking a million cars off the road.

September 1930
The nuances of formation flying were still somewhat novel when *PopSci* explored the precision needed for squadrons to maneuver in unison. Adding to the tension: the fact that the planes often eschewed comms equipment, which would have weighed down the nimble flyers.