Segment Guests

Nicola Twilley

Nicola Twilley is the author of *Frostbite* and the co-host of Gastropod. She's based in Los Angeles, California.

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Segment Transcript

IRA FLATOW: This is Science Friday. I'm Ira Flatow. As we sweat through another torrid summer, imagine how much worse the heat would feel if you couldn't reach into the fridge for another cold one. Summertime is a good time to consider how much refrigeration has changed the way we exist.

From keeping our food from spoiling to allowing us to survive on a warming planet, most of us just can't imagine life without a fridge. John Dankosky is here with the story of how it all came about.

JOHN DANKOSKY: Thanks, Ira. A new book called Frostbite– How Refrigeration Changed our Food, Our Planet, and Ourselves looks at our relationship with the fridge and how it transformed how and what we eat. Nicola Twilley is the author of Frostbite and the co-host of the podcast Gastropod. Nicky, welcome to Science Friday.

NICOLA TWILLEY: Thank you for having me.

JOHN DANKOSKY: OK, so what it is about refrigerators that made you want to write a whole book about them?

NICOLA TWILLEY: Well, I mean, Americans are obsessed with refrigerators. We open them apparently on average 117 times a day, which I think has to have gone up since that study was done because it was pre-

COVID. And now, with all the work at home. Yeah, I spent a lot of time telling people about this book and being like, no, no, refrigeration is much cooler than you think, badoom.

JOHN DANKOSKY: Badoom-ch.

[LAUGHTER]

NICOLA TWILLEY: Exactly. So painful. It's a miracle any of my friends still speak to me. But really, what I became obsessed with was refrigeration, not refrigerators per se, because your refrigerator is just the tip of the iceberg. And I mean that very literally.

There is an entire artificial winter of refrigerated warehouses and trains and ships and trucks and juice tanks and ripening rooms and all sorts of weird spaces that you never imagine that lie kind of behind your fridge and that get your food from the farm to the table. And that's really how the fascination started for me.

People were writing about farm to table. People were opening farm to table restaurants. This is a while back because I've been obsessed with this for a while, but people like Michael Pollan and Eric Schlosser were writing books that were showing us the behind the scenes of our food.

But they were covering the farm piece, and I was like, what about the "to" piece? What about how our food gets from the farm to the table? And so I decided to go take a peek in those spaces, too.

But then, when I started looking there, I found the ways that we have found to extend the life of our food are totally weird and fascinating. You know, you hear about Silicon Valley guys doing all these bananas things to try and live longer, injecting themselves with the plasma of young boys, et cetera. This is so much weirder.

JOHN DANKOSKY: Well, you actually– you tell some of these stories about the weird things that we do. So let's take the story of the humble avocado. So I live in Connecticut, in the Northeast of the US. So it's grown in California. Explain to me what exactly happens between when it's picked and when it gets to me at my grocery store, because there are some details in here that I just frankly can't believe.

NICOLA TWILLEY: [LAUGHS] So an avocado, when it's ripe, it's not a very shippable thing. We know this. It bruises very, very easily, right? And for a long time, that's why it was an extremely rare fruit, too. So what happened was, the avocado farmers wanted to make their industry big. And they looked around, and they

found another squishy fruit that you can't ship when it's ripe, which is the banana. And they stole basically the banana playbook.

So the deal is, you harvest when the fruit is completely unripe, just green, hard, disgusting. And then you ship it around because it's hard and sturdy during this time. You obviously refrigerate it, just to keep it fresh, to slow down its respiration, to stop it from getting any riper to freeze it in time.

And then, when it's reached the point of sale, it's a few days away from going on to the supermarket shelves, you do something called ripening. And this uses a gas called ethylene, which turns out to be the most produced organic molecule on Earth because it's the basis of all of our plastics, polyethylene.

But in plants, it's a hormone. And it's just this sweet smelling gas that you blast the avocados with, and it tells them, hey, it's time to ripen. And they ripen. And from that point onwards, their shelf life is very limited, and they have to be treated with the most tender care.

But that's how they get onto your shelves. And it's a really delicate process because they get very hot as they ripen. And so you have to refrigerate them, otherwise they explode and you just end up with guacamole all over the ripening room walls.

[LAUGHTER]

JOHN DANKOSKY: Hold it. You have exploding avocados if you don't do this right?

NICOLA TWILLEY: Oh, yeah. Talk about control of nature. We are deliberately trying to tell a room full of fruit, hey, it's time to ripen, something that would happen naturally on the vine. And when they all do it at once, they generate a lot of heat. So it's a very delicate process.

JOHN DANKOSKY: OK,. So there's a few different places where your book kind of broke my brain a little bit. And one of these times is when you talk about how orange juice is made. Now, if you're the sort of person that wakes up every day and drinks orange juice and loves your orange juice out of a box, you might not want to listen to this next part as you walk me, Nicky, through the life cycle of OJ.

NICOLA TWILLEY: Well, yeah. So I mean, first of all, the carton is lying to you. It has a picture of an orange, with some leaves. But listen on. It's nothing to be afraid of. The truth will set you free here. So if you have an

orange tree in your yard because you live in California or Florida, or you've ever drunk fresh orange juice, you know it tastes different at different times of year.

It also has a shelf life of about 24 hours, thereabouts, maybe 48. So what to do? And so the US Army, during the Second World War, wanted to get orange juice, which is very high in vitamin C, as we know, to the soldiers as a way to make sure they had– they didn't have to take supplements, they were getting everything they needed.

Only problem was, you couldn't can orange juice. And at the time, that was really the only way of preserving juice. You could can tomato juice, and people had that for breakfast. But canning orange juice just really– the result tasted disgusting, so no one did it.

So they came up– they used a method that had actually been developed at the Kodak labs for drying photographic film to think– how this occurred to them, who knows. But to basically deaerate and de-oil the juice. So you take out everything that gives it any flavor because those are the volatile pieces. Those are the parts that will go bad over time.

So you take them out. You concentrate it down. You're left with orange-colored sugar water. And guess what? It lasts forever. They have these tanks where it's just these giant ice cream paddles going round. Two story-high tanks full of this kind of viscous, brown sludge, just being stirred. And you can keep that for two years.

The problem, of course, is that it doesn't taste of anything, right? If you add water back to that, it will be an orange sugary drink, but it won't taste of orange. But the genius is that the companies who figured this out, primarily Minute Maid at first, they saw what was a problem was actually an opportunity.

Because you've taken out all the flavors by deaerating and de-oiling it, you have to add them back in. But guess what? You can add them in at exactly the same ratio every time. And once you have something that tastes the same all year round, you have a brand. And you have something that people can prefer, say, to other orange juices, the same way you might prefer Pepsi to Coke.

And so it really takes off. And orange juice consumption– after this method comes in, orange juice consumption quadruples in a decade. It goes from nothing to being something that everyone has for breakfast.

JOHN DANKOSKY: OK. So there's a lot to unpack there, but I'd like to turn back to produce. By the time that most of it has been delivered to us, it's pretty fundamentally different than when it was picked. Like, I don't know, my tomatoes are mushy, the strawberries are oozing sometime. How does refrigeration change the chemistry of these fruits and vegetables?

NICOLA TWILLEY: Yeah, it's a funny thing. It's done this in a couple of different ways, but the tomato is a classic example on a couple levels because, for one, if you put it in your home refrigerator for three or four days, that's long enough. That exposure to the cold is long enough to switch off the DNA that is the machinery for creating flavor.

The other thing is, OK, remember the problem of squishiness? Tomato is also very squishy when it's ripe. There's no way you're going to be shipping that around the country. The losses are going to be horrendous. You'll end up with sauce. So what they do is they have to harvest it when it is green and hard and unripe.

And again, you gas it using this plant hormone when you're at the destination. And it ripens, sure, but it never ripens the same way off the vine as it does on. And the third piece is, well, because we wanted a tomato that we could ship around and basically practically play ping pong with, we bred for a tomato that we could do that. We bred for the sturdiest tomato possible.

Guess what we didn't breed for? Flavor and nutrition. You can actually survey heirloom tomatoes and see which genes are missing from the commercial variety that we just bred out because they weren't useful in delivering the tomato of commerce.

JOHN DANKOSKY: There's actually a lot of fascinating chemistry, and even engineering in things as simple as those salad bags that we get, or pre-washed greens. And maybe you can talk about how those bags are designed to keep these delicate greens fresh while they're in the refrigerator.

NICOLA TWILLEY: Yeah. I mean, I have to confess, before I wrote this book, I just thought a salad bag was a plastic bag. Like, nothing special there. Actually, it turns out, it's a high-tech respiratory apparatus. It is specifically creating the perfect atmosphere inside the bag to slow down how fast those leaves are breathing.

So the trick with produce is, once you harvest it, it's still breathing. They call it respiration technically, I think, not to freak us out, but really, it's breathing. And like us, it has a certain number of breaths it can take before it will die. And so the whole trick of everything we do to our produce is to make it breathe more slowly.

Refrigeration slows down how fast produce breathes. So does a lowering the oxygen levels and tweaking the atmosphere very precisely. And so what those salad bags do is they are multiple layers of differentially permeable membrane, which just basically means they have different kind of microscopic holes in them that are tuned to let different amounts of the various atmospheric gases and water in and out of the bag, matched precisely to the leaves in the bag and how fast they're breathing and what they need.

And that leaf mix, too, you think, oh, they put in the baby spinach and the arugula and the endive and the radicchio because they taste good together. No, no, no.

[LAUGHTER]

They're balancing each other out. So baby spinach breathes really fast. It's so young. We harvest it when there are only five true leaves on the plant. And it's just like, [PANTING]

Radicchio is breathing much more slowly, much more chill. So you balance that out. You basically kind of put the blend together in the right ratio to get an even kind of breathing rate. And then you design the bag to match that.

And then someone like you or me buys that bag, comes home, realizes it doesn't fit in our crisper drawer and opens it, and ruins everything.

JOHN DANKOSKY: [LAUGHS] So of course, as the planet gets warmer, we're working harder to stay cool. And that goes for our food too. How does refrigeration play into a warming world?

NICOLA TWILLEY: Yeah, this is the scary part because, of course, as the planet warms, we need to work harder to keep things cooler. And as you know, much of the rest of the world develops and builds the same kind of food system that we have here in the US– China's basically built that now, is still expanding. Sub-Saharan Africa is just embarking on building this. But it takes an enormous amount of power.

So currently, about 2% of global electricity usage is for cooling food. That will increase at least five-fold as the rest of the world comes online and more as temperatures rise. Plus, the chemicals we use to refrigerate food are actually global warming, super greenhouse gases.

So they're much more polluting than, say, carbon dioxide, many thousands of times more as they leak into the atmosphere. And so the combination is actually a disaster. And the irony is that as our natural ice caps, our natural cryosphere melts, the Arctic disappears, the Antarctic disappears, we're building this artificial winter, this artificial cryosphere that's expanding rapidly.

I mean, it increased by 20% between 2018 and 2020 alone. So as that expands, the natural one shrinks. And the two are connected.

JOHN DANKOSKY: Has all of this changed the way that you think about the food that you eat?

NICOLA TWILLEY: I mean, I definitely never open the salad bag just to squeeze it into my crisper drawer anymore. And yes, absolutely. Having seen people who specialize in this kind of shudder in horror at the idea of putting a peach in the refrigerator, I never do that anymore either because, I mean, the words "the stone fruit killing zone" just kind of echo in my head.

So definitely, I have a sense, much more so, I think, that the refrigerator is just one solution for keeping food fresh. And that also things don't get fresher in there. It's not a bank vault where you put something in and it stays exactly the same and you can take it out a week later. If you put that bag of spinach in there and you eat it a week later and it hasn't gone bad. you might be patting yourself on the back, but it's going to have half the nutrients it did when you first put it in.

To me, it's just one of the ways that we preserve food. It's not the only way, it's not the best way, and it's definitely not necessarily the most sustainable way. And at the end of the book, I spent some time looking at people working on other ways to keep food fresh.

Because that's the thing to remember. For beer, we want it cold. For everything else, we want it fresh. And there's a lot of ways to do that. It doesn't have to mean cold.

JOHN DANKOSKY: I guess the last thing to ask you about– and you touched on this earlier when we were talking about taking that tomato and putting it in the refrigerator. I'm wondering if the food that we have today is just substantially different because of refrigeration than the food our grandparents had.

NICOLA TWILLEY: Absolutely. And you can even see people foretelling that this will be the case. In 1911, there was a cold storage banquet held in Chicago to introduce people to this wild, new food preservation

technology that they were actually very suspicious of. And one of the editorials that came out around this kind of promotional meal to convince people that refrigerated food was safe and wouldn't kill them said, listen, it may not kill you, but it doesn't taste the same.

And the only silver lining is that soon the generation that knows what fresh food tastes like will be dead, and the generations that follow will think that refrigerated food is fresh. We just won't know what we're missing. And when I read that, I got chills down my spine because we are that generation. We have forgotten what food tasted like before it met the cold chain.

And I think we've lost out as a result. I should say, we have gained in other respects. Most of those people would never have tasted a banana or a ripe avocado. And again, so there's flavors that it's brought to our table, but there's flavors it's taken away.

JOHN DANKOSKY: Nicky, thanks for this interesting historical look at refrigeration. I really appreciate it.

NICOLA TWILLEY: Thank you. This was fun.

JOHN DANKOSKY: Nicola Twilley is the author of Frostbite and co-host of Gastropod. To read an excerpt from Frostbite, you can head to sciencefriday.com/frostbite. I'm John Dankosky.