TPWKY - Special Episode - Nicola Twilley

EW: [00:00:00] Hi, I am Erin Welsh, and this is, this podcast Will Kill You. Welcome to another episode in the T-P-W-K-Y Book Club series. If you haven't tuned into one of these episodes before you are in for a treat, because this series is where I get to chat with authors of popular science and medicine books about their latest work, where they get their inspiration, the strangest thing they learned, and how their book helps us to better understand ourselves and the world around us. We have featured some just fantastic books so far this season, so if you'd like to take a look at the full list of book club books for this season. Past seasons and any future ones on our list, head to our website. This podcast will kill you.com. Under the extras tab, you'll find a link to our bookshop.org affiliate page, which includes a bunch of podcast related lists, including one for this book club series. I am always updating this list to include the topics of future book club episodes, so check back in regularly if you're the type who likes to read ahead. As always, we love hearing from you all, so if you have anything you'd like to share about these episodes, our regular episodes, your firsthand account, or just whatever else is on your mind, reach out through the Contact Us form on our website. Two final things before moving on to this week's book. First, please rate, review and subscribe if you haven't already. And second, you can now find full video versions of most of our newest episodes on YouTube. Make sure you're subscribed to the exactly right Media YouTube channel, so you never miss a new episode Drop.

Okay. Now on to our thrilling and chilling book of the week. How many times a day do you open your fridge to peer inside? Maybe you're taking a quick inventory to see what you need to pick up for tonight's dinner. Or maybe you're pulling out the ingredients to make a sandwich, or maybe you're checking if a tasty snack has somehow materialized since you last looked. As someone who works from home. I'm doing that last one constantly. When we swing open that fridge door, our thoughts are mostly on what's held inside, what's there, what's not there. Rarely do we stop to think about the extensive journey that food has taken to land in our fridge. And I don't mean Costco car or home. I mean the whole journey from where it was grown or where the ingredients were grown to its processing, to its transport, to its storage, to its transport, again to the grocery store where you picked it up and a whole lot of steps in between that I probably missed. Our cold chain is a logistical and technological modern day marvel, and yet we rarely give it a second thought unless something goes awry and our supply chain is disrupted or the power goes out at home and all of our frozen burritos turn into a mushy mess. But this week's book Frostbite How

Refrigeration Changed Our Food, our planet, and ourselves by Nicola Twi will have you pausing before you reach for that bag of apples or loading steaks into your cart at the store. Three quarters of the food that Americans eat is refrigerated at some point along the processing, shipping, storage and selling pipeline. A relatively recent development in our species history. TWI co-host of popular podcast, gastropod and frequent contributor to the New Yorker, introduces readers to the major players in the invention of mechanical refrigeration, explores the preservation strategies people used before it was available, and reveals the tremendous impact refrigeration has had on our planet and health. From ice harvesting to banana, ripening from the unfathomably, huge refrigerated warehouses to subterranean cheese caves, frostbite is a fascinating and sobering examination of a technology that has revolutionized our lives. I am so excited to share this interview with you all. So let's take a quick break and get started.[00:05:00]

Nikki, thank you so much for joining me today.

NT: Oh, it's a thrill. Thank you for having me.

EW: I am so excited to chat with you about your book Frostbite, which takes readers through the truly fascinating story of refrigeration from its long history of development to the tremendous impact that this technology has had and continues to have on our lives, and one that we don't often think that much about. Did your feelings about refrigeration change as you worked on this book?

NT: Oh, a hundred percent. And I think that's part of why it took me so long to write the book. Uh, I, I honestly started working on, on this in a way nearly 15 years ago, but I just kept falling deeper down the rabbit hole because there was more and more. At first, I just thought, oh, this is gonna be an interesting little look at a sort of peek behind the scenes at refrigerated warehouses. And then I realized, oh no, this has changed what we eat, where it's grown, how good it is for us, what it tastes like, what it does to the planet, like. Everything. So it just sort of kept, uh, expanding and spiraling and I kept going deeper and deeper. And so yes, my feelings, you know, it's a cliche to be like, this thing changed the world, but I started out sort of like, oh, this is an interesting thing. And ended up fully on team. Refrigeration changed the world.

EW: Oh, I mean, I'm there as well. Like, count me in, I'm on the side. One of the things just initially that absolutely blew my mind was the cold chain itself. How massive it is. You know, when we go to the grocery store to buy a pack of yogurt or a bag of frozen fruit, you know, I don't think that, I have never

thought about the entire chain, the process from somebody picking that fruit off the tree to, you know, when it gets to in between and stored all the way to the, our, the shelf of my closest Safeway. Can you take me through some of the components that make up the cold chain?

NT: Yeah, and I think this is so interesting because it is called a cold chain. Um, because the idea is that once you know, you're, you're. I don't know, your apple has been harvested or your, you know, pig has been slaughtered. It, it is chilled and it never rises above that temperature until it gets all the way to you. And so for people in the industry, they see it as a seamless chain. But I think for us as consumers, we never see that. Because it is all in sort of separate places. So you have, you know, the cooling that takes place in the slaughterhouse or on the farm. You then have trucks or trains or in some cases for high value things, Wagyu beef, you know, out of season fruits, you're talking about air transit. That's all cooled. Then it's going to refrigerated warehouses, often more than one. So it, it'll, it'll go to a warehouse to be stored. It'll go to a supermarket distribution center, then to go out to whichever of the various supermarkets it's going to. It'll sit in the cold room at the supermarket, and then it'll go out onto the chilled shelves and then you'll take it home. This is a little mini break in the cold chain right there and put it in your fridge. Um, so really it, you start to see the fridge as. Literally the tip of an iceberg. And then once you realize, add it all together and, and it's all mostly invisible to us. This is 5.5 billion cubic feet of cold space. It's, I started to realize, oh, it's like a third Arctic. I mean, you see. The polar regions there, all this natural cold in one place. But we've built all this artificial cold in multiple places, and once you start to see it as a whole, that's when it, it started to blow my mind.

EW: Oh, absolutely. I mean, I am, I've been driving around thinking like, where are the cold refrigerated warehouses in this city? You know, what am I not seeing? It's all, you're right, it's all just like invisible to us, or maybe it's more that we just don't ever think of it. And so we keep it invisible to us and thinking about this technology as really so, so recent and in human history and how for centuries. Natural scientists and philosophers struggled to conceptualize what cold was. And part of that challenge was the fact that it's the absence of a thing heat rather than a thing in itself, which was is so cool. Um, and but during that time before we were able to truly harness the power of cold humans came up with some very inventive ways to preserve food [00:10:00] without it spoiling. I would love for you to share some examples of this.

NT: Yeah. I mean, this is being like the hotspot for human creativity since before we were modern humans. Because obviously the minute you have a wooly mammoth that is too big to eat in one go, what are you gonna do? And so

you can do what anthropologists calls social storage, which is where you share. That wooly mammoth with your community and then hope that they share back with you. So it it's a food preservation sort of system under crucial

EW: storage. I

NT: love that, that it's a neat name for it, right?

EW: Yeah, yeah.

NT: But also you really want to be able to save food for a rainy day. And so going back in as far as in human history as possible, people have been drying food, smoking food, using honey or later sugar to preserve food. It all works by depriving the microbes that want to eat this food too, from eating it before we can. So if you remove the, the water from meat and turn it into jerky. All you're doing is it making it hard for microbes to live there so that it can last long enough for you to then eat it? And so smoking does that too, with the addition of some like microbe bone friendly chemicals that it deposits there. Um, making jam does that too, reduces water activity. Oftentimes these are changing the pH too, which, which helps preserve, uh, cheese, which I love. It's being called milk's bid for immortality, which I love. That's adorable. That's, that's, that's, you're also, you're, you're reducing the water content, but you're also recruiting friendly microbes to keep out. Bad microbes that want to eat it. So that's another way where you can sort of recruit microbial allies in your war against rot. Um, so yeah, and it, the other thing that's kind of funny is it's not like humans didn't realize that cold would preserve food. It's, I mean, that they notice that right away and you get these examples of storing bones in caves and, and building kind of ice chests in the ground where ice was available. It's just that we didn't understand how to make cold. And as you say, it's astonishing to me that we've been able to add heat to food since before we were modern humans. That goes way back. Some people say that's why, why we became modern humans, why we have our big brains is because we figured out cooking. We couldn't figure out how to get heat outta food until, I mean, basically about 150 years ago. So it's just, it's just a really recent innovation for us.

EW: Talking about all these different ways of preserving food. You touched earlier on how much refrigeration has changed the foods that we eat and the way that they taste. Were there any foods that were kind of resistant to methods of preservation historically that then maybe would've kind of shaped the diets in some ways during, you know, times of scarcity?

NT: Absolutely. In terms of produce, especially, that's something where, so with meat and with, um, fish and with dairy, what you're trying to do is stop microbes from rotting the food from, they want to eat it before we can with produce. What's happening is actually when you harvest, uh, an apple or, or a lettuce or anything, it's still breathing. And what is happening is like humans, it has a certain number of breaths it can take before it dies. And so what you need to do is slow that down. Um, and that's what refrigeration does. So. Before we had a way to slow down how fast fruit and vegetables breathed. We literally couldn't preserve fresh fruit or vegetables. You had to have them in some alternate form, so you had to turn your strawberries into jam. You had to turn your apples into cider, where the alcohol also helps protect. Those are the only ways you boil down your tomatoes into a, you know, thick, dark conserv negra. That was so conservative era, I should say, that was so thick and dark that you sliced it with a knife. I mean, that was what tomato paste was like before, you know, we get modern canning. So there was no way to eat fresh produce out of season historically, because the only way to preserve produce was to utterly transform it.

EW: I, I think especially we think about, oh, um, people on farms and just had fresh produce all the time, and that's like not the reality in any, in any situation. And it especially wasn't the reality in like the transition period when industrialization was happening. But refrigeration had not yet been widespread.

NT: Oh, totally. But even medieval folks where you're like, oh, they would've just gathered stuff from the fields. No, historians say that for farmers, at least hunter gatherers had [00:15:00] often more luck boosting their, their nutrient content in the winter. But pretty much the thinking is that everyone in pre refrigeration Europe. Basically what they call pre-scorbutic, which is like being pre-diabetic. But for scurvy, they were on, they were, they were tending towards scurvy by February march, at which point the storable produce is run out. You can store apples in a cellar, you can store, um, turnips, potatoes, but you're really starting to run out of produce and that hungry season before you start to get fresh. Spring produce again was a really tough time before refrigeration.

EW: Let's take a quick break and when we get back, there's still so much to discuss.

Welcome back everyone. I've been chatting with Nicolae about her book Frostbite, how Refrigeration changed our food, our planet, and ourselves. Let's get back into things. As you mentioned, people knew that cold would preserve food to some degree, but it was just sort of a, an availability question of that. And when you were working on this book, one of the things that you did is you

went to Maine to participate in Harvesting ice. I loved that chapter. Tell me all about that experience.

NT: It was super fun, and if you can do this near you, there's some, there's like, I think a couple lakes in Wisconsin where you can still do this. The, there's the one I went to in Maine. If you do get a chance to do this, I highly recommend it. Apparently there's a big boom in popularity after Frozen came out because there's, ah,

EW: yeah,

NT: I used harvesting scene there. Anyway. A hundred percent recommend ice harvesting. But there was a time where every lake in the Northern United States would have been. Harvested multiple times per winter. And the United States was basically like the Saudi Arabia of of ice because we had so much fresh water and so much natural cold. So it was like, this was our huge natural resource actually. So as you said, we knew that cold preserved food. We just didn't have a way of kind of making that happen on demand or happen at scale. And so for most of human history, cold was something that was, especially if you didn't live like on a glacier cold was something that was very much a luxury. And so you used it for luxurious things, status symbols, like uh, the Medici had ice caves and they would bring down ice from the mountains and have ice cream parties. And that was a huge, you know, and then there were ice heist. You find in the, in the Medici archives, you know, the ice is being stolen because it's a luxury product. People are using it for wine slushies, they're using it for ice cream, they're using it for the most exquisite, the oysters, you know, in summertime it's just a, it's a, it's a flex and it's just not available for your daily food. That all changes, uh, in the 18 hundreds when this absolutely adorable high school dropout called Frederick Tudor from, from Boston is like, you know what I'm gonna do? I'm gonna turn this ice business. He, like most New England families, or at least wealthy New England families, he had an ice house on his estate and they used it for ice cream and wine slushies, and it was an elite thing. And he was like, wouldn't it be great if this was an industry and people who didn't have ice locally? Could have access to this ice. Actually what happened is he went on holiday to Cuba with his brother and he was too hot. It's like at this new Englander who can't handle the heat. And he was like, oh, what I wouldn't give for an ice drink right now. And then he was like, Hey, what they wouldn't give for an ice drink right now. Uh, this is a business. And so he goes home and he writes letters to everyone being like, I'm about to make so much money, I won't even know what to do with it. Uh, come in with me on this scheme. We're gonna ship eyes around the world. And of course everyone is like, you are completely crackers my friend. That is not happening. And he

doesn't care. He, he goes ahead with it and of course, hasn't thought a single thing through. And this is why I love him 'cause it's so exactly how I operate. But he harvests the ice and then he's like, oh, but the harbor's frozen. If it's cold enough to freeze the lakes, the harbor's frozen. So no ships are leaving. So now I need to build an ice house, like a place to store the ice crap. Does that, um. Then when the harbor finally opens up the ship, captains are all like, I'm sorry, I'm not taking as my cargo this. Frozen water that's gonna melt and like, make my boat unsteady. Are, you know, are you [00:20:00] completely mad?

EW: Right?

NT: He gets it to Cuba. I mean, first of all, the Cubans can't figure out how to tax it. They're like, is it a mind substance, like a metal like you, or is it a harvested, so like an agricultural product? Like what is this? And that's, and then the Cubans themselves are like, yeah, what am I gonna do with this again? Sorry. Uh, they don't have fridges. They've like, he's selling them something that's literally melting on the way home and that they've never used before. So every single thing goes wrong, but could possibly go wrong in his diaries, which are at Yale still. He just has like the word failure written in, in block caps multiple times. He has little pep talks to himself about how he's still young and he can still do something else with his life. Um, he goes bankrupt three times. He goes to prison twice and. Somehow he actually succeeds. And what is bananas about this whole story is not that like he builds this global empire and he's shipping ice to Mumbai and Sydney, although that is bananas. But what's even more, uh, important to understand is that before he did that, ice was a frivolous, decadent, luxury product. After he did this, after he showed you can harvest cold at scale and get it all around the world. That's when people realized, oh, cold is really useful. Like cold can transform our food system. And so engineers who actually had already figured out how to make cold just saw it as a party trick 'cause there wasn't much use for it. Um, they were like, oh, we could build a machine to do this. And, you know, make ice on demand. And so it was him making this happen at scale that basically led to the invention of the refrigeration machine. But I realized I was supposed to be telling you about harvesting ice, which is super fun. You

EW: just get No, I I, I love the story of Frederick Tudor because one of the, one of the, the jokes are, I feel like the running jokes throughout this season of the show has been that everything is tuberculosis. Because John Green's new book, and I, I read how Tudor went to Havana in the first place with his brother because his brother was looking for cleaner, warmer air for his tuberculosis. And so refrigeration is tuberculosis. Unbelievable. But, but yeah. Tell me about,

tell me about what it, what is it like, what is the process of harvesting ice? How, how long does that ice last? Is it basically like frozen?

NT: It is basically like frozen and it's, it's kind of incredible. So Frederick Tudor and his team over the course of the decades they spent figuring this out, developed all the tools that are still used today. What you do is you sort of carve a grid onto the top of. The frozen lake. And then you usually using horses, kind of drawing the lines on with a, with a particular tool. Then you have a really big saw and you saw down, um, and sort of carve off long columns of gigantic ice cubes. What are gigantic ice cubes? They're about like two foot by one foot, so really big ice cubes. Okay. Huge. And then you split that long column of ice cubes apart using something called a breaker bar that is really fun. And so now they're individual ice cubes, these oversized ones, and you sort of, you have a, a, a metal pole that kind of helps you guide them along the open channel and you get it to, again, a horse drawn sort of sled that takes it up a hill. And from there it kind of falls down into an ice house and a team in the ice house have to guide it into position. And this is where a lot of people end up breaking their ankles. They don't let the, they don't let the amateurs in there.

EW: Oh gosh. Yeah.

NT: But, uh, but when you go to an ice harvest, you can usually, you can take your turn at sawing, you can take your turn at using the breaker bar is super fun. Definitely my favorite. Um, lot of rage. You can get out that way and then take your turn at guiding it around, which is a core workout. Um, but the stuff that happens inside the ice house, it's like Tetris, but happening with this giant sliding ice block that can break your ankle. That's moving incredibly fast. So it's, it's intense. And then once it's packed in, once all these giant ice cubes are packed in there and any broken bits kind of fill in the gaps, it stays there for months, months and months and months. I, so I harvested ice in Maine in January and I went back in July and they were using the ice that we had harvested to make ice cream for a, for an ice cream social. So, and there was still leftover and they sell it to fishermen to take it out because it actually lasts longer than machine made ice. 'cause it has fewer bubbles in it.

EW: Oh, that,

NT: that's fascinating. So it's really good quality. And so

EW: who knew there could be such variation [00:25:00] in ice? Oh, I love that. I would love, that's gonna be a bucket list thing for me for sure. To see that, to participate

NT: in that. Oh, it's super fun. And I mean, going back for the social in the summer is even more fun. 'cause you can't, you're like, what is this? Like, it's just, it's completely different. And the same ice is still there unmelted in the, in the like July heat, you know? It's

EW: wild. That is so cool to see, have like a glimpse back into this is what people used to do, this is how people used to keep things cold. And you talked about how Tudor kind of came up with this idea of harvesting ice. There were people who already knew how to create cold or remove heat to, you know, create a a, an atmosphere of cold. And yet. It really wasn't until these two things happened that an industry arose who were the ones leading the charge? Like who were the people interested in being like, oh, I see a potential for this. Not beyond just like the transport of ice, but like this could change everything.

NT: Well, what I love about this story is that you would think it would be, you know, something nutritious like milk or meat or something. No. It's beer, it's the course of this who led the charge. We did this for booze and it's just such a beautiful story. 'cause there's, you know, a lot of, uh, archeologists and anthropologists believe that one of the reasons we adopted farming and of grains especially, is because we wanted to make beer. Well, it turns out refrigeration. I mean, I like that you were joking. Everything is tuberculosis, but really everything is beer. Um, refrigeration gets started because brewers want to keep their lager. Beer caves cold. And so what happens? Is in the 18 hundreds lager beer gets going and it's a slightly different form of yeast than had been used previously in European history. And it's a slightly different brewing process that requires colder temperatures and can't happen at warmer temperatures. And beer historians will be able to give you much more technical detail than that. But the long and short of it for our purposes is you, you can't make lagger beer in the warmth, like above 50 degrees. It's over. So, uh, they became huge consumers of ice, and particularly because in the 18 hundreds, so many Germans immigrated to North America. They're living in places like St. Louis where it gets really hot in the summer. They want lagger beer. I mean, the reason, the reason you have such a thing as beer gardens is because those were planted above the lagering sellers to try and keep the lagering sellers cold.

That's how they were. They were, they really needed to be cold. And so brewers become the largest consumers of ice, um, competing with everybody else. I mean, anyone who, like New York City is, you know, one of the largest consumers of ice. Everyone wants ice. And so they were the ones who actually put the money up for these, these first commercial refrigeration machines. What happened was a Scottish doctor had figured out how to actually create cold on demand, like remove heat essentially. And he had done that in the 1750s and he,

he had just, he wrote a little pamphlet at the end of a much larger book describing his process and saying, this seems interesting. Someone should look into this. And it was like a little party trick almost no one looked into it. Um, it, it relied on noticing that as liquids evaporate into a gas, they can pull heat energy away with them, and then the water that's right there will freeze. Great. So we sort of knew how to do it. I mean, in a flask he did this. And so what happens after Frederick Tudor shows the value of ice at scale is that engineers start to get interested. And it's like many things in technology, there's a bunch of people working on it simultaneously. There's a doctor in Florida who actually wants the ice for his patients to keep them cool. There is an engineer in, uh, London who was working with the railway companies and, and thought this would be a useful ad for them, but the person to get there first was an Australian printer who. Australia is one of the continents that really doesn't have natural ice. So they were dependent on ice from being shipped from North America, and however, well you pack it, there is melt getting that far. And so it was very expensive by the time he got there. So there was a lot of demand. And so he, I mean, he blew himself up twice trying to build this machine. I mean, the, the types of liquids that, uh, uh, evaporate that quickly to gas are very volatile, very flammable. And you're operating with steam powered machinery. So the whole thing is just a giant health hazard, um, and, and the size of the house. But [00:30:00] he, he built the first two working refrigeration machines and it was Brewers, one in Australia and one in London, who were the first ones to buy them. So thank you beer.

EW: Thank you. Beer. That's so funny 'cause I had, I had written down when I was, when I was reading your book like, oh, necessity is the mother of invention. But no, it's beer is the mother of invention. Like it's pretty much like,

NT: I mean, some could argue that a cold beer in summertime is a necessity. It might

EW: be a necessity. Yeah. So from from beer then it kind of turns into food. This is when we start to see particularly meat. We have a whole lot of meat here, a whole lot of cattle here, here. But we don't have very much here. And so how did the kind of, the, the dead meat trade, I think is what you call it, emerge out of this or from this refrigeration for beer, refrigeration for dead meat.

NT: Yeah. And dead meat is what they called it. Okay. To differentiate, because at the time meat was slaughtered before you ate it, it was life meat. Now it was. There was this gap in between when it was slaughtered and when you ate, and so you were buying dead meat. Um, it's really, it gives you a sense of how weird that change was for people that they deliberately had to

differentiate it. Nowadays all we eat is dead meat, obviously. Right, right. Pretty much. Unless you're a hunter and you, you know, you go out and we're all eating dead meat, but for them, they were used to live meat and so yes, it's really, really interesting. I had no idea about this until I went down this rabbit hole, but in the 17 hundreds especially, people start moving to cities by the early 18 hundreds. London is bigger than any city in the world has ever been. It's up to, mm-hmm. It gets past 1 million, up to 2 million, up to 3 million. And the thing about that is. Now people aren't living close to their food source now. At the time, the only food source that was seen as important was, well, grains obviously, but you can transport them. But meat protein people thought that was the essential nutrient. And yet you have all of these workers living in cities who can't get enough protein. And it was, it's wild. There were cattle being stored in basements, living in basements underneath the strand, which is like the theater district in London now. Um, and they would get a two week holiday above ground each year, be sent out of the city. I mean, it's terrifying. There were more pigs living in Kensington, which is one of the pst parts of London today, um, than there were people because it was like, how do we, how you couldn't transport meat, right? People would try and herd. Turkeys in from the countryside and you, I mean, herding a Turkey sounds like a joke, but it wasn't a joke. Yeah, they had like, how are you bringing, so it was a, you know, today we have like protein maxing and things. In the 18 hundreds, they were in a full on protein panic because there was just this sense that people in cities. We're not getting enough of this one essential nutrient. And so people tried, came up with all kinds of things. This is where you get the ancestor of the bullion cube because people were trying to compress meat and get all its nutrients in a shelf stable form. There were jerky banquets in London in the 18 hundreds to try and say, this is how we're gonna preserve meat and get it to people.

British people did not like jerky. It did not go down well. People tried, uh, shredding meat and coating meat and fumigating meat and like all kinds of processes to try to get meat to people in cities. And so once ice started being available at scale and affordable. At least reasonably affordable. That is when, you know, the meat industry was like, gosh, we can get meat to people in cities where there's this huge market and we can make so much money doing it. And it's another new Englander not to, you know, but the stereotype of thrift does, um, come into play here because, uh, a New England butcher called Gustave Swift, he moved to Chicago and they were shipping live cattle to New York to be slaughtered because that's how you have to do it. And it drove him nuts because what you're doing when you ship a live cow is you were shipping. 50% of that, that can't be eaten. And so you're paying to ship it, but you're not making any money off it. And what's more, you're not making any money on the byproducts because if you slow to all your cattle in one place, yourself, oh, well now you have enough blood and guts and, and fat. And so you could make

margarine and sausages and all kinds of things, but if you're shipping these live, you're paying the train company to transport something that can't be sold and you are losing money on the buy. It's just, it just drove him bananas. And so. [00:35:00] He's the one who really figured out how to make the dead meat trade work. And it was, it's, it sounds so simple. It's like, right. Oh, just put, put the meat and some ice together and it'll be great. No, there were, I mean, his, his son wrote a biography that's actually like, genuinely, uh, amusing this full of very passive aggressive comments. Clearly he was a difficult man. Anyway,

EW: um, I gotta read that,

NT: but yeah, it's like, available for free online 'cause it's so old and it, it did, it made me. I had some feelings anyway, but he would, he shipped load after load of meat that would arrive rotten and moldy. They would just dump it in the river because there was no EPA then. But also, um, like figuring out the air circulation in the, in the train car of figuring out how often you had to add fresh ice. And then if you have to fill up a whole train car full of meat, then that means you have to slaughter a lot of meat. And each time you bring a fresh, warm carcass in, it's warming everything else up. And so. All of these problems you don't think about. 'cause they're solved problems nowadays. He had to solve them. It took, it took decades. He lost a lot of money, but he finally figured it out in the 1870s. And you can see meat consumption just skyrockets. It's incredible. It goes from being like here on a graph to like four times that on a graph in 10 years just because suddenly it's so much cheaper if you can only ship the meat, not the whole cow. And you can monetize the byproducts too. People, you're selling a steak for a lot less all of a sudden. So yeah.

EW: Let's take a quick break here. We'll be back before you know it.

Welcome back everyone. I'm here chatting with Nicola Twilley about her book Frostbite. Let's get into some more questions. And then this also happened, this dietary change also happened when fruits and veggies started to be refrigerated. Because when we talk about scarcity and you know, the trouble of getting meat in from the rural areas where it's plentiful to the cities where it's not, you know, that's one issue of scarcity. But then when you talk about seasonality and growing seasons, that's another kind of dimension of, of scarcity. So how did the focus of refrigeration broaden to encompass fruits and veggies? More than just meat, but like, what else can we do with the refrigeration?

NT: So really fruits and vegetables were seen as optional extras throughout most of the 18 hundreds. Like they were like a, a nice to have, not a necessary to have. And it was some mistaken, you know, these were the early days of

nutrition science. People didn't know, for example, that you could get your proteins from beans, not just meat. So, you know, they, they were obsessed with meat, but they really didn't, they didn't know what vitamins were they had sort of discovered, and apologies, I say vitamins. I'm British originally. It's, I'll also say tomato. It's, I'll

EW: allow it, I'll allow it.

NT: Um, but uh, but until the 19 teens when vitamins are really sort of hammered out and people start to realize like, oh, fruit and vegetables have, they're not just sort of these nice seasonal, extra, they're essential part of our diet and we need to eat leafy greens and citrus and, you know, suddenly. When that happened, then it was worth shipping fruits and vegetables using refrigeration. So it's really, it's like what's worth doing there was, you know, beer is a high value, desirable product, so it was beer, meat, high value. People thought it was the only essential nutrient, so that was worth doing. So it's not until when fruits and vegetables become worth it, um, because science tells us we need to eat them. And really the early 19 teens were like a huge vitamin kind of era. I mean there were New York Times cover stories about, you know, we need more fruits and vegetables. And they had been ignored before that. So that's when you start to see California citrus being transported in those same dead meat rail cars using the ice and iceberg lettuce catches on, um, because that is sturdy enough to survive a multi-day, multi-week, sometimes journey across the country in those rail cars full of ice. That's how it supposedly got its name. It was a very sturdy varietal that depending on who you talk to, is either called the Los Angeles lettuce or the New York lettuce. 'cause it was for the New York market, but it was grown in [00:40:00] California. And um. And you know, it is the lettuce we know today very sturdy, like very closed head, not light and fluffy like in a arugula or something, you know, crispy. Um, and so people would stick 'em in the rail, cars load 'em up with ice on top, and kids seeing these train cars coming would say the icebergs are coming because there was ice visible from the top of the rail cars. Oh my. So that's supposedly how, how it got its name. But yeah, once you start, you know, once you start getting this pressure from consumers who want to eat more vegetables, then you start this system. And as you say, it's a different kind of scarcity. You know, Californians could have eaten citrus and lettuce in winter, but at the time there were very few people living in California and the people in New York suddenly realized they needed this. And so. A refrigerated rail car was the, was the, the trick to make sure that you could eat fresh fruits and vegetables all year round. And something that a fellow food writer of mine, Joanna Lyman, is called Permanent Global Summertime, which I love as a, it's like no longer do we have seasons, we just have permanent global summertime, and you can have a strawberry in December if you so wish.

EW: I, I mean there, there are so many points about the fruits and veggies that you touch on in your book. Uh, you know, I have a bag of cosmic crisp or co whatever the, those apples are. And then to think about how long those apples possibly have been removed from the tree is just, blew my mind.

NT: I mean, if you have your cosmic crisp apples right now and they're harvested in Washington state, those, those are, um, 11 months old. Yeah. And coming up to their first birthday, because think about when the apple harvest is. It's just getting started right now in, in August in Washington State. So the, your apples are not the first ones off the tree from this year. They're certainly not. Not. Yeah. And, and the other thing is like, what's possible. For example, before the banana, perfectly delicious tropical fruit. No Americans had ever tried one. When a banana palm was exhibited at the 1870 something Philadelphia, you know, Centennial Exposition. It was so valuable and rare and desirable that it had an armed guard, this tree, so that people didn't steal the bananas. And now if you think about it, there's no gas station even that doesn't have a banana. I mean, every 7-11 it's just, they're, they're, they're the most available fruit. And that is thanks to refrigeration, which is funny because you don't store bananas in a refrigerator at home. But actually to get them from the tropics to, uh, all the way to North America, you have to harvest them when they're green and unripe and then refrigerate them so they don't ripen until they get to the destination. So the banana, which is the world's most popular fruit, would never have been, would've just carried on being a tropical fruit that was liked by people who lived in the tropics without refrigeration. So it really transformed the fruit scape.

EW: It's the fruit scape. I love that. And so, yeah, we, now, we are, many of us are the final step in the cold chain or the, the tip of the iceberg of the cold chain. But this happened later than industrial refrigeration happened. When did the refrigerator become the home? Domestic refrigerator become a thing.

NT: Yeah. So those first machines, like I say, they would blow up all the time. And this is how James Harrison, the, a Australian who made the sold the first machines sort of lost eyebrows, you know? Uh, it was, it was a dangerous business. And when you ha are using steam power for your refrigeration machinery, these things are the size of a house. So that's. You're not gonna have that in your house. And people did try to have one central steam powered refrigeration machine at a, at a warehouse or something, and then pipe cold to houses nearby. So under the streets in, in downtown Boston, these pipes are still there going from what used to be a refrigerated warehouse out to homes and businesses in the neighborhood. And you would've got your cold, kind of the way we get our electricity or our gas like through a pipe, which is a whole different imagine anyway.

EW: Yeah.

NT: So you just have a pipe, go into a cupboard and that would be your cold box,

EW: one of your utilities. Yeah,

NT: exactly.

EW: How much cold did I buy this month? Yeah,

NT: totally, totally different way of thinking about it. But what happened actually was electrification. And so, uh, once people had electricity at home and you were able to shrink the various component parts [00:45:00] of a refrigerator to make them work, the, you know, the motor, the compressor, things like that, to make them work using electricity, that's when refrigerators, the domestic fridge. Becomes domestic. Even still the very first ones, they would put the machinery in the basement and the fridge up in the kitchen because it was big and it was ugly. And it was loud, honestly. But you know, gradually by the twenties, by the thirties, you get a home, a reasonable home refrigerator that you can plug into the wall. And actually General Electric promoted it very hard because this is their idea of a gold mine. You have to plug it in 24 7 and run it. It's a power hungry machine that you can never unplug if you're an electricity company. That is the dream. Yeah. So they loved it.

EW: It's the ultimate subscription service, just Exactly. Can never unplug. Yeah. And you know, refrigeration has made, you know, we are now dependent on refrigeration in many different ways. Maybe it's for food, maybe industry science and medicine is hugely dependent on refrigeration. And yet refrigeration has, you know, solved so many problems at the same time that it has created so many problems. What are some of the unintended negative consequences of refrigeration?

NT: And then this is really why I think this book matters now. I, I got into it just because I was fascinated. As I started researching it, I was like, oh, this is actually an urgent problem as well. Like this matters right now. And actually, during the process of writing the book spoke at the first UN meeting of the sustainable cooling team because the world has started to wake up to this too. And here's the problem. When you, uh, cool things, it takes a lot of energy. It takes a lot of energy to remove that heat, to move it around. And so you might say, okay, well we could, we could power all our refrigeration machinery using renewables. There's no way we can't even keep up with our existing demand, let

alone the fact that cooling is. Growing so rapidly, it's incredible. The US has, you know, it's the most refrigerated country on earth. We have the most amount of cold space and still we are building new refrigerated warehouses. The US uh, cold chain market is a huge investment opportunity right now 'cause we're building so much the rest of the world, like China has been building a cold chain for the past decade and a half is still like. A sixth of the amount per person that we have. Most of Sub-Saharan Africa, which is where also 2 billion people are projected to join the world's population during the next, you know, 20 years doesn't even have a cold chain yet, but they're building one. So if every person alive just today not taking those future 2 billion into account was to have the same amount of cold space as it takes to feed an American. The current demand for refrigeration would multiply by five, five times over the, and, and, and so that the emissions then from refrigeration, which are already more than the emissions from global aviation. And we hear, and I'm, I'm just talking about refrigerating food. I'm not talking about cooling our houses or all the stuff we use for medicine or data centers or everything else, just talking about cooling our food already more than global aviation.

And all the time we hear about we shouldn't fly. No one is like, what are we doing about. Refrigerating our food. That's just not a conversation. 'cause it seems essential. But imagine that then multiplying by five, then it's gonna be the same size as all of us emissions, which is just unimaginably huge. That isn't even taking into account the fact that for every degree warmer the planet gets refrigeration is less efficient, has to work harder. So we're actually making the job harder, using more power to do even just the cooling that we have, let alone the expanded future cold chain. So it's a, it's a real critical problem and you can't just say to, you know, countries in Sub-Saharan Africa, sorry, you can't have refrigerators. Right, right. Like, that's not an option. So it's, it's a gigantic problem. You know, a lot of un sustainable development goals are sort of dependent on having refrigeration. That's how countries are planning to grow their farming sector and waste less food and build export markets. A country like Kenya, their majority of their overseas income comes from exporting fruits and vegetables now, but that's because they're, they built a cold chain and it's like this, if this happens all over, it's anyway. So it's a real, it's actually a really huge crisis and less than 1% [00:50:00] of global R&D goes into refrigeration technology, let alone other ways of preserving food. So it's really like we've sort of taken our eyes. Off the ball and just being like, wow, we have this great system. It works great. Hasn't really changed since the, you know, for a hundred years we're using the same technology, but, you know, little refinements to make it more efficient here and there, but not works the exact same way. An engineer from, you know, the 1910s would know their way exactly around your fridge. So.

EW: Yeah.

NT: Yeah.

EW: Time travelers. Stroll on in. Oh, your, your fridge is broken. I got you. No problem.

NT: Pretty much.

EW: So you mentioned that there is at least a teeny tiny portion of r and d and innovators going into this problem and, and trying to think how can we, you know, come up with creative solutions to the growing planet of cooling, ironically, even though it is warming. Um, what are some of those ways that people are rethinking the future of refrigeration?

NT: Yeah, this is, I mean, I, I hate to use the pun, but this is kind of the coolest stuff because it's, it's,

EW: it's, I'd love that you used the pun. It was necessary. It had to happen at some point. Come on.

NT: Seriously. But, um, but yeah, so there's a lot of really interesting work. So one, on the one hand, for example, you can change how you refrigerate. It turns out there are certain types of materials where if you kind of mess them up, get them disordered, put, throw them into chaos, they absorb heat energy to get themselves reordered again, because they need, they need energy from that. They absorb energy from their surroundings in the form of heat to kind of get themselves. Back in their nice little grid again. Um, and so you can do that disordering with a magnet. You can do do it with heat, you can do it with all kinds of things. This forever has been how we get down to absolute zero for physics experiments, um, using, uh, a magnetic cooling. It's just that there has been no way to make that work at this, at, you know, a normal refrigerator economic scale because the material's very expensive, specialized, whatever. But there is a group at the University of Cambridge in the UK who have found a very cheap and common form of plastic actually, that if you squeeze it and release it, so you mess the, you mess the atoms up, and then you, and then you release it so they bounce back, but they suck in energy to get themselves all sorted out again. It works and it gives you the same amount of cooling as a regular fridge for less than half the emissions because you're just squeezing and releasing some plastic using the same. Yeah. So that's really interesting. And they have, you know, working prototypes. The problem is the people who will save money on that are the end users and the people who make refrigerators are

not the people who will save money. They will. They just make the equipment. So it's, there's a business model issue there. We'll see how that goes. People are investing in it. It's exciting. The other thing I find really fascinating is that. We don't have to use refrigeration to preserve food. And I'm not suggesting we all go back to like canning our own tomatoes either.

I mean, for most of human history, this is where we started. We have thrown enormous amounts of human ingenuity at the problem of how do you preserve food? And then it's like, we invented the refrigerator and we were like, eh, we're done. Good, finished. But it's like, no, uh, actually we can keep going. And so there are people working on all kinds of cool things. There's a potato farmer from India who was fed up with his potato harvest rotting, um, before he could get it to market. And has come up with a, a system that keeps potatoes, formerly frozen French fries that you would buy frozen, deep frozen. He can keep them at rim temperature, good for six months. Plus he uses something called super critical carbon dioxide, which is. Carbon dioxide, just the regular stuff in the air. But that is in the form of both a liquid and a gas. That's what super critical meal means. So you, you pump it around these slice up potatoes like that, and it preserves them. I mean, and you're not doing anything to the potatoes themselves. There's no, like health implications, in fact, because it's sort of slightly like a cooking process. They end up a little crispier. It's like triple cooked french fries, you know? Oh,

EW: my favorite.

NT: So, um, so that's something where they're, they're building their first, uh, commercial, uh, production line right now, which will be really exciting. And again, it's just like, I'm not saying that's going to replace everything, that this process also works on meat. It works on all sorts of things. Um, Australian meat producers are actually really interested in it because it would enable them to ship, [00:55:00] quote unquote fresh meat rather than frozen meat. Um, but. It's, it's not like this is gonna take over. We're always gonna have a place for refrigeration. What I think is so exciting about these additional methods that are being invented is that some of them have benefits too. Not just sustainability ones, but ones for flavor. There's a coating for produce, for example, edible, fat-based coating, basically, but it's nanoscale, so it's not like you're actually eating like a tablespoon of fat with your food or anything. It's just, but what it does is it, it does exactly what refrigeration does in that it's, it slows down how fast the fruit or vegetable is breathing, but it means that, for example, fruits and vegetables that don't refrigerate well, like all the tropical ones like Tira, Moya, finger limes, delicious things that we never see in grocery stores. They can be given this coating instead. And now, oh, we can have them, they, because they

can't be refrigerated. Or for example, you could use it to take things outta the refrigerator. I mean, when I visited them, they had put this spray on bell peppers and sat side by side with some bell peppers that hadn't been coated. Stored at RI temperature for eight weeks. Eight weeks. I mean, if you left a bell pepper on your counter for eight weeks, it would've slid off the surface as slime at that point. I mean, it would be gone. And the ones that weren't coated were like that. The ones that were coated. Yeah, they weren't fresh enough for your cruciate platter anymore. But they were perfectly fine for a stir fry. So I just, you know, and of course here in America, we're used to buying our fruits and vegetables refrigerated. It's gonna be really hard to change that. But in, there are a lot of places in the world where people don't buy their fruits and vegetables refrigerated, and they don't want their fruits and vegetables refrigerated 'cause they think it means it's not fresh. Mm. Well the spray could help prevent food waste and things going bad while not refrigerating the food. So, and the other thing is people think, oh, refrigerated food is fresh. It's not getting any fresher in your refrigerator. If you put your bag of spinach in there a week later, you can eat it. It still tastes fine, but it has lost up to half its nutrients. So it's. It's not like it's getting any fresher and so something that can help us preserve food differently, better, I think it's really exciting.

EW: I, I love these innovative solutions. I, I have loved exploring so many rabbit holes of refrigeration. There are so many more in your book that everyone who's listening should go out and read right now 'cause it's fascinating. You'll be telling everyone fun facts. And Nikki, I just wanna thank you so much for taking the time to chat with me today.

NT: Oh, thank you. As you can tell, I could basically talk about this for the rest of my life, so it's really fun to have the opportunity. Thank you so much.

EW: A big thank you again to Nicola Twilley for taking the time to chat with me. I certainly haven't looked at my fridge the same way since reading this book. If you enjoyed today's episode and would like to learn more, check out our website. This podcast will kill you.com, where I'll post a link to where you can find frostbite. How refrigeration changed our food, our planet, and ourselves, as well as a link to Nikki's website where you can find her other work. And don't forget, you can check out our website for all sorts of other cool things, including but not limited to transcripts, quarantining, and placebo. Rita recipes show notes and references for all of our episodes. Links to merch, our bookshop.org affiliate account, our Goodreads list, a firsthand account form, and music by Blood mobile. Speaking of which, thank you to Blood Mobile for providing the music for this episode and all of our episodes. Thank you to Lianna Squillache and Tom Breyfogle, focal for our audio mixing. And thanks

to you listeners for listening. I hope you liked this episode and are loving being part of the T-P-W-K-Y Book Club. A special thank you as always to our fantastic patrons. We appreciate your support so very much. Well, until next time, keep washing those [01:00:00] hands.