STE Episode Transcript – New Harvest

> **ISHA DATAR:** Industrial scale farming is like coal production in that it is very dirty and dangerous, but it gets the job done.
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> You can't deny it feeds a lot of people – but it also drives climate change with a lot of methane emissions and carbon dioxide emissions. And it's also susceptible to public health disasters like swine flus, avian flus.
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> The whole supply chain of animal products could change if we start veering towards cultured meat. With animal agriculture, you're developing the whole animal: its horns, and its skin, and its nervous system, all this stuff. But what you really want is mostly muscle tissue, some fat, connective tissue. So it seemed so clear that we could extract those things and just grow exactly what we needed.
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> Now we actually have the opportunity to create an ideal cut of meat that does not necessarily come from an animal. That's a completely new paradigm for food.

CATERINA FAKE: That was scientist Isha Datar, the CEO of a nonprofit called New Harvest. She's on a quest to not only reinvent meat, but the entire meat industry.

For six years, Isha has been working to further the development of "cultured meat", which is meat that's grown in a lab, rather than in a stockyard. And while the cultured meat movement is still in its early days, Isha believes it could be the key to disrupting animal agriculture. How? By questioning the notion of what meat is.

There is something enormously appealing about the idea of eating meat that arrived on your plate without an animal having to die. But does meat grown in a lab really take animals out of the picture? And do we want to step further into a landscape of man-made, mass-produced food, and get farther away from eating natural, living organisms as our ancestors have done for millions of years?

[THEME MUSIC]

FAKE: I'm Caterina Fake. And we know that the boldest new technologies can help us flourish as human beings – or destroy the very thing that makes us human. It's our choice.

About me: I co-founded Flickr, and helped build companies like Etsy, Kickstarter, and Public Goods from when they first started. I'm now an investor at Yes VC, and your host.

Everybody knows the dark underbelly of industrial meat production. In fact, I consider the first horror movie my daughter saw to be the documentary "Food Inc.", which is about this very topic.

She was only 10 at the time, but it was terrifying for her when she saw what goes into chicken McNuggets. So when I went to the drive-thru of a McDonald's to get myself a salad, she threw a fit. She's like, “We Can. Not. Go. Here.”

The reality is that our world – at least the Western, carnivorous side of it – runs on meat. Cheap, readily available meat is a centerpiece of our culture, from holidays to rural employment to the American mythology of the West to what you can afford to buy to feed a family of four.

And this tradition is at least partially because of Big Ag – meat production companies like Tyson and Perdue – that make it exceedingly easy to pick up a pound of ground chuck for less than $4.

But as consumers, we don’t often consider the hidden cost of meat production. As Isha likes to describe, here’s what it takes to get you a single eight-ounce steak:

- 18 ears of corn,
- 2 liters of gasoline,
- enough energy to power your laptop 60 times,
- 3,515 liters of water – what you drink in approximately 5 years.

This is all for just one meal for one person. Experts say that giving up beef alone is better for the environment than giving up your car.

But what if you could have your cake and eat it too? Isha imagines a world where you could have a burger made of real 100% ground beef without all the climate ramifications.

Her solution is cultured meat, which is meat grown in a lab using animal cells. Unlike popular plant-based products such as the Impossible Burger and Beyond Meat, cultured meat actually is meat. It's not vegetables that are made to taste like meat. And It's not imitation meat either.

> **DATAR:** Our goal is to fund and support and accelerate academic research in this new field of cellular agriculture, and to support the scientists that are making this field happen.

FAKE: In recent years, the cultured meat movement has gained significant momentum. Bill Gates and Richard Branson are among the celebrities who have invested in cultured meat startups, and more and more scientists are getting on board.

> **DATAR:** There really was no organization that preceded the type of work that we were doing, but we are seeing some startups emerging. It's grown from probably zero to maybe 40 startups in the past four years.

FAKE: But there's still a ways to go before cellular agriculture really disrupts Big Ag. For starters, Isha needs to create an infrastructure of scientists, funding, and public acceptance. Like Carl Sagan said:

> **DATAR:** "If you want to bake an apple pie from scratch, you must first create the universe." If we want to make cell cultured meat, we have to create the universe in which cell cultured meat can exist, which means an environment of talented people with resources and expertise that can move the science along.

FAKE: So is cellular agriculture what we've been waiting for to dismantle Big Ag and save the environment? We'll hear from a journalist…

> **KEVIN DELANEY:** The reality of our planet and climate change suggests that we need to dramatically redefine our relationship with protein.

FAKE: We'll talk to two butchers...

> **BRENT YOUNG**: I absolutely hate that idea.

FAKE: And we'll meet a biophysicist…

> **ANDREW PELLING**: I'm fully on board with the dream, man. I would love to see this type of world, but I'm a scientist as well and we live by rigor and evidence.

FAKE: Isha remembers the moment when she saw the future of food. She was majoring in biochemistry at the University of Alberta when, on a whim, she enrolled in a graduate level meat science class.

> **DATAR:** It was in the basement of the animal science building in a little classroom with 15 to 20, primarily agriculture, students in it. I wanted to learn about biology that everyone cared about, the type of biology that touches people every day, which to me was food. I grew up really caring about food. I would eat steak tartare in high school, so I cared about meat too.

FAKE: There, in a faraway basement, she had her "aha" moment.

> **DATAR:** My professor, in passing, mentioned the idea of growing meat from cells. And I thought, "Oh, that's so obvious. That's clearly the next step for food technology." Then I thought, "How on Earth is no one working on this right now?"

FAKE: Growing meat in a lab might seem like something from a science fiction movie, but it's not a completely new phenomenon.

Scientists have been growing human organs in the lab for decades. They've successfully grown them using the same techniques as Isha: by taking cells from the human who needs the organ,

"growing" them on an organ-shaped scaffold, and eventually implanting them into the body. Scientists have grown a human heart, bladder, muscle, and skin by this process.

Is using cell cultures to grow food such a huge departure? Isha doesn't think so.

> **DATAR:** I think it's important to place the idea of growing meat or milk proteins on a continuum of things that we already produce and consume. The first time biotechnology was put to use in food was many thousands of years ago when we started fermenting foods.
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> And before we fermented foods, we had a glass of milk. We could have never imagined that we wanted that milk to become solid and have these mold growing through it.

FAKE: She's talking of course, about cheese.

> **DATAR**: I like to think of cellular agriculture almost as a fermentation 2.0 or 3.0 or 4.0, where in the introduction of these new technological processes, we unlocked these food products that we just could not have imagined. So in the same way we went from milk to cheese, I'm so curious where we might go from muscle cell to who knows what?

FAKE: So how do you grow a muscle in a lab? All lab-grown meats – dairy, eggs, and what have you – have four components.

> **DATAR:** One: Cells that you would need to collect from whatever is your organism of interest. If you wanted to grow chicken, you would collect muscle cells from a chicken. If you want to grow foie gras, you would collect liver cells from a duck.

FAKE: Two: Once you have your desired cells, you take the culture and adhere it to your desired surface. This is called a scaffold. The cells will grow in the shape of the scaffold. So when scientists grow, say an artificial organ in the lab, they use a scaffold that is shaped like the organ. In the case of food, this offers up the opportunity for some scientific creativity.

> **DATAR:** One that I'm really excited about is removing the cells from vegetables and replacing them with muscle cells. So instead of this idea that we would use a scaffold that looks like a chicken nugget, instead we could take a piece of celery, remove all the celery cells, and seed that scaffold material that was previously celery with muscle.
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> And suddenly we have this culinary opportunity that has never existed before: A combination of a plant and muscles cells. That's a completely new paradigm for food.

FAKE: Three: You need to feed the cells to keep them growing. And this requires a nutrient mixture called the media, which mimics the fluid that surrounds growing cells inside an animal. When it comes to beef in particular, this stage is controversial because scientists often use

something called fetal bovine serum. It's a fluid taken directly from living cows, but you have to kill a cow fetus to get it. We'll come back to that later in the show.

And then finally, four: For the cells to grow, they need heat.

> **DATAR:** The cells on scaffold in the media – all of that would be combined inside a bioreactor, which emulates the body. It's the container in which all this growth will take place.

FAKE: Then 70 to 90 days later, an animal-free steak or a chicken wing or a pork chop appears. Up next we'll jump into our Should This Exist workshop, after the break.

[AD BREAK]

FAKE: Beef is more than what's for dinner. What we eat is who we are. For this episode's workshop, I spoke to four people with different perspectives on how cultured meat could change – or fail to change – the landscape of food.

First we have Kevin Delaney, the editor-in-chief of Quartz, and a regular on this show. I asked him what cultured meat brought up for him.

> **DELANEY:** So years ago I lived in Paris and I'd go into the local butcher store and you would walk up the counter and there would be these color photocopies with photos of cows on them with the cow's name, with the cow's address, with the cow's weight, with the date the cow was slaughtered.
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> And it turns out that these were literally the cows that the butchers behind the counter were serving – you saw the cow. And the tie between the protein that you were buying from the butcher and this cow who lived in the French countryside was very direct.
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> We actually are comfortable with the idea that when we eat meat we're eating something that has a provenance, which is a living thing. How do we culturally redefine our relationship to the protein that we consume?

FAKE: Kevin's story is filled with nostalgia for an earlier time when more of us had a personal relationship to the meat we eat. But now, as consumers, we look at packaged meat in the grocery store and don't intuitively associate it to the animal it came from. Does Isha think cultured meat will connect us to the animal origins of what we're eating? Or distance us from them further?

> **DATAR:** You could still purchase cultured meat from a cow that has an identity and an address and a name, although it didn't have to die. We could even watch a live stream of

it roaming the countryside. You can continue to have a relationship with them as existent animals. That scene doesn't need to change too much.

FAKE: There's something villainous about eating meat. The desire and relish in eating another living thing has even become a movie trope. Think about Cypher eating the computer generated steak in "The Matrix", or any episode of "Game of Thrones". Somebody bad is always sawing into a big, juicy steak.

Even if eating meat is socially accepted, I think there's something in our subconscious that knows it's not totally cool. The vegetarians have always had the moral upper hand. Potatoes have no feelings.

Next we have biophysicist Andrew Pelling. Andrew is often described a "biohacker." It's worth noting he and Isha have collaborated, and New Harvest actually funds research projects in one of Andrew's labs. Andrew has made his career by inventing a way to use plant tissue to grow human cells.

> **PELLING:** We've gotten famous for using apples to make human ears. We've been growing bones out of apples, as well. We've grown skins on Lego mini-figures, little genetically modified skins that emit green light. And really all of this is sort of a series of experiments really testing the limits of biology: How extreme can we get? Where does biology break down?

FAKE: Andrew has a lot to say about cultured meat – and specifically about fetal bovine serum, often referred to as FBS.

> **PELLING:** Fetal bovine serum is the liquid portion of the blood from a calf that has been aborted. So you have to kill the cow, the mother, you abort the fetus, and you purify the fetus' blood.

FAKE: Fetal bovine serum is the "media" I mentioned earlier, the nutrients that feed the cells that allow them to grow into meat. And right now, it's the only low-cost option for culturing animal cells.

> **PELLING:** They tried to do it without fetal bovine serum. I mean, like this stuff sucks. Nobody likes it. I hate this stuff. But as soon as you take it out of cell culture, all your cells die.

FAKE: Unless scientists find a viable, cheap alternative to FBS, cultured meat fails to remove the animal from animal agriculture. Isha is hopeful that an alternative animal-free medium will arise soon.

DATAR: I think we can absolutely move away from fetal bovine serum, and many groups already have been able to grow cells without it. There's no need to rely on this specific animal product.

FAKE: Andrew is openly skeptical about cultured meat.

PELLING: I mean, I hate to be the party pooper here, but I don't see any evidence to show that we can actually do this at scale in these big bioreactors. Everything I've talked about was actually on a Petri dish.

The second you try to grow cells in a stirred bioreactor where they're kind of floating around in liquid, all the biology changes and everything you thought you knew goes right out the window. Like, it's crazy.

FAKE: He envisioned a dystopia where the production of lab-grown meat goes mainstream.

PELLING: These companies, because they need so much fetal bovine serum, are on the side, maybe in the basements have herds and herds of cows that they're impregnating and aborting and killing and there's this horrible bloodbath going on beneath the greenscape of these beautiful company headquarters.

The public finds out: In fact, what you've been feeding us all along is an animal product, it's pumped full of antibiotics, it's nothing clean, and it's a huge waste of water. And of course, the bottom drops out of this company, a lot of people lose a lot of money, and these companies go completely bankrupt and eventually disappear and we're back to traditional agriculture.

At this stage, someone may come along with a real solution. But all the investors who had invested earlier are not going to want to invest again in this type of technology. So this technology doesn't ever come to market, and what could be a real solution and have a real impact on our lives and on our planet never comes to be – and simply because of a lack of rigor, a lack of transparency, and obfuscation of truth.

FAKE: I asked Isha if Andrew's nightmare scenario resonated with her.

DATAR: I do really believe that we can move away from a fetal bovine serum for culturing cells. I just think there haven't been incentives in place that have pushed that type of innovation forward before. I think it's possible. And the reason why I think it's possible is kind of similar: I'm 39 weeks pregnant now and people are talking about breastfeeding versus formula.

Formula exists and you could say that fetal bovine serum is kind of like breast milk. It's a kind of magical mixture but we can come up with substitutes that are very, very good;

that provide a nutritional profile that is necessary for that growth to happen. So similarly fetal bovine serum provides everything cells need to grow and divide but you could provide an alternative set of very well-defined nutrients that can do the same thing.

His story about the herds and herds of cows where they're artificially inseminating – that's kind of what the current situation is like now, this looks like the dairy industry in some ways. So let's not forget what we should be comparing against, which is the status quo.

FAKE: The status quo is pretty bad. But what do we have to lose by giving up the old ways? Is there anything worth saving from traditional animal agriculture? I talked to Ben and Brent, two New York City butchers. They believe there is a lot worth saving.

BEN TURLEY: I'm Ben.

BRENT YOUNG: I'm Brent.

TURLEY: We're from The Meat Hook.

YOUNG: We're a whole-animal butcher shop in Williamsburg, Brooklyn; we've been operating there for about 10 years.

TURLEY: So we get the whole animal in and we take responsibility for making sure none of that animal – the gristle, the fat, the bones – goes to waste.

FAKE: What about taste? And what would it be like to cook cultured meat?

YOUNG: I absolutely hate that idea. Initially, from a culinary perspective, what brings you joy and excitement is when we try a different meat or vegetable from a farm and it's excellent because of a set of seasons, or the way that the farmer actually tended to the way that they were rotating these animals, or feeding them the excess from their garden. It brings a unique taste to it and it's different and exciting. So the idea of making that homogenous infuriates me, because it really takes the joy out of cooking.

DATAR: It would actually be a shame to think about cultured meat as purely optimization of nutrients. Brent mentions that some of the joy comes from the flavors and the experiences of eating this animal, but a lot of the joy also comes from the social aspect of it.

I mean, a lot of people brew beer, a lot of people are very much in tune with these actual processes related to producing foods. I would say there's probably joy that comes with being at a barbecue and seeing the meat being prepared. I think food is so much more

than just the nutrition and the flavor of it, it is where it comes from, it is how its prepared, it's who you're eating it with – and I don't want to see those things get lost.

I also want to open up the idea that these cell cultured food products don't have to be envisioned as just uniform products, and that perhaps there is a different type of flavor that comes from feeding these muscle cells an algae-based feed as opposed to corn or grass. We may have a whole new suite of feeds to feed these cells which may impart flavors that we've never experienced before.

FAKE: You could have, say, "this one ate exclusively sesame seeds" and "this one was raised on marshmallows" and "this was the strawberry beef".

DATAR: I guess what I want to summarize by saying is I think a lot of visions for the future of food and for the future of efficiency and sustainability come back to this uniform optimization way of thinking about protein, but I really don't think that we have to think that way.

FAKE: Kevin was less preoccupied by the taste of lab-grown meat than he was about the necessity of this option in a world of great alternatives.

DELANEY: I think the notion is that you will see it as closer to real meat. It's kind of an intermediary product between the cow and the soy-based meat substitute basically. My skepticism about this is if we're going to not eat the cow, why are you going to eat a more expensive lab-created meat when we actually do have plant-based substitutes that currently are cheaper and becoming more convincing substitutes for meat? It's not your lame Tofurky. It's something that actually looks and tastes like a burger and in a lot of context would actually be hard to tell a difference from a burger.

DATAR: Yeah, I don't really disagree with Kevin. Beyond Meat and Impossible Foods have done such a great job in rebranding the veggie burger. It used to be thought of as like the downer food at the barbecue and now it's something people are really excited about it. And you can get it at a fast food place, you can get it at a high end restaurant, and it's really something that non-vegetarian people want to try.

But I still think there is quite a ways to go in terms of thinking of alternatives beyond just the burger format and the nugget format. I think that's still pretty limiting.

FAKE: I agree, but it's hard to talk about this bubble of delicious meat alternatives without talking about the cost. Part of the reason why Impossible Foods has scaled so well is that it's cheap and easily available. It's sold at Burger King, White Castle, and more. What would it take for cultured meat to get to that place?

DATAR: The cost would have to come down quite a bit. The types of bioreactors that people are using to grow these cells are still quite small. And the price per pound on cell-cultured meat is still many, many times that of meat from an animal. The greatest amount of change would occur only when the costs are pretty comparable.

FAKE: Cost is one thing, but the type of meat that we would culture is another. Would it be chicken breasts? Rib eye steaks? Or something else? And who gets to decide that? Brent and Ben worry that if cultured meat takes off, the less-eaten cuts could be forgotten.

YOUNG: We have this show on Eater where we have the opportunity to meet all these different chefs and talk about the way to cook different things. So we did this episode with an Izakaya chef who took a single chicken and he was like, "I'm going to show you 14 different ways to make skewers out of the different parts."

FAKE: Izakayas are Japanese restaurants that serve a range of small-sized inventive dishes, similar to a Spanish tapas restaurant.

YOUNG: He blew our mind. And he made 14 different ones without touching the chicken breast or the chicken leg, and took off just the part of the chicken thigh. So it was like, okay cool. You can set those major muscle parts aside and just off of all of the bits and pieces, we're going to make all of these wonderful things.

And that led the conversation that we were like, we were eating a lot of the cartilage and the knuckles. And he was like, "Yeah, this is huge in Asia. People really love tendons. People love things with lots of collagen in them." And personally I love that too.

But so the idea of just being like, “Oh, we're going to forget what other cultures deem as an interesting texture” or something to challenge the way that you eat food – it always comes back to a freaking chicken breast, because it's like the most boring thing in the world. The cultural impact of eating as well seems monolithic from doing that and yeah, kind of awful.

DATAR: My favorite Izakaya is the chicken skin, and I remember my Grandma coming to me and saying, “Isha, wouldn't it be great if the chicken was made only of skin?” Which is kind of a funny backwards connection. So, I agree with them and I do wonder what it means as we advance these alternatives where we're going to focus probably on these very Western iterations of meat.

FAKE: I come from a culture where we buy a whole chicken and it's a whole week’s worth of food.

DATAR: It gives and gives and gives until there’s soup.

FAKE: And then you know what we do with that? We actually pressure-cook it in vinegar, grind it up, mix it with rice and vegetables, and make dog food out of it. So we even use up the bones. So it's a hundred percent. Nothing is thrown away. Zero. I think that Ben and Brent would approve.

FAKE: Back to Andrew, who is concerned about the hype surrounding cultured meat.

PELLING: I mean, there are lots of scientists involved here and there's some really well-known and very well-respected scientists, and you can see when you read their interviews their comments are much more measured. But then there are groups of people who are making statements and claims that just really, you got to think twice about those statements, you've got to scrutinize them a little bit because they're just a little too wild and unrealistic.

We need to be transparent about what these companies are actually doing and how they're doing it, especially when they're making claims to investors and to the public.

DATAR: I think it is important to be measured about the claims. I think it's also important to dream big. The bigger theme here, which is popping up not just around the cell cultured meat, lab-grown meat world, is people talking about biology as if it is software, people talking about cells and molecules as if they're electrons. They're not, they're so different. And I think one of the conditions that leads to any kind of runaway investment situation in biotech is a lot of investors just not knowing that crucial difference.

So we do have a lot of investment which is very much excitement driven and we can poo-poo it and say, "Oh these are not savvy investors," but the fact is that that type of investment is driving the conversation right now in a way that the conversation kind of needs to go in order for us to bring on some of those rockstar scientists.

FAKE: Let's assume for a minute that cultured meat solves all of its problems. Scientists come up with an alternative to FBS, the cost goes down, the investors stop making big promises they can't deliver, and it successfully scales: You can go to McDonald's and buy an animal-free hamburger, no problem. What's the downside to this world?

One secondary effect from our factory farm system is that we need an enormous amount of corn and soy to feed the animals we're eating. But when you grow corn on the same field for 40 years, the nutrients deplete into nothing and the soil is dead.

Our butchers, Ben and Brent, believe animal farming is an important part of regenerating the soil. They explain the theory of regenerative agriculture.

YOUNG: Regenerative agriculture is an idea of land management, predominantly. It really has more to do with soil health than anything else. The idea being that if animals

are led to a new pasture they're going to eat the best things that they find. Like a kid in a candy shop, they're going to find the thing that you really like, you're going to go after it. So those are just different grasses.

Through doing that, they're also trampling the ground and creating new growth. They also, believe it or not, they poop. And it's the best fertilizer in the world. So, if you have natural grasses and you have natural fertilizer, it really can rebuild soil health, which then can retain more water and create cleaner water systems.

So using animals in this strategic way you create a great product in and of itself in that this is super clean protein but in the process you are also rebuilding soil health.

TURLEY: These systems are as old as time. So that's just part of just getting back to something that was already working. Sometimes the old ways are the best ways, kind of thinking.

FAKE: Is regenerative agriculture a viable way to dismantle Big Ag? Here's what Isha had to say.

DATAR: If we move towards the type of regenerative agriculture that they are talking about, then meat consumption has to go just way, way down. These manure lagoons, this runoff problem like that comes from factory farms where we have thousands and thousands of cattle in a very concentrated area. That's essentially mining.

You know, it's mining because it's not cyclical anymore. It's a linear process, it's not a cyclical one. But if we were to move to a style of agriculture that was entirely cyclical, entirely regenerative, I don't know how often we'd be eating meat but it's probably something like once a week or once a month.

FAKE: This speaks to Kevin's earlier point. Why put all these resources into cultured meat when we have an alternative? Why not just eat an Impossible Burger?

Demand. Consumers want meat and with current demand, they cannot use the land to supply enough. That's how we got to this place to begin with. Isha hopes that cultured meat will be the thing to help break the cycle – or at least change the conversation.

DATAR: Alternatives are something that are so hot right now is because we're really excited about new stuff. We're excited about Innovation. We're excited about technology and are excited about new experiences. And so, maybe cultured meat ends up just being a conversation that drives forward plant-based alternatives.

I think that would be a fine outcome if it turned out that way, but I also think that it is really exciting to think about these new iterations of what foods can be if we start

envisioning growing foods from cells. I think there's a lot of opportunity there that is hard to see unless we actually engage with the science.

FAKE: "Save the World Caterina" has lived in misery and conflict with "Carnivore Caterina" for so many years now. Having these conversations with Isha was the first time I could see to resolve this conflict, to have my steak and eat it too.

So is cellular agriculture the way to disrupt Big Ag? Maybe.

The future of protein is about new kinds of protein. It has to be. At this point, our survival could depend on whether we as humans are willing to switch to Impossible Burgers or a 100% oyster diet, falafel made from cricket flour, or cultured meat steaks – or if we're just willing to go fully vegetarian.

Everyone in this story has a common enemy in Big Ag. Big Ag is indisputably destroying not just the environment, but communities, family farms, and our health alongside it.

But the various players we talked to are not aligned about the way to get there. New Harvest is about movement building, and we've seen this before in other movements: shared goal, different tactics. Nonetheless all of them are moving in the right direction. They need to progress, but how?