

# UPSIDE Foods: real meat, no slaughter

**Uma Valeti (UV):** We love the product, and what we don't love is the process of how this product comes to the table.

**Lawrence Burns (LB):** Every biological reaction to it in your body is just telling you, this is the chicken, this is the beef that you've always tasted.

UV: We're going after a mission where we can show that eating our favourite food can also be a force for good.

LB: If it works, there is real and significant global change.

**Claire Shaw (CS):** Hello and welcome to Invest in Progress, a podcast brought to you by the Scottish Mortgage team. I'm Claire Shaw, a director and investment specialist. This podcast is designed to give you a behind-the-scenes look at the conversations that take place between our managers and the visionary founders, entrepreneurs and business leaders of some of the world's most exceptional growth companies.

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For today's episode, we've invited Uma Valeti to join us. Uma is CEO and Founder of the cultivated meat company, UPSIDE Foods. Now, it's no secret that meat production and consumption is incredibly harmful for the environment. So imagine eating meat that doesn't require slaughtering hundreds of millions of animals a day and is kinder to the environment. And we're not talking about plant-based alternatives here. We're talking real meat without the slaughter.

To discuss this topic and the company leading the charge in this space, I'm joined by Scottish Mortgage Deputy Manager, Lawrence Burns. Welcome, Lawrence.

LB: Thank you for having me.

CS: So, Lawrence, you've tried the meat produced by UPSIDE Foods. The first question I have to ask you is, does it really taste like chicken? And then, secondly, how relieved were you when you heard it got FDA approval?

LB: So, firstly, it does taste exactly as you imagine, like chicken. Why? Because it is chicken. And then secondly, yes, so I got an email the day it got FDA approval

from Uma, announcing the good news. And my first reaction to it was, oh wow, this is a really quite important step on the path to meat without slaughter. This is good for Scottish Mortgage as well. That's a nice proof point along the journey.

And then I suddenly paused and thought, if it had been a different email that said the FDA have lots of questions, having eaten quite a bit of that chicken earlier in the year, I would've had a few concerns. So I think, even more than usual, there was quite a bit riding on this, perhaps more than I realised at the time.

CS: Well, Lawrence, you and I are going to be discussing the investment case for UPSIDE later, but let's focus on the company first. What is it that excites you about UPSIDE Foods?

LB: So meat isn't the traditional industry that we'd associate with transformational change, but it is a multi-trillion-dollar industry, and UPSIDE Food have a chance of totally transforming it. And through doing that, I think they have the opportunity to change how you and I, how everyone listening potentially is to move from meat that involves the slaughter of animals to meat that involves no animals being harmed, and to have environmental benefits, so lower emissions potentially, lower usage of water and a whole range of different health benefits as well potentially, in the very long run.

And I think why that matters towards the opportunity is because when things are moving with the greater society, they're more likely to have positive tailwinds that are helping them. So whether that's consumers wanting to lean in and get involved with the product, whether that's the supply chain being inspired to move, or whether it's even governments and regulators also trying to make that move, but at the end of the day, this is a multi-trillion-dollar global industry that this company has the chance to completely reshape.

CS: I was so excited when we confirmed Uma was coming on, because this is a company, I really think, that's going to stretch people's imaginations. So let's get to it.

LB: Thank you so much for joining us. It's great to see and talk to you again. I think it's been a few weeks since we met in London. Really appreciate you making the time to talk to us today.

UV: Absolutely, Lawrence. Thanks for having me here. I'm delighted to be talking about some of the most important problems in the world.

LB: So we're fortunate to have a number of companies in Scottish Mortgage's portfolio that are really tackling big problems in the world, and UPSIDE is definitely one of those. So perhaps we could just start with what problem is it that UPSIDE are trying to solve?

UV: Here's what it is. Our love for meat comes at enormous cost. And the answer is to not ask people to give up eating meat or ration meat or force people to become vegetarian or vegan. It is to improve the process of making meat. And that brings us to a food system that's at a critical crossroads.

Right now, for producing the meat that the humanity is demanding, we have to raise about 70 billion animals every year. And that demand is expected to double by 2050, in which case we'll have to think about finding space for 150 billion animals, all the feed to feed them, the greenhouse gas emissions to be able to accommodate all of that and the water pollution and things of that nature that come from having that many lives every single year to feed humanity.

Meanwhile, consumers are demanding an absolute need for transparency in food production, humanity in food production and sustainability in food production. And that's really where UPSIDE Foods is working, at this intersection. We are cultivating meat from real animal cells. We're developing a process where we can have meat on the table, grown from real animal cells, without having to raise full animals and slaughter billions of them every year.

So we are building a category that can put the meat that we've loved for thousands of years on the table in a way that can satisfy consumers' tastes, their expectations of humanity and sustainability, while preserving our planet. And I think ultimately what it comes down to is eating our favourite food can also be a force for good.

LB: That's fascinating and profound. When I talk to people about what UPSIDE Food are doing, there's almost a difficulty of comprehending it because, A, the scale of the change, but B, just, I think to some people it almost feels, the science fiction-like nature of what you've been able to achieve. Many of our listeners will be familiar with plant-based meat, but to be really, really clear, this is not imitation meat. What you're developing is what you've quite rightly referred to as cultivated meat.

And is it worth just going in a little bit more detail, what exactly we mean by that? Because this is meat that is... I remember, when we were trying it back in May last year, you said, well, if you put it through an Illumina genetic sequencing machine, it will come out and it'll say it's genetically identical to chicken. Same product. It is just produced in a different way that doesn't require, as you said, the animal slaughter, but it is genetically identical as chicken.

UV: Absolutely. I think it is definitely worth taking a moment and explaining this, because not long ago, this idea of cultivated meat was just an idea and was completely in the realm of science fiction. And UPSIDE Foods is the first company in the world that came out and said, we want to be able to grow meat from real animal cells and not have people go to a meat alternative if they don't want to.

There's plenty of people that love to eat plant-based proteins, and that's great. But the majority of the world, 90%-plus of the cultures in the world have meat as the centre-plate in their cultures, in their traditions, in their daily meals. And what we're doing at UPSIDE Foods is really saying, we love the product, so let's really not worry about changing the product. And what we don't love is the process of how this product comes to the table, and UPSIDE Foods is working on that process.

So this is how we do it. We go and identify the highest and the best quality animals, and we take cells from them that are going to continue to grow and grow and grow, just like they are in an animal, because they're naturally programmed to divide every 18 hours or 24 hours to continue to build muscle, build tissues.

So what we do is we identify these highest quality cells and we provide them with the nutrients that the cells need to grow. And this is very familiar to the animal. An animal survives by eating a mix of sugars, proteins and fats, vitamins and minerals. So the feed that we develop for these cells includes those things, the very familiar amino acids, the fats, the sugars, the vitamins and minerals, oxygen and water.

And we provide that in a very clean, controlled environment. So this is where the meat is growing, and what we call it is a cultivator. And imagine it very similar to a small or medium or large-sized brewery, where you have the cells and the feed basically in a clean environment, and the cells are doubling and doubling and doubling.

And ultimately, after two to four weeks, we have enough meat that's formed, because these cells are essentially the building blocks of meat, and we harvest this and shape it into a product that a consumer is very used to seeing. And it could be a chicken breast, it could be a chop, it could be a burger, a sausage, a steak. That's the four-step process.

And once we do that, we package it, and if it's a chef that's cooking it in a restaurant, they're very used to handling how meat cooks on a grill. If it's someone who is at home, making a chicken salad, they can throw it on a grill or they can throw it on their stove and make a chicken salad and slice it up and eat it. So we're trying to not change the consumer experience but just the process of how the meat is grown.

LB: And I was lucky enough, again last May, to... You were kind enough to have me in your facility and to try, I think it was duck pâté and chicken breast. And people always ask me and they go, well, what does it taste like? And I always feel my answer is sometimes a bit disappointing to them, because the answer is, well, it tasted like chicken. It was nice, but it was as you would expect.

But I did think the bigger reaction was you had a colleague that had just joined UPSIDE, and he'd been a vegetarian for about 30 years and so hadn't tried meat since he was a child. And that reaction was a lot more powerful. This was his first taste of real meat in all of that time. And I thought that was quite profound. And I remember him saying how it brought him back to his childhood memories even, because we do have that emotional connection with meat.

You're a cardiologist by training, Uma. Is it worth taking a step back to your story with this project and where that initial fascination with this field and the passion came from?

UV: Yes, no, absolutely. Thanks for asking that question. I trained at the Mayo Clinic in Cardiology. But I think my love for this field and fascination for it goes back a very long time, when I was a child, when I was 12 years old. I grew up in a meat-eating family and a meat lover, and I went to a friend's birthday party that was just a neighbour to where I grew up in South India. And we had music in the front of the house, lots of dancing, festivities and great food. And I walked to the back of the house, and that's where I saw chickens and goats being slaughtered to feed the people in the front.

So it became a moment where I'm like there's intense happiness in the front of the house, celebrating a birthday, and there's a profound amount of sadness and suffering in the back of the house, where it was like a death day for the animal. And that was very hard, as a child, for me to keep in my mind. It just stayed as an image, and I kept eating meat.

I went to medical school after that, and in medical school, I was running our cafeteria for all the students. And I went to the market to bring meat for the chefs, and that's the first time I saw large-scale animal production and animal slaughter. And that really made me step back and think and say, look, I love, love, love the taste of meat, but I'm going to stop eating meat.

And every single day after that, I kept missing the taste of meat. I would say, oh, I'd love to have this on my table, but didn't know how to achieve that. And I tried the meat alternative products, and it really never substituted for the taste of what I believed was like, wow, this is what humans fell in love with.

Went through cardiology training, and during that training, we were working on stem cells. And that's really where this idea came from, saying, could I think about growing meat from animal cells directly? And as a physician, I got really excited about the opportunity to improve the nutritional profile and the health profile of meat.

So I was talking about this with my wife and children for almost ten years. Finally, I think they got fed up with me, and they said, dad, why are you not doing it? And

that became that clarion call of like, wow, here's my family looking at me every day and saying, he's been talking about this non-stop, why is he not doing it?

So I decided that I would write to one venture capitalist in the San Francisco Bay Area. And within an hour of writing about this idea, they were on the phone and asking us to move to the Bay Area. So I moved there with my Co-Founder, who was a research associate in my basic science lab, and we both went down to San Francisco and started building the team out there.

And one thing led to another, and this field that lived in the realm of science fiction, where no one was willing to believe this could happen, there were millions of reasons why this field could fail, to six years later, here we are with 150 companies in this space, major food and ag universities in the world with undergrad and PhD programmes in this space, and we have numerous countries and regulators wanting this technology in their country, to be able to bring it to their people.

And that's brought together a group of investors who have really taken the view of, this is a paradigm change. It's not going to be easy to do, but this is completely worth supporting. I couldn't be more grateful for, in six years, to move a field this far, and going to the next phase now of trying to scale the production.

LB: And as you say, you've been able to attract a range of very credible investors, everyone from Bill Gates to Richard Branson to Kimbal Musk, Elon's brother. And I think if we fast forward in terms of how you've helped move the industry on, late last year, we had a really important milestone for you and the company. You received the green light from the US Food and Drug Administration, the FDA. How important a moment was that for your company, for the industry and for you personally?

UV: Well, it's the biggest moment for the industry, for UPSIDE and for me personally since bringing this idea from the realm of science fiction to reality. There has not been a bigger moment than this, because the FDA, after a very thorough and rigorous evaluation over many years, concluded that UPSIDE chicken, the way it's made and the nutritional features of it, are safe for human consumption. And it's the first time it's ever happened in the history of humanity, and it's the FDA that sets the standards for not only the United States but is the flag bearer for food safety across the world. It's a watershed moment for the entire industry.

So it's an amazing opportunity for us to be able to go to the next stage of this before we come to the market, working with the US Department of Agriculture, USDA, which helps us put a label on the product so the consumer knows that this is real meat coming from real animal cells.

And they'll also have a set of inspectors that'll come and inspect the production facility to ensure that it is following clean, hygienic manufacturing standards and

give us a grant of inspection. So what we're working on is to do the label and inspection now so we can get on the market, go to restaurants and let people experience UPSIDE chicken.

LB: And I think a key point to me, and this is what we talked about a few weeks ago when we met in London, was where and what the US FDA say, other regulators follow. So there have been other instances of regulators in much smaller countries that have given some form of approval, but with the US FDA, you're getting multiple countries presumably looking at that as the gold standard. And it's presumably also changed the level of interest you're getting in from different people in the ecosystem that could help you accelerate your project from here.

UV: Yes, absolutely. And it's been a journey. And it could have taken ten years or longer to get this green light, but the fact that the agencies worked with us closely, understood the potential of this technology and the fact that there is enormous interest from people, from investors, from academia, it just is a number of people asking for this to come into the world. And the fact that we became that vehicle to show this is how it can be done safely, I think, has been a really big deal, and nearly every government wants to be able to bring this into their world.

Now, the most important thing to keep in mind is we have to start somewhere. We had to start small. We had to take the first step and the next step, and this is not much different than trying to build an airplane while it's flying and trying to land it safely and trying to make sure we replicate that over and over and over and practicing it.

So the path ahead involves us trying to make this scalable, bring it to a cost that is affordable and also show to people that it is worth investing in it in a large scale, because what we're doing now is a drop in the bucket of how much meat is produced in the world.

LB: How big a challenge do you think it is of convincing people to look at this as just chicken? Is there a consumer jump that you think you have to be aware of in engineering that, or do you see it as being one that, actually, that's a smooth journey that will happen naturally over time?

UV: Well, I think if I look at a timescale of decades, looking back, it'll look like a smooth journey. But when you're in the moment, living it and going from month to month, year to year, I think it's going to be really hard, lots of hills to climb in helping a consumer understand it.

So we need to figure out how to communicate this category of cultivated meat as a choice that brings real meat to the table. And the most important thing a consumer needs is to taste it to believe it and have that magical moment of tasting, that aha moment, and say, oh my gosh, this is meat, and if I can do this

in a way that is good for me and everybody else and the planet, why would I not make that choice?

LB: And at the moment, you're focusing on chicken and then beef. I even tried, as I said, your duck pâté, which is something I don't regularly try in real life but was interesting and nice, all the same. But the plan, I presume, is to move into all meat areas, including seafood in the long run. All of that is within your sights when the time horizon is long enough?

UV: Yes. One of our foundational values is building a big-tent company. And by that, what I mean is a company and a movement and an idea that can appeal to nearly all people and all stakeholders. And when I say stakeholders, it means consumers, but corporations, governments and different cultures. So the reason for us picking chicken in the first place is chicken is the most consumed meat or protein in the world. It is beloved, it is made in every ethnicity, and it's very easy to make it.

When we have cultivated meat that's brought by UPSIDE to the world, that UPSIDE chicken product, whether it's cooked on a salad, whether it's in a chicken tikka masala or whether it's in a dumpling, should be universally remarkable for how it came to the table, but also universally unremarkable because this is chicken, and this is the most familiar product in the world. And that's the reason we picked chicken.

We also know chicken has the largest animal welfare impact. Of about 70 billion animals that are raised, 69 billion are chicken. So we know that that's going to be a big check-off for people. Especially Gen Zs and millennials care a lot about life of animals.

We picked beef for the simple reason that beef has had an enormous environmental impact. And there may be close to a billion cows that are raised every year in the world, and 300 million in the US, and we think that the demand for beef is continuing to increase.

And because of the environmental impact of raising beef, if we can use UPSIDE's technology to also bring beef to the table, it'll be really enormous for people who are trying to raise beef, and saying, if the demand for beef is doubling, what if we can fill the demand with cultivated meat? Suddenly, we don't have the challenges with the greenhouse gas emissions or the environmental impact. And that's really why we picked beef.

Now, seafood, we recently acquired a seafood company based in Madison, Wisconsin, called Cultured Decadence, because they were working on crustaceans like lobsters, scallop and crabs and some seafood. We ultimately know that UPSIDE's technology has been built to be species agnostic. And for that reason, in R&D, we have multiple species we are working on. And as time



goes on, our plan is to introduce that, but introducing the product that's very familiar to all of us, and starting with chicken.

LB: And in the long run, do you think you can actually enhance the properties of the meat that people are eating? By that, I mean does there exist an opportunity to give them healthier properties? So for example, adding Omega 3 to make beef as healthy as salmon. And I suspect that's one example, but you could probably give ten or 20. How do you think about both that possibility and opportunity? And particularly with your background as a cardiologist, I imagine it has some interesting linkages there to solving some of the problems that you might have seen in the past.

UV: Yes, it's the singular most important thing that makes me excited when I start thinking about how are we going to break out of the boundaries set by an animal. All meat has cells in it. The building blocks of meat are cells. And when we have the capability and the capacity to pick the best possible cells that offer us the nutrients we need, offer us the texture and the flavours we need, we go beyond the capacity of an animal at speeds that are just not possible in an animal.

Because for a single trait, like saying I want to improve Omega 3 percentages in an animal, it'll take seven years or so to breed the single trait into an animal. But when we start screening trillions and trillions of cells in a matter of days to weeks, we will be able to find cells that have those features.

And when we start stacking the features we want, and say, can we have steak that has the Omega 3 profile like salmon, that's going to be the real opportunity, where we can start saying, can we make foods that have lower saturated fats, healthy cholesterol, maybe a lower calorie content or maybe mix it with some of the best features of plants and have fibre in there? The opportunity is very significant here.

And I think, in the next decade, the products that come from UPSIDE Foods and other cultivated meat companies will be substantially similar to what we are eating now. But in the subsequent decade, I think, is when we start saying, let's start going after the health impact, the health benefits and start really painting the palette really, really wide, to say, how can we make meat healthier, how can we make it better, how can we see if we can have meat that can help us live longer?

And these are things that are enormously exciting in a very, very wide field. And that's part of the reason we think about UPSIDE as being the tip of the sphere, but really championing an ecosystem that is self-sustaining so we don't have to keep focusing on just building one type of product, but the product has so many implications across the ecosystem, it just becomes its own self-sustaining part that doesn't need too much investment afterwards.

LB: And that's pretty profound, not just to change the way people eat but to have meat that saves the lives of animals and humans. Because when you scale that up in terms of the benefits you've been having on a global scale, I know this is far out, but...

UV: Yes.

LB: The number of lives that could potentially be saved by those healthier properties is huge. Most people, they will be listening and familiar with a number of plant-based meat companies and brands. How should we think about the development of the industry in the cultivated meat space?

Does some of the things that you were talking about, about the scientific and regulatory barriers, some of the science that's going into this and the ability for it to keep getting better in those different ways you alluded to, does that point to a market structure that is different from what we've seen in plant-based meat? Is there going to be higher barriers to entry? How many players do you think are going to exist in this market in the long run?

UV: Yes, it's a really important question to consider. The barriers with cultivated meat are significant, because it's not for everyone. For instance, you've got to be able to understand the biology of the cells. So there's a significant scientific underpinning of picking the best breeds of cells. Then you have to have a really significant understanding of chemistry, which is the best nutrients that the cells need to eat.

And you do have to have a significant understanding of good manufacturing techniques that can grow meat in a way that continues to scale at larger and larger quantities, and finally, have the ability to put it together into the format of what a consumer is used to eating.

These four are fundamentally high barriers to entry compared to plant-based meats or plant-based proteins, where you would be able to take plant proteins and add flavours, then extrude it through a machine and have various features come out of it. The barrier to entry is low there. So there could be tens of thousands of plant-based companies that could do something similar with technology that is not complex at this time.

When I think about cultivated meat, I hope it'll get there in the future, but for the next few decades, it's going to have to be developed carefully. The closest analogy is asking combustion engine manufacturing cars to switch to electric vehicles, it's going to require a pretty substantial change in the mindset of how the car is built.

And cultivating meat will need to have its own investment, similar to electric vehicles, where the benefits are enormous, but to get to the market share that you need, it's going to take some time to get there. It's absolutely more

sustainable, it's absolutely more credible as a platform to continue to improve the health of meat, but it's going to take some time.

And that's really the difference between cultivated meat and plant-based alternatives, where while their challenges are to make it as close as possible to the real product, cultivated meat's challenge is to be able to scale it so that we can get it to everybody in a way that we can meet them where they are, without asking them to change their habits.

LB: The other thing it'd be good to explore is you've been first in the world to get that green light from the FDA. There are other people around the world, given the importance of this transition almost, that are also going at it, also investing in it...

UV: Yes.

LB: Also thinking about it. How should we think about what are the main things that differentiate UPSIDE within the field of cultivated meat?

UV: Oh, fantastic question. Yes, I think about it as four legs of a stool or a table, the taste, the team, the technology and our track record. On the taste, it's an absolute magical moment when people come and taste UPSIDE chicken or burger or beef, very simply, because we have the ability to make not only the full cuts but also the ground meat and the full portfolio of products. And a number of people have come and tasted products made by UPSIDE and products made by other technologies or companies and have said, this just nails the taste and the texture. So I think that's an important piece.

The second one is the team. We're about 240 people right now, and our team members come from some of the best in each of the fields, so the biology, chemistry, manufacturing and food science and chefs. And many come from Fortune 100/Fortune 50 companies in the space, and they have been at the top of their field. They've been at the FDA as regulators. They've been in food manufacturing companies. They've been in the top biology and medical or pharma companies. So we've assembled a team that has been literally bringing all the scientific breakthroughs needed to bring this category of food to the market. So there is that ability to say our team is very differentiated.

The third thing is the technology. The technology that we've built from day one has always been something we thought as being species agnostic. And what I mean by that is the technology we are building should be able to work for beef, should be able to work for chicken or duck. So ultimately, when someone is investing in this, it's a much simpler technology to scale.

And the last one is the track record. And this one is not to be underestimated, because from the day we've started the company, there have been enormous amounts of sceptics and people who said this was never going to work, you're never going to be able to do it. At that point, we didn't have anything really to

push back on. All we had was an idea on a piece of paper or a slide, and said this is what we intend to do here so it'll work.

Now, looking back on the last six years, there are so many moments I can count and say these are things that people said was unachievable, and here we are. We're past that, and now we're doing the next thing. And building that track record builds a level of scar tissue on the team, that they know that what we're doing is not easy, it's never been easy and it's never going to be easy.

When people come together with a singular purpose, and they've seen that pay off, that builds a level of confidence and that builds a level of resilience that's, I think, really important, especially for this field, when we are going after something that's never been done before. So I would say those are the four things that differentiate us as a team.

**LB:** When you've got the underlying science in place, you've got the regulatory approval in place, what are the big hurdles from here? And I think you've hinted at it a few times in some of your answers, of getting the economics to work to the point that cultivating meat is available at a price point that people are able to buy it in the restaurant or even buy it in the supermarket. Is that the biggest challenge from here? And take us through that a bit to understand that challenge and what you're doing to address it.

**UV:** Yes. What we've done in the last five years is we've shown that the science works, we've shown that we can grow real animal cells into meat that tastes really good, and we've shown that we can do it in a safe way, so that a regulator looking at it with a very rigorous lens, we've done that. That's a really important phase of showing that this is viable.

The next five years I look at is the phase of scalability. We as a company will have to prove that the technology that's come this far is scalable and the product that comes out can be sold at a price that a consumer is willing to pay. And in the next five years, I believe the product will be at a premium, a premium to organic, so that as we lower our costs of production and the consumer is willing to pay for all of the upsides that come with the product, the scalability of the underlying technology will continue to get better and better.

Because as I've said, the ecosystem needs to grow, and the ecosystem includes people that supply ingredients to us that we need to feed the cells, the people that are willing to invest in making the cultivators. And because this involves the ecosystem building, I think the next five to ten years is this field - getting to scalability.

And the analogy is very similar to, again, electrification of transportation. It's not been easy to do that, but look at where we are. Nearly every major transportation company has made commitments to improve their fleet of vehicles, electric

vehicles, with lots of fuel stations building the gigafactories. All of these are going to have to happen for cultivated meat to really unlock the opportunity ahead of us.

And one of the trends that's very helpful in letting people see why this is inevitable is the cost of conventional meat keeps going up and up and up, and the risks of conventional meat, with billions of animals being confined in small spaces, the awareness of those risks are profound now, especially after COVID, especially after the recent shortages of eggs, with avian flu wiping out a majority of chickens, challenges we've had with swine flu, and saying that, look, this love for raising animals in intense production facilities, it could be a significant threat for our own existence on this planet.

**LB:** I think the other thing that a lot of people don't realise about the meat industry is you also don't have a fair playing field, because there's huge amounts of subsidies that go in, thinking the US, \$40 billion or so into soya beans and corn for the feedstock, which actually if you took out, meat would be a lot more expensive, and as you say, that there's a multitude of different benefits around shifting that transition as well. When do you think it is possible to achieve parity with traditional meat production? Is that price parity possible, and on what kind of timeframe?

**UV:** Yes, I'll answer directly, parity is possible, and I'll also go ahead and say parity is inevitable and parity is where it's going in the future, for a few reasons. One is, any technology in its early days and any bold and transformative risk that we are taking is going to be expensive in the initial days. And it is completely worth that investment, because it opens the path to go to a better place.

So we know that in the next five years, we're going to have to price the product at a premium, because it's really expensive to make it. But between five and 15 years is when I'm looking at the cost of conventional meat continuing to go up, and the cost of cultivated meat is going to keep coming down. So I believe in the next five to 15 years.

And it's a wider range for a few reasons. One is, once governments start realising the external costs of supporting conventional meat is significantly higher than going into a technology like cultivated meat and governments start making decisions to start doing the public/private partnerships and the incentives and support, just like they have done for electrification of transportation or other technologies, we feel that that doesn't have to go as far as 15 years. It could be ten years.

And that's really when we can start talking about food safety and food security across the world, where nearly anyone can have a cultivated meat production facility in their neighbourhood that can produce meat with significantly lower water input, not have the level of environmental impact of conventional meat.

And suddenly, that opens up areas that cannot produce meat right now because they have to import it from other countries.

So the entire Middle East that, for instance, has lower water supplies could start doing that. For instance, in India, where raising and slaughtering a cow is very challenging, there's lots of legal hurdles to be able to do that, suddenly, if you don't have the need to slaughter a cow for eating beef, it suddenly opens up 800 million people into a new market. So these are the kinds of things that I think will start needing to happen for us to get to conventional parity.

LB: And I suppose a self-interested question, a question I get a lot whenever I mention UPSIDE is, when will I be able to access it, and when will I be able to try it? Which isn't a bad question, because you've got people clamouring for your product and really interested. Do you have any sort of guess as to when it might be available in some form within the UK market?

UV: Well, I would love to be in UK as soon as possible, because our mission is global. For now, given the importance of scaling, and scaling well, we've kept our laser focus to be the US market. And I think in time, because our mission is global, we would want to be in UK, we would want to be in EU and Asia, but I think that's the second phase. And we haven't focused on that yet, but I hope to in the near future.

LB: And in the US, what's the timeline in terms of restaurants and supermarket shelves that you currently have?

UV: We are hoping that we can get into restaurants as soon as we get the USDA label and grant of inspection. And we are working with the USDA as we speak, so we hope that will be in 2023. And we are preparing to launch product in the market this year, and we've announced a partnership with Dominique Crenn. She's a very well-respected chef in the world. Her voice means something. Because four years ago, in 2018, she took meat off her menus, and she looked at UPSIDE. She came and tasted and said, I love this product. Can I put this back on my menu?

And we want chefs and people that really get excited about the vision of where we're going and see the opportunity that they can add value to us in getting to that vision that also is aligned with their own personal values. So that's really why we say we want to go through restaurants initially, so the chefs can tell the story of the 'why?' behind cultivated meat. And 2023 is a big year for us. We're hoping that'll happen this year.

LB: And meat itself, it's not a small industry. I think you said earlier, it's a \$2-trillion industry. What proportion of the industry do you think cultivated meat can capture? Should we be thinking about this in the very long run as being a complete replacement for our current system? And how do you think about the process of getting there and almost the penetration rates?

UV: Yes, I think it's a great question to speculate on. Obviously, this is a solution that has never existed in the marketplace, and the potential of it is yet to be determined in the long term, not only for us but our kids and grandkids. I think the dominant and the most sustainable, scalable and life-friendly technology is cultivated meat.

And in the next five to ten years, I think it'll be low single-digit per cents, but by the time we get to 2050-2060, it's not just our projections but projections of lots of others who've looked at this field deeply, I think a third to 40% of the world's meat production is capable of converting into cultivated meat. And who knows after that. We have to compete in the marketplace effectively. We have to continue to improve the science that drives it, improve the health of the meat.

And if we do that, I think, just like change in society at this scale needs time to happen, I think in the next 50 to 100 years, it's very possible cultivated meat is going to be the most common method of bringing meat to the table, and raising animals, regenerative technologies that take care of the animal until the animal's slaughter I think will be a smaller per cent. But that's 50-plus years.

In the next 50 years, I'd say, if cultivated meat captures about a third of the market, it'll be meaningful impact on climate, it'll be meaningful impact on animal welfare, and a huge impact on the opportunity to save human lives and animal lives in generations to come.

LB: And we often finish with the question of, what does the world look like if UPSIDE Foods succeeds? And I know you've touched on this a number of times, but this is one of those opportunities that, if it works, there is real and significant global change in multiple different ways. And it'd just be good, I think finally, just to recap what those are.

UV: A few things. First and foremost, we will have helped shape a world where eating meat can actually be a force for good, where people can eat meat they love without threatening the health and wellbeing of animals, the planet and people alike. That's number one.

And broadly, if I step back, our success will show that preserving life and preserving choice are not necessarily mutually exclusive options, and sometimes, if we try hard enough, that we can create solutions that satisfy not only our needs but also our desires.

But ultimately, our success should signal something even bigger. It'll show that when we come together with a purpose, humans are capable of extraordinary things and things that are not going to show immediate results, things that take time, things that require a lot of capital, things that overcome odds and things that are very difficult to scale, in other words, the simplest way of saying this is things that really matter.

I think we as humans need to develop more patience and more tolerance for these kind of endeavours. And if we are successful at UPSIDE Foods, I believe a big part of our contribution will be showing that it pays off.

LB: Thank you so much for giving us the time, taking us around the facilities, giving us the opportunity to try the meat. We look forward to continuing to do that as you expand into a multi-species, ever more, company. So we're very grateful for the time you've given us.

UV: Absolutely. Thank you for joining us on this journey. It is definitely for people who want to be able to see a world where things that are thought of as impossible can be challenged and made possible and actually can thrive. So I'm very grateful for you joining us on this journey, Lawrence.

CS: Lawrence, I think you would agree, that was such an inspiring conversation. And I think coming back to what he said, probably at the top of the podcast, talking about why there was millions of reasons why this would fail, there are so many companies going after this space, I think the place to start for me is, plant-based foods have struggled to find that regular place onto a meat-eater's plate. Why do you think cultivated meat is going to be any different?

LB: So I think the first big difference is this is not an imitation product. It's not a product that's trying to trick you into thinking this is like meat and it's close enough to be like meat. It is meat. And when you're trying to change the way the world eats to be more sustainable, and I think a lot of people would also say more ethically acceptable in terms of your views of animal welfare, the idea of separating humanity from its meat, I think, is incredibly difficult.

And so this is a product that, unlike plant-based meat, is not doing that. This is, as we said, genetically identical to meat. It'll taste the same. There are some properties, as he alluded to, that might even be better. So I see this as being very, very different in that you're, I think, very much as he said, giving the consumer the same product that they love, but without all of the negative externalities of the processes that go into making it.

CS: Yes. I think the plant-based companies, they've obviously tried to change the minds of the consumer, to make a product that's more appealing than meat. Uma is trying to circumvent that and sort out the process that's at the heart of this. He talked about the importance of getting that FDA approval. What for you, Lawrence, is the next proof point from here for UPSIDE?

LB: They've got proof points on the science.

CS: Yes.

LB: They've, I think, overcome some of the hardest regulatory barriers around this. There's still the labelling element with the Department of Agriculture that he



mentioned, but I think one could be hopeful about that. The next big challenge is the one we spent a bit of time talking about, which is, today, cultivated meat is, per pound, much, much, much more expensive than the meat that you and I would go and buy at the supermarket.

And what they're really about doing is taking what they have done in certain situations in an R&D setting and scaling that up, getting it to cheaper and cheaper price points. And that'll be a long journey, but it'll be a continual journey of improvement.

And I think for us, the proof point is looking at what that price per pound is, how it's trending down, how the inputs that go into that process and the different costs are also trending down. So the next proof point really is on the economics of where the price comes out on the cultivated meat that they're producing.

CS: Yes. And I think, in terms of the challenges, Uma alluded to this, about almost the marketing challenge. How does he and the company communicate this category of cultivated meat, and demystifying it? I guess what I was thinking during the podcast was do you think there's going to be cultural differences in the global appetite, excuse the pun, in this? Do you think there's going to be differences in terms of the scepticism around this area?

LB: I think you'll always find that some markets will be keener than others, and some cultures may adopt it quicker than others. But I think, in the long run, it's a bit like he was saying. If you stretch out the time horizon, given this is meat, I think you'll get there, and you'll make that argument and you'll win it over time.

My own personal experience of tasting it is, I don't think Uma would mind me saying this, but when you first taste it for the first time, you're a bit apprehensive because this is cultivated meat, this is different. And it was amazing, as we were talking whilst I was sampling and eating it, how quickly it became normal, because every biological reaction to it in your body is just telling you, this is the chicken, this is the beef that you've always tasted. And so I think once you get over that hurdle, it normalises very, very quickly.

Now, getting over that hurdle, I think, is lots of different steps. For some people, it will be easier. For some people, it will take longer. I think what's also interesting in what he said is that you're starting in really high-end restaurants, with world-famous chefs doing it. So it's the idea it's starting almost, in a way, as an aspirational, luxury product that's going to be available eventually to everyone. And I think that'll probably help in terms of that process.

CS: Yes. I think he used a phrase in the podcast, it was unremarkable in taste, but what's remarkable is the process. I think it was quite a nice way of articulating that. Lawrence, I think, for Scottish Mortgage shareholders, it's helpful just to take a step back and think about this in the context of our philosophy in the overall

portfolio. At our core, we're trying to find companies that can disrupt huge industries. So could you maybe just talk about the role you think UPSIDE Foods will play in terms of the size it is, and also, what could it go on to become?

LB: Yes. So I imagine a lot of Scottish Mortgage shareholders are familiar with some of our largest companies, largest both in market cap size and in holding size. UPSIDE Foods is one of our smaller, earlier-stage investments. But I think one of the reasons it was great to get Uma on to talk about it is not just because there are a huge positive benefits of their success to all of us, but also because I think it shows what we're trying to do is invest in companies that have a small chance of really changing the world, really being the next big thing.

And UPSIDE Foods, to me, is an exemplifier of that potential. If this works, it is a huge company and it is very meaningful and it is one that we could potentially own for the next ten, 15, 20 years. And yesterday, it's a small holding, but it's that huge potential to be one of those outliers of tomorrow. And so the hope is that we have a number of companies that today are at earlier stage, are small holdings, but that each have that outlier potential to be the next Tesla, to be the next Amazon, to be the next Moderna.

And that I think is really key for Scottish Mortgage, to invest in companies where they make the most out of that asymmetric nature of equities, that what could this company become? If it succeeds, it'll be many, many, many multiples of its current size.

CS: Yes. And as you say, the progress that Uma and UPSIDE have made, in six years you said, how far they've moved this field is quite remarkable. So on that, I'm looking forward to hopefully serving some UPSIDE Foods meat at the next Scottish Mortgage event and in years to come, hopefully.

LB: Yes, that's the aim. And I think, again, that would be another proof point when we reach it.

CS: So that just leaves me to say a huge thank you to our guest today, Uma Valeti from UPSIDE Foods, and of course, Scottish Mortgage Deputy Manager, Lawrence Burns. That's the end of this season of Invest in Progress. Over the past six episodes, we've covered everything from drone delivery to cures for Alzheimer's to using robots to pick our groceries.

You can listen to season one on all major podcast platforms, and hit follow or subscribe so you don't miss out on future seasons of the show. And you can learn more about Scottish Mortgage by visiting our website at [scottishmortgage.com](http://scottishmortgage.com). You've been listening to Invest in Progress. Thank you for joining us.