Connor Morrin:
3D printers are a common sight in design spaces, workshops, and increasingly even in homes. But what about in a kitchen? 3D printing technology is carving out a bold new future for food production, reshaping the very structure of our food and unlocking endless possibilities for customization.

Robin Simsa:
My name is Robin Simsa I'm the founder and CEO of the Austrian company Revo Foods, and we develop new manufacturing technologies based on 3D printing to make plant-based or alternative proteins better.

Connor Morrin:
Robin is harnessing this cutting-edge technology to solve one of the biggest challenges facing the appeal of alternative proteins, texture and mouthfeel. By structuring fat with protein, his company is able to mimic the flakiness and juiciness of muscle meat, using plant-based ingredients that require significantly less land, water and energy than traditional animal farming. His journey began with a single book, Eating Animals by Jonathan Safran Foer.

Robin Simsa:
I was 18 years old back then when my grandfather gave me the book and it was very explicitly explaining how industrial animal agriculture works. And I hadn't been that aware of it before, like I knew it's not the best systems maybe, but then reading in great detail about how detrimental. Many of these practices are how resource inefficient, for instance, cows are. Like this kind of opened my eyes. And I was talking with my girlfriend back then and saying, I want to try going vegetarian for a month. And I quite liked it. And out of one month became 15 years now. So I sticked with it. I liked it. And it was always important for me, this topic of food system. It just seems silly to me that we spend a lot of time and energy on sustainability of transportation or sustainability on energy, which is important, of course. But in comparison, I feel that we spend way less effort on sustainability and resource efficiency of the food system, where there's a massive leverage if you look especially at proteins and especially at animal proteins. So this is kind of how I got started, and I started studying biotechnology with this in mind, because I saw there could be a way to move forward in this direction, but back then I had no clue how exactly I would do it. I was basically just studying, but without a big purpose. I thought I would go to a pharma company later on to work there. But then I believe in 2014 or 2015 I saw this picture of the first cultured meat hamburger from Mark Post from Maastricht University, which was the first ever cultured meat hamburger that was showcased in public. And for me, immediately I was hooked on this idea. I was like, wow, that's amazing. That's such a great and cool idea to make cultured meat from animal cells.

So I tried everything to get into this field. I wrote applications to all of the four companies that existed back then. Now it's much more, of course. All of them rejected me, rightfully so probably because I didn't have cell culture experience. But I landed a PhD, which allowed me to go to Tufts University in Boston with Professor David Kaplan, who's one of the big names in this field, academically speaking, and there's a big lab there where many, many people are working on cultured meat research. But there also emerged the idea that a problem has always been to combine protein and fat with one another, which is one of the key characteristics of meat and which is very important for the taste and the texture. And we saw in the lab that this has quite big effects if you combine these two components in a very structured way. So what we used was 3D printing. And of course 3D printing is a small scale process that requires a lot of time and where people said like it's very hard to scale this up. But I saw potential there and I thought, together with two colleagues, that if we can make this work, if we can make this 3D structuring approach where you can combine fat and protein in a large-scale system, that this could have massive implications for the quality of these types of products. So that's where we started out about five and a half years ago, and we thought it would take us about two years. In the end, it took us almost five years, but we did get it done. From the very first idea, our very first idea was to scale this technology and use it to produce fillets and steaks and whole cut products. And now, five years later, we opened our first big production facility in Vienna with this technology that we developed ourselves, where right now, today, 15 people are working, for example. So yeah, that has been quite an amazing journey, and it's great to see that it has worked in the end. Basically back then when we started, it was the time when Beyond Meat went on the stock market and there was a massive hype and many companies were founded and we thought, okay, for beef and chicken there's already a bunch of solutions, but if you look at whole cuts like beefsteaks or fish fillets, there's hardly any technological solution that could create such products from plant-based ingredients. So very first idea was actually to start with something like a salmon fillet because it's a big market and it didn't really exist yet. And to produce in a large scale with just 3D printing. So often people ask me, how did you come up during the journey with these kinds of products? Did it change a lot the vision on the way? Within the first two minutes of coming up with this idea, we knew we want to make salmon fillet based off plants with this 3D structuring approach. So it's 100% exactly the same thing that we always imagined that later came true. There's many different plant-based protein sources. Most people know soy and pea protein. In our products we use microprotein that we use, so fermented mushroom protein, which has some super interesting characteristics. For example, it has low requirements on nutrients. It just needs basically sugar and some minerals to grow in a fermenter similar like how beer is being brewed. It doubles its biomass every five hours. That means it grows super rapidly with low nutritional intake, but it creates a really good nutritional source of protein. By this I mean a complete amino acid profile and a very high bioavailability. Actually, the bioavailability of microprotein due

to the fermentation process is higher than that of beef, which is crazy if you think of it. So we can grow very cheap and very sustainably with little resource input a protein source which is fantastically good for us. And the best thing is you don't need to process it a lot. Like soy protein or pea protein you have some processing steps which require high temperature and high pressure which inevitably destroys some of the nutrients. While in this case you can basically take this microprotein it's grown in these like tanks You can harvest it and more or less use it directly without further processing. And this makes it super interesting because this way it's just a biomass, it's a natural biomass that you then consume. This is why I hope that some protein sources like this one will gain more traction now. A problem with many of these plant-based protein sources is that they are a bit boring by themselves. So mycoprotein, for example, it's nice, it's okay, but it's not really having this juicy bite or this fiber formation that many people associate with the nice taste of animal meat. And this is basically where our technology comes in because we have developed this new 3D structuring approach where you can align protein fibers within the same product and integrate fat within the product. For us, for instance, microalgae oils which also have omega-3. So what you do there is you create this what's called anisotropic fiber structure. That means the fibers are aligned in a certain direction and interlaced with fat, for example, like in a salmon fillet. And this way you get a completely new texture profile that wasn't possible beforehand. And it took us forever to get to this point. We were researching in the beginning at a lab scale, super small scale, super slow. But over time, over the past year, we were able to develop a system where now we have this 3D structuring system. which works with multiple nozzles. So multiple products can be produced at the same time, which delivers the scale. And it's a continuous process, which means that you can feed material in it and you don't constantly need to refill it. It works continuously, and that's really how you get to the scale. So now, for example, we have a first product out, which is called the Filet, inspired by salmon, a salmon-like product based on microprotein, which is selling more than 700 supermarkets across Europe. This is a scale that you can only have if you produce in a large enough amount and it's the first time really that this technology has been shown to scale to such a high amount that the products are ready for retail. The alternative protein industry has been in a hell of a rollercoaster the last years. It's super exciting being into it, but also many nights where you lose a bit of sleep. So basically I think it will divide into two kinds of areas. One, and we see many companies there, most companies like produce on very large scale cheaper and cheaper. This doesn't necessarily improve the quality of these products, even though some of them do get better. But there's also a certain kind of stagnation because there's just too much price pressure. We see this with products like burgers or chicken chunks where like there's hardly a premium segment anymore because it's just been commoditized. And then there's other companies which really drive the technology forward, I would say, where I would like to count us in there as well, where you try new processing technologies like ourselves or new ingredients, all kinds of R&D driven efforts to

make the technology better. These are More premium offerings, probably with a smaller volume initially because of the higher price. But it's super important that we get there because we see only in the last years how much better some of these offerings have gotten, how much better many of these choices and now if we can get communication right and as the price goes down with higher volume, I'm pretty sure there will be a big societal shift where these products are more and more accepted. But the past years there have been probably too many companies, too many offerings too much of it all for a too short time. And I think it's quite good if it calms down a little bit again so that the industry can catch up with the hype that it has created in the past. I believe that we have defined the problem wrong because what we do for instance is the problem is overfishing therefore you can eat plant-based seafood but that's the wrong definition of the problem because a solution would also just be eat lentils and potatoes or whatnot. You don't necessarily need these types of products that us and others in our industry are producing and to be honest most Well, flexitarians don't really purchase them today because there's not really a clear reason for them to do so. I think that the alternative protein space needs to evolve into something bigger because for sure we need proteins like this. We need plant-based proteins and probably only eating lentils and beans is a bit boring for most people. But what we believe is that it often doesn't need to 100% recreate animal-based products. It doesn't necessarily need to taste like beef, taste like chicken, taste like fish. And this is something that we are exploring right now, for instance, where we go in a direction where we have something which has a natural umami-like taste. a nice fibrous texture, but not exactly tasting or looking like an animal product. We call this internally the prime cut, and sometimes we say tofu 2.0, because tofu, for instance, would be such a product, but it's a bit bland, it's a bit boring, most people don't like it. But if you create something like this, which is more fibrous, more juicy, more meaty, without necessarily being an exact replica of an animal product, but something that you can cut, slice up, fry, do whatever you want with it, basically use just as a protein source in the meal, I think something like this has the potential to move to the next step and reach more people without the morality that is often implied in these products. Now, if you call it a meat alternative, most people are like, I don't need an alternative. I don't care for an alternative. While if you brand it in a different way, where you really highlight the health properties, and many people are nowadays interested in healthy nutrition, longevity or other such topics where you say, hey, It has great fiber content, which basically all of us eat too little in the Western world. It has all these minerals, it has these vitamins, it is low in carbs, low in saturated fatty acids, but high in protein and omega-3, for example. Then you can really have like a healthy yet tasty protein source that you also market, like this. But you're more marketed to fitness lovers or health lovers than to, well, animal lovers, let's say. There's one thing that I could give listeners to think about. I think it would be to think about change and how change is achieved, because most of us want it and most of us try to force it, but it is often very hard and change in the mindsets of people. In the past in

our industry we have often tried to argue against people, against farmers, against people who like meat and it's way easier to have an inviting strategy where you don't maybe say everybody needs to be vegetarian or vegan but where you say hey you can still eat your meat maybe but maybe a bit less often and maybe you want to give some of these options a try without basically forcing it on people as hard as this sounds. And yeah, this is I think the biggest challenge we have ahead because the technologies are there and they're getting better. It's more to get also people on board.