

2016 Conference Transcription

Date	Friday 1 April, 2016
Session Title	Life
Session Time	10:15 - 12:15
Moderator	Matthew Cobb
Speakers	Abi Aspen Glencross
Notes	n/a

Intro	<p>Hello and welcome to FutureEverything 2016 Festival Podcast Series. Over two days, in Manchester's iconic Town Hall, we task designers, artists, scientists, and many more, to rethink our resources from life, earth and intelligence to community and uncertainty. Our speakers ask what we might need less and more of in our new future.</p> <p>Can we imagine new realities and revolutionary materials taking shape in laboratories, cellular agriculturalists for post and [bio charity? 00:47], New Harvest and Kings College London. Abi Aspen Glencross's work centres on the creation of cultured meat. In this session on Life, she looks at the public reaction to its potential future in the context of current agricultural practices. Would you eat lab grown steak, and if not, why not?</p>
Abi Aspen Glencross	<p>Hi. My name is Abi Aspen Glencross and I am here today to tell you a little bit about what I do, why I do it and what the future might hold for us. You might think why would you want to know about this? Essentially, I'm a meat maker, however, possibly not in the conventional sense that you would think of, because I make meat in the lab. And you might think this is sci-fi, especially from David's talk, out-there sci-fi notion. But actually, if we look back, we just need to go to 1931 to Winston Churchill when he said this, and at this time it seemed a pretty absurd notion, but I am here to tell you today a bit about how I am part of an international team trying to make meat, beef, in one of these essentially, without one of these. [<i>Gestures to pictorial representation</i>]. I have just put that in there because you look so happy and I want to ask you a question.</p> <p>Have you ever really looked at meat? Have you ever had a steak before you have cooked it and run your hand across the fibres or looked at the veins of fat that run through it, or given it a pull and seen how that connective tissue holds it all together and gives it that really nice bite? I have. I have thought about this and done this a lot. They say that guys think about sex every seven seconds. Well, if you replace that with meat, that pretty much sums up my life now. And I think this whole obsession with food and farming and agriculture and meat came</p>

from my childhood, because I am actually from a really rural place. I am from a town called Bodmin in Cornwall. I don't know if anyone knows Bodmin. It is where Poldark was filmed, apparently. I think that I spent most of my childhood frolicking through fields and riding our horses through green pastures, and it was all very now, and now I actually live in London. I live in a warehouse in London and I work as a Cellular Agriculturalist and Cellular Agriculturalists, as a field, we create animal products without animals. And you might think, how has someone who has grown up so close to nature, ended up doing something that is seemingly so unnatural? Well, for that, I have got to take you back to my childhood, and how we source food. I lived under the impression that all eggs came from hens that pecked around in fields, and milk came from cows that grazed in green pastures, and meat came from animals that lived outdoors and basked in the sun.

I never knew anything different, so I never questioned it. And then when I went to university at Bath to study chemical engineering, I learnt some really, really hard truths, that for the majority of the animals that we farm, they don't live like this at all. They live like this [gestures], and I think we all know it, even if we don't choose to see it. But I think the thing that really got me, you can choose your free range eggs in a supermarket, but it is the eggs that is hidden in your cake, or the milk that is hidden in your tea every day, and the fact that we have this romanticised view of farming of cows that live outside, and it's all lovely and we can drive past one of these farms on our commute and you would never know. It looks like any other factory. And I think, as I dug deeper, I really realised it is not just the ethics that we have lost a bit of respect for, it's our environment, and our health too.

Do you know that a third of all ice free land is used for livestock farming, and in turn, eighty percent of all Amazon deforestation is accountable for by animal agriculture? So we are kind of taking from the environment and then polluting it. Eighteen percent of all greenhouse gases are accounted for by animal agriculture, and to put that in perspective, it was spoken about yesterday. That is more than the whole transportation sector, and then also, in examples like this, we are polluting in other ways. So this is a feed lot in Texas, and it is not very clear here [gestures] but all the dots here are cows, and all their waste, instead of being used to fertilise the land, now goes into these cesspools like this. And the green you see is an algae blue, where hypoxic or low concentrations in the waste, cause algae to live, and then nothing else can really live or grow. But the problem is, this is leaking into our water systems and things like that. Off the Gulf of Mexico, there is a massive dead zone where there is one of these where nothing can probably live and nothing can probably grow.

And so that leads into how it is affecting our health. Three quarters of all infectious diseases originate from animals, and then because we are keeping them in these cramped, confined conditions, we are feeding them low dose antibiotics, regardless of their health. This is becoming a real problem, as microbiologist, Lane Price, once said: 'Even the most diabolical villain couldn't have created a better system than we have for producing superbugs.' Superbugs are mutated antibiotic resistant bacteria. So this is becoming a real problem, and to put it into perspective, from 1940 to 1962, we generated twenty

new classes of antibiotics. From 1962 to last year, we created two. So this is becoming a more and more prominent threat. And the problem is, this is only going to get worse if we continue the way that we are going.

It is projected, that by 2050, we are going to be a population of ten billion, and we are going to need one hundred billion animals to suppress our appetite. I thought about this, and the more I learnt, the more I thought there must be something I can do. There must be something that we can do. And that is where being a Chemical Engineer came into play. So I wasn't really the model student at university. I would much rather be off adventuring or being a bit of a hippy, trying to save the world. I worked in oil and gas for a year and I just didn't really understand why I was there. And, like most people in university, in their final year, I was just mega confused. I had no idea what I wanted to do. And then in our final year, we had to do a design project, and I chose one on milk, because my best friend back home is a dairy farmer. We had to design a product, and he actually makes cheese. So I thought, you know what, I have got this sorted. I have got a product and he even has a combined heat and power system on his farm, which Chemical Engineers absolutely love that sort of stuff. So I was sorted.

But then it turned out, I didn't get my first choice. Obviously, I got my second, and this was to do with meat, but not normal meat. This was the sort of meat that could generate conversation and possibly change the world. This was lab-grown meat, and before I knew it, I was working under the amazing Chemical Engineer, Dr Marianne Ellis, and she introduced me to New Harvest. New Harvest are a non-profit charity in the US and they are supporting these kind of projects all over the world. It is not just meat. This is the burger created by Mike Hoskin and his team in 2013, but this is [moos? 09:05] free milk. This is milk made from yeast, having never been from a cow, and this is Clara Foods' egg whites, which has never have needed a hen. And it extends further than food. This is Pembiant's Rhino Horn, and they have created Rhino horn to combat the illicit Rhino horn trade. This is Bolt Silk, never having touched a silk worm or a spider, and this is Morden Meadow, and this is the leather they showcased on Ted, and the leather is six cell layers thick. So if you hold it up to the light it is almost translucent, you can almost see through it. So not only are we creating animal products without animals, we are creating them with these superior qualities, or additional qualities, we could never before have dreamed of.

And this kind of next product revolution sort of makes sense, because if we look back right to the start of time, there has been quite a few different steps to get where we are today. If we look right back to the start, we actually never killed for food. We were scavengers. You know, we're not exactly made like a sabre-toothed tiger sort of thing. So we just used to scavenge leftover food from the other animals. It wasn't until about two million BCE that we started to develop the tools in which to hunt. This was about the time we developed language, so we could coordinate this.

The next big revolution was about eight hundred BCE. This was when we began to domesticate animals in the way we know and love today. And this as well, it

was really good, because we had more time because as we domesticated animals, we didn't have to worry about going and gathering and killing our food. So we could chill a bit out and have some time to write, and we started to, and that was when history began, because we had the time.

The next big revolution was industrialisation, and this where farming stopped being cyclic and started to get more linear. So the story goes, in 1921, a farmer and his wife in the US, they had an extra shipping of chickens. Instead of giving them back, because they were getting free chickens, they actually had to find a way of keeping all of their stock. So they kept them indoors, and they realised this was actually a very economic way of doing it, and ten years later two hundred and fifty chickens turned into two hundred and fifty thousand chickens. This was also promoted by the fact, that after world war two, there was an abundance of nitrate, and since nitrate was used in the fertiliser and fertiliser was used to grow crops which then we used to feed animals.

So what's next? What is the next revolution in animal agriculture? Why can cultivation not be part of that? From an animal ethics point of view, we are not exploiting animals in the same way. From a health point of view, we can tailor our product to what we want. And also from an environmental point of view, if we could look at cultured meat versus conventional beef, we produce about twenty five percent of the greenhouse gases that conventional beef would - this is a projection, of course - ten percent of the land, and although not directly comparable, it has about five percent of the atrophication potential of conventional beef.

So this was great. I came out of university suddenly inspired. I knew exactly what I wanted to do and what I wanted to be part of, and as a scientist, the general thing you go into is research and I thought 'cool, I can do that, find something new.' The problem is, for research, you need funding. I learnt very quickly that funding meant you needed money, which we didn't have. And the really hard thing is, cellular agriculture lies between two established fields or disciplines. Medical science, so like tissue engineering and food technology, so we are making this for food. It has also got this amazing dash of art and design in there as well, not just to showcase what we are doing, but also to help us think in a different way and produce something that people are going to want to eat.

So this was a bit of a problem, because I had an idea, I was inspired, just had no money. So, to combat this, I created what I like to call, 'The Dream Team' which was New Harvest, which had supported me through university. Mark Poste, as someone you might recognise, I call him 'The Burger Man'. Not sure if that's right, but him and his team created the burger and actually an amazing tissue engineer called Lucy DeSilvio at Kings College. I saw a lot of supervisors and she just got it. I went into her office, I explained what I wanted to do and she was on board.

So it's great, I had a team, I had an idea of what I wanted to do and I still had no money and we exhausted all the conventional sources as well. And so I started to look at slightly more obscure ways of looking how to get money. I actually

ended up just hanging around where I thought rich and famous people might be. So like train stations and Piccadilly Clubs and banks, and that really didn't get me very far either. And while I was doing all this, I had to stay afloat. I was living in London. It's really expensive, but there is only so much sparkling bottled water you can give out in Kings Cross before you start to question your own existence. And I almost gave up. I am not going to lie. Ironically, I actually took a PhD in antibiotics. So to celebrate this, my friends and I went to a festival, and to celebrate I had got a job sort of thing, we went to this, and I went to a talk by Paul Dolan on happiness. He is a professor of happiness. He said, in life, you need purpose and pleasure, and one without the other, you will never be truly happy. So I was that girl in the corner in the sparkly cat-suit and hat like crying, knowing what she wanted to do and how to positively impact the future, but just no means to do it.

So I went back to the tent, tail between legs, and ironically, I actually had an email from New Harvest saying they had found funding from two philanthropists in the US, which was great. I came out the tent and said to my friends 'guys, guys, I am going to be the meat lady, I am going to make meat'. There was no reaction, at all. I am not sure if it was because we were at a festival, and weirder things had happened, or because it was me, and weirder things had happened. But they did have one question for me, and I am wondering if that is what you guys are thinking now. How do you make meat in the lab?

So this is the way we do it, and I will explain. We take a cell [biopsy? 15:43] from a cow. We separate it all out to get the muscle stem cells and then when we have those, we take a few muscle stem cells, and we make them into a lot of muscle stem cells, proliferate them. And then the next part, we differentiate them. So this is where we change them from muscle stem cells into the muscle cells that we know and love. For this, we place them in a gel, and we actually put anchor points, and in the lab we actually use velcro so you stick two velcro points, and over time, if you feed them right, you know, a cocktail of ingredients, they will grab onto these two anchor points and they will do this and they will start to twitch. And then after about three and a half weeks, you harvest them, and you can make a burger. However, burgers are easier because their structure and their texture, and all the other things you associate with eating one is not as defined as whole cuts of meat. And also, whole cuts of meat are what drive the meat industry. So my project is, I actually work on steak. The start of the process is very similar, but actually, we get to this differentiation stage, and we are limited by the amount of oxygen and nutrients we get to our muscle fibres. So the problem with this is we need to make a thicker tissue to create a steak, or the future of steak. So that is what I work on, the vascularisation of the profusion of this tissue. So what do I do on a day to day though?

Lesson One. I have learnt, to make meat, you have to understand meat. Meat is very, very complex, as is muscle tissue. So it's finding out all the interactions, breaking it all down and building it back one cell at a time.

Lesson Two is edible architecture. So we want to create a steak and grow cells in something that we can eat. So I work a lot with thickness, and the food

	<p>industry, and all sorts of things like this, to try and replace the conventional collagen that chemical engineers use.</p> <p>Lesson Three I feel is the most important as this time. Don't know if anyone has done a PhD in the lab or in biology, but cells like to die, and they die really well outside of the body, I have learnt. The other day I killed about forty million of them in a battle with an aspirator. So we do a lot of work outside of the lab with public engagement, teaching people about where their food comes from and what we can do to shape our future on food, and working with these people also gives us a really different outlook as a scientist. Artists and scientists working together can really create something beautiful. So we work around [pasting? 18:22] and stuff like that as well.</p> <p>So a lot of people still find this concept really sci-fi and weird and bizarre, and I can relate to that. But if we look at fermentation, which is actually used to make cultured milk, it seems less scary. If you can imagine an artisan, a brewer, showing you round a brewery and saying that could be the same for cultured meat or cultured milk, it starts to break down that scare factor. And actually, when you say the word bio-reactor, we make something a bio-reactor as a scientist again, people don't like that it's really scary, but put examples in the home, a bread-maker is a bio-reactor. You put something in, you have the biological reaction and you get out tasty treats, and suddenly it doesn't seem quite so scary.</p> <p>So I will leave you back with Winston, because he did have one really good point, that the way we create animal products today, it is absurd, and hopefully I would like to stimulate the conversation of through old practices and new techniques, we can look at addressing this, and creating a more positive future of food.</p> <p>Thank you so much.</p>
<p>Outro</p>	<p>We hope you enjoyed Abi's talk and thanks for listening. You can hear the rest of the talks from 2016 at futureeverything.org/2016podcasts.</p>

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