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Moderator questions in Bold, Respondents in Regular text.

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Mike Adams: Hi. My name's Mike Adams. I'm the product innovation manager at Campden BRI and I'm here to talk to you about how we can help meet the alt meat and milk boom and overcome some of the challenges that producers face when reformulating with plant based materials. What I'm gonna cover in this webinar is why all of the interest in plant based. Certainly, why all the interest in plant based alternatives to meat and milk. I'm also going to talk about some of the challenges. So, some of the challenges around how we convert animal products to plant based products and then also how we overcome some of the challenges around making plant based healthier. And then, going to talk a little bit about the future of alternative meat and touch on a little bit the future of alternative milk. I won't be covering lab-based cultured animal meats or milks. That's not because they are not interesting or potentially game-changing but that's a presentation all by itself and if there's any interest, certainly happy to put some-, put a presentation together to cover that. So, let's talk a little bit about the plant protein market or the plant based market. I think everyone knows there's significant growth in plant based products over the past decade. Milk and meat by far are the two largest categories for consumer product. The next biggest categories being, kind of, based on plant based milk, being things like plant based yogurts, plant based ice creams and there's lots of different figures from lots of different surveys but on average, between 5-8% annualised growth rate forecast over the next decade, taking it, you know, from what is already quite a significant market to-, into a very sizeable market, so there's a huge opportunity in terms of, you know, supplying these products to consumers. Now, what is interesting is the growth isn't in every product type, not in every product category. So, one thing that's quite interesting we've seen over the past few years is whilst plant based milk has grown significantly, it's grown very much in one particular direction and as we can see in Germany and the UK, which are the two biggest markets for plant based milk in Europe, soya milk has not grown significantly. You know, 1% in the UK, 1.1% in Germany.

Whereas what we've actually seen, and where we've seen the growth is in non-soya based plant milk. So, we're talking things like almond milk, oat milk, coconut, where, you know, we've seen tremendous growth. You know, nearly 30% growth in the UK over the past five years. You know, and, and that really is forecast to, to continue. I mean, that's, that's compound annualised growth rate, so in some years that figure is likely to be higher and we're maybe seeing a slight plateauing of, of growth but really is in plant based milks, we're really seeing a decline in the-, in the use of soya. However, that is no true for all categories. These are the-, this is a chart showing the, the protein sauce or the protein base in the top 25 plant based meat products by dollar sales in the US in 2020. As you can see, soy still being a very, very significant portion of that. You know, of the 25, twenty contain soy. Either by itself in the case of three but usually in combination with wheat or pea. As you can see, soy and wheat being the most popular combination. So, you know, it, it really does show that although soy in the milk category is, is showing a

lack of demand and a lack of growth, almost flat growth over the past five years, soy protein is still in high demand in terms of manufacturing, and that's really for a number of reasons. You know, it is available in huge quantities, both as a crop but-, and as a, a purified protein isolate or protein concentrate. You know, soy protein isolate or concentrate have been around for a number of years. So, there was a market already there, it was the most popular source of plant based protein versus, kind of, whey protein and casein in the sports nutrition field. So, it's already a very developed supply chain and it's a large crop grown in, in a number of countries globally, which means from a price perspective, it's very attractive. It's also a very functional protein. It's-, it has good quality protein in terms of, of nutritionally and you are able to, to turn it into meat analogues. You know, as you can see, often with the addition of, of things like wheat protein or gluten protein as well but, you know, it really goes to show there is a dichotomy emerging in the market of, you know, in some segments, soya decreasing and you're seeing a real growth in, in, kind of, emerging protein sources. However, the same cannot be said for meat where, you know, soya is still king and whilst, you know, a lot of NPD is going on in using things like pea protein, certainly in, in the big market which is the US, soy is still remaining the most popular. But we're seeing significant demand in the-, in the UK. You know, a couple of news articles here. The UK is the largest-, excuse me, largest market in Europe for meat alternatives and plant based milk.

As you can see, this was 2018 where over a third of the European market was in, in the UK and that's really been reflected in industry as well. We're seeing, you know, large plant based factories opening in the UK, making use of, of capitalising on that market. However, it is-, one thing is clear. You know, the raw materials that are feeding that demand, the vast majority come from outside of the UK. You know, there is, at the moment, no large scale manufacture of, of protein concentrates or protein isolates for plant based meat in the UK and the pea protein, for example, which is one of the most popular sources of protein for, for plant based meats, is coming from outside of the UK, even though we're one of the largest growers of, of peas in Europe. So, you know, there's quite a few airmiles in terms of source of these ingredients. Slightly different story for milk. Milk, obviously, we don't grow a lot of almonds in the UK so-, or coconuts, so those materials tend to come from outside of, of the UK but oat milk is, is really gaining traction as one of the most popular milk alternatives. Often, you know, we grow a lot of oats in the UK, and I'd, I'd hope that some of those oat milks on the market are, are being made using British oats. 'Cause as I say, we are one of the bigger-, biggest oat growers in Europe. And why are British consumers buying so much plant based meats and drinking so much plant based milk? Well, there's three primary motivations that you see when, when you're speaking to people consuming these products. We've got animal welfare. Obviously, one of the, the longest standing justifications or reasons for, for seeking out alternatives to animal by-products. You know, lots of concern, you know, people-, and I say historically one of the, you know, longest standing reasons for, for people taking up meat alternatives and, and it's not going to go away, you know, it's-, you know, people still are-, it's not one that's grown massively over the past ten years but it's still a significant factor as to why people are seeking out alternatives to, to animal by-products. There's health concerns. So, you know, there's been significant press over the past few years about processed meat being negative for health and a lot of interesting studies showing the benefits of a vegan diet.

So, you know, there's a significant amount of the population out there that are seeking out plant based

alternatives because they feel that they are a healthier alternative and, and it's certainly true that plant based products, whether it's meat or milk or some of the other plant based alternatives out there have what we call a health halo. You know, they are assumed to be healthier than the animal based version and, and we'll talk about that a little bit later as to why that's not always necessarily true but, as I say, you know, once that association is there, it's very difficult to get away-, you know, move the public opinion away from the fact that, that they feel that they are healthier. One concern which has grown significantly over the past ten years is the environmental concerns. You know, a huge amount of people out there who are, are moving to plant based diets or, or more of a plant based diet because they feel that eating plant based foods, drinking plant based drinks, is better for the environment than animal by-products and this, in some ways, is one of the strongest arguments. You know, there's been a huge amount of published work showing that, you know, our use of animals in our diets is a huge contributory factor to, you know, CO2 levels and anthropogenic climate change. So, it's a growing argument and one of the main drivers that's, that's-, we've seen increase over the past few years. And then there's a, a smaller motivation but I think a very important one to talk about, which again, has been here for a-, been around for a significant period of time is, is allergen or intolerance and avoidance. This is certainly very important for the milk market. You know, huge amount of people out there drink plant based milks-, excuse me, because they're, they're intolerant of lactose or allergic to milk based proteins. So, again, very important to those consumers because they have no other choice and, and, you know, a significant portion of the market. So, just to summarise, we're seeing significant growth in plant based meat and plant based milk over the past decade and it's forecast to grow at, at quite high levels. Milks and meat are the, the headline categories but we're seeing some expansion in, in others. Some based on milk such as ice cream and, and yogurt and then we've got some very new products coming to the market in things like egg replacement. You know, that is a, a very challenging sector.

Egg is an incredibly functional ingredient but we're seeing some real interesting products coming onto the market, either as ingredients in things like cakes or to be used to make products that are, you know, mainly eggs such as omelettes and, and scrambled eggs. And, as we just talked about, demand driven by three main concerns but allergies and intolerances remaining a strong legacy driver. You know, there's plenty of people out there, you know, crying out for, for new products. And that sort of market growth really is an incentive to innovate in the plant based space. You know, people are, are not going to stop buying plant based meat and plant based milk and it's very likely that they will buy more. The largest market by far is for casual consumers, the so-called flexitarians, where people are swapping out part of their diet for plant based alternatives. And one thing is, is clear, is that consumers want to replace current products like-for-like. So, they don't want new things, they want the same sensations, the same hedonism that they-, that they've had eating animal by-products and they want to be able to just swap, pay the same, for it to taste the same and look the same. A great example of this is the famous Greggs vegan sausage roll. You know, that worked well because of the fact that people were able to swap to plant based without having to sacrifice the fact that they enjoy their sausage rolls. And this is really driving producers to try and match in market products and anybody that works at NPD will tell you that this is by far the hardest type of new product development, trying to match in market products. Certainly, when you're taking out very, very useful ingredients such as animal proteins, which, which tend to be very functional in terms of, of what they do to the properties of the-, of the material.

And one, one market that we can learn from is the allergen free market. So, gluten free bread is a great example of where both there are significant challenges in terms of you have a unique protein like gluten to replace, and also, the fact that gluten free bakers have spent significant time and money over the past ten years to take bread, gluten free bread, from what was a poor substitute ten or fifteen years ago to breads now where you're getting very, very close to the eating experience, the taste, the texture of conventional wheat-containing bread. And that's been a long, difficult journey for, for gluten free bakers and required significant investment from people like ingredient suppliers in order to get those functional ingredients that can help replace the, the-, those gluten proteins within, within the bread. And it really highlights the-, some of the challenges that, that certainly the plant based meat sector are going to face in terms of, of trying to replace those, those proteins and highlights some of the challenges. And just to talk about some of those challenges, in terms of making plant based meat, they tend to fall into three main categories. We have the technological challenges, we've got some supply chain challenges and then finally, once you have your product, we have some commercial challenges and it's important to realise that all three of these are interlinked. You've got to understand that each of these challenges cannot be addressed in isolation. You cannot find a technological solution to your problem without considering the implications on supply chain and the implications on commercial. That's the same whichever way you, you look at it. So, just a bit more meat on the bones or plant based meat on the bones, I should say. Breaking down some of the main challenges in making plant based meats. So, in terms of the technological challenges, this is around product design, making sure you're delivering what your customer wants. You've got things like texture, appearance, flavour and then there's the food safety aspect that has to be considered. Food safety of meat is very well understood. It's challenging but those challenges are very well understood and a huge amount of work has gone in, you know, in the past hundred years to make sure that, that we can understand the safety implications of meat, the consumer education piece about the dangers of raw meat and about cooking it properly, how long chilled meat can stay on shelf for before you have risk of things like botulism those challenges, safety challenges, are not as well understood for plant based meat and they may well be different and it may well be that consumer's understanding of how to treat plant based meats are different because of those, those challenges.

They may assume that you have to treat the plant based meats like you treat meat and it may well be the challenges-, food safety challenges are different enough that there are safety implications there. Something that Campden BRI are doing a lot of work on at the moment in terms of challenge testing plant based meats to understand their shelf life, and really understand the risk. In terms of texture, appearance and flavour, they're all very much part of the-, of the, kind of, three sides of the same coin, if that analogy works and it's about the, the design of the product. How do you-, what ingredients and what process do you use to make your meat as appealing as possible? And as we've talked about, making it as similar to existing animal meat products as possible, whether that's mince or whether that's, you know, a piece of protein like a chicken nugget or a steak. And moving on, we have the supply chain issues. So, this is certainly a key thing to consider when you're maybe looking at some of the newer ingredients on the market. You know, there's a huge amount of different proteins that are available to be used and one of the main challenges there is, what is the commercial stage of the production of that protein? 'Cause there's lots of really interesting proteins out there that are, at a lab based scale or pilot scale, do very interesting things and can really produce some, you know, really interesting textures, really interesting products but there's no scale in terms of the production of that material. And what that means, if there's no scale, it means the cost of the materials is high and the volumes available are low. And whilst this is a challenge

I've talked about with some of the emerging proteins, it's a challenge for some of the existing proteins. Pea protein, for instance, this year, has really seen a-, the volume drop and the cost rise due to problems with harvest. So, again, you know, we have a long-standing supply chain for, for meat based proteins or animal based proteins. Plant proteins are still emerging and whilst I talked about earlier soya being (inaudible 18.33) if you're not looking to use soy, you know, there is a limited supply chain for, for other plant based proteins at this time. And then, once you-, we have your product, you have your product, you've designed, you've, you've secured your materials, you need to think about the commercial aspect. So, what's the consumer attitude to your product? You know, are they willing to accept maybe you're using a source of protein that isn't, that consumers will find disagreeable.

You know, the typical plant based consumer is quite knowledgeable in terms of the, the food industry, so it may well be that they have concerns over some of the ingredients that you're using. How are you going to position your product? Are you going for putting it in the aisle with meat based products? You know, have you spoken to your supermarket and your-, the retailer about where you're going to put it, how you're going to sell it, what's your marketing message? How are you going to sell your product? And then finally, you know, arguably one of the most important aspects from the commercial side is pricing. Can you make this product cheap enough that people can see it as a viable alternative? You know, if you want to make a mainstream product, you, you have to be able to price it in such a way that, that people are not having to think twice about replacing their animal based product with a plant based product. And those-, certainly the supply chain, commercial aspects apply just as much to plant based milks as they do to plant based meats. Some of the technological challenges in, in milks are slightly different, I'll talk about those in a couple of slides time. Just to drill down into what is arguably the biggest technical challenge for plant based milk-, meat is texture and structure generation. And here are the five most common methods to produce texture with plant proteins. We've got mass market technology, so fermentation with things like Quorn. Extrusion, so that's the production of textured vegetable proteins. So, soy being the most common but we see soy and wheat blend also being very-, very popular. Then we have fibre spinning which is a, a technology that's been around for, for 70 years and this is a way of producing fibres using soy. Potentially mass market. I think still under patent by the inventor but not very big, certainly in Europe. Much more of a US and there's a number of products that have been on the market since the 1950's that traditionally used fibre spinning and have actually moved into using extrusion. So, extrusion is by far the single largest sector of plant protein texturing, with estimates being, you know, up to 80% of plant based products-, of plant based meat products being made using some form of extrusion. Obviously, Quorn uses fermentation as primarily their way of generating texture and structure and there are other companies working in this area but Quorn remains, I think, the only mass market product currently using that. And then over towards the right, we have some much more experimental technologies.

We have the shear cell, which is-, uses similar principles to extrusion but has advantages and it can make large pieces of, of, of protein. So, approaching, kind of, chicken breast size, which extrusion struggles to and then we have 3D printing, which is producing some wonderful products according to the-, some of the articles that I've read but again, is still very much a research scale technology. When we move onto talking about some of the challenges around plant based milk, I've highlighted, you know, the commercial we've talked about previously but in terms of the technological challenges for, for milk, they really focus

around two. So, we have the stability and, and the flavour. I'm going to talk about the flavour a little bit now. You know, milk has a-, sorry, dairy milk has a very distinctive flavour and often when you're making a plant based milk, it is very, very difficult to, to mimic that flavour and often that's due to unwanted flavours coming from the materials that you're using. You know, we have things like cereal notes, beany notes, you can get some bitterness coming through from, from some of the materials that, that you can use and there are ways of minimising those flavours but it, it really does remain one of the main technical challenges in terms of, of making plant based milks that are palatable to, to consumers. And there's a lot of consumers out there that are willing to, to taste different milks and, and often some of those tastes are-, can be quite pleasant. You know, coconut for instance but, you know, certainly some of the pea protein based milks can have flavours that need masking or, or removing prior to the, the milk being 100% acceptable to consumers. In terms of stability, one of the main challenges around milk is what people use milk for. You know, obviously, plenty of people out there drink it as it is or, or add it to things like cereal, in which case, stability is maybe not a, a huge challenge but, you know, a significant portion of the population add milk to other materials or heat it up. And as an example for that, adding milk to coffee.

Coffee is an incredibly hostile substance. It's hot. It's-, can be quite acidic and one of the challenges is it often causes plant based milks to split and, and you see a very similar effect as to if you add very old dairy milk to your, your coffee and you get, you know, a not particularly pleasant, lumpy cup of coffee. Ensuring that your emulsion remains stable can be a challenge, you know, and that often involves maybe different processing methods, different ingredients. You know, and, and that can be a challenge to get that right and it's certainly true that a lot of plant based milks on the market still don't quite have it right because you, you still certainly-, I certainly see when I have plant based milk added to my coffee, you know, a number of them still, you know, don't mix in particularly well. And we've talked about consumer attitudes a couple of times and these are critical to address for both milks and meats. And these are five of the, the main, kind of, questions or areas that you see raised by people when talking about plant based meat or plant based milk is how healthy is it compared with the, the animal versions. We'll talk about that a little later on, on the next slide. We've got soy concerns. As I say, not a huge issue for milk. We've seen milk, plant based milk, really move away from soy over the past five years but in meat, especially a lot of certainly British consumers, you know, not big fans of soy. It's still used in quite a few plant based meats, either as soy protein or, or other soy based ingredients and there's a number of concerns there around things like deforestation and, and GMO's. Ultra processed foods, getting more and more, kind of, recognition in the media around health challenges associated with, with ultra processed foods and it's true to say that both plant based meat and plant based milk would be classed as ultra processed foods.

Not all milks but certainly most meats would be classed as ultra processed foods according to various different ways of defining them and, you know, there's a big challenge there around ensuring that it's-, you know, we're, we're trying to process them as less as possible, which is challenging when you have very specific things like textures and flavours that you want to hit. There are allergen worries. So, we've got allergen worries in terms of wheat, proteins, in terms of soya and then there's a big cross contamination risk and, and we've seen reports in the press of, of a number of products that are, are vegan, having warning-, allergen warning on them for things like milk and, and egg. So, there's a big

challenge there around making sure that, that we keep people with intolerances or allergies safe by ensuring that the, the marketing messages on if there is a risk of cross contamination. And then, cost is king. You know, if we want people to transition to a plant based diet, we have to make sure that they're not going to be paying a premium and that is a challenge because we're-, we need to use specialist manufacturing methods, we need to use specialist ingredients and unfortunately, they both tend to add costs. We've got very, very mature supply chains for animal products within the UK especially and globally. Those same supply chains are not yet in place for plant based and that tends to add cost, so it's very important, to, to make sure costs are as low as possible. And just one area to talk about, we talked-, mentioned that as, as a concern, is plant based proteins or plant based products have a halo. You know, people assume that they're healthier and I just want to talk about four of the main areas regarding health and just, kind of, compare and contrast slightly. So, we talk about macronutrients. So, macronutrients are things like protein, fibre, carbohydrates, sugar, fat and how do they compare? So, plant based meats typically have a higher level of fibre and carbohydrate than equivalent meat versions. It's not necessarily a bad thing. Fibre consumption is something to be encouraged but it does mean protein levels tend to be lower. Plant based milk often lower in fat and protein, higher in carbohydrates and fibre. This can be an issue. Certain populations require the fat and protein from, from animal milk that they wouldn't get from plant based milk and that's certainly true for, for groups of consumers such as young children. In terms of micronutrients, we're talking about vitamins and minerals, animal proteins tend to include high levels of things such as iron, zinc and B-vitamins in very bio available forms.

That means very easy to absorb and for the body to use them. Now, you can fortify plant based products, whether that's plant based milk, plant based meat, to give very similar levels but there are questions around how bio available that-, those vitamins and minerals are, so how easy they are for the body to absorb and, and utilise. Just to pick up on milk, milk has a very-, dairy milk has a very high level of vitamin D, which is a very important vitamin. Again, plant milk can, can be fortified with vitamin D, there's a number of very good vitamin D's on the market but again, they may not be as bio available when added to plant based milk. So, again, it's, it's the difference between what's on the label and, and what effect it actually has on consumers. In terms of FSS, we're talking about fat, sugar and salt. Talking about salt first of all, typically, salt reduction strategy has been, certainly in the UK, has been one of gradual reduction in many categories. Often, there isn't a magic silver bullet to take salt out and put something else in and a lot of savoury categories have gone with just gradually reducing it over a number of years. Given the newness of plant based meat, you know, and it's a category that has been around for a while but it's still relatively new, relatively young and, and has been relatively low profile, so has escaped, kind of, a lot of attention, this hasn't quite happened yet. And often with the flavour challenges that, that plant based meats have, salt levels are typically higher than their meat-containing equivalents or their animal meat-, animal protein containing equivalents, so there's maybe something to address there in terms of, of making sure salt levels are, are brought down. In terms of fat, we've talked on it a little bit in, in the macronutrients. Fat is a fairly controversial nutrient and there's controversies around, around the health effects of fat but putting that aside, most plant based meats and milks do not deliver the same fatty acid profile. This is most likely a positive because they have lower levels of saturated fat but it may be seen as a negative by some people. Plant milks typically have a lower level of fat than cows milk and the fat in plant milk tends to be unsaturated-, unsaturated, sorry, rather than saturated. Sugar, not a huge issue for plant based meats. They don't typically have a high sugar content. In some reviewed products, it is, is higher than the meat equivalents but in real terms, it's, it's quite insignificant because although it is

slightly higher, it's still very low so it's not necessarily a huge concern.

Similar tends to be true for plant milk. Protein quality. So, protein quality is a measure of, of how much a protein or a blend of proteins deliver the essential amino acids that humans require. So, amino acids are the building blocks of proteins and there are some amino acids that humans need in their diet, that-, because others that they can-, they can make-, we can make ourselves but there are a selection of amino acids that we call essential and we score proteins based on how much of these essential amino acids they deliver. In plant proteins, these range from good, which means it has a PD CAS (ph 23.26) which is a measure of, of quality of protein in terms of its range of, of amino acids, is a score of more than 0.8. Now, a score of 1 is casein, which is a milk protein and, you know, some vegetable proteins or plant proteins that score well are, are things like soy and potato, which score above 0.8 and these range down to low, with a PD CAS score of about 0.2 or 0.4, such as corn or almond protein. So, it really just shows the huge range of challenges there in, in plant based and it is fair to say that not all plant based products are as helpful as, as animal based products but it is not black and white. It's very much shades of grey and it tends to be a mixture of good and bad. Better in some areas, worse in others but, you know, it's very difficult to say conclusively that processed plant protein based milk and meat are definitely better for you than animal. It's very, very much the pros and cons. And delivering against all of the challenges we've outlined. So, we've outlined a number of the challenges, we've talked about some of the ways around it, some of the, the different methods, (inaudible 33.45) when selecting a protein source or technology, you've really got to balance some of the quality attributes that, that ingredients or methods deliver, whether that's a production technology or whether that's a, a certain source of protein that maybe delivers texture or good taste or good nutrition versus the commercial challenges, which could be cost, it could be allergen profile or it could be availability. You really have to balance the priorities to give consumers what they want, whilst ensuring that the ingredients you use are in supply and the finished product is cost effective. It is a fast moving sector. Lots of new ingredients coming to market so important to constantly review, adapt and update your product and your product portfolio. New processing technologies, much slower in coming to market than ingredients but lots of interesting work is being done and as other industries have shown, where the process has not essentially changed for decades, there's lots that you can do to make incremental improvements.

Again, going back to the gluten free bread example, the majority of those improvements in product quality have been based on ingredient technology rather than process technology but there have been some small and important changes to processing that have unlocked the use of some ingredients. What does the future hold? Well, I think it's clear that the market is moving beyond soy and wheat. We've seen in plant based milk, soy becoming very much a (inaudible 35.10). Still one of the biggest plant based milks available in terms of market share but very little growth. In terms of plant based meat, you know, wheat protein is very, very functional, very useful but certainly it's a protein that a lot of people are looking to avoid in their diet, so, you know, the growth of pea. There's a new plant in the UK opening up soon to produce potato protein. So, really, you know, at the moment, soy and wheat by far the most used in, in meat but the market is, is moving beyond that. In terms of milk, as we've talked about soy becoming, you know, still a good cash cow for, for the producers but really very much an afterthought. Customers becoming much more discerning. They know what they want. There's a lot of competition out

there, they will pick and choose the best products. You know, we're seeing a lot of companies growth really tailing off over the past couple of years and that is because the market is becoming saturated. In both milk and meat, you know, consumers have so much more choice now than they did even five years ago and that means that consumers will vote with their wallets and they will buy the best products, so it really makes it important that you are delivering an excellent product that ticks as many boxes as possible for the consumers. Seafood is an area where there's not been a huge amount of, of products launched. It's one of the most challenging sectors to deliver plant based products in but it is also one where we're seeing the most growth now because there are a number of technologies out there, some excellent new flavours on the market, delivering great seafood and a variety of seafood flavours as well. So, expect significant growth in vegan seafood offerings over the next few years. Then I eluded to it a little bit at the beginning of the, the webinar, cultured meat and cultured plants and cultured milk all becoming potentially very significant.

Still very much lab scale and more of a curiosity at the moment but it's technology that can be scaled very, very quickly. So, it's certainly worth looking at and considering because arguably, it will make plant based meat a-, irrelevant in the coming decades because you won't-, you will remove the-, certainly two of the biggest concerns in terms of environmental and animal welfare for certainly animal protein in the form of-, in the form of meat. Cultured plants, that's more around things like algae which has a huge variety of species, a huge variety of, of nutrients and functional proteins and algae's been there or thereabouts for, for a number of years and no-one's quite cracked it but there's a number of companies doing some very interesting work where, again, you can really tailor the algae to produce the particular compounds that you want. Very environmentally friendly, no deforestation to grow algae, so potentially very interesting sector in terms of sources of plant protein. Thank you very much for listening to this webinar. You'll see at the bottom my email address. Feel free to reach out if you have any questions about things that I've talked about and I'll be more than happy to answer your questions and if I can't answer them, I'm more than happy to put you in touch with one of my colleagues here at Campden BRI who may be able to. Thank you very much. Captions by www.takenote.co