



Multiple routes to
protein innovation

Introduction

Plant-protein blends continue to make inroads into traditional animal-protein markets, but fermentation, too, promises to open up many more protein opportunities of its own. Paul Gander reports

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Consumer food fads and fashions come and go and, naturally enough, those helping to bring to market non-animal proteins worry that this particular party may be drawing to a close.

According to Dr Jaakko Paasi, principal scientist at Finland's VTT research centre, they have nothing to worry about. "Consumer interest in plant-based and other alternative proteins is increasing," he states. Nor is this some sort of uninformed shot in the dark, given that VTT is working as part of the EU's multi-partner NextGenProteins project.

As a researcher on the business rather than the science side, Paasi admits that many—if not most—companies starting out in the plant-protein area suffer

from a lack of profitability. "But this does not mean that the boom is over," he cautions. "It just means that the food business is not an easy one."



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He goes on: "Many of these companies have a good niche kind of 'hit' product with plant-based protein, and have done good, small-scale business." If

problems arise during the transition from a niche to a volume business, those issues are not specific to their type of product.

At the same time, formulation and NPD can pose some particular challenges.

At Dutch research company NIZO, expertise group leader for protein functionality Fred van de Velde says: "When developing products for sports, active nutrition products or for healthy ageing, the overall protein content and balanced amino acid profile is crucial." To create that profile, the level of plant proteins, in whatever combination, needs to be high. In this respect, he contrasts the relatively low content levels in many 'plant-based' beverages currently on the market.

"Increasing the protein content has complications for the sensory profile of these products," van de Velde explains. "This can be about the flavour (beany or 'green'), the taste (bitter) or the mouthfeel (gritty or astringent). Thus, for these specific products requiring high levels of plant proteins, [ensuring they] have a good taste and mouthfeel can be challenging." NIZO is among those developing strategies to improve the quality of ingredients and end products—and regarding this as a crucially important endeavour. "In our view, fermentation is a powerful tool to obtain 'cleaner' products," he adds.

More on this later. But just how significant is the more established—and



Market dimensions

Data from Meticulous Research published in June 2021 indicates that the value of the global plant-based protein supplements market was

expected to reach US\$9.57 billion by 2027. This was in response to a compound annual growth rate (CAGR) of 7.8% over the period 2020–2027.

Slightly older data from Frost & Sullivan, cited by Vitafoods Insights in a report last year, projected a market value of over twice this size by 2026, running at a CAGR of 8.6%. The

discrepancy in the scale of the market could be explained by contrasting definitions of 'plant-based protein ingredient.' The Frost & Sullivan figures included a rather nebulous 'food and beverages' category, which accounted for over half forecast volumes. The more recent figures refer more specifically to 'supplements.'

The flip side of this can possibly be seen in Euromonitor research which focuses on meat-free substitutes for meat and seafood, taking in such options as soy, mycoprotein and non-soy beans. Here, the global value of the category was put at \$5.6bn in 2021, with 7.3% CAGR taking this total to \$9.32bn by 2025.

In short, it seems that the markets for plant proteins

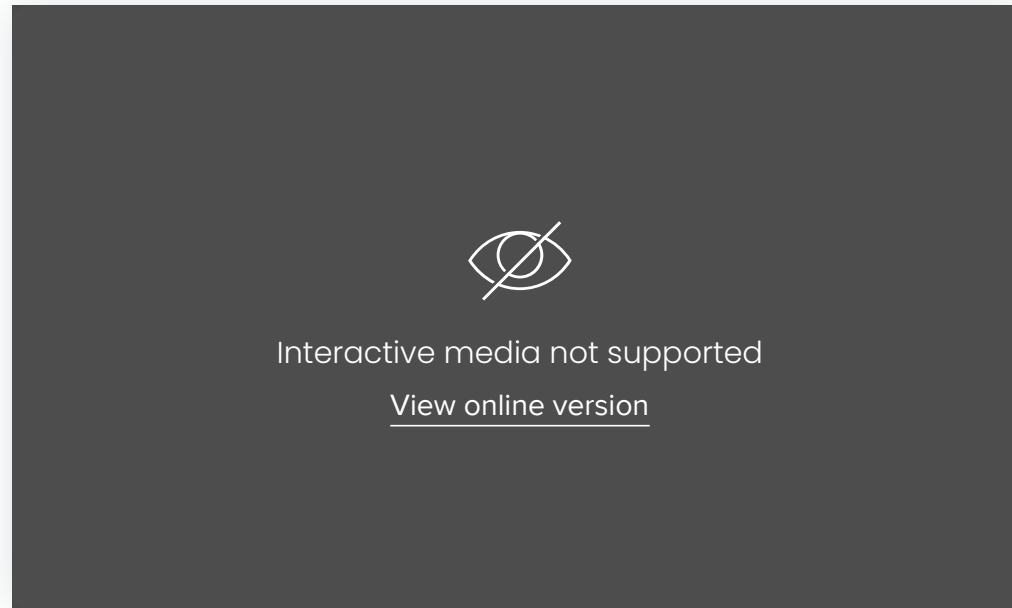


[Alternative proteins: from quality to consumer perception – video](#)

destined for nutritional and supplement end-uses, on the one hand, and for food-and-drink protein substitution on the other, seem to mirror each other and are currently of a similar size, growing at comparable rates.

The Meticulous research highlights particularly high growth in Asia-Pacific (APAC) markets. Here, it predicts, for the next five years at least, a CAGR of 8–9% in plant-based proteins for supplements will outstrip, for example, Europe and North America.

While soy remains strongest across all nutritional applications, pea protein retains the position of the fastest-growing alternative, and is especially sought-after for higher-value formulations,



typically in sports nutrition. The same research projects likely year-on-year growth for pea protein at 11–12%, up to 2027.

According to supplier Roquette, other industry estimates put the expected growth in demand for pea protein at between 15% and 24% annually over the next decade.

Similarly, while ready-to-mix (RTM) protein blends in powder form remain dominant in terms of format and delivery, convenience means that ready-to-drink (RTD) seems set to show the fastest pace of growth (9–10% CAGR) up to 2027, says Meticulous.

Parallels between alternative proteins in the food and nutrition sectors may only stretch so far. But by way of a corrective to any over-selling of plant-based options, Irish food and agribusiness consultancy Farrelly & Mitchell quotes a Boston Consulting Group (BCG) report from March 2021. This estimates that the 13 million tonnes of alternative proteins consumed globally in 2020 accounted for just 2% of the animal protein market.

It goes on to forecast an 11% share of the global protein market by 2035. Technological step-changes combined with regulatory support could lead to a doubling of this figure, the BCG report states.

Consumer optics



Tom Rees, Euromonitor International's industry manager for food and nutrition, sees evidence of a continued evolution in consumer attitudes towards sports nutrition and protein.

"Whereas the world of protein powders and bars used to be confined to the gym-goer, we've seen a softening to more of a lifestyle appeal," he says. "That's where the plant-based comes in more. People looking

at lifestyle goals and overall fitness seem more willing to use plant proteins."

Meticulous Research quotes the 2019 US consumer survey carried out by the International Food Information Council (IFIC) Foundation. This shows that over 70% of respondents claimed a positive health perception of protein from plant sources. Among women, the figure was closer to 80%. The 70%-plus average was ahead of

omega-3 and probiotics in terms of health perceptions. Dairy lagged behind below 50%.

Euromonitor confirms this. "From our data, it's clear that, for the majority of people who consume these products, health is the number one driver, rather than sustainability or animal welfare, for instance," Rees says. In the minds of many consumers, 'plant-based' is often equated with 'healthier.'

As has been widely reported, for many consumers, the pandemic has underscored the importance of maintaining underlying good health and the risks associated with weight gain and obesity. Arguably, this growing awareness has helped to usher in more of a flexitarian approach to protein sources,



Variety of protein sources may lower hypertension risk

even for those who are not dedicated vegans or vegetarians.

At the same time, the sustainability claims for plant-



based proteins are strong. But as we know, what consumers say about these issues and what they actually do can be two very different things. At VTT, Finland, Paasi highlights a large European online consumer survey conducted by his team assessing attitudes towards alternative proteins.

"In the first instance, European consumers highly value environmental sustainability relating to most (if not all) alternative proteins," he says. "But at the point of purchase, this is not directly turning into choices of food products containing those alternative



Ingredient replacements in the alternatives category

proteins. What consumers choose depends on price, taste and other sensorial properties." In the United States, Josh Schall of J. Schall Consulting points out that, in developed markets, there is very little evidence that the number of vegans or vegetarians has undergone any significant change in recent years. "Too much attention is paid to the all-in consumer," he claims.

"Many more take a flexible approach to proteins. They're more conscious of their consumption. In this case, it's about incremental change." What has changed, he maintains, is the quality of alternative-protein sports products. "A plant-based protein drink from, say, five years ago was probably not a good experience," Schall says.



Developing new plant-based gummy formulations could help vegetarians and vegans with intake of critical nutrients such as vitamins B12 and D.

Now, any grittiness in the texture is likely to have gone. "And the flavour science has evolved massively. These products can taste almost as good as whey."



Development and
delivery

Pea remains one of the most consistently sought-after plant proteins and, as Roquette knows only too well, suppliers are racing to keep up with demand. At the end of 2021, the French company opened a new pea protein plant—the world’s largest—in Manitoba, Canada. The company already has a plant able to handle similar volumes in its home market, bringing its annual pea processing capacity on both sides of the Atlantic to 250,000 tonnes.

But beyond soy and wheat, there are many other plant proteins appearing in blends and formulations, as NIZO explains. “Other pulse proteins such as faba bean and chickpea are of interest, as well as proteins from other sources

such as potato, canola and oat,” says van de Velde.

“To develop a nutritional product, a combination of proteins can help to improve the amino acid profile,” he adds. “The best-known combination is that of pulses and cereals; for example, rice and pea.” Experience tells van de Velde that the fewest problems in NPD occur with the creation of RTM powders, followed by RTD beverages. But in many cases, bars will—surprisingly, perhaps—be the most challenging format to develop, he says.

As Schall explains, the general quality of plant-protein products has improved dramatically. When it comes to the RTD segment, there are some mixed signals in terms of



Protein source and product format are among the considerations for product developers.

innovation. “Plant-based RTD is still small, but with some really good products out there, and much larger growth rates,” he says. “There’s a lot of wait-and-see going on, with many of the bigger brands sticking with animal-based RTD for now.”

When it comes to the sources for alternative proteins, as we have seen, NIZO is highly focused on fermentation as a

route to improved sensory and nutritional quality. Van de Velde’s interest does not extend as far as insect protein, for instance, but he admits it is not an area he has researched in any depth.

The novel foods status for many types of insect protein within the EU can make it far more challenging to bring products to market in this area. It will be

interesting to see whether, beyond niche and novelty foods for human consumption, the bulk of insect protein developments shift over time towards animal feed applications.

Schall is to-the-point on this. "It's a hard ask for a lot of people to eat bugs," he says. He makes a similar point when it comes to consumer perceptions of algae-derived proteins.

Meanwhile, the fast-growing category of fermentation-based alternative proteins does not depend on one single approach or technology (see box-out for more detail).

"Next to algae and mushroom, a wide range of yeast and bacteria are currently being developed to produce protein-

rich biomass," says van de Velde. "On the other hand, precision fermentation will deliver proteins with the amino acid composition of their animal parents."

Towards the end of last year, California-based precision fermentation specialist Perfect Day facilitated the launch of two proof-of-concept RTM

sports protein powders in the US. Also available in Singapore and Hong Kong, these were launched under the auspices of its own Urgent Company subsidiary and partner

Intent to ferment

Fred van de Velde of NIZO, the Netherlands, summarises the two categories of proteins obtained by fermentation.

Fermentation to obtain biomass rich in protein. In this case, the micro-organisms themselves constitute the biomass and the supply of protein. In this category you will find micro algae, yeast, fungi, and bacteria. They grow on different substrates, include food industry side-streams and waste products. Or more sustainably, they grow on gases such as CH₄ or CO₂ (so-called gas fermentation). The biomass can be used as such (Quorn is the best-known example) or can be processed to obtain a protein ingredient (an isolate or concentrate).

Precision fermentation to obtain animal proteins. This is closely related to cultured (or cell-based) meat, but focused on dairy or egg proteins. Startups and other companies, such as Perfect Day, transferred the genetic coding for dairy proteins (whey proteins and caseins) to a production organism and create the proteins in a fermentation process. The desired proteins are secreted by the production organism and purified from the fermentation broth. In this case a very specific protein is produced and harvested and the cell material itself is not used.

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Natreve's MOOLESS brand. The idea is that these precision-fermented whey products appeal to consumers of traditional whey and plant-based protein alike, while boasting only 3% of the greenhouse gas emissions associated with conventional animal proteins.

According to spokesperson Anne Gerow, Perfect Day has

"regulatory approval underway" currently in Canada, the EU and India. "We are operating at full scale and producing protein in many of the largest-scale fermentation plants that exist globally," she says. "Our focus now is on building out additional sites and expanding our strategic partnerships to be able to produce tens of thousands of metric tonnes over the next five years."

Since the company's food team has worked on everything from ice cream to prototypes of salad dressings—as well as RTD sports beverages—not all of these projected volumes are likely to find their way into nutrition and supplement applications. "Our R&D team is using our technology to extend our impact into new animal-free ingredients,

including other proteins and lipids, in the future," Gerow states.

Schall adds the point that, alongside benefits in sustainability and hygiene with precision fermentation, as economies of scale increase, the protein produced should be much cheaper—and ultimately, cheaper than competitor proteins.



Protein isolation techniques help to define the properties of insect powder, which can support use in human food products.

Challenges and responses



Farrelly & Mitchell points to certain plant proteins, such as soy and spirulina, as being more complete than others. In some markets, though, consumer concerns about GMO content may militate against soy. On the other hand, it says, spirulina can be difficult to source.

In fact, with today's international supply chains for many ingredients facing severe challenges, sourcing problems can affect a range of plant proteins. The advantages of blending different sources together go beyond the ability to create complete protein profiles, director Dr Michelle

Riblet reminds us: "It can also be more cost-effective, with fewer availability issues."

Anyone looking for cracks in the architecture of plant-based markets might wonder about the 'health halo' enjoyed by these products. Riblet underlines evidence that today's consumers are more focused, overall, on health and wellbeing, and so pay more attention to food labels.

This can have negative ramifications on products seen as being over-complex or excessively 'processed.' "Clean label is important in this, and overly-processed foods with a long list of unrecognisable ingredients will be put to the test," she says. "This is equally applicable to both plant and animal proteins."

Rees at Euromonitor has identified this risk with plant-based foods. "As people come to believe that processed foods are bad for us, the health claims associated with them are called into question," he says. EU nutritional labelling initiatives may also help to undermine assumptions about the comparative healthiness of some plant-based foods, he suggests.

But Rees admits that the processing of plant-based foods, with their more complex flavour and texture requirements, is not the same as nutritional protein. "Whether for whey powder or pea protein, it may not prove too much of an issue," he concludes.



Consumption of plant-based alternative products is increasing; however, high levels of processing, varying nutrient content, and high salt content indicate the necessity for nutritional guidelines.

The 'halo' effect could also be seen as extending to take in the sustainability and, generally, low environmental impact of plant proteins. Yet nothing can be taken for granted. "There are certainly many challenges that will need to be faced in plant-based supply chains, production and processing," says Riblet at Farrelly & Mitchell. "This includes the responsible sourcing of ingredients for plant-based foods, and driving efficiencies in production processes to limit environmental footprints."

As much of an opportunity as a challenge is the 'healthy ageing' market for plant-based proteins, where the health 'halo' and sustainability story can, together, provide real leverage. "It's an extremely attractive

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"It's an extremely attractive market, but it's not one where current marketing is really aiming,"

Joshua Schall

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market, but it's not one where current marketing is really aiming," says Schall. "Some upstart brands in the US are starting to pay attention to this 50-plus age group, which tends to have significant amounts of disposable income, and which is typically trying to extend its health span," he says. "But there's still a lot of misunderstanding about it, and maybe 30-something entrepreneurs are not best-placed to address it."



Protein prospects



The consensus appears to be that, like the consumer hunger for protein overall, interest in plant-based nutrition is not a bubble that is about to burst. The next few years could, among other developments, see health-conscious Baby Boomers being more consciously targeted by alternative-protein nutrition brands.

Regarding their environmental credentials, tangible and growing evidence of the climate crisis will, sadly, not require too

much in the way of marketing campaigns. “So it seems the focus on sustainability in food systems will only intensify,” Riblet at Farrelly & Mitchell surmises.

“Research shows that plant-based proteins will more than likely play an important role in this, so it is unlikely that interest will decrease.”

Predictably, no one expects one form of protein—animal-derived or not—to corner the nutritional market. Taking the wider dairy industry as her point of

reference, Gerow at Perfect Day says: “We see a diverse future of food being one where consumers enjoy animal-free dairy, traditional dairy produced by sustainable businesses, and plant-based options alongside each other.”

But it seems that, as a part of this mix, new and emerging products, particularly those relying on fermentation, will take an ever-larger slice of the market. This is at least in part to do with the climate emergency, sustainability and carbon footprint as issues which will be increasingly persuasive for growing numbers of consumers – and brands. Gerow calls sustainability “a top driver for consumers.”

The rationale behind these fermentation products is also, as NIZO says, about flexibility in formulation, from the point of view of flavour, texture, functionality, and more precise amino acid profiling.

But with simpler, cleaner food labelling returning to the fore, ingredients lists highlighting pea, rice or other pulse and grain proteins will continue to have a strong appeal, with improving sensory and organoleptic properties helping to bolster their success.

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Anne Gerow

Industry Experts - Q&A

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Q&A

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1 How is the overall proteins market evolving in response to consumer demands to provide unique new options in addition to meeting demand for more established ingredients?

“High protein” label claims are now common on mainstream consumer products. Indeed, consumers increasingly recognise the benefits of protein consumption in areas like muscle

recovery, satiety, weight management, and general wellbeing, which are supported by a growing body of scientific research. As a result, there has been a surge in demand for various proteins to fortify food, beverage and nutritional products.

Another growing market trend is the plant-based movement, which is now filtering through to products targeting “high protein” claims. This has driven demand for ingredients such as soy, pea, and rice protein isolates. However, with plant proteins varying in nutritional properties, functionality and mouthfeel, there is also interest in emerging sources.

2 What protein ingredient(s) do you consider to be your company’s specialty, and how are those ingredients sourced responsibly?

One of the fastest growing areas where we are seeing interest is our ability to support plant-based solutions and vegan protein label claims. We are one of the largest global distributors of pea protein, which, in the dairy alternative sub-category, accounts for a higher percentage of

new product launches than soy. It’s highly digestible and offers an amino acid profile close to that recommended by the World Health Organization. Additionally, it’s ideally suited to sustainable food production.

Our portfolio of plant protein concentrates and isolates also includes products from various other sources, including soy, pea, rice, pumpkin seed, fava bean, and many more.

3 Into what type of applications can your ingredient(s) be incorporated, and are there particular unique benefits to your ingredient compared to others in the category?

Our plant-based protein ingredients can be used in everyday foods and beverages, as well as in specific nutritional applications, such as sports or infant nutrition. In addition to a very broad portfolio of plant protein concentrates and



isolates, we also offer speciality grades. Thanks to our premix expertise and capabilities, we are able to create customised blends of different plant proteins, which deliver exactly the nutrition profile and functionality you need.

4 What product development and/or research support do you offer your customers?

Our expertise in the intricacies of plant protein formulation means we can help our customers solve common problems relating to taste, texture, solubility and nutritional quality.

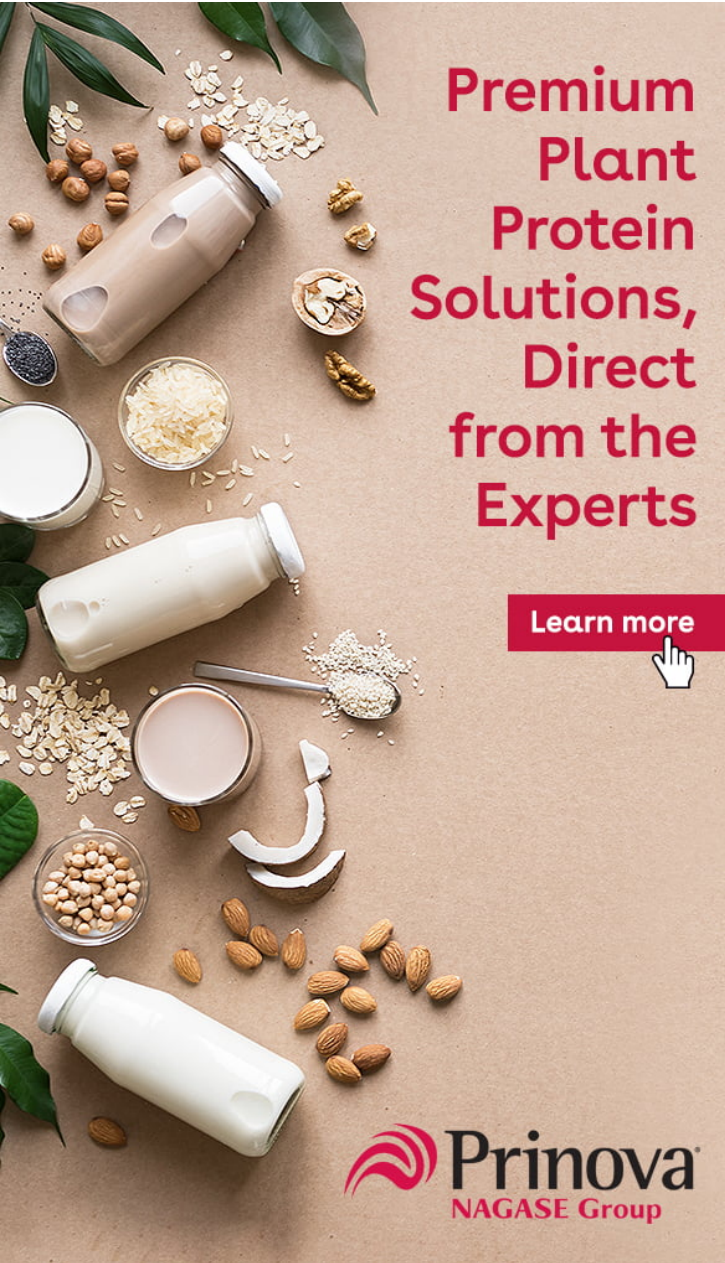
There's a long list of companies who've chosen to work with Prinova because they know they can rely on our deep understanding of the challenges they face when formulating with plant proteins. For example, we recently helped a brand create a plant-based protein powder that delivers a similar nutritional profile, mouthfeel, and neutral flavour to a whey-protein product.

As a large-scale distributor, we offer a great deal of protection against supply chain instability and price volatility, so we're an ideal single source partner for both raw materials and product development support.

Plant-based potential: Meeting the demand for alternative proteins

High-protein is now a mainstream consumer need, resulting in a booming market. According to some estimates, the number of new products launched with a high-protein claim has been increasing by almost 20% a year...

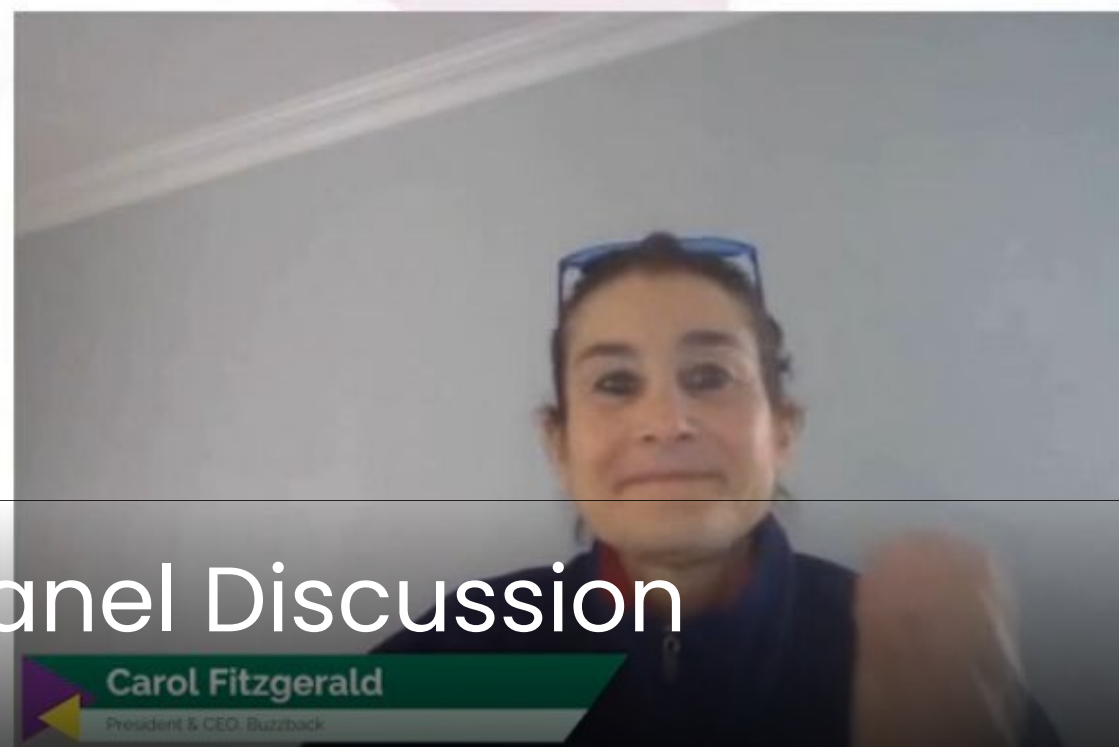
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Biographies

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Eva Criado is an experienced marketing and communications professional with over 20 years of experience within the health, wellness and fitness industry.

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Tom Rees is an industry manager at Euromonitor International, with a focus on food and nutrition. Based in London, he has more than 15 years of experience in the industry. He is the author of publications including last year's The Rising Tide of Non-Animal Proteins.

Dr Michelle Riblet, PhD

Dr Michelle Riblet, PhD, is a director at Irish food industry consultancy Farrelly & Mitchell. She has over 20 years of experience in the industrial, research and regulatory environments of the agri-food sector. In particular, she has extensive knowledge of international policy and legislative development.

Joshua Schall MBA

Joshua Schall MBA is a consumer packaged goods (CPG) industry strategist with an emphasis on the intersecting categories of functional food, beverage, and nutritional supplements. In less than 10 years, he successfully built J. Schall Consulting into a leading authority on growth strategies.

Fred van de Velde

Fred van de Velde is expertise group leader for protein functionality at Dutch research company NIZO. His main focus is on the extraction, processing and application of alternative proteins to customers' products. He is also a senior researcher at the HAS University of Applied Sciences.

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