

# 2018 PROTEIN TRENDS & TECHNOLOGIES SEMINAR

## SUMMARY: FORMULATING WITH PROTEINS

### What's Inside on Proteins...

- Trends & Takeaways in the Protein Product Marketplace
- Protein Quality & Labeling
- Allergies: A Challenge for Current & Emerging Proteins
- Plant Proteins: Tips for Successful Use in Formulations
- Formulating with Whey in a Fully Transparent Market
- Nutrition Strategies to Protect Muscle Health During Aging
- Non-GMO Transparency: Understanding your Options
- Protein + Flavor = A Formulation Challenge



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# 2018 Protein Trends & Technologies Summary

Global Food Forums® Inc.'s 6th annual Protein Trends & Technologies Seminar, North America's largest conference dedicated to the protein ingredient market and technologies, took place in Itasca, Ill., USA. Its Pre-conference: Business Strategies Program was held May 22, 2018, and was followed by the Technology Program: Formulating with Proteins on May 23. Information from the Technical Program is offered on these pages. Complimentary PowerPoint presentations made available by speakers are online at [www.globalfoodforums.com/store/protein-seminars/](http://www.globalfoodforums.com/store/protein-seminars/). Our 2019 Protein Trends & Technologies Seminar will be held May 21-22, 2019, at the Westin Hotel, Itasca, Ill., USA.



PHOTO COURTESY PETER D. O'DONNELL

A registration of more than 200 attendees, all focused on the topic of proteins, made for robust networking.

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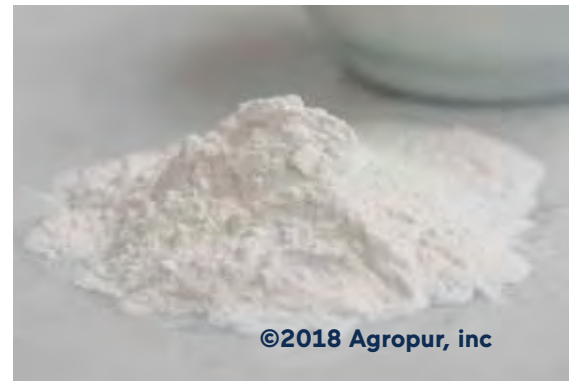
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# The Global Food Forums Story

Welcome to our post-conference magazine from our annual Protein Trends & Technologies Seminar. This publication touches on key concepts taken from presentations given during the Technical Program: Formulating with Proteins on May 23, 2018.

We incorporated Global Food Forums in May 2012. Our vision was to develop a family of in-person, niche product development conferences for the food, beverage and nutritional products industries. The technology-based programs provide R&D and other food scientists with practical and non-commercial formulation advice, as well as consumer and product trend information; insights into emerging ingredients; nutritional and regulatory updates; and other factors impacting product formulations.



The 2013 Protein Trends & Technologies Seminar was our very first event. We underestimated interest in protein-based products and sold out six weeks early! The “passion for protein” continues to this day.

Our Protein Seminar has since been joined by our annual Clean Label Conferences ([www.globalfoodforums.com/clean-label-conferences](http://www.globalfoodforums.com/clean-label-conferences)) and Sweetener Systems Conferences ([www.globalfoodforums.com/sweetenersystems](http://www.globalfoodforums.com/sweetenersystems)).

The conferences have now drawn over 3,500 attendees. They range from bench-level food scientists to VP/directors of R&D and other stakeholders in these segments of the industry.

We hope you’ll attend some of our future events. We’ll work hard to make them among your best conference experiences ever!

Warm regards,  
**Peter Havens & Claudia O’Donnell**  
 Co-owners, Global Food Forums, Inc.

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For an inside look at the team, visit [www.globalfoodforums.com/about-us/gff-team](http://www.globalfoodforums.com/about-us/gff-team)

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## Consumer Demand Spurs Innovation in Protein-Based Products

**RESEARCH REVEALS** that consumers continue to seek foods that provide a good source of protein, whether that protein comes from a traditional source or new, innovative products. “Consumers are interested in protein, but they also understand they can get it from a lot of foods,” said Lynn Dornblaser, Director, Innovation & Insight, Mintel, in the opening presentation “Trends & Takeaways in the [Still] Hot Protein Marketplace.”

Although a growing number of products talk about having a good source of protein, being high in protein and/or or having added protein, what often happens is that consumers simply look at the grams of protein per serving on the nutrition label. Protein claims most often appear in categories where they are not expected.

Consumers are conflicted. They want animal-based protein, and they want plant-based protein. According to Mintel research, the top three reasons consumers eat plant-based protein are because of taste, health concerns and to avoid processed foods. Some 70% say plant-based protein is healthy, and 53% say plant-based foods are better for the environment than animal-based options. However, 57% also say that plant-based foods are more expensive than other foods.

On the other hand, 67% say meat is essential to a balanced diet. Men are more likely than women to agree. However, only 51% say a meal is not complete without meat.

In the U.S., the top six categories of new product introductions that make the most protein claims are “snacks,” “dairy,” “fish, meat and egg products,” “meals and meal centers,” as well as the miscellaneous categories of “other beverages” and “other.” Delving further into individual subcategories, Mintel finds that only five subcategories account for more than 50% of all new product introductions. They are “snack/cereal/energy bars,” “spoonable yogurt,” “prepared meals,” “meal replacements & other drinks” and “meat snacks.”

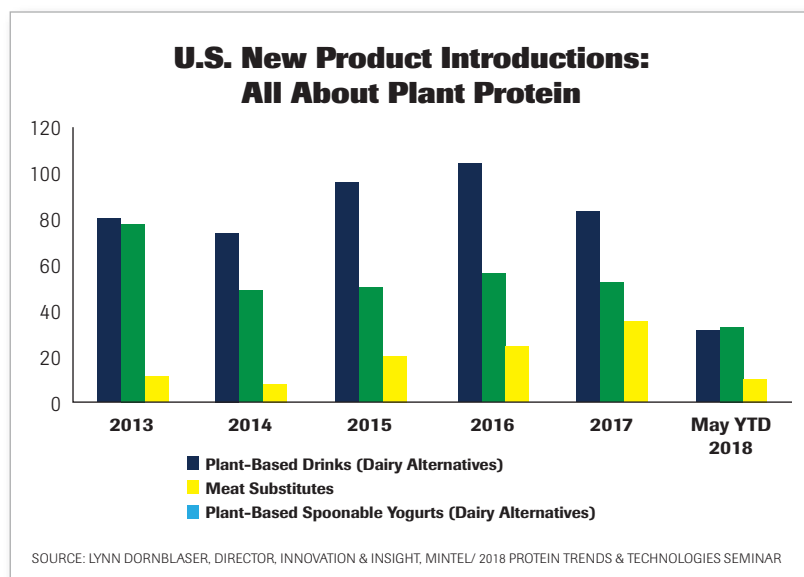
Growth in the meat substitutes category has spurred new product introductions, new company partnerships and much innovation. For instance, the producer of Beyond Meat® plant-based burgers, made with 20g of protein, has a partner—Tyson Foods. This is just one of a number of animal-based protein companies joining with a plant-based protein company, said Dornblaser. “This illustrates how companies that make and process animal protein understand the importance of plant protein in the marketplace,” she added.



❏ **Consumers are conflicted. Some 73% say plant proteins are healthy, while 67% say meat is essential to a balanced diet.**

What is on the horizon for new products with protein claims? Dornblaser offered several predictions. For one, there will be more foods made with plant-based protein, particularly new sources of ingredients. Also, more beverages made with egg protein will be introduced, especially if they’re made from eggs that don’t make it to the store because of size or shell discoloration.

Additionally, cellular agriculture is already in the development stage at some companies. “In Europe and North America, developments that engineer, rather than harvest, food and drink staples, such as laboratory-grown meat and animal-free dairy have grabbed headlines. But the resulting products are often expensive, and some are still years away from widespread commercial availability,” said Dornblaser.



❏ **Although the number of new product introductions is small, growth in plant-based beverage entries have leveled off (e.g., almond milk)—a sign of saturation. Meanwhile, meat substitutes climb steadily, and plant-based, spoonable yogurt intros have increased, as new brands enter the marketplace.**



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“We [hear] lots of talk in the industry about insect protein, but for the U.S. market, it would surprise me if we see much beyond niche companies making products with insect protein,” said Dornblaser. “Think about it; we can’t get U.S. consumers to eat dark meat chicken, how can we get them to eat insects, even if its cricket flour, without visible particulates reminding them of bugs? We’ll see what happens, but clearly for other parts of the world, eating insects and insect parts isn’t that big of a deal,” she added.

While new foods made with plant proteins and meat and dairy substitutes continue entering the market, U.S. customers shouldn’t expect to see lab-grown meat or insect protein at significant levels in the marketplace anytime soon.

*“Trends & Takeaways in the [Still] Hot Protein Marketplace,” Lynn Dornblaser, Director, Innovation & Insight, Mintel, lynnd@mintel.com*

## Allergenic Potential of Novel Proteins

**IN A RICHLIY** illustrated presentation with global and historical examples on the topic of “Food Allergies: A Challenge for Current and Emerging Proteins,” Steve Taylor, Ph.D., Co-Director of the Food Allergy Research & Resource Program at the University of Nebraska, discussed a key concern that food manufacturers need to keep in mind when using novel proteins in food products: Can novel food sources of proteins be allergenic?

“It’s inevitable,” says Taylor.

Certain foods have long been recognized as allergens. The “big 8” allergens, which include milk, eggs, fish, crustacea, wheat, soy, peanuts and tree nuts, cause about 90% of allergic food reactions in the world. Other countries include additional foods, such as sesame seed, mustard, celery, buckwheat, molluscan shellfish and lupine on their lists of allergens. While the importance of the “Big 8” allergens is not debatable, data on prevalence, potency and severity to support the inclusion of these other foods on allergen lists may be limited.

When new proteins are introduced as foods, allergenic reactions in some individuals will inevitably occur. As precedent, Taylor cited the emergence of soybeans as a novel food source in the U.S. in the 1930s. While soybeans had been consumed in Asia for thousands of years, it wasn’t until the 1950s, when soy-based infant formula was developed for milk-allergic infants, that soy allergies were recognized in the U.S. Ironically, some children with milk allergies also had allergic reactions to soy.

Reactions to multiple allergens are usually due to cross-reactivity to a similar antigen found within different foods. Sometimes



❗ **Allergenicity of botanically related species, such as peanuts, peas and soybeans, gives researchers cause to test for the abundance of and amino acid sequence structure of these proteins, as well as cross reactivity and digestive stability.**

the allergenic potential of novel proteins can be predicted because of their similarity to other allergenic proteins. Lupine, a legume that has historically been used in cattle feed, is botanically similar to peanuts. Because lupine has not been genetically modified, it has been widely adopted as a soy replacement in the European Union and Australia. Lupine protein can trigger allergic reactions in some individuals with peanut allergies, which raises a labeling conundrum: Do you warn those with peanut allergies not to eat the food, when only about 20% of Europeans with peanut allergies also have lupine allergies?

Cross-reactivity can also make it difficult to pinpoint the precise allergen that triggers a reaction, especially when cross-reactive allergens with differing potencies may be present. Taylor described severe allergic reactions that occurred in peanut-allergic individuals who consumed a soy-containing muscle-building supplement. Taylor’s group demonstrated that there was no peanut (a highly potent allergen) present; instead, very high levels of soy protein in the product likely caused the reactions.

Soy protein has a low potency that appears to share cross-reactivity with the peanut allergen.

Proteins that demonstrate allergenic cross-reactivity may also be challenging to distinguish analytically. Pea protein is surging in popularity right now and may have allergenic cross-reactivity with peanuts. The analytical challenges in differentiating pea vs. peanut protein have elicited food recalls for potential peanut allergen presence—even though pea, not peanut, was present.



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It's important to remember that not all adverse reactions associated with novel proteins are allergic reactions. Quorn is a fungal mold product that is high in both protein and fiber and is popular in the U.K. In some individuals, the high fiber content of Quorn can trigger gastrointestinal symptoms that may be confused with allergic reactions.

As consumer appetite for protein grows, novel proteins will continue to be developed. Determining the allergenicity of new proteins can be difficult and expensive. However, knowing whether the food product has already been shown to be allergenic (in other parts of the world where it is consumed) and whether the food is related to known allergenic foods (i.e., is it a legume?) may help predict whether a novel protein could have significant allergenic potential.

*"Food Allergies: A Challenge for Current and Emerging Proteins," Steve Taylor, Ph.D., Co-Director, Food Allergy Research & Resource Program at the University of Nebraska*

## Plant Protein Demand Drives Ingredient Innovation

**TRENDS DRIVING CONSUMER** demand for plant proteins include health and wellbeing; the desire for plant-based and clean label products; and concerns related to food security and sustainability. The number of opportunities to use plant-based proteins will grow, as the number of novel protein types grows, as well. Choosing the right plant protein for a formulation depends on several factors, from source availability and cost; to functionality and taste; to nutritional considerations—as well as consumer perception and the presence of anti-nutrients.

"In comparing plant proteins with egg and other animal proteins or in trying to replace them, the first and most important challenge is the taste," said Anusha Samaranayaka, Ph.D., Senior Scientist, POS Bio-Sciences, in her presentation "Plant Proteins: Opportunities, Challenges & Tips for Successful Use in Formulations." "No matter how functional or how the protein ingredient looks, it doesn't fly if it doesn't taste good," she added.

Careful consideration about the protein source being used in the creation of an ingredient is crucial. Functionality and taste are very important; however, when processing an ingredient, co-products also merit a consideration. Cereals and pulses are composed of about 50-60% starches and fibers. If the goal is to make a protein ingredient using a raw material containing 25% or less protein, finding an application for these co-products is a must;

it's not economically feasible otherwise, Samaranayaka noted.

Variables at different stages of plant protein ingredient production affect flavor, functionality and quality of the ingredient. These stages include growing, harvesting and storage; extraction, fractionation and drying; further processing, such as fermentation, germination and physical, chemical or enzymatic modification; and formulation parameters, such as temperature, pH and mixing. For instance, "protein content deviates with the climate and soil, and even the maturity of harvesting; this affects downstream processing," explained Samaranayaka. If it's difficult to remove the seed coat during dehulling—for example, if the seed is not mature—off-flavor notes can occur in the final product. The extraction and fractionation techniques, and most importantly the protein drying technique, are very important in creating these functional protein ingredients, as is further processing, she added.

The molecular structure of plant vs. animal proteins differs. Cereals and pulses mainly have globular, storage proteins, while meat, egg and milk proteins have more soluble and fibrillar-like proteins. Understanding different plant proteins at the molecular level helps in creating processes to effectively extract and isolate the functional proteins of interest. It is also helpful in use of enzymatic, chemical or physical methods to further modify protein ingredients' functionality.

"Establishment of standard methods for assessing the protein functionality and creating a functionality database of different protein ingredients available would really help food formulators in selecting protein ingredients for their specific needs," suggested Samaranayaka.

Researchers and food companies have had some success with product modifications to see if plant proteins can replace animal proteins in products. "These process modifications additionally help remove some of the anti-nutrients and off-flavors. Processing also improves the digestibility of these proteins," Samaranayaka stated.

One example is the creation of meat analogs or alternate meat products. Since most plant proteins have a globular structure, rather than the fibrous structure of meat muscle, they won't provide that "bite" that is typical of a burger. What can you do? The globular structures must be unfolded, and the proteins aligned, so as to make aggregates that come close to the structure of fibril proteins. That's what techniques like extrusion can do, continued Samaranayaka.

Plant proteins can also be used in non-dairy beverages, but protein modification via controlled enzymatic or chemical hydrolysis is often needed to improve the protein's solubility. Improving



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## Pros & Cons of Plant Proteins in Various Applications

Plant Protein	PDCAAS	Functionality Pros	Functionality Cons	Applications
<b>Soy</b> Flour (50-65%) Concentrate (65-90%) Isolate (>90%) Textured Vegetable Protein (TVPs)	0.9-1.0	<ul style="list-style-type: none"> <li>• Good thickener (limited solubility depending on protein)</li> <li>• Good film forming</li> <li>• Good gelation</li> <li>• Largest plant-based protein source</li> </ul>	<ul style="list-style-type: none"> <li>• Allergenicity</li> <li>• Slight off-flavor (grassy/bitter)</li> <li>• Often unstable to heat and acids</li> </ul>	Beverages, Nutrition bars, Meat applications, Meat substitutes, Bakery, Snacks, Cereals, Pasta, Soups, Sauces, Desserts
<b>Wheat</b> (Gliadin & Glutenin)	0.40 Whole wheat 0.25 Wheat gluten Low, because protein is limited in lysine	<ul style="list-style-type: none"> <li>• Excellent viscoelastic, thermosetting &amp; water-holding properties</li> <li>• Good flavor profile</li> <li>• Lower cost/Combine w/higher cost proteins to reduce overall cost</li> </ul>	<ul style="list-style-type: none"> <li>• Allergenicity</li> <li>• Poor water solubility</li> <li>• Poor foaming</li> <li>• Poor emulsification</li> </ul>	Bakery, Cereals, Bars, Meat substitutes, Textural meat analogs when combined with soy protein
<b>Pulses<sup>1,2</sup></b> Pea Chickpea Lentil Pinto Bean Faba Bean	At 0.5-0.6 Low, because protein is limited in sulphur-containing amino acids	<ul style="list-style-type: none"> <li>• Gelling</li> <li>• Structure</li> <li>• Set characteristics</li> <li>• Emulsification</li> <li>• Encapsulation</li> <li>• Extrusion stability</li> </ul>	<ul style="list-style-type: none"> <li>• Beany off-flavors</li> <li>• Bitterness</li> </ul>	Egg replacers (faba & pea protein), Baking, Deep-frying, Pasta, Soups, Snacks, Meat Products, Meat substitutes
<b>Hemp<sup>3</sup></b> (Industrial) <i>Cannabis sativa</i> L Flour Seed Protein isolate	0.48 (flour) 0.51 (seed) 0.44 (isolate) Oil (3:1 Omega 6: Omega 3 fatty acids) High protein w/complete amino acid profile	<ul style="list-style-type: none"> <li>• Easily digestible</li> <li>• Good fiber &amp; minerals</li> <li>• Gelling</li> <li>• Set characteristics</li> <li>• Emulsification</li> <li>• Encapsulation</li> <li>• Egg replacer</li> </ul>	<ul style="list-style-type: none"> <li>• Disassociating it with the drug Cannabis</li> <li>• Selling consumers on its health benefits</li> </ul>	Soups, Protein shakes, Energy drinks, Desserts, Salad dressings

1 PROPERTIES OF PULSE PROTEINS ARE DEPENDENT ON EXTRACTION/FRACTIONATION METHOD  
2 MOST PEA PROTEINS NO LONGER HAVE A BEANY, GRASSY FLAVOR, BUT A CLEAN TASTING PROFILE FOLLOWING WORK DONE BY INGREDIENT COMPANIES AND GROWERS  
3 LEAVES & FLOWERING HEADS CONTAIN < 0.3% TETRAHYDROCANNABINOL (THC), THE PSYCHOACTIVE COMPOUND  
SOURCE: ANUSHA SAMARANAYAKA, PH.D., POS BIO-SCIENCES /2018 PROTEIN TRENDS & TECHNOLOGIES

the solubility helps make the beverage's texture, consistency and mouthfeel more appealing to consumers.

The composition of each plant protein type differs, as does its inherent flavor and protein functionality. If changing the raw material source or the process used in protein ingredient preparation does not produce the needed flavor and texture in the final product, the food formulation stage can also be used to improve both flavor and textural issues. Approaches include incorporation of a physical or chemical process; or of additives, such as flavor masking agents, companion flavors and/or stabilizers.

Most importantly, finished formations should be presented to consumers in a way that is appealing in flavor and texture. "It's a complicated story. Growers, food chemists, ingredient manufacturers and formulation scientists have to work together to come up with these crave-worthy creations using different plant protein sources," Samaranayaka concluded.

*"Plant Proteins: Opportunities, Challenges & Tips for Successful Use in Formulations," Anusha Samaranayaka, Ph.D., Senior Scientist, POS Bio-Sciences*

**Plant proteins provide a wide array of functionalities in various applications. Properties will vary, depending on the method used to process the protein ingredient.**

### Formulating with Whey Protein for Maximum Health Benefits, Functionality and Taste

**AT THE OUTSET** of his presentation, "Formulating with Whey in a Fully Transparent Market," Chris Lockwood, Ph.D., President, Lockwood LLC, described some of the advantages that protein possesses, including its function as the only major nutrient to stimulate muscle building (muscle protein synthesis, or MPS). Just a few of the many advantages of consuming more protein, in comparison to fat or carbohydrate, is that it promotes greater thermogenic effects, hunger reduction, and body fat and weight loss when combined with a calorie-restricted diet.

Whey protein [for sports nutrition] is most often classified in one of three ways: As whey protein concentrates (WPC), whey



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	WPC	WPI	Low DH WPH (<10%)	Mod DH WPH (10-25%)	High DH WPH (>25%)
↑ Size	x		x (from WPC)		
↑ Strength	x		x (from WPC)		
↑ Performance	x		x (from WPC)		
↓ Weight				x	x
↓ Body Fat		x		x	x
↓ Aging Effects			x	x	
↑ Clinical Health				x	x
Keto Diet/Carb Restricted		x	x (from WPI)	x (from WPI)	x (from WPI)
Lactose Avoidance		x	x (from WPI)	x (from WPI)	x (from WPI)
Low Allergenicity				x	x
Affordable Price Point	x	x			
Fashion Over Function (i.e., Taste & Speed to Market Priority)	x	x	x		

SOURCE: CHRIS LOCKWOOD, PH.D., PRESIDENT, LOCKWOOD LLC/ 2018 PROTEIN TRENDS & TECHNOLOGIES SEMINAR

📌 **The type(s) of whey product selected for a formulation depends not only on the finished flavor, nutrition profile and price goals, but on the demographic target selected, as well.**

protein isolates (WPI) or whey protein hydrolysates (WPH). Filtration and other purification processes are used to produce WPC and WPI, with WPI containing 90% or higher total protein. The final composition of WPH is influenced by enzymes and reaction conditions used, as well as the number of available bonds that are broken. Generally speaking, the greater the degree of hydrolysis (DH), the smaller the number of amino acids per peptide molecule and the more challenging the taste issues.

In an overview of its beneficial effects, Lockwood noted that whey stimulates muscle growth and elicits significant anabolic response to weight training. A study designed to assess rapidly digested proteins (i.e., whey and soy) and slowly digested proteins (i.e., casein) found whey to be 93 and 18% more effective than casein or soy, respectively, for MPS in men at rest (Tang, JE, et al. 2009. *J Appl Physiol.* / <https://bit.ly/2ubvfNF>). Following exercise, whey consumption resulted in 122 and 31% greater MPS than casein or soy. “These differences have largely been attributed to how quickly the proteins are digested and the leucine content in whey,” said Lockwood. “The faster the rise in blood amino acids, the greater the peak and total MPS response,” he explained.

“Whey can improve recovery speed, so you can exercise more and recover more quickly,” noted Lockwood. He illustrated findings in a study of 10 resistance-trained men who had been supplemented with WPI, soy protein isolate (SPI) and a maltodextrin-placebo control for 14 days, and then performed an acute heavy resistance

exercise test (Kraemer WJ, et al. 2013. *J Am Coll Nutr.* / <https://bit.ly/2ubo2gq>). Whey rapidly and significantly lowered the catabolic steroid hormone cortisol during recovery, whereas soy significantly decreased the post-exercise levels of the anabolic hormone testosterone.

“The research for my Ph.D. work revealed that people consuming 30g of whey, regardless the form, twice per day, significantly increased muscle mass,” stated Lockwood. An extensively hydrolyzed WPH, also reduced body fat without significantly affecting total body weight (Lockwood CM, et al. 2017. *J Am Coll Nutr.* / <http://bit.ly/2wFSHnH>).

Further work confirmed that a moderately hydrolyzed WPH vs. its intact (nonhydrolyzed) WPC significantly elevates markers of fat and carbohydrate metabolism, and reduces markers of protein breakdown (Roberts MD, et al. 2014. *Appl Physiol Nutr Metab.* / <https://bit.ly/2KV1Vpi>).

These effects may be explained by observations showing that plasma amino acids rise more rapidly as a result of some forms of WPH, compared to when consumed as an intact WPC (Morifuji M, et al. 2010. *J Agric Food Chem.* / <https://bit.ly/2NuaJkh>). “A study in 10 men also found that whey provided a significantly greater stimulation of insulin release than soy, and that the moderately hydrolyzed WPH tested was significantly more insulinotropic than intact whey. This collectively suggests that certain peptides and the amino acid composition unique to whey—and not just leucine or its fast absorption—as being behind this protein’s superior effects on human physiology,” Lockwood stated.

Lockwood acknowledged that there has been a movement to plant-based proteins by the food industry for many reasons. However, he stressed that “whey is the bodies first protein—it is the predominate protein in mother’s milk to support offspring development and growth.” Additionally, Lockwood indicated that whey is vegetarian; sustainable and renewable; can be certified non-GMO and/or organic; and is gluten-free.

There are many categories of whey available, and Lockwood noted that his research used a 32-degree DH derived from an 80% whey protein concentrate, “which is about as high as you’ll want to go, because the bitterness becomes overwhelming,” he noted. And, although less allergenic and seemingly more efficacious in

terms of overall clinical health outcomes, the higher the DH, the more expensive the product becomes. When a combination of a favorable taste profile plus speed to market are considerations, the best options include WPC, WPI and low-DH (<10%) WPH.

*“Formulating with Whey in a Fully Transparent Market,” Chris Lockwood, Ph.D., President, Lockwood LLC*

## The Value of Protein on Muscle Health During Aging

**RECENT ADVANCES** in research show protein’s potential to improve health status in aging adults, according to Douglas Paddon-Jones, Ph.D., FACSM, Department of Nutrition and Metabolism; Center for Recovery, Physical Activity and Nutrition; The University of Texas Medical Branch, Galveston, who spoke on the topic “Nutrition Strategies to Protect Muscle Health During Aging: The Value of Protein.” The most effective interventions to reduce muscle loss during aging include physical activity, overall nutrition and protein, he stated.

Paddon-Jones’s research has shown that the ingestion of sufficient protein is important for muscle protein synthesis (MPS) and maintenance of muscle mass and function. He described a study that looked at MPS in healthy young (41 years +/- 8) and elderly (70 years +/- 5) adults (Symons, TB et al. 2007. *Am J Clin Nutr.* / <https://bit.ly/2yu8Gt7>). Basal MPS was measured prior to and after the consumption of a 4oz serving of lean beef containing 30g of protein. “Very encouraging results showed that decrements in MPS did not occur in the elderly,” noted Paddon-Jones. “There



■ Paddon-Jones’s research looked into whether leucine could protect skeletal muscle during bed rest. The amino acid prevented an increase in body fat percentage and reduced whole-body lean mass loss after seven days, but not at 14 days of bed rest.

was a 50% increase in MPS, suggesting that aging doesn’t impair the ability of the body to build and repair muscle.”

Recognizing that typical intakes of protein are much greater than 30g, further research sought to compare changes in MPS following a single moderate serving (113g; 220Kcal; 30g protein) or large serving (340g; 660Kcal; 90g protein) of lean beef in young and elderly adults (Symons et al. 2009. *J Am Diet Assoc.* / <https://bit.ly/2tg5yfm>). Despite a threefold increase in protein and energy content, there was no further increase in MPS. “This is a powerful example that suggests an ‘intake ceiling’ of 30g of protein for optimum muscle building,” he said.

The synergistic effects of resistance exercise and a protein-rich meal on MPS has been evaluated (Symons, TB, et al. 2011. *J Nutr Health Aging.* / <https://bit.ly/2u3xi6s>). Following ingestion of 340g lean beef and resistance exercise (knee extensions) in healthy young (29 years ±3) and older (67 years ±2) adults, Paddon-Jones reported that “the results were encouraging, as muscle building increased by approximately 108% in young and older adults following the protein and resistance exercise.”

“Our research suggests that protein intake should be optimized at every meal to positively impact MPS,” noted Paddon-Jones, “If you are consuming 65g of protein at dinner, your muscle is only using 50% of this.” His research has also shown that MPS is blunted in the elderly, when the quantity of protein is less than about 20g per meal (Paddon-Jones D and Rasmussen, BB. 2009. *Curr Opin Clin Nutr Metab Care.* / <https://bit.ly/2s6ClC1>).

### Leucine Content of Proteins

Protein Source	Leucine
Whey Protein Isolate	13%
Milk Protein	10%
Egg Protein	8.5%
Muscle Protein	8%
Soy Protein Isolate	8%
Wheat Protein	7%
Collagen	2%

SOURCE: DOUGLAS PADDON-JONES, PH.D., DEPT. OF NUTRITION AND METABOLISM, THE UNIVERSITY OF TEXAS MEDICAL BRANCH/2018 PROTEIN TRENDS & TECHNOLOGY SEMINAR

■ **Supplementation of the amino acid leucine, a stimulator of MPS, could possibly protect muscle health during short periods of inactivity.**





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Bed rest has a profoundly negative effect on muscle metabolism, mass and function in adults. In one study, patients remained in bed 95% of the time over four days with no activity. The remaining 5% of the time involved only about 15 steps per minute, resulting in rapid muscle atrophy. Middle-aged adults showed few phenotypic signs of aging, yet they may be more susceptible to inactivity than younger adults (English et al. 2016, *Am J Clin Nutr.* / <https://bit.ly/2K6LO7z>).

“We need to start focusing on muscle health the same way as we do bone health,” Paddon-Jones stressed.

Nutrition is one area where a difference can be made. Paddon-Jones’s research also examined whether leucine, a branch-chain amino acid and stimulator of skeletal MPS, can protect skeletal muscle health during bed rest (English et al. 2016 / <http://bit.ly/2OqoSC8>). Middle-aged adults (52 years ± 1) were supplemented with leucine (0.06g/kg/meal or about 4g/meal) or an alanine control during 14 days of bed rest. Bed rest decreased post-absorptive MPS by 30% ± 9% (Control group) and by 10% ± 10% (LEU group). Leucine protected knee-extensor peak torque and endurance. “Interestingly, leucine prevented an increase in body fat percentage and reduced whole-body lean mass loss after seven days,” noted Paddon-Jones, “but not at 14 days of bed rest. Perhaps leucine supplementation could partially protect muscle health during relatively brief periods of physical inactivity,” he concluded.

*“Strategies to Protect Muscle Health During Aging: The Value of Protein,” Douglas Paddon-Jones, PhD, Professor, Department of Nutrition and Metabolism, The University of Texas Medical Branch*

## Proposed Non-GMO Labeling and Certification Options

**WHILE NON-GMO** claims are fast growing, the regulatory landscape is unclear. Nancy Knight, Director of Quality and Regulatory Compliance, Orgain, Inc., discussed current challenges, as well as options for non-GMO labeling in her presentation “Non-GMO Transparency: Understanding Your Options.”

The final rule for the National Bioengineered (BE) Food Disclosure Law is expected to be issued later this year. The Agricultural Marketing Service of USDA comment period ends July 3, 2018. Federal law pre-empts state law. Knight en-



Consumers may find some of the USDA’s proposed new symbols for bioengineered foods confusing, particularly the “smiley face,” which implies positivity and acceptance of GMOs, some complained. Comments to the proposed rule were due July 3, 2018. The final ruling is expected late 2018.

courages companies whose brands might be affected to read the lengthy rule.

USDA is silent in the regulation regarding third-party, non-GMO certifications. The proposed rule requires GMO ingredients to be labeled if they ARE in the product. Third-party certifications indicate that GMO ingredients AREN’T in the product. Whether the two approaches to labeling will align is still a grey area.

FDA’s guidance for voluntary labeling was issued November 2015. Certain terms are recommended, such as “not genetically engineered,” “not bioengineered” or “not genetically modified using modern biotechnology.”

The guidance emphasizes avoidance of “GMO-free” claims and to avoid intervening material in the list of ingredients, such as “non-GMO corn.” Knight reasoned that FDA views this as a gateway labeling violation. “In (and of) itself, it’s not that big of a deal,” she said, “but it may indicate that you have people on your staff who don’t know much about labeling.”

Companies seeking non-GMO verification have choices. The nonprofit Non-GMO Project is highly recognized. Their logo has earned consumer trust and retail promotion. They stand by their standards. “The Non-GMO Project thought it important that I state that they are looking at new technologies [used by the industry],” she said. CRISPR and novel technologies will not be able to be certified under the standard.

The process to achieve certification begins with selecting a technical administrator (TA) who is affiliated with an outside agency. The Non-GMO Project requires a license agreement. The TA will complete a product evaluation. Once verified, products will be eligible for marketing. Verification is renewed annually. She cautions it can take four weeks or (up to) a year and a half to get through the process.

“I can’t stress enough how the key to success is partnering with the right TA. Everyone has a different competency. If you [use] citric acid, for example, see if they have certified citric acid before.” TAs must understand how products are made, so it can avoid a

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lot of education and loss of time if they've worked with the product before.

Food Chain ID, NSF, Where Food Comes From and SCS Global are all TAs. Food Chain ID has the longest history of verification. She recommends interviewing the TAs, getting pricing and negotiating. "If you're big enough, say you want a project manager. Tell them your timeline. The flip side is, make sure someone in your organization is up to speed on the standards and knows what type of documentation is required," she said.

Other options to the Non-GMO Project include USDA Organic and USDA Process Verified. NutraSource I-Gen, a testing lab, is another alternative with fewer documentation requirements. NSF True North was created in collaboration with Whole Foods. Available to other companies, its advantage is ease of certification if already organic.

Some companies do not follow a certification route and use their own logos. This is acceptable, as long as it meets FDA's definition of what is truthful and not misleading. Some retailers require third-party certification.

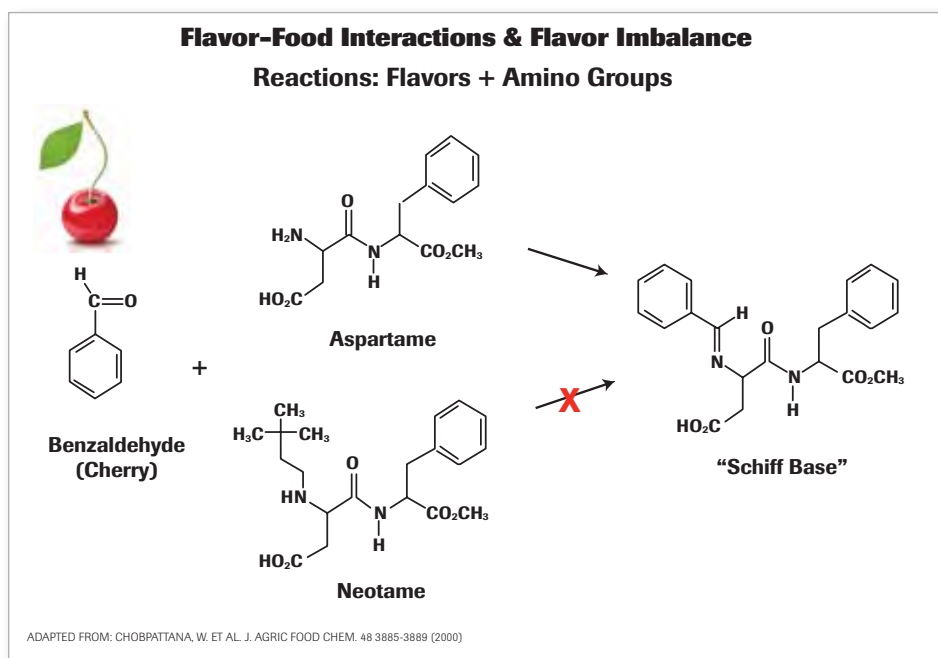
Nevertheless, USDA guidance is coming. "You don't want to go down the path of a third-party certification that may be inconsistent," she cautioned. "Some companies, like Whole Foods, are pausing until the rule is clear. They still want third-party verification, but ingredient statements might be affected by the rule."

*"Non-GMO Transparency: Understanding Your Options," Nancy Knight, Director of Quality and Regulatory Compliance, Orgain, Inc.*

## Complications of Formulating Flavors with Protein

**NO FOOD INGREDIENT** may be more influential than flavors. "We make selections about taste and preference of food based on these small sets of molecules that are barely perceptible and measurable," said Robert McGorin, Ph.D., CFS, Department Head and Jacobs-Root Professor, Food Science & Technology, Oregon State University, in his presentation "Protein + Flavor = A Formulation Challenge."

Creating the right balance of flavors is especially demanding when developing high-protein foods. The addition of protein may alter the flavor by either adding off-flavor notes, such as beany or bitter



Aldehydes will chemically react with proteins to form irreversible bonds called Schiff bases. In this diagram, benzaldehyde (cherry flavor component) reacts with aspartame, a protein dipeptide. The reaction degrades at 8% per month, resulting in complete loss of cherry flavor and sweetness after a year. Neotame can block this reaction.

types often associated with soy protein, or by causing astringency, which falls into the category of chemesthesis, producing a chemical sensation. Proteins may also change the flavor profile through flavor interactions, flavor binding or flavor release, McGorin noted.

The type of protein can pose a challenge. "Soy, whey, casein, pea, rice, depending on how they are heated—high temperature-short time or ultra-high temperature—can bring in notes we describe as burnt, caramelized, nutty, beany, sulfuric or bitter. Amino acids also provide their own bitterness and metallic off-flavors," said McGorin.

Because proteins are good at binding and absorbing flavor, any sensory evaluation done on a new formulation should be delayed for at least a week to give the flavor a chance to equilibrate. It is important to "bucketload" the formulation with flavor at perhaps four to 10 times the initial quantity needed to basically titrate the active sites on the proteins until that equilibrium point is reached, cost permitting, noted McGorin. "You have to compensate for flavor loss." Flavor in clear beverages may be affected by incorporating hydrolyzed protein. These systems require less flavor, because less binding occurs with these proteins, but McGorin cautioned that more off-flavor defects may be present.

Factors, such as pH, can also influence the protein's contribution to flavor. Beverages at a pH of 3.5 can accentuate more off-flavor defects (e.g., bitterness, astringency, chalkiness). The optimum pH to avoid a gritty texture or astringent taste is pH 6-7. However, "pH 3.5 is best with citrus beverages to make orange and lemon flavors pop," explained McGorin.



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Flavor requirements are also dependent on the food product. For example, water activity ( $a_w$ ) is very influential. Protein bars have low moisture ( $a_w = 0.2$ ), undergo non-thermal processing and are stored at room temperature. Conversely, protein beverages are high moisture ( $a_w = 1$ ), are thermally processed and are stored in refrigeration. However, their flavors are unstable, because they are more reactive in solution—finding mobile sites to bind to on the protein; and flavor scalping, or muting, can also occur as protein absorbs the flavor, McGorin noted.

Flavor masking is a technique used to minimize inherent protein off-flavors. Sweetener modifiers/enhancers or bitter blockers can often help mask off-flavors, as well. Sodium chloride, monosodium glutamate and adenosine monophosphate are examples of bitter taste receptor blockers. Vanilla or peach flavor may help mask beany notes from soy protein. Using a complementary flavor is another method used to mask off-flavors. For example, pea protein contains earthy notes. Soy has beany notes. These flavor notes are also common in peanuts, so adding peanut or nut flavors complements and helps mask these off-notes by creating flavor synergy.

Instead of masking undesirable notes, flavor completion or insertion allows these notes to become part of the flavor system. McGorin gave the example of undesirable green notes in soy protein. By adding a “jammy-style” strawberry flavor that lacks green notes to the flavor system, the green notes inherent in soy protein complete the perception of the strawberry flavor profile.

McGorin stressed the importance of involving the flavor supplier to reduce development time. Formulation secrets need not be revealed; but, process method, storage environment, moisture content, pH, added vitamins, presence of high-potency sweeteners and percent protein will help identify an appropriate flavor choice early on, he added.

*“Protein + Flavor = A Formulation Challenge,” Robert J. McGorin, Ph.D., CFS, Department Head and Jacobs-Root Professor, Food Science & Technology, Oregon State University*

## Accuracy in Protein Labeling: Following the Letter of the Law

**WHEN IT COMES TO** labeling, given the litigious society we live in, food and ingredient manufacturers have more to worry about than government oversight from the FDA and FTC. “The FDA looks at your labeling; the FTC looks at your advertising. Most of your labeling is also your advertising. So, you can count on both the FDA and the FTC to look at anything you put out there about your product,” said Justin

Prochnow, Stockholder, Greenberg Traurig, LLP, in his presentation “Protein Quality and Labeling: Defending Attacks from Regulators, Attorneys and Competitors.”

Any product-related material is subject to oversight, including labels, brochures, website and media. If a website address appears on a label, or if products are sold from a website, then that website is considered labeling. Anything found on the site is viewed as if it was directly on the product.

Disputes between competitors, typically involving comparative claims, may be heard by the Advertising Self-Regulatory Council, an arm of the National Advertising Division (NAD), which also hears disputes from consumers regarding advertising claims. Yet, it’s the State Attorney Generals and District Attorneys that have captured the spotlight by essentially forming “cabals” of offices that have pursued companies, noted Prochnow. “We’re dealing with a case right now with 13 different States’ Attorney Generals who have piled on. They’ll send you a letter stating you’re making these 15 claims for six of your products. They want to see the science and the substantiation for those claims. And, if you don’t have it, then they’re looking to settle out the same as some of these plaintiff lawyers,” Prochnow added. Meanwhile, the plaintiff attorneys are busy forming class action lawsuits on behalf of consumers for false or misleading claims.

In dealing specifically with protein declarations per 21 CFR 101.9(c) (7), companies should be well versed in the Daily Recommended Value (DRV) of protein at 50g per day; how to express the number of grams per serving on the Nutrition Facts panel; and whether the daily value percentage (DV%) must be included. The DV% for protein must be included in the Nutrition Facts or Supplement Facts Panel when a protein claim is made, even if that claim is on the front of the package. By not following these rules, companies leave themselves open to lawsuits, which costs both time and money.

Any protein content per serving greater than 1g should be rounded to the nearest whole number. “While the FDA isn’t going to put yellow tape on a product that has 2.7g protein on their label, what it tells the FDA is that whoever’s responsible for labeling didn’t know what they were doing,” said Prochnow. A violation such as this gives the FDA pause, possibly opening the door to further scrutiny in other areas of the business, such as manufacturing.

In the U.S., protein quality—considered a critical attribute—is based on the Protein Digestibility-Corrected Amino Acid score (PDCAAs), which evaluates the quality of a protein based on both the amino acid requirements of humans and their ability to digest it. A protein score of 1 means that the source of protein provides 100% of the amino acid requirements. As various sources of proteins have different PDCAAs, companies need to be cautious when assessing the DV% of protein in its products. Both cows’ milk and soy protein have a PDCAAs of 1, but



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SOURCE: JUSTIN J. PROCHNOW, SHAREHOLDER, GREENBERG TRAURIG, LLP / 2018 PROTEIN TRENDS & TECHNOLOGIES SEMINAR

■ **Plant protein powders could inherently have some lead or cadmium from soil, requiring use of the Prop 65 warning label when sold in California. As of August 30, 2018, Prop 65 warnings must include the caution triangle and the identification of at least one chemical.**

protein from peanuts have half as much at 0.52 PDCAAs. Therefore, a product containing 10g of whey protein has a DV% of 20%, which allows for a “high” or “excellent” source of protein claim, while a product with 10g of peanut protein has a DV% of 10%, and thus supports a “good” source of protein claim.

Three types of claims are permitted for foods, beverages and supplements—nutrient content, structure-function and health claims. Nutrient content claims are the hardest cases to defend (i.e., you either have the amount of nutrient advertised or don’t), noted Prochnow. The types of nutrient content claims permitted are well-defined per 21 CFR 101.54. For instance, descriptions such as “rich in,” “high” or “excellent source of” mean there is a least 20% of the RDI or DRV of the nutrient per Recommended Amount Customarily Consumed (RACC). And, these descriptions are only allowed for ingredients that have an RDI or DRV. Words such as “good source,” “contains” or “provides” mean there is 10-19% of the RDI or DRV per RACC. And, “more,” “fortified,” “enriched,” “added,” “extra” and “plus” mean there is a least 10% or more of the RDI for vitamins/minerals per RACC than in a reference product. The product must also comply with fortification policy.

Structure-function claims are those basic, “building block” statements relating to the aroma, taste or nutritive value of an ingredient that describe its effect on the structure or function of the body. “The number-one statement to think about when you’re making claims is that you cannot sell a non-drug product to diagnose, treat, cure or prevent a disease,” emphasized Prochnow. A permissible statement might be, “25 grams of soy protein help support lean muscle and strength.” Per the FDA, a claim must be tied to a nutritive value. Claims not associated with the nutritive value of an ingredient, but rather the ingredient itself, are not permissible, he added.

If a food or beverage is sold with the disclaimer label stating it has not been approved by the FDA, and is not intended to diagnose, treat,

cure or prevent a disease, the FDA will again assume that whoever reviewed and approved these labels didn’t know what they were doing, as that disclaimer is only permitted on dietary supplements. While the FDA may not take specific action on the product, other than sending a warning letter, they may decide to take a closer look, Prochnow noted.

Substantiation of a claim can’t be based on personal experience, opinion or customer testimonials, but instead must rely on competent and reliable science. What then defines competent and reliable science? The Gold Standard is a double-blind, placebo-controlled, clinical trial on the product or a combination of ingredients. And, the amount of the ingredient or level of nutrient used must be the same as that used in the study. “This (policy) is often used to prevent what the FDA often calls the ‘fairy dust rule,’ which is when companies ‘sprinkle’ a small little bit of the ingredient in the product, so they can tout that it’s there, when they know there’s not actually enough in the product to provide the benefits they’re talking about,” Prochnow said.

“Whether a claim about an ingredient is on your website or your label, it represents a claim for your product as a whole, because what the FDA and the FTC say—and of course they’re right—is there’s no reason for you to be talking about those benefits, other than to imply that your product, with those ingredients, offers those benefits,” Prochnow added.

Most importantly, when it comes to product labeling and protein claims, you need to be well-informed. Sometimes, a food or ingredient company’s marketing department refers to our regulatory services as the “sales prevention team,” joked Prochnow. We prefer to think of our efforts as the “jail prevention team.” Either way, information and accuracy keep the ball in your court, he concluded.

*“Protein Quality and Labeling: Defending Attacks from Regulators, Attorneys and Competitors,” Justin J. Prochnow, Shareholder, Greenberg Traurig, LLP, [www.GTLaw.com](http://www.GTLaw.com)*

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Formulate for “excellent source of protein,” “high in protein,” “added protein,” “non-GMO,” “gluten-free” and “sustainably sourced” claims. VITESSENCE™ Pulse protein isolate delivers 80% protein content to help enable protein claims. Through our partnership with AGT Foods, Ingredion offers a comprehensive line of pulse protein concentrates and flours—including clean-taste options. VITESSENCE Pulse protein concentrates help deliver nutritional balance and excellent functionality. HOMECRAFT® Pulse flours help boost the nutritional profile of your formulations, while supporting gluten-free claims. [www.ingredion.us](http://www.ingredion.us)



**Agropur Ingredients** is a global supplier of ingredients and services developed to create success in the food, beverage and nutritional industries. Whether sourcing ingredients or offering finished products, Agropur Ingredients has vast expertise in health, wellness and functional applications. [www.agropur.com/en-us](http://www.agropur.com/en-us)

## 6th Annual



**Sophisticated Solutions  
for Simplified Products**

**March 25 - 27, 2019**  
**Westin Hotel, Itasca, Ill. USA**

Efforts to formulate packaged foods, beverages and nutritional products with consumer-friendly ingredients continue to grow. The 2019 Clean Label Conference focuses on providing practical advice to R&D and application scientists working to simplify ingredient statements.

**NEW! Pre-conference  
Workshop (free):  
Formulating with  
Natural Colorings**

**10 General Session  
Speakers**

**18 Technology  
Snapshot  
Presentations**



[globalfoodforums.com/2019-clean-label](http://globalfoodforums.com/2019-clean-label)



## Additional Resources



### 2018 New Innovative Protein Product Sampling Station

Have you tried Beyond Meat's The Beyond Burger with pea protein isolate

or Genuine Health's Fermented Vegan Proteins + with fermented pea protein isolate, brown rice protein concentrate, as well as fermented proteins from hemp seed, quinoa and alfalfa, among others? How about Vital Proteins' Collagen Creamer or Snickers' Protein Milk Chocolate Bar milk protein isolate, milk protein and whey protein concentrates? Some 26 on-trend and/or innovative products were available for sampling at the 2018 Protein Trends & Technologies Seminar. See the product list, along with their ingredients and Nutrition or Supplement Facts panel information, at <http://bit.ly/2oRhlf>. See the slideshows and information on products showcased in previous New Innovative Protein Products Sampling Stations for 2017 (<https://bit.ly/2Mb1yU4>) and 2016 (<https://bit.ly/2MaRyr>).

### Looking Ahead

Our next Protein Trends & Technologies Seminar will take place Spring 2019 at the Westin Hotel, Itasca, Ill., USA. On May 21, 2019, the Pre-conference: Business Strategies program will look at factors impacting the global protein ingredient market. On May 22, the Technical Program: Formulating with Proteins will provide R&D and application food scientists with practical, non-commercial advice on how to work with protein ingredients in a range of foods, beverages and nutritional products. Keep updated at [www.globalfoodforums.com/2019-protein-seminar](http://www.globalfoodforums.com/2019-protein-seminar).

### From the [Web] Pages of Protein Trends & Technologies News Bites

A recent study found that whole eggs spur more muscle synthesis than egg whites. While the effect of the consumption of isolated protein sources dissolved in liquid beverages has been documented, the impact of consuming a food, such as whole eggs, on postprandial protein metabolism has rarely been studied. Recent research put this question squarely in the forefront. See more information at <https://bit.ly/2oPYmUD>.

## Global Food Forums' Online Library

### COMPLIMENTARY

- Post-conference Summaries
- Conference Presentations
- 2013—Current Year

### NOW WITH FASTER DOWNLOAD SPEEDS!

Practical, non-commercial formulation advice. Consumer & new product trends. Nutrition, sensory & regulatory insights. Ingredient supply chain issues. Emerging ingredient technologies.



### TOPICS

#### CLEAN LABELS

<http://bit.ly/2NyEnHN>

#### PROTEIN TRENDS & TECHNOLOGIES

<http://bit.ly/209Qrwb>

#### SWEETENER SYSTEMS

<http://bit.ly/2CJC4xE>



Global Food Forums® Inc. Events

# Enabling the next generation of protein



Givaudan is the global leader in the creation of flavors and tastes. In close collaboration with food and beverage partners, we develop tastes that delight consumers the world over.

With a passion to understand consumers' preferences and a relentless drive to innovate, Givaudan is at the forefront of creating flavors that "engage your senses."

Strategically focused on Health and Wellbeing, Givaudan is investing in advanced solutions for flavorful high protein products and next generation protein sources.



# PROTEIN TRENDS & TECHNOLOGIES SEMINAR

[www.globalfoodforums.com/ProteinSeminar](http://www.globalfoodforums.com/ProteinSeminar)



## CLEAN LABEL CONFERENCE

[www.globalfoodforums.com/CleanLabel](http://www.globalfoodforums.com/CleanLabel)

## SWEETENER SYSTEMS CONFERENCE

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