

2023 CLEAN LABEL CONFERENCE

“SOPHISTICATED SOLUTIONS FOR SIMPLIFIED PRODUCTS”

What's Inside on Clean Labels...

- The Importance of Clean Labels to Consumers
- The Latest on Labeling Claims from “Healthy” to Eco-Friendly
- Clean Label Bitterness Blockers
- Case Studies: Supply Chain Disruptions & Clean Labels
- Strategic Food Structures for Plant-based Formulations
- Protein Claims Using “Clean Label” Ethical Analysis
- Changing Consumer Attitudes Toward Food & Technology
- Challenges and Opportunities of Upcycled Ingredients and Foods
- Formulating Through Supply Chain Disruptions
- Low-Calorie Sweeteners' Health Impact
- A Practical Approach to Delivering Sweet Flavor
- The Reality of Trace Elemental Contaminants
- Clean Label Impact on Consumer Buying
- A Holistic Formulation Approach to Clean Label Products
- 2023 Technology Snapshot Ingredients
- Magazine Sponsor Profiles

ADDITIONAL COPIES ONLINE AT

globalfoodforums.com/global-food-forums-magazines/

Note: This digital magazine, initially posted at <https://GlobalFoodForums.com>, is now at <https://foodtrendstech.com/global-food-forums-magazines/>

A GLOBAL FOOD FORUMS[®], INC. EVENT



Let's Partner For Great Taste

Discover our unique blend of art, science & innovation.

At Sensient, we take a collaborative approach—bringing together expertise, insight and technologies to creatively solve your toughest taste challenges and get you to market faster.

Let's be taste buds!



Get in touch with us today and let's start the conversation.
1.888.200.9211 | flavors.info@sensient.com
www.sensientflavorsandextracts.com/partnerships

**SENSIENT®**

2023 CLEAN LABEL CONFERENCE MAGAZINE

Sophisticated Solutions for Simplified Products



On May 23-24, 2023, in the Chicago area, Global Food Forums held its 8th in-person conference focusing on clean labels. In 2012, we had been unsure whether the term “clean label” accurately described the phenomena taking place or if the expression would have staying power. However, the term has remained relevant by becoming mainstream with a growing consumer base and by expanding its meaning to include increased responsibility for the environment, animals and fellow humans.

This magazine touches on this year’s program covering applied food and sensory science in areas like reducing sugar, formulating plant-based meat alternatives and heavy metal contaminants (an ultimate “free from” goal). Deep dives into nutritional and labeling



issues; changing consumer attitudes; real-world advice on unique R&D challenges; and the use of upcycled ingredients are also provided for our R&D audiences.

Warm regards,

Claudia O’Donnell & Peter Havens

Co-owners, Global Food Forums, Inc.

SPONSORS OF THIS 2023 CLEAN LABEL CONFERENCE MAGAZINE

SPONSOR	PAGE
Sensient Flavors	2
Nexira	5
Ribus	6
Idaho Milk Products	8
Munzing	12
Applied Food Sciences (AFS)	15
Ingredient	17
Culinex	19
Farbest	21
Siemer Specialty Ingredients	22
Silky Sweet	26
Incredo Sugar	28
Evergrain	33

Global Food Forum Team

Claudia Dziuk O’Donnell, Co-owner & Summary Writer |

<https://www.linkedin.com/in/claudiaodonnell/>

Peter Havens, Co-owner |

Peter@globalfoodforums.com | 630.621.0230

Jennifer Bogdajewicz Stricker, Conference Manager |

jenniferstricker2009@gmail.com |

<https://www.linkedin.com/in/jennifer-bogdajewicz-stricker/>

Paula Frank, Content Manager, Summary Writer |

paula@franklyspeakingtech.com

Barbara Nessinger, Copy Editor

Ashley Dziuk, Summary Writer

Wendy Bedale, Summary Writer

Kelley Fitzpatrick, Summary Writer, NutriScience Solutions, Inc.

Sharon Gerdes, Summary Writer, SKGerdes Consulting, LLC

Lauren Swann, Summary Writer, Concept Nutrition, Inc.

Peter O’Donnell, Cover Design

Global Food Forums, Inc.

P.O. Box 686, Farmington,

CT 06034 USA

www.globalfoodforums.com



The contents of this publication are copyrighted. Reproduction, in whole or in part, is not permitted without the written consent of the owners of Global Food Forums®, Inc. (Contact Peter@globalfoodforums.com.) To reference materials, at minimum, please attribute the speaker; their affiliation; and 2023 Clean Label Conference Magazine.

TABLE OF CONTENTS

- 5 Clean Label: What Matters to Consumers?**
Stephanie Mattucci, CFS, Director, Food Science, Mintel
The definition of what's clean label has evolved. What are consumers seeking?
- 7 The Latest on Labeling Claims from "Healthy" to Eco-Friendly**
Lauren Swann, MSc, RD, LDN, CEO and President, Concept Nutrition, Inc.
FDA takes steps to regulate E-commerce to ESG symbols and claims.
- 9 Natural Bitterness Blockers: Neuroscience, Ingredient Technologies, Applications**
Alex Woo, Ph.D., CEO and Founder, W2O Food Innovation
Advice on masking & bitterness-blocker categories, as well as ingredient choices.
- 10 Formulation Strategies & Solutions for Ingredient Cost Increases & Disrupted Supply Chains**
Jaime Reeves, Ph.D., Executive Vice President, Product Development & Commercialization, Mattson
Case studies on an RTD beverage and a clean label frozen side dish.
- 11 Strategic Use of Food Structures for Superior Plant-Based Formulations & Cleaner Labels**
Jeff Casper, MSc, Partner, Voyageur Foodworks
Nontraditional protein sourcing & processing requires unique approaches to assembling protein foods.
- 13 Ethical Analyses and Labeling for Protein Claims**
David Plank, WRSS Food & Nutrition Insights/Senior Research Fellow, Dept. of Food Science and Nutrition, University of Minnesota
Update on progress toward non-animal testing and why it is needed.
- 14 Food and Technology 2023: Consumer Trends and Tensions**
Shelley Balanko, Ph.D., Senior Vice President, The Hartman Group
Growing food system challenges lead younger generations to look to food technologies.
- 18 Upcycled Ingredients and Food Products: Challenges and Opportunities for Product Developers**
Jonathan Deutsch, Ph.D., CHE, CRC, Professor and Director, Food Entrepreneurship and Innovation Programs, Dept. of Food and Hospitality Management, Drexel University & V.P. Upcycled Food Foundation Board
Advice on expanding the use of upcycled ingredients in the food industry.
- 19 Practical Insights to Formulating with Supply Challenges**
Michelle Tittl, ACAP, BS, Product Development Manager, CuliNEX
General strategies to specific examples given in three case studies.
- 20 A Holistic Formulation Approach to Clean Label Products**
Lucile Jarry, MSc, R&D Manager - Food Brands, The Hain Celestial Group
Development teams must align with cross-functional teams on a project's scope. Two case studies.
- 23 Low-Calorie Sweeteners' Impact on Blood Glucose, Hunger, Weight & the Microbiome**
Richard Mattes, Ph.D., RD, Distinguished Professor of Nutrition Science at Purdue University, Affiliated Scientist at the Monell Chemical Senses Center
Research into LCSs' health benefits challenges some current views.
- 24 Blending Culinary & Food Science: Innovative Approaches to Sweetness**
Zal Taleyarkhan, Corporate Research Chef & Jenn Farrell, Director of R&D, Charlie Baggs Culinary Innovations (CBCI)
Fibers, proteins, fats & salt, as well as flavor enhancers, all play a role in sweetness.
- 25 Heavy Metals—Closer to Reality**
Walt Brandl, Regional Director of Chemistry & Bill Adams, MBA, Product Manager North America—Mérieux NutriSciences
Heavy metal analysis, current regulations and areas of interest.
- 27 Clean Label Trends & Consumer Purchase Behavior**
Kasey Farrell, Senior Manager of the Product Intelligence R&D, SPINS
What categories, sweeteners and attributes are finding success?
- 29 2023 Technology Snapshot Ingredients**
- 31 Magazine Sponsor Profiles**

The Importance of Clean Labels to Consumers

OPENING HER TALK, "CLEAN LABEL: WHAT MATTERS TO CONSUMERS," given at the 2023 Clean Label Conference, Stephanie Mattucci, CFS, Director, Mintel, stated, "Clean label is, and always has been, about health and safety. [This is especially important] now, with the advent of climate change and the after-effects of the Covid-19 pandemic."

The trend to clean labeling began about 10 years ago and focused on simple, "real" and natural ingredients and easy-to-understand messaging. It also emphasized what wasn't in the product, said Mattucci. As "natural" is ambiguous in the U.S., there has been a shift to clean labels and free-from claims, including no-GMO and no additives/preservative statements.

Clean Label Expansion

The clean label concept has expanded to include processing, packaging, and ethical and environmental concerns. "Ethical and environmental claims are growing," noted Mattucci, "with messaging increasing around human welfare; giving back to communities; and ensuring sustainable habitats and resources."



Mintel's Stephanie Mattucci noted that from 2018 to 2022, there was an increased percentage of food and drink launches with claims related to "Recycling," "Environmentally Friendly Product," "Sustainable (Habitat/Resources)" and "Vegan/No Animal Ingredients."

Mintel data reveals three current and future trends: minimalist messaging, conserving resources and keeping people and the planet safe. For minimalist messaging, Mattucci suggests "paring down label information to better connect with overwhelmed consumers," focusing on the critical benefits of package labeling and saving stories for websites, social media and marketing.

naltive

locust bean gum

CRYSTAL SIZE CONTROL

CREAMINESS

STABILITY

MOUTHFEEL

ROUNDNESS

SPREADABILITY

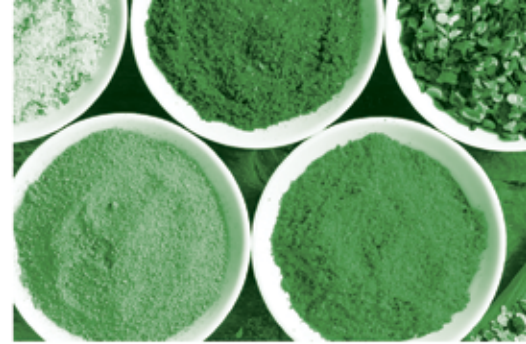


CREATE THE PERFECT SENSORY EXPERIENCE

www.nexira.com • info@nexira.com

This communication is not intended to the final consumer. It provides scientific information for professionals only. Communications to the final consumer have to be checked according to local regulations in force, since the conditions of use are beyond our control.

nexira
Innovation Inspired by Nature



The Original
Clean Label
 Ingredient Company™



RIBUS®

Founded in 1992 as a functional ingredient manufacturing company, RIBUS, Inc. supplies natural and organic plant-based ingredients to food, beverage, dietary supplement and pet companies around the world. The foundation of our business is to provide clean label alternatives that can help solve production issues and bring innovation to your products, while removing synthetics.

RIBUS.com



With ongoing inflationary concerns, Mattucci recommended that the industry could assist consumers in stretching their budgets by driving value through versatile ingredients that support long-lasting products and curb food waste.

“Although consumers may not yet be looking to reduce nutritional waste, how processing can preserve nutritional qualities will become more important in the future,” advised Mattucci.

Responsible Manufacturing

The urgency to act on environmental and social issues is becoming more critical, and consumers are looking for manufacturers to be more responsible. The impact of transportation on carbon footprints and emissions is more top-of-mind for consumers than in the past.

“Water awareness creates new advantages for concentrated products,” noted Mattucci, “we anticipate newfound appreciation for concentrates and dehydrated formats, such as their ability to reduce carbon footprints.”

Mintel’s data indicates that more respectful use of resources will become a priority. As climate change challenges ecosystems, future foods must tolerate a range of temperatures, water and soil conditions, and other environmental factors.

“Sustainability will move from a ‘nice to have’ to a ‘must have’ for innovation,” noted Mattucci; “‘Do no harm’ means putting people and the planet first.”

Packaging must also be addressed for a product to be “authentically clean.” Environmental contamination from plastics and PFAS will keep packaging at the forefront of the clean label debate. Mattucci reported that 28% of U.S. adults try to avoid per- and poly-fluoroalkyl substances (PFAS).

Next-Level Sustainability Counts

Mintel has found the importance of next-level sustainability practices that consider human welfare, not only animal welfare, with messaging about the treatment of farmers. Mattucci noted, “48% percent of U.S. consumers say that companies are most responsible for ensuring fair conditions and fair pay for workers.” Chobani was provided as an example. The company has adopted a \$15 starting wage for its employees to reduce hunger among its workers.

“By communicating its pay policy, Chobani points out that the minimum wage is not sufficient for a decent life,” observed Mattucci. “Chobani’s point of view is shared by 79% percent of U.S. consumers who, during the pandemic (Sep 2020), said that essential workers were underpaid and underappreciated.”

In concluding her talk, Mattucci stressed that today’s safety concerns related to clean labels are expanding beyond ingredient statements to include important

issues such as sustainability, clean agriculture, and the welfare of animals, farmers and workers. Companies must ensure that label claims make a difference to connect with cynical consumers.

“Sustainability initiatives will need to be about improving the future of people and the planet for the long term,” stated Mattucci. “Past processing has led consumers to have safety concerns about plastics and chemicals in the food supply, illustrating that personal health is tied to the planet’s health.”

“*Clean Label: What Matters to Consumers*,” Stephanie Mattucci, CFS, Director, Mintel, <https://www.mintel.com>

Progress on Clean Label Claim Regulations

CONSUMERS CONTINUE TO PERCEIVE “CLEAN LABELS” as covering a full range of health-conscious messages. This has prompted government initiatives to update regulations on product labeling claims reflecting trends involving nutrients, functional ingredient components, environmental concerns and toxicology. The FDA currently has rulemaking, guidance, proposed regulations and consumer research in progress regarding these rapidly emerging dynamics, noted Lauren Swann, MSc, RD, LDN, CEO and President, Concept Nutrition, Inc., in her 2023 Clean Label Conference presentation, “The Latest on Labeling Claims from ‘Healthy’ to Eco-Friendly.”

The extended comment period for FDA’s proposed “healthy” claim revision—which updates product composition criteria for compliant use—closed February 2023 with over 1,500 comments. Existing requirements limit fat, saturated fat, sodium and cholesterol, while requiring significant amounts of certain nutrients, except for fruits and vegetables.

The proposed revision currently awaiting finalization limits sugar, sodium and saturated fat, based on food group amounts. Nielsen IQ’s “What America Eats and Thinks About Food” reports that a top priority for 67% of consumers is to avoid negatives and gravitate toward low- or no added sugars, low- or no sodium, low-carb and low-calorie labels.

Types of ESG Claims

- Animal welfare—“cage free,” “cruelty free,” “not tested on animals”
- Environmental sustainability—“compostable,” “eco-friendly,” “carbon footprint,” “upcycled”
- Organic positioning—certification
- Plant based—“plant based,” “vegan”
- Social responsibility—“fair wage,” “ethical,” “fair labor”
- Sustainable packaging—“plastic free,” “biodegradable”

A McKinsey NielsenIQ joint study about consumers and sustainability categorizes six types of Environmental, Social and Governance (ESG) claims.

Researching Symbols & FOP Labeling

Initiating research for a voluntary Healthy Symbol, FDA has over 20 existing images from international governments, trade associations, health organizations and retailer rating systems under review.

The Symbol will need to represent certain basic information. Information sources under consideration are established nutrient content claims, percent daily value thresholds, the USDA Dietary Guidelines and USDA's Food Guide Pyramid groups. A visual representation as an iconic checkmark or stylized graphic is also being considered and tested.

FDA is also exploring Front of Package (FOP) labeling—a standardized, science-based scheme intended to help consumers easily identify foods quickly for a healthy eating pattern. FDA is examining perceptions about healthful contributions, label believability, trustworthiness and effectiveness regarding levels of calories, saturated fat, sodium, added sugar, fiber and calcium provided in various formats.

In March, FDA issued a Draft Guidance for Dietary Guidance Statements, which are “nutrition-related statements focusing on foods and groups relative to nutritious eating patterns.” Either written or graphic—based on consensus report recommendations—these statements focus on nutritious dietary patterns, e.g., “eat a variety of vegetables.” The Draft Guidance recommends that foods bearing such statements contain meaningful food amounts and are limited in saturated fat, sodium and added sugars.

A Focus on E-Commerce

FDA's 2021 New Era E-Commerce Summit addressed online grocery shopping platforms to evaluate what labeling information appears; how and where it's presented; and what's most important for consumers—nutrition, ingredients, allergens or food safety. Without regulations, online pages can obscure certain vital information or highlight appealing aspects of less healthful products, because retailers can decide what to display and where. They can also track and target site visitation to promote specific products.

In April, progress was made based on FDA-solicited feedback regarding the pursuit of regulatory initiatives that make product content, format and accuracy easily accessible online.

To determine the most effective format for easy access, FDA focused on information consistency and accuracy; how information is presented; and consumer viewing experiences and expectations—including informing consumers of what is available. Online shopping also allows food search results to be filtered for specific health-related attributes, unlike product package merchandising on a retail store shelf.

An electronic label ruling concludes that QR codes don't fulfill USDA Agricultural Marketing Service (AMS) required bioengineered “GMO” disclosure requirements, so USDA must add additional options for compliance. All text or graphics on a page linked by a QR code for a branded product must comply with any applicable labeling regulations.

We are proud to not only provide the freshest, most consistent, high-quality milk proteins and milk permeate powders on the planet, we also forge lasting, trustworthy partnerships.

Producing our milk protein concentrate (MPC), milk protein isolate (MPI) and micellar casein (MC) involves the use of filtration and low-heat processes that result in clean, bland flavor profiles.

Dedication
Sustainability
Innovation



While caseinate production can result in off-flavors usually described as “cow-ey”, “barny”, “gluey”, and “livestock”, our MPCs, MPIs and MCs enhance your products' desired flavors, resulting in more satisfied consumers that will want to come back for more.



While you'll find our products are exceptional ingredients in clean label RTMs, RTDs and other applications, you'll also discover our unwavering commitment to your success.
sales@idahomilk.us

The Appearance of Eco-friendly

Eco-conscious descriptions drive third-party certifications and environmental “green” claims, which can be implied in established state laws, such as perishables shelflife date labeling or beverage container deposit “bottle bills.” Optional package recycling symbols, organic seals and origin claims implying miles traveled also relate to today’s sustainability trends.

Regulating labeling authority over meat and poultry products, the USDA Food Safety & Inspection Service (FSIS) announced testing new labels for safe handling. It also was petitioned to separate “free range” from “pasture-raised” claims; update living/raising conditions guidance; and prohibit the recently approved USDA-AMS Process Verified “low-carbon beef” claim. Third-party verification for similar carbon claims and numerical on-pack carbon disclosure requirements were also announced.

The Federal Trade Commission (FTC) held “recyclable” advertising claim workshops as part of its ongoing review of its Green Guides for Use of Environmental Marketing Claims. FTC discourages broad, unqualified general claims which are difficult to substantiate and advises qualifying descriptions with specific, clear and prominent benefits.

“The Latest on Labeling Claims from ‘Healthy’ to Eco-Friendly,” Lauren Swann, MSc, RD, LDN, CEO and President, Concept Nutrition, Inc./ <https://www.facebook.com/ConceptNutrition/>

Clean Label Bitterness Blockers

BITTER ISN’T ALWAYS BETTER, which leads food manufacturers to seek clean label ingredients (natural flavors) to make foods less bitter. Alex Woo, Ph.D., CEO of W2O Food Innovation, discussed the neuroscience behind the perception of bitterness and how this knowledge is being used to specifically target and reduce bitterness in foods and beverages. He gave this talk in his 2023 Clean Label Conference presentation “Clean Label Bitterness Blockers: Neuroscience, Ingredient Technologies, Applications.”

Most of the roughly 100 substances that are bitterants to humans are small, hydrophobic molecules. Detection of bitterness starts in the mouth, where bitterants interact with taste receptors on the tongue. Of the about 40 known human taste receptors, some 25 are bitterness receptors, known as TAS2Rs. The binding of a bitterant to these receptors generates a signal to the brain that results in the perception of bitterness. Two approaches are used to modulate bitterness in foods: masking or blocking, said Woo.

Bitterness Blockers: Applications in Foods and Beverages

Natural Bitterness Blockers (Partial List)	Foods and Beverages (Partial List)				
	Coffee	Juices	Energy Drinks	Stevia	Tea
Apple phloretin		✓		✓	
AMP	✓				✓
Na gluconate	✓		✓	✓	✓
Sugar cane distillate	✓		✓	✓	
Naringenin	✓	✓	✓	✓	✓
1,3-Propanediol	✓	✓	✓	✓	✓
Citronella	✓		✓		✓
Trp-Trp	✓		✓	✓	✓
Polymethoxy flavones		✓			

SOURCE: ALEX WOO, PH.D., W2O FOOD INNOVATION/2023 CLEAN LABEL CONFERENCE

Masking & Blocking Bitterness

First, masking changes the perception of bitterness in the brain but not the binding of the bitterant to its receptor(s). For example, cola itself is bitter, but sweeteners and vanilla added to cola beverages mask cola’s bitterness.

Sweetness at medium and high levels masks bitterness, while saltiness at any concentration suppresses bitterness. Blocking is a more powerful approach to reducing bitterness, utilizing knowledge of the specific taste receptors where bitterants bind. Most bitterness blockers are either receptor antagonists or negative allosteric modulators (NAMs).

Receptor antagonists actively block taste receptors. Bitterants bind tightly to their receptors. Antagonists (often similar in structure to bitterants) bind receptors loosely: not enough to activate the receptor, but enough to block a bitter compound from binding and reduce the signal that generates the perception of bitterness, explained Woo. In contrast, NAMs work indirectly by binding near (but not at) the receptor in a way that alters the receptor’s ability to bind the bitterant.

Each TAS2R can be activated by many bitterants. Conversely, one bitterant can trigger multiple receptors. Knowledge of the specific relationships between bitterness receptors, bitterants and antagonists can be found in the literature or the BitterDP database (<https://bitterdb.agri.huji.ac.il/dbbitter.php>). Putative interactions between specific receptors and antagonists can also be inferred from sensory testing. This information can identify strategies to block specific bitterants.

Bitterness blockers, categorized as mature (commoditized, patents expired, commonly used); pacing (newer, currently popular blockers); and emerging (not yet in wide use), were discussed.

Mature bitterness blockers include the following:

- Phloretin is extracted from apple bark/roots and may actually function by enhancing sweetness via positive allosteric modulation.
- Adenosine monophosphate is a natural, highly soluble compound found in milk that may explain why adding milk to coffee makes it less bitter.

- Sodium gluconate, made by fungal fermentation, may be a direct blocker or could interact with a salt ion channel.

Examples of “pacing” blockers were also described:

- Sugar cane distillate (SCD), produced from sugar cane waste, is one of the best universal bitter blockers, as it contains five distinct bitterness blockers.

- Naringenin, extracted from grapefruit, is structurally similar to naringin, the bitter compound in grapefruit and works across all families of bitterness.

- 1,3-propanediol, a natural product from corn fermentation, blocks multiple TAS2Rs and is highly soluble.

Finally, emerging blockers were discussed:

- Citronellal, a well-known compound found in lemon and lemongrass, was recently shown to block caffeine bitterness receptors and may be responsible for lemon’s reputation for reducing tea’s bitterness.

- Polymethoxyflavones (PMF), derived from citrus fruits, is a patented extract containing multiple blockers that may also act as bitterants at higher concentrations.

- The tryptophan-tryptophan dipeptide blocks multiple receptors, including those associated with caffeine, quinine and stevia, but is not yet commercialized.

Choosing Bitterness Blockers

Woo recommended several strategies when choosing bitterness blockers. (See chart “Bitterness Blockers: Applications in Foods and Beverages.”)

Start with blockers that work on many receptors (e.g., SCD, naringenin, 1,3-propanediol). Then select blockers that are most water-soluble, especially for beverages. Adopt a mature blocker or validate a pacing blocker in your food product. Going forward, monitor emerging technologies for future competitive advantage.

Woo’s final words of advice were that, because blockers may also have some bitterness, remember that more may not be better.

“Clean Label Bitterness Blockers: Neuroscience, Ingredient Technologies, Applications,” Alex Woo, Ph.D., CEO of W2O Food Innovation, <https://www.linkedin.com/in/alex-woo-827b833/>

Case Studies: Supply Chain Disruptions & Clean Labels

MATTSON HELPS ITS CLIENTS IDEATE, then takes those concept creations from rapid prototyping to commercialization, noted Jaime Reeves, Ph.D., Executive Vice President, Product Development & Commercialization. In her 2023 Clean Label Conference presentation, “Case Study Stories: An Inside Look at Reformulating Products Due to Supply Chain Disruptions & Increased Prices,” she



SOURCE: HONEY BAKED HAM CO.

In the scale-up of the Honey Baked Ham Co.’s Sweet Potato Souffle, the co-packer’s equipment produced a product with excess water. This was addressed with the addition of adding extra potato flakes.

described how reformulating products to address these challenges and create clean labels became necessary to refresh product lines and reduce costs.

One case discussed a plant-based creamer from Tevriya. The other two case studies are presented below.

Case Study – RTD Beverage:

Pirq™ Plant-Based RTD Beverages containing superfoods curcumin and maca are available in Decadent Chocolate, Golden Vanilla and Caramel Coffee. Mattson helped create the successful line in 2018. Sales were good until Covid hit. Supply chain disruption of erythritol sent the owners of the small company back to Mattson for reformulation with the following goals:

- Remove erythritol. Maintain “no sugar added” claim but with the same sensory attributes.

- Increase plant-based protein from 12 to 15g/serving.

Since Mattson had several variables to address (i.e., sweeteners, flavor, protein increase, viscosity), they systematically broke down the process and started with the sweeteners system on the vanilla version.

Although new sweeteners were sourced and sampled, they found the best-tasting stevia was already being used, so they increased its level. The vanilla flavor was increased to mask the bitterness associated with stevia.

The same strategy was applied to the other two flavors. However, the increased coffee flavor also increased bitterness. “We started scouting for sweetener enhancers or bitterness (maskers). Many sweetener enhancers have underlying notes of monk fruit and erythritol, which helped deliver the same flavor profile,” explained Reeves. “We ended up using sweetener enhancers across all three SKUs,” she added.

When increasing protein, Mattson found that pea, almond and brown rice were still optimal sources, but a new pea protein at 1/3 the price of the original saved on cost; however, it also added more pea flavor. “We had a pea masker in the original formula (that) worked really well. We ended up increasing the pea masker,” claimed Reeves.

Viscosity was the final hurdle for Mattson. As the increased protein helped increase viscosity, it was just a matter of adjusting gum levels, noted Reeves. Following the relaunch in 2022, the products have the same quality flavor with 15g of protein and without the erythritol that had caused such supply chain disruptions.

Case Study – Frozen Side Dishes:

Mattson was tasked with reformulating The Honey Baked Ham Co.’s frozen side dishes based on the following criteria:

- Convert from lengthy ingredient statements to clean labels.
- Target year-round consumption vs. holidays only.
- Expand product line from 10 to 11 SKUs.
- Identify new co-packer(s) and help commercialize.

Mattson began by using Protothink, its online brainstorming and ideation tool. TURF analysis, sourced to assess the effects of product combinations on consumer purchase decisions, was also used. SKUs were refreshed by converting items, such as sweet potato casserole to sweet potato souffle, followed by developing new SKUs, such as Tuscan Broccoli.

Culinary standards were developed from scratch, then converted to formulations by sourcing robust ingredients conducive to freezing, noted Reeves. Freeze/thaw cycling was tested, followed by the development of microwave cooking instructions by a third party.

Finally, formulations were scaled up. All went well, except for the sweet potato souffle, which was watery. It was determined that the co-packer’s equipment setup resulted in residual water in the kettle. Mattson’s commercialization expert worked with the co-packer to solve the issue by adding extra potato flakes without compromising the clean ingredient statement or adding capital, noted Reeves.

“We were able to shift their product offering from old-school to new, clean contemporary, (and) helped them save money by starting from scratch; looking at every ingredient; and finding a new co-packer,” said Reeves.

Evaluating new vendors is advantageous, “especially if they have something new, novel and differentiated from everyone else,” expressed Reeves. “Evaluate what’s out there to find new technology and better tasting, better costing ingredients,” she concluded.

“Case Study Stories: An Inside Look at Reformulating Products Due to Supply Chain Disruptions & Increased Prices,” Jaime Reeves, Ph.D., Executive Vice President, Product Development & Commercialization, Mattson, <https://mattsonco.com/>

Strategic Food Structures for Plant-Based Formulations

THE CHALLENGE IN MOST PLANT-BASED ANALOG FORMULATIONS is that the ingredients available to formulators are isolated from plant structures and purified in non-standardized processes. Each plant-based protein is unique, based on its source and processing, which results in highly variable and modified functionalities within an ingredient class, said Jeff Casper, MSC, Partner at Voyager Food Works, in his presentation, “Strategic Use of Food Structure of Plant-based Formulations & Cleaner Labels,” at the 2023 Clean Label Conference.

Formulators seek to create new structures using these ingredients in a different, unique way that mimics animal-based protein. “Structure determines the textural perception, flavor release, nutrient bioavailability and environmental impact of plant-based foods,” noted Casper.

Protein Extraction Methods

Casper noted that when we extract protein from seeds, we might use aqueous, salt or dry fractionation methods to physically separate protein bodies from starch granules. For example, the pH is often varied for both the extraction and isoelectric precipitation steps in aqueous pea protein extraction. This dramatic pH swing impacts the functionality of protein ingredients.

Dry fraction methods use air classification based on density to separate proteins from starch granules. This process has limits on purity,

Different Strategies for Creating Structure

- Strategies have been described as “top down” or “bottom up.”
- Bottom-up strategy: individual structural elements are assembled into larger structures.
- Top-down strategy: mimics the structure on larger length scales.

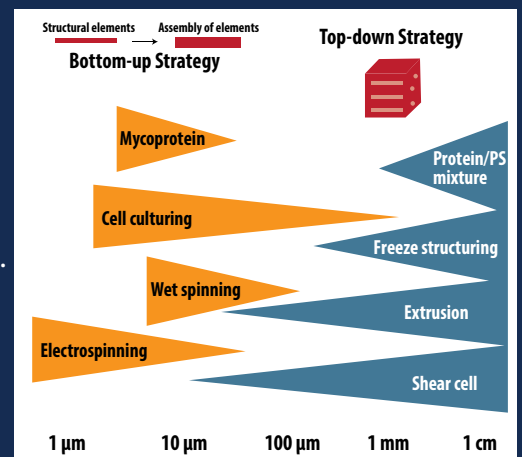
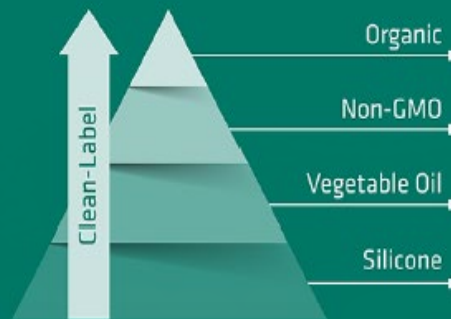


DIAGRAM SOURCE: ADAPTED FROM DEKKERS, ET AL., 2018/JEFF CASPER, VOYAGER FOOD WORKS/2023 CLEAN LABEL CONFERENCE

MAGRABAR® Food Grade Antifoams

CLEAN LABEL ANTIFOAMS WE PROVIDE THE FULL RANGE



ORGANIC ANTIFOAMS

We offer organic certified antifoams and options which can be suitably used for processing organic food.

VEGETABLE OIL BASED ANTIFOAMS THE NATURAL ALTERNATIVE TO SILICONE OIL

We offer clean-label alternatives to silicone oil, including identity preserved non-GMO products.

SOLUTIONS FOR ALL TYPES OF FOOD PROCESSING

Dairy - Bottling & Packaging - CIP & Wastewater - Fermentation - Fruit & Vegetable Washing
Microwaveable Foods - Protein Processing - Ultrafiltration

www.munzing.com



with the maximum approaching about 70% protein using currently available technology. The dry-fractionation process also leaves more grassy or beany notes from the native material.

Not all proteins produced by the same methods give the same result, so it is essential to evaluate the impact of the process on the functional properties of protein ingredients. Breeding is another method to modify proteins. In the future, Casper said, we will see much more work around genetics in protein processing.

When creating new protein structures, a good strategy provides a clear roadmap of guiding principles or rules. This defines the properties that ingredients in the formula should have to achieve desired goals.

Strategies for New Structures

Food companies can use a top-down or bottom-up strategy. A bottom-up approach assembles a structure to resemble muscle tissues, for example. In contrast, a top-down strategy takes existing material and manipulates or deforms it into the desired structure. (See diagram "Different Strategies for Creating Structure.")

One case study offered by Casper illustrates the replacement of methylcellulose in plant-based hot dogs and sausages using emulsified, filled protein gels. The sausages also incorporate particulates of a high-moisture, extruded material made from pea or soy protein, plus gluten. The goal is to create a protein gel that is as firm, elastic and springy as methylcellulose.

Casper used transglutaminase to set the gel. As it approaches the isoelectric point, the gel's pH affects firmness, elasticity and syneresis. Oil droplets were dispersed into the gels as an active or inactive filler. Different pea proteins have differing resiliency and springiness, depending on their processing. In this case study, each formulation he worked with was 16% protein, 10% oil and water. This material can then be stuffed into a casing and cooked in a smokehouse.

Casper's second case study illustrates fixing hydrocolloid filaments in pea protein gels to create a plant-based scallop using a water-in-water emulsion. This application uses two biopolymer solutions that are relatively thermodynamically incompatible. Phase 1 is a 10% pea protein solution, and phase 2 is a 0.6% pectin solution. These two phases want to repel each other. Shear cell technology creates filaments, which are then set with transglutaminase. The product can be pan-seared and is visually and texturally similar to a real scallop.

The third example discussed was a plant-based yogurt. Plant-based yogurts have flavor and color issues; fermentation can act differently on those proteins. The goal is to obtain the cleanest tasting protein that forms the best emulsion. Soy protein yogurts have been around for a long time. Replacing these with pea or other plant proteins is challenging, noted Casper.

A fluid gel approach uses a system of gel particles dispersed in a non-gel continuous phase. This will work with almond, pea milk,

oilseed proteins or soy protein. Casper's first approach used an agar and gellan fluid gel to create a yogurt with 11g of protein per 150-gram serving. His second approach used a pectin source, such as citrus fiber, for a cleaner label.

In conclusion, Casper pointed out that we don't always have to mimic animal protein. We can create unique foods with high consumer appeal through the development of imaginative applications.

"Strategic Use of Food Structure of Plant-based Formulations & Cleaner Labels," Jeff Casper, MSc, Partner, Voyager Food Works, <https://www.linkedin.com/in/jeff-casper-733a2443/>

Protein Claims Using "Clean Label" Analysis

COMMUNICATING THE PROTEIN CONTENT of a formulated food or beverage to consumers is often crucial for commercial success. When making a protein label claim, regulations require analytical protein content and protein quality determinations. This can be expensive and time-consuming. It also presents an ethical issue for some. The FDA-specified protein quality test requires animal sacrifice. "This is not what you'd want for an aspirational clean label product," said David Plank, Managing Principal, WRSS Food & Nutrition Insights and Senior Research Fellow, University of Minnesota, Dept. of Food Science & Nutrition. His presentation, "Ethical Analysis and Labeling for Protein Claims," at the 2023 Clean Label Conference, delved into common industry misbranding errors; the current state of protein analysis; and the progress toward non-animal (*in vitro*) testing.

Label Claims and Analysis Needed

Protein content claims like "Contains xx Grams Protein" are popular. Plank explained that grams of protein is the amount of "Crude" protein. Its determination is straightforward and relatively inexpensive. When proteins are added to fortified or fabricated foods, they are



Efforts to obtain an FDA-approved Protein Quality method to replace one requiring the use of animals are advancing toward FDA approval. Crucially, the gap between the test results of the traditional analysis and the new protocol is closing.

considered Class 1 nutrients and must be present at 100% or more of their declared label value. (21 CFR 101.9(g)(3))

In contrast, a protein's % Daily Value (DV) is based on the amount of Quality Protein in a product. The "standard adult" must have 50g of Quality (not Crude) Protein per day to reach 100% of the DV of protein in their diet. Thus, if 20g of Quality Protein is declared on the label and divided by 50g, the product has 40% DV. (20g/50g = 40%). Quality Protein is defined as having a PDCAAS (Protein Digestibility Corrected Amino Acid Score) of 1.0. Few single-plant sources have PDCAAS values this high. It is not uncommon for smaller manufacturers to confuse Crude Protein with Quality Protein in calculations—resulting in inaccurately high %DVs on labels.

Any protein claim outside of the Nutrition Facts Label must include the labeling of the protein's % DV, which requires a PDCAAS determination. Although some manufacturers disagree, a consensus among larger manufacturers and legal experts is that making a protein content claim outside the Nutrition Facts Label also implies a "Good Source of Protein" in consumers' minds. For a "Good Source of Protein" claim, regulations require the product to have at least 5g of Quality Protein/serving (i.e., 10% DV), stated Plank. Therein lies the challenge.

PDCAAS Analysis Issues & An Alternative

Protein labeling errors are common. Requirements are often poorly understood, and some manufacturers follow competitors' labeling mistakes. True compliance is expensive and time-consuming, Plank pointed out. And the current analytical method may be contrary to the ethics of manufacturers or their clients.

The usual method to quantify PDCAAS Protein Quality includes analysis of the amino acids in the food product and calculating the limiting amino acid relative to the 1991 FAO Complete Protein amino acid profile. Lastly, the protein's digestibility in rats must be determined, since this value is multiplied by the limiting amino acid value to calculate PDCAAS.

This involves measuring a sample's total nitrogen, amino acid profile, fat, sugars, etc., which the animal is fed over weeks. The rats' food intake, body weight and fecal nitrogen are also measured during this time. The animals are then sacrificed. Typically, five rats per sample plus controls are needed, said Plank.

An *in vitro* method under development and informally named "ASAP-Quality" is based on enzymatic analysis. It eliminates the need for animal testing (US Pat No. 9,738,920). Numerous technical challenges are being overcome, including the need to compensate for individual amino acid reactivity, preventing the enzymes used for digestion from interfering with measurements and not inactivating the enzymes prematurely. As adaptations have been made to the analysis protocol, the method produces results increasingly similar to the current FDA-approved analysis.

The next steps toward FDA regulatory approval include launching an improved equation; conducting an AOAC collaborative study; and recruiting international participation from academia, industry and government agency labs. Then a much desired "AOAC First Action Status" should be obtained, followed by a Citizen Petition to the FDA, said Plank.

Companies currently using the *in vitro* test include those with animal testing bans; those who want to comply with the law using an ethical test for clean labels; and/or those who want to reduce class action risk at low cost.

"Ethical Analysis and Labeling for Protein Claims," David Plank, Managing Principal, WRSS Food & Nutrition Insights/Senior Research Fellow, University of Minnesota, Dept. of Food Science & Nutrition, <https://www.wrssfni.com>

Changing Consumer Attitudes Toward Food & Technology

THE DAYS OF "IF YOU BUILD IT, THEY WILL COME" ended years ago, noted Shelley Balanko, Ph.D., Senior Vice President, The Hartman Group, during her presentation titled "Food & Technology 2023: Consumer Trends and Tensions," given at Global Food Forums' 2023 Clean Label Conference. "We live in a demand-centric industry. It pays to understand the consumer," she added. As such, Balanko presented the findings of The Hartman Groups' "Food & Technology Study 2023" revealing consumer attitudes toward food and technology.

The Hartman Group first researched consumer sentiment and food technology in 2019. Since then, it has seen "a mounting sense of urgency from consumers around the challenges of our food system. It's pushing consumers toward considering science and technology as the best path forward," explained Balanko.

Food System Challenges

Challenges around our food system include sustainability, such as climate change or reducing resources, like energy, water or carbon; food security—defined as population growth; ethics or animal welfare (including the possibility of removing animals entirely from the food supply); and health and well-being. These challenges are softening consumers' resistance to science and technology in food. Consumers are endorsing both a natural narrative and a science/technology narrative. (See chart "Attitudes toward Agriculture, Science Technology and Food.")

In Hartman's "Food & Technology Study 2023," respondents were asked about their awareness, motivations and barriers to trial (i.e., a consumer's first usage experience with a product, service or, in this case, a technology) of 11 food technologies. They were regenerative agriculture, hydroponic farming, plant-based proteins, biomass fermentation, precision fermentation, GMOs, cultured meat, cellular

Master Plant-Based, Gluten-Free Baking With Hemp Protein



The Best Tasting Plant-Based Protein for Gluten-Free Dough

It's time to inspire keto-friendly, gluten-free foods with our latest plant-protein, PurHP-75™ organic hemp seed protein. This innovative new protein helps condition dough, retain moisture, and create structure for desired elasticity and texture in baked goods. Because we only use the white inner heart of the hemp seed, PurHP-75™ has a neutral flavor and superior texture for a smoother sensory experience across many applications. Your baked goods, puffs, and bars will benefit from the 75% protein, complete with all nine essential amino acids, but it is the delicious flavor that sets this plant protein apart.

PURHP-75™

organic hemp seed protein by **AFS**



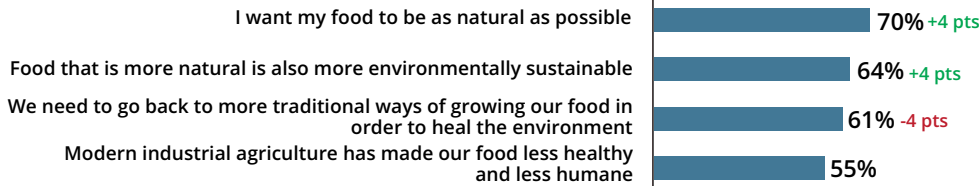
Inquire Today
AppliedFoods.com/PurHP-75
1-800-345-9666
Sales@AppliedFoods.com



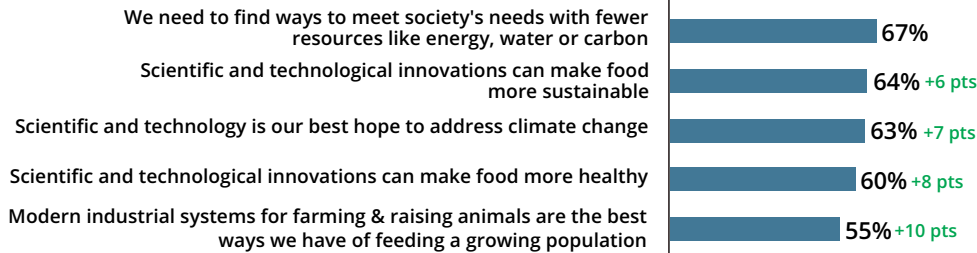
Attitudes Toward Agriculture, Science, Technology & Food

Among all respondents, showing % agree strongly/somewhat

Ideals of Natural Food Production



Progress Through Science/Tech



+/- Statistically Significant Difference vs. 2019

NOTE: THE ONLINE STUDY, COMPLETED IN THE 4TH QUARTER OF 2022, INCLUDED QUANTITATIVE RESULTS FROM 2,365 U.S. ADULTS AGED 18-76. QUALITATIVE RESULTS WERE GATHERED FROM 15 PARTICIPANTS IN A WEEK-LONG IMMERSIVE PROCESS VIA AN ASYNCHRONOUS VIRTUAL PLATFORM. NINE OF THOSE PARTICIPANTS WERE SELECTED FOR IN-DEPTH ONLINE INTERVIEWS.

SOURCE: "FOOD & TECHNOLOGY 2023 STUDY," © 2023 THE HARTMAN GROUP/2023 CLEAN LABEL CONFERENCE

The statistically significant increases in the "Progress through Science/Tech" portion of the chart demonstrate that science and technology are gaining traction among consumers who want healthier, more sustainable foods. Consumers question whether returning to traditional, "natural" production methods is viable.

dairy, cell-based seafood, nutrient fortification using nanotechnology and AI-driven food science/production.

Consumers showed more familiarity with established production methods and agricultural/land connections, such as plant-based proteins, GMOs, hydroponic farming and regenerative agriculture. Interestingly, cultured meat ranked among the top five in terms of familiarity because of mainstream media coverage.

"Qualitatively speaking, consumers stressed that trial is very different from adoption. It will take much more to bring (certain technologies) into their cultural repertoires," emphasized Balanko. Taste will be primary, as are health and wellness, ethics and experience. While many food technology companies are leading with ethics-related benefits, she noted that health-related benefits are the strongest purchase drivers.

Plant-Based, Cellular Ag & GMOs

The global plant-based market is projected to reach \$162 billion by 2030. Plant-based protein motivators included health, low price, ease of preparation, environmental benefits and improving animal welfare.

Consumers tend to be more experimental with prepared foods vs. making foods from scratch. The Boomer generation is more critical of plant-based foods, because producers of products such as the Impossible Burger and Beyond Meat focused on processing at the expense of health and nutrition. As a result, consumers began scrutinizing ingredient statements more thoroughly. "Now, the category is

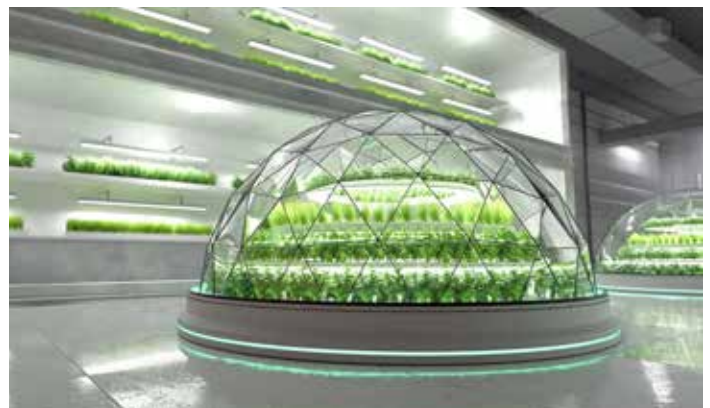
fighting the perception of being overly processed," said Balanko.

The non-GMO market is growing and expected to reach \$4 billion by 2027. Consumers, particularly younger generations, see GMOs as a solution for feeding growing populations. Yet, Boomers and Gen X "still carry much baggage from the 1990s and the initial introduction of GMOs," explained Balanko. Even though younger generations are more open to GMOs, they're "concerned about GMOs' impact on long-term biodiversity and (whether) corporations are owning life," she added.

The size of the global cell-cultured meat market is projected to reach \$319.8 million by 2028. Consumers are most skeptical of cell-cultured foods, although this varies by category. "When it comes to barriers, it's the 'ick' factor," said Balanko. Educating consumers will seemingly be the best way to break some of their barriers to this technology.

"It will take a little time for our culture to overcome [the barriers]. You can bend culture, but if you push it too hard, too fast, you can break [it], which means your products will fail," Balanko said. "Consumers want to know that technology isn't being brought to market just for the sake of it...the consumer is at the helm. That behooves us to understand what they think; what they need; and how they feel," she concluded.

"Food & Technology 2023: Consumer Trends and Tensions," Shelley Balanko, Ph.D., Senior Vice President, The Hartman Group, <https://www.hartman-group.com/>



Younger generations see GMOs as a solution for feeding growing populations. However, they're "concerned about GMOs' impact on long-term biodiversity and (whether) corporations are owning life," said Shelley Balanko.



Ingredion.

Be what's next.



Grow your clean label appeal with sustainable citrus fibers

Looking for a fresh opportunity in clean label? Made from upcycled citrus peels, Ingredion's FIBERTEX™ CF citrus fibers bring new dimensions of sustainability, nutrition and performance to savory, bakery and meat applications — allowing your brand to overcome formulation challenges and create appealing new products consumers will love.

Download the FIBERTEX™ CF citrus fibers e-book from Ingredion.

[Download](#)

For more resources, case studies and opportunities, contact:

Jacqueline Becker

*Business Development Manager,
Clean & Simple Ingredients*

jacqueline.becker@ingredion.com

Challenges and Opportunities of Upcycled Ingredients & Foods

ACCORDING TO THE USDA'S ECONOMIC RESEARCH SERVICE

(<https://bit.ly/3ITX0I9>), one in 10 households faces food insecurity in the U.S. However, up to 40% of the nation's food ends up in the trash, according to the FDA (<https://bit.ly/3MZKT7s>). Additionally, the World Bank estimates that we need to increase food production by 70% by 2050 (<https://bit.ly/3MKzLuU>) to keep up with the growing population. With these statistics in mind, reducing food waste should be a top priority in the food industry, and it is at the Food Lab at Drexel University.

Jonathan Deutsch, Ph.D., CHE, CRC, founded the lab in 2014. His presentation, "Upcycled Ingredients and Food Products: Challenges and Opportunities for Product Developers," provided insights into consumer research into upcycled foods and the lab's journey to becoming an upcycled food R&D lab. The presentation was given at the 2023 Clean Label Conference.

In a video within his presentation, Deutsch commented, "Waste is a social construct, so what you do with food determines whether it's food or waste. We want to reframe waste to think of it as not recycling food waste but preventing food waste."

In the Food Lab, food producers reach out with a problem, and students help provide solutions, including creating commercially viable products. "We're getting many requests from food producers who want to green their habits or make healthier food, but they need help doing that," Deutsch explained in the video. "They need ideas, energy and talent, and we can work with them to provide that."

Build Upcycling Integrity

One example project involved working with Baldor Foods to create a vegetable powder from fruit and vegetable scraps. One of their first applications was to reformulate a school muffin for Boston. Using the powder, the new, upcycled muffins had a full serving of vegetables, which has now evolved into a full serving of fruit.

"We have also tried to destigmatize upcycling," Deutsch said. "In order for upcycling to work, the message can't be that we're taking our leftovers from those of us who have enough and giving them to people who don't. We want the messaging to be: 'We should all be working together to take advantage of this precious resource of food and use it to its highest potential.'"

While the Food Lab did not invent upcycling, they have helped apply it and define it within the food industry. Deutsch gave the current definition of upcycled foods as using ingredients that otherwise would not have gone to human consumption; are procured and produced using verifiable supply chains; and that positively impact

the environment. Having a shared definition is important to ensure the integrity of the term and its application to products that meet the required standards.

Deutsch also offered insights into consumer research. Consumers see upcycled food as a new category closer to the organic and natural foods space than conventional food. However, consumer awareness around upcycled foods is very low. "You can look at that one of two ways," he said. "One is 'I'm not doing a very good job speaking, publishing, doing all this work, and my colleagues aren't either, and we're not getting much traction.' That's the pessimistic way to look at it. The optimistic view of it is as having much room for growth."

Demystifying Concerns

Two of the key concerns Deutsch hears a lot are that people are going to get scared of upcycled food because of safety and quality concerns—which does happen—or they're going to expect a discount because they know that a company is making money taking

Increase in Consumer Willingness to Pay



Consumers see upcycled food as a new category closer to the organic and natural foods space than conventional food.

One study in which Deutsch participated found that consumers would pay less for upcycled food than comparable conventional products. However, this reversed when messaging was added. In another study to which Deutsch contributed (Bhatt, S. et al. 2020. *Food Quality and Preference*. <https://bit.ly/3IZ2oUd>), if consumers' willingness to pay for a conventional group of products was indexed at 4.46, the addition of "emotional messaging" increased their willingness to pay to 4.67, and "rational messaging" increased their willingness to pay to 5.11. Examples of emotional messaging included "perfectly good food is being thrown away" and "people are starving." Rational messaging could be a few words, like "good for the environment" or "wasted food is x% of the greenhouse gas emissions."

something that otherwise would have gone into the trash and upcycling it. At face value, there seems to be some truth to that concern. "If you say, 'Do you want a cookie or an upcycled cookie?' they'll take the cookie," he explained. "But with messaging, that flips. If you say, 'Here's an upcycled cookie that reduces food waste and is good for the environment,' they want that."

What worked especially well was rational messaging with few direct words, such as "reduces food waste," "good for the environment" and "reduces greenhouse gasses." (See sidebar "Increase in Consumer Willingness to Pay.")

"In 2019, we started the Upcycled Food Association with just nine founding members. That group has about 250 now...We also have an upcycled food certification and an upcycled ingredient certification," Deutsch said. "[Upcycled food] has evolved to be more of a movement. We're proud to be part of it."

"Upcycled Ingredients and Food Products: Challenges and Opportunities for Product Developers," Jonathan Deutsch, Ph.D., CHE, CRC, Professor and Director, Food Entrepreneurship and Innovation Programs, Dept. of Food and Hospitality Management, Drexel University/Vice President, Upcycled Food Foundation Board, <https://www.linkedin.com/in/jonathan-deutsch-ph-d-che-crc-364787/>

Formulating Through Supply Chain Disruptions

PRUDENT ADVICE WAS GIVEN BY MICHELLE TITTL, Product Development Manager, ACAP, B.S., CuliNEX, throughout her presentation titled "Addressing Formulation Challenges Through Supply Chain Disruptions," presented at the 2023 Clean Label Conference. CuliNEX is a food product development consultancy specializing in clean label product development from innovation to commercialization, blending culinary excellence and leading-edge food technology.

Several key factors have posed industry challenges, greatly affecting product development—the Covid pandemic being a prime example. When the lockdown was lifted, the number of employees that returned to the workforce was significantly reduced, posing labor shortages that impacted manufacturing. "Limited resources impacted capacity, which influenced throughput... (and) ingredient supply," said Tittel. "Import and shipping challenges have improved within the last six to 12 months, although shipping challenges remain. Pricing of shipping containers has dropped from USD \$40K to USD \$2-4K. This shed light on how complex and fragile our [food] system is and identifies opportunities for improvement," she added.



Need Craveable Taste with Clean Label Formulation?

Then we're your product development pros!

At CuliNEX, we are pioneers in **clean label** and **flavor-first** product innovation and development for food industry clients of every size. We combine culinary and food science expertise to achieve your vision across ALL food categories and applications, from innovation to scale up.

Visit [CuliNEX.biz](https://culinex.biz) or drop us a line at marcom@culinex.biz to discover your new, favorite food development partner!

**LAUNCH.
REFORMULATE.
REVIVE.**



Erratic weather changes have impacted commodity supply and availability. Geopolitical disruptions, such as the war in Ukraine, affected sunflowers and wheat. “That puts a strain on other countries to create availability for those products,” expressed Tittl. Consumer demand for animal welfare is another factor affecting ingredient supply.

Trickle-Down Effect

When industry challenges trickle down, affecting ingredient supplies, stress is placed on product development. Price increases and volatile pricing, specifically commodity-driven ingredients, involve certain specialty ingredients, particularly those formulated with a commodity item. Labor shortages and account management turnover can extend the time it takes to get a product by two to three weeks in some cases, noted Tittl.

Other product development challenges due to ingredient shortages include manufacturing and demand; higher minimum order quantities; the rise in plant-based alternatives; and the need for ethically sourced ingredients.

For product development teams, this means a constant state of urgency that can only be solved by imagining and “banking” key development strategies that can be engaged seamlessly—almost like muscle memory in an athlete. These strategies include:

- Use multiple suppliers; have a backup plan where growing season and climate can affect supply.
- Quickly order temporary packaging while you resolve supply issues.
- Screen multiple ingredient options and analyze cost impacts.
- Consider process changes with ingredient adjustments.
- Lean on ingredient suppliers for development support.

Case Studies

Tittl provided case studies as examples of ingredient supply challenges and solutions. Key aspects in three of the case studies are as follows.



Single Origin Berry Ice Cream

- Wildfires eradicated the client’s source of single-origin fruit prep.
- Client’s sales were regional; looking to expand domestically.
- CuliNEX broadened fruit prep sourcing globally to ensure volume requirements are met.

Evaluated 12 different fruit preps. Found three that met organoleptic properties and added all as supply sources to mitigate future shortages.

- Used short-run packaging until the ingredient is sourced.
- **Takeaways:** Use multiple suppliers; have a backup plan where growing season and climate can affect supply; order temporary packaging.



Fruit-Based Pouch

- The product was a kids'-based applesauce with omega-3 added.
- The client was aware of rising prices in a commodity-based ingredient (i.e., apple purée concentrate).
- Client wanted help optimizing the formula to meet target cost and help with an off-flavor base ingredient (i.e., apple purée) associated with omega-3 near the end of shelflife.
- CuliNEX ran a cost analysis of all ingredient components to determine cost drivers in the formula. Flavor suppliers were also contacted to identify key masking agents that prevent off-flavors from omega-3 oxidation.
- Out of five flavor maskers, CuliNEX identified one that mitigated off-flavor, which enabled shelflife extension from 12 to 18 months.
- **Takeaways:** Run cost analysis on the formula. See where ingredient(s) can be reduced or removed.



Plant-Based Burger

- Developed plant-based burgers ready for commercialization.
- Product contained specialty palm oil granules for the visual effect of fat globules similar to meat-based burgers.
- A ban on Malaysian palm oil exports resulted in a supply shortage.
- CuliNEX expanded its search into other formats (e.g., granule, flake, block) and looked for sources from other countries. Because formats were limited, only a block format could be used.
- CuliNEX contacted co-manufacturers to determine if they could alter their current process when using the palm oil block to create a similar fat globule effect.
- In-line processing steps (i.e., chilled, bowl chopper) were added to reduce the block to flakes. Consumers thought the flakes looked more natural.
- **Takeaway:** Consider changing processing methods to mitigate supply chain challenges.

Tittl concluded by sharing what keeps her up at night—“Identifying the right types of co-manufacturers that have the ability, technology and innovation to produce the products [CuliNEX] is looking for [and have a backup plan with ingredient alternatives].” The story’s moral is...work with your ingredient suppliers and be prepared!

“Addressing Formulation Challenges Through Supply Chain Disruptions,” Michelle Tittl, Product Development Manager, ACAP, B.S., CuliNEX, <https://www.culinex.biz>

Holistic Clean Label Product Development

“HOLISM” REFLECTS A CONCERN for the complete system and its interactions instead of its parts. This concept is how Lucile Jarry,

MSc, R&D Manager (Foods), Hain Celestial Group, manages clean label product development, as she described in her 2023 Clean Label Conference presentation, "A Holistic Formulation Approach to Clean Label Products." Several of Hain Celestial Group's brands, which have been "pioneers in the organic, natural and better-for-you space," explained Jarry, were presented as case studies; two are presented below.

Why might food manufacturers consider producing clean label products? Some reasons include satisfying consumer demand for product transparency; opening doors to incremental distribution; creating differentiation in the marketplace; and contributing to sensory and nutrition (e.g., flavors, colors, micronutrients).

"We know why clean label. Now, how do I, as a food formulator, determine what clean label means for my company, my brand and my product," asked Jarry.

Based on the external and internal cues, it is critical for the cross-functional team to create a project charter and align on the scope of the project. "The charter should clearly include what is in scope, but also what is out of scope and could derail the timeline, budget or even the relevance of the project," explained Jarry. (See "Holistic Clean Label Product Development Charter" chart for explanations of the four challenges that need to be addressed in the Charter).

Case Study 1: Replacing Citric Acid in Earth's Best Fruit Puree Pouches

For Earth's Best Fruit Purees, the challenge was that ingredients such as natural fruits and real organic yogurt are often not acidic enough on their own to classify the purees as high-acid foods.

The product development team considered clean label acidulants as alternatives to citric acid, such as lemon juice concentrate, to limit thermal processing. While lemon juice concentrate was more expensive than citric acid, its low usage rate and the reduction in processing mitigated that extra cost. Regarding sensory, the lemon juice also allowed the fresh fruit flavor to shine through, avoiding the more cooked notes attributed to additional thermal processing. Lastly, the lemon juice met existing certifications, such as organic and kosher, which are important to Earth's Best consumers.

Case Study 2: Removing Coconut in MaraNatha Coconut Almond Butter

Coconut cream, used as a flavoring in MaraNatha Coconut Almond Butter, presented an allergen in the plant, adding a sanitation step in processing. The approach was to replace the coconut cream with a natural coconut flavor.

The natural flavor improved manufacturability by eliminating the unique allergen, and the revised formula fit within the manufacturing line capabilities and set-up. In addition, lower usage of the natural flavor vs. coconut cream maintained the formula cost.

Farbest
BRANDS

Our Ingredients.
Your Sourcing, Simplified.

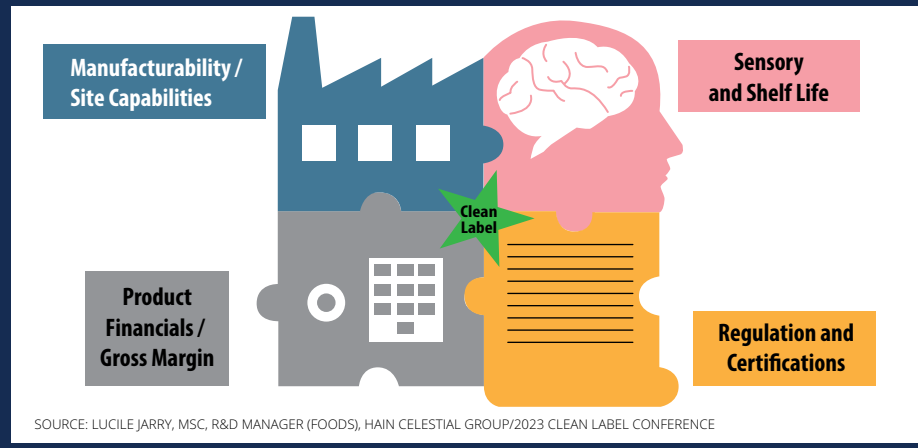
Dairy Protein, Pea Protein, Gums, Natural Colors, Dairy Powders, Soy Protein, Fiber, Nutrients, Novel Proteins, Sweeteners, Lecithins, Vitamins

USDA ORGANIC, NON-GMO PROJECT VERIFIED, and other certification logos.

1.800.897.6096 • farbest.com

Holistic Clean Label Product Development Charter

The Challenges



The cross-functional team decides which pieces of the puzzle get priority when creating the charter for product development.

"[Was] this a true clean label win?" asked Jarry. "Yes, the new flavor did meet our original objective: improve manufacturability. And we also met the requirements of sensory acceptability, financial guardrails, regulatory and certifications...[However], consumers are becoming more suspicious of natural flavors. Is the natural flavor real enough for our consumers or did we take a step back by removing

the coconut cream, which is closer to the actual fruit," she questioned.

Palm oil, which is used as a stabilizer in the no-stir product, also posed an issue due to environmental and nutritional (saturated fat) concerns. This issue was mitigated by sourcing a sustainable (RSPO) option. The palm oil's low usage rate also limited the saturated fat contribution compared to the unsaturated fats from almonds. Lastly, the company decided to offer two options: the no-stir option that is stabilized with palm oil and an un-stabilized version which it calls its "stir and enjoy" nut butter, so consumers can choose the product that best aligns with their values.

The takeaway is that "clean label formulation is not always a clear 1:1 solution," Jarry said. "Sometimes, prioritizing clean label might mean making sacrifices in other areas of the puzzle. The cross-functional team needs to decide which puzzle pieces take priority based on a deep consumer understanding," concluded Jarry.

"A Holistic Formulation Approach to Clean Label products," Lucile Jarry, MSc, R&D Manager (Foods), Hain Celestial Group. <https://www.hain.com>

Let's Get Functional.

Replace chemically modified starches with all-natural, heat-treated **functional flours**

Yes, you can create an all-natural savory product without compromising quality – and at a competitive price point. Our naturally heat-treated **functional flours** allow savory foods to retain a smooth, homemade texture and clean mouthfeel throughout a variety of conditions.

[siemersi.com](https://www.siemersi.com)

SIEMER
SPECIALTY INGREDIENTS

Low-Calorie Sweeteners' Health Impact

“CURRENT RECOMMENDATIONS BY THE WHO for added sugar consumption are that it should contribute less than 10% of energy in the diet,” stated Dr. Richard Mattes, Ph.D., Distinguished Professor of Nutrition Science at Purdue University, Affiliated Scientist at the Monell Chemical Senses Center. Thus began his presentation, “Low-Calorie Sweeteners Impact on Blood Glucose, Hunger, Weight & the Microbiome,” at the 2023 Clean Label Conference. “Yet in the U.S., three-quarters of four-to-18-year-olds and about 50% of adult men and women are exceeding the goal, at around 13% of energy,” he noted. This corresponds to about 400kcal/day and 300kcal/day for males and females, respectively.

Mattes explained that the recommendation to limit sugar intake originated from dental health and highlighted that this guideline lacks scientific evidence regarding overall energy balance and body weight. He argued that the recommended goal should be 5% instead of 10%, which increases the potential value of low-calorie sweeteners (LCSs) as alternatives to caloric sweeteners. However, the beneficial impact of LCSs continues to be questioned—without a well-founded reason to do so.

Regarding blood glucose, an analysis of 29 studies showed no overall effects following the consumption of various doses and types of LCSs (Nichol et al. 2018. <https://pubmed.ncbi.nlm.nih.gov/29760482>). Similarly, other meta-analyses of 55 studies found no effects on insulin responses to LCSs. (Greyling et al. 2020. <https://pubmed.ncbi.nlm.nih.gov/32672338>).

Low-Calorie Sweeteners & Weight

In a clinical trial with 166 individuals who consumed various LCSs over an extended period, no significant impact was reported on self-reported hunger, fullness ratings or desire to eat (Fantino et al., 2018. <https://bit.ly/3JJ6e3Q>). “Hunger represents an energy-driven desire to eat,” explained Mattes, “while sensory and cognitive factors influence the desire to eat.” Mattes presented research showing that LCSs may not directly influence appetite sensations, challenging the notion that sweetness alone primes the body to desire energy.

An early meta-analysis of cohort studies revealed a small but statistically significant increase in body weight among LCS users. However, small but statistically significant benefits were observed in terms of BMI, fat mass and waist circumference based on randomized controlled trials, a stronger methodological approach (Miller & Perez. 2014. <https://pubmed.ncbi.nlm.nih.gov/24944060>).

A more recent meta-analysis by the WHO examined the effects of replacing sweeteners with LCSs, which is where the most significant impact would be expected (Rios-Leyvraz & Montez. 2022. <https://apps.who.int/iris/handle/10665/353064>). “When a source of

energy is removed by substituting an LCS, the anticipated effect would be more significant than simply adding an LCS to a diet where it replaces water,” explained Mattes. The results found that substituting LCSs for nutritive sweeteners lowered BMI and body fat mass. This was driven primarily by findings from trials less than three months in duration.

Among the limited number of trials of longer duration (N=6), no overall effect was observed, but two did report significant benefits—with one noting an adverse outcome, compared LCS to water. And, while both groups lost weight, the water group lost slightly more. “Overall, the claim by the WHO that LCSs lead to weight gain is considered flawed and not supported by their own scientific evidence,” stated Mattes.

Different Structures, Different Physiological Effects

Mattes explained that LCSs have diverse chemical structures, ranging from carbohydrates and proteins to small molecules. Like any other array of chemicals introduced into the body, these substances would be expected to have different physiological properties.

Different LCSs bind to the same sweet receptor but with varying strengths and locations. This binding sets off a chain of physiological reactions within taste receptor cells, ultimately releasing neurotransmitters and the perception of sweetness in the brain (Dubois. 2016. <https://pubmed.ncbi.nlm.nih.gov/26992959>) that are LCS-specific. (See sidebar “Sweeteners & the Microbiome: What’s the Goal?”)

Importantly, “sweet taste receptors” are found not only in the mouth but throughout the body. When a sweetener binds to these extra-oral

Sweeteners & the Microbiome: What’s the Goal?

The impact of LCSs on gut microbiomes is a hot topic in popular and peer-reviewed literature. Studies and general health advice point to the importance of microbial diversity (*Editor’s Note: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6366966>*).

Other research works to identify desirable and undesirable microbial strains. These two approaches are not necessarily consistent. “If the desire is to determine which sweeteners can be used to preferentially increase ‘good’ bacterial strains and decrease the ‘bad’ ones, that is antithetical to the originally stated goal of increasing overall diversity for a healthful gut microbiome,” Mattes concluded.

Mattes walked through an analysis of what could be the mechanism behind the proposed impact of artificial or LCSs on the microbiome. LCSs that reach the colon may serve as signaling molecules or substrates for the microbiota there, whereas LCSs that are fully digested or absorbed prior to reaching the colon would have to work by other mechanisms.

receptors, it stimulates the cell to perform its specific function (e.g., enteroendocrine cells release gut peptides; beta cells release insulin), suggesting a broader role for LCS in the body.

Mattes summarized that using LCSs appears not to be associated with disordered blood sugar levels, increased appetite or increased overall food intake. In fact, LCS use is associated with lower BMI. He emphasized that each LCS may have different physiological effects, including sensory, gastric, neural and metabolic effects. It may prove important to consider each sweetener individually rather than viewing them as a single class of compounds with uniform effects.

“Low-Calorie Sweeteners’ Impact on Blood Glucose, Hunger, Weight & the Microbiome,” Richard Mattes, MPH, Ph.D., RD, Distinguished Professor of Nutrition Science at Purdue University, Affiliated Scientist at the Monell Chemical Senses Center, <https://hhs.purdue.edu/directory/richard-mattes/>

A Practical Approach to Delivering Sweet Flavor

“FLAVOR IS AN ILLUSION, a sleight of hand to trick the senses,” declared Zal Taleyarkhan, Corporate Research Chef with Charlie Baggs Culinary Innovations (CBCI). One challenge in working with sweet flavors is that many companies try to reduce sugar, but sugar-reduction solutions are constantly scrutinized. For example, the Cleveland Clinic recently suggested that erythritol increases the risk of cardiovascular conditions. Taleyarkhan, along with Jenn Farrell, Director of R&D at CBCI, provided sugar-reduction tips in their presentation, “No Sugar Coating—A Practical Approach to Delivering Sweet Flavor,” at the 2023 Clean Label Conference.

Additionally, “Sugar provides many properties to foods,” explained Taleyarkhan. With its sweet taste, sugar can mask bitter flavors and enhance fruity and brown flavors. The particle size of sugar affects mouthfeel. Sugar can enhance flavor, including savory flavors, when used at low levels and more complex brown sugar flavor profiles. It can be used as a decoration on cakes. It helps produce various textures and can add body and viscosity, as in meringues.

In the presence of heat and protein, sugar will add color. Brown and golden sugars create unique shades. The sugar’s particle size can be used for solubility control, based on the rate at which it dissolves. In frozen desserts, sugar depresses the freezing point. Smaller ice crystals create a smoother texture. Invert sugar inhibits recrystallization and thus aids moisture control in some applications.

In combination with an acid, sugar facilitates natural preservation in jams, preserves and

chutneys. By increasing viscosity, sugar can stabilize the dispersion of active ingredients in liquid medicines. Sugar also serves as a food source for yeast fermentation, noted Taleyarkhan.

When replacing sugar, one must consider bulk, body, mouthfeel, taste and balance of flavor in the formula. There is no “one size fits all.” Using fibers, proteins, flavorful ingredients, flavor enhancers, naturally occurring glutamates and non-nutritive carbs in unison is a way forward.

Some sugar is essential to bring the formula to life. Everything we do in product development to change flavor profiles is a deception—a way to confuse the senses and rebalance the interplay between sweet, sour, salty and bitter perceptions, said Taleyarkhan. The flavors we want to be intensified should get onto your taste buds first.

Spices and flavor combinations Not only do spices have anti-inflammatory properties, they also work as fantastic flavor maskers. Modulating the amount of salt in savory applications is essential in sugar reduction. A dark cocoa mass or chocolate heightens mildly sweet items. Molé dressing is a great example. Cocoa pulp, a sustainable new ingredient, can partially replace refined sugar in chocolate and confections.

Fibers/gums/non-nutritive sweeteners Some soluble corn fiber can reduce sugar content in chocolate, while retaining similar sweetness levels and leaving no aftertaste. A blend of gum acacia and stevia can work as a sugar alternative. Some fibers have behavior comparable to a bulking agent, added Taleyarkhan.

Proteins/fats Proteins, in combination with fat and soluble fibers, have a fantastic effect on a formula’s ability to reduce sugar. Sunflower protein enhances sweet, nutty and roasted flavor profiles. Isolates and fiber protein blends can slow down the staling process.

Flavor enhancers Familiar flavor enhancements, such as tomato concentrate, stevia extracts, yeast extracts, mushroom extracts, fermented products and protein sources, can enhance flavor and facilitate sugar reduction.

Naturally occurring glutamates Flavor-enhancing glutamates are naturally present in roasted nut pastes, cheese and cheese oils,

What Is Being Replaced?

A formulator must first understand what functionality will be impacted when efforts are made to reduce sucrose.

Sweet Taste	Mouthfeel	Flavor
Decoration	Texture	Color
Solubility control	Freezing Point and Crystallization	Moisture control
Preservation	Stabilizing and Suspension	Fermentation

SOURCE: CHARLIE BAGGS CULINARY INNOVATION (CBCI)/2023 CLEAN LABEL CONFERENCE

shitake and porcini mushrooms, and whole tomatoes. Their flavor profiles allow formulators to take down the sugar level.

Jenn Farrell, Director of R&D at CBCI, provided examples of sugar reduction in baked goods. In bakery applications, the most straightforward path is to use different types of syrups, fruit pastes, purees and fiber powders. Date paste worked well in a brownie; it binds moisture, extends shelflife and doesn't count toward added sugar. Enzymes like maltase or glucoamylase will break down their respective substrates to glucose. She also suggested that dextrose, which has half the relative sweetness of sugar, binds water and aids in moisture retention.

Farrell noted one negative: replacing sugar with a combination of many ingredients conflicts with a clean label objective.

"No Sugar Coating—A Practical Approach to Delivering Sweet Flavor," Zal Taleyarkhan, Corporate Research Chef; and Jenn Farrell, Director of R&D, Charlie Baggs Culinary Innovations (CBCI), <https://www.charliebaggsinc.com/>

The Reality of Trace Elemental Contaminants

THE FDA'S CLOSER TO ZERO INITIATIVE focuses on the exposure of trace elemental contaminants in foods commonly eaten by infants and children, noted Bill Adams, Product Manager, North America Chemistry, Mérieux NutriSciences, who co-presented "Heavy Metals—Closer to Reality," with Walt Brandl, Regional Director of Chemistry, North America, at Global Food Forums' 2023 Clean Label Conference. They provided detailed information that presented a realistic overview of trace elemental contaminants.

In January 2023, the FDA released the first of its guidelines for lead, one of four primary trace elemental contaminants, which also include arsenic, cadmium and mercury. "The FDA's Closer to Zero [initiative] has been on the docket for many years. We're talking about it now because [the FDA] just released the first of its draft guidelines," said Adams. (See chart "Current Status of Campaign.")

Heavy metals are found naturally in the environment but are also present from industrialization and pollution. Yet, "heavy metals are NOT always heavy," expressed Brandl. "And, in some cases, typically arsenic, they're not always present as a metal," which is why it's best if they're called trace elemental contaminants, he added.

Current Regulatory Landscape

Currently, there are no regulations for these contaminants in the U.S. or Canada. In the

past, the FDA has moved to set limit guidelines for questionable reasons, Brandl noted. One such instance happened after an episode of *Dr. Oz* focused on arsenic in apple juice, causing widespread panic. "We ran a couple of hundred apple juices for the FDA for arsenic and found one positive sample, which was exactly (.1ppm)," said Brandl.

To keep issues in context, it's important to see what the rest of the world is doing. Codex, an offshoot of the WHO and the United Nations, is not quite as data-driven as the guidelines set by the EU. Codex regulations are highly compromised because of the diverse political nature of the organization.

Brandl provided some interesting facts on each contaminant. The FDA is starting with lead, because it's the most prevalent contaminant in our environment—although it's not necessarily more toxic. Most of any arsenic contained in rice is found in the husk. Flax and shellfish are naturally very high in cadmium. Mercury is the opposite of lead, in that it's very toxic but not very prevalent.

Heavy metal concentration generally ranks from lowest to highest in fruits, fruiting vegetables, meat, legumes and grains, leafy vegetables and seafood. One source needing consideration is leafy vegetables, noted Brandl. On a fresh basis, the level of lead could be <.5ppm. But, he explained, if you're drying spinach down by a factor of four, that 0.5ppm becomes 2ppm.

Preferred Testing Methodologies

Most labs use microwave digestion followed by determining heavy metals using Inductively Coupled Plasma with a Mass Spec (ICPMS). Microwave digestion uses sealed vessels that prevent outside contamination and prevent loss of volatile metals such as mercury and arsenic. Pros include the technique's sensitivity and the ability to run all the metals simultaneously. Cons include the

Current Status of Campaign (as of May 2023)

	Lead	Arsenic	Cadmium	Mercury
Current Phase	Consult with stakeholders	Evaluate data	Evaluate data	Evaluate data
Next Steps	Finalize action levels, late 2023	Propose draft action levels in 2024	Propose draft action levels in 2024	TBD

SOURCE: WALT BRANDL, REGIONAL DIRECTOR OF CHEMISTRY, N.A.; AND BILL ADAMS, PRODUCT MANAGER, N.A. CHEMISTRY, MÉRIEUX SCIENCES/2023 CLEAN LABEL CONFERENCE

In January 2023, the FDA released the first draft of its guidelines for lead. Data is being evaluated for the three trace elemental contaminants, arsenic, cadmium and mercury.

Silky Sweet™

- WORLD'S FIRST -
FLAVOR ENHANCING SWEETENER

✓ ALL NATURAL



✓ SUGAR-FREE

TASTES BETTER THAN PURE CANE SUGAR!

- REFORMULATE NOW -

AVAILABLE IN
3 CONCENTRATIONS

✓ SILKYSWEET INTENSE 1:1

✓ SILKYSWEET 8X

✓ BULK-FREE 125-200X



**REQUEST LAB
SAMPLES**

silkysweet.com

NON-ADDICTIVE #GOURMETCURE



When a *Dr. Oz* episode focused on arsenic in apple juice, widespread panic ensued. “We ran a couple of hundred apple juices for the FDA for arsenic and found one positive sample, which was exactly (.1ppm),” said Brandl.

need to vent the machine and run with high-purity argon gas. Also, there’s a risk of carry-over between samples, especially for sticky elements like mercury.

Brandl suggested product developers ask labs what digest technique they’re using. Also, ensure reporting limits are at least half the target limit to reduce uncertainty. “You get two things. You know when you’re over; you’re over because you’re out of the uncertainty zone. And you also get an early warning if you get close to that limit,” he explained.

Brandl concluded by advising product developers to be aware of trace contaminants when substituting ingredients in formulations, particularly fiber sources. He advised that it depends on the source, but you’d be well advised to be aware of a potential issue.

“Heavy Metals—Closer to Reality,” Walt Brandl, Regional Director of Chemistry, North America; and Bill Adams, Product Manager, North America Chemistry, Mérieux NutriSciences, <https://www.merieuxnutrisciences.com/na/>

Clean Label Impact on Consumer Buying

“CLEAN LABEL IS NOW MAINSTREAM,” stated Kasey Farrell, Senior Manager, R&D, Product Intelligence SPINS, in opening her talk, “Clean Label Trends & Consumer Purchase Behavior,” given at the 2023 Clean Label Conference. “Brands are trying to differentiate themselves with new ways to say they’re clean.”

Consumers are savvy and are increasingly familiar with ingredients and their functionality. These consumers also have strong preferences.

Which Categories are Growing?

In Ready to Drink Beverages, SPINS data shows continued vilification of sugar. However, agave nectar and allulose are leading in the natural sweetener segment.

“Interestingly, counter to the clean movement, artificial sweeteners are still doing relatively well, due to the continued prevalence of their use in keto and low-carb diets and an overall interest in reducing calories for weight loss. Supply chain and pricing may play a factor in their performance, as well as consumers feeling the impact of their rising grocery bill and looking for less-expensive options where they can,” noted Farrell.

In the Protein Supplements and Meal Replacements category, animal-based protein sources, like whey, outperform plant-based alternatives. “Whey carries benefits for those seeking high protein and low carb,” explained Farrell, “It also is considered a cleaner ingredient source; minimally processed, coming from milk.”

In 2022, SPINS saw strong growth in sales of products with specific health and wellness attributes that are driving purchase decisions. These product attributes often are not transparent to consumers and include how ingredients are sourced.

Attributes that Attract Consumers

The labor practices of the companies involved in cultivating, manufacturing and distributing products are being examined. Farrell said that every component of the supply chain is being assessed and reported either as an on-pack claim, a certification or a data point, which consumers use to factor into their purchasing decisions.

Snacks and Candy is a category typically not known for its health and wellness attributes. But such products recognized as clean are doing well across the category.

Clean label has evolved from restriction to mission-driven, and SPINS has seen a shift in the consumer sets as well. First, “diet-based” are those shoppers that follow a specific diet for health or wellness goals. They seek certain categories of foods or specific nutrient content.

The next set is “natural ingredient-focused” consumers. They want to avoid chemical-sounding names and look for shorter ingredient statements with recognizable ingredients.

Transparency is essential for the third set of “sustainability-focused” shoppers, in terms of contents, sourcing/production/labor practices and the brand’s values.

As for packaging attributes, “Some 86% of shoppers are more likely to purchase a product based on its packaging. Four of five people would buy more sustainable packaging options if given the choice. And 76% have made an effort to purchase more sustainable products in the past year,” Farrell offered.

For young and older shoppers, 77% view sustainability as an important factor when selecting their products. “Despite the pressure of high inflation this year, 66% of young consumers are willing to pay



Counter to the clean movement, in Ready to Drink Beverages, SPINS data shows artificial sweeteners doing relatively well, due to their continued use in keto, low-carb diets and an overall interest in reducing calories for weight loss. Supply chain and pricing may be factors as well.

more for sustainable products,” stated Farrell, “yet have a hard time identifying these products on shelf.”

Certified Upcycled is gaining momentum, as food waste is a top consumer concern. Manufacturers are seeking new and innovative ingredient sources to use discarded food.

Plant-based is performing well, as it continues to evolve. A category that has historically catered to vegan or vegetarian audiences, about 50% of shoppers now practice flexitarian diets.

“Seaweed and sea vegetables are poised to become the next big trending ingredient group,” observed Farrell, with “buzzwords

of organic and regenerative, non-GMO, sustainable, as well as their versatile use in food applications.”

Next-generation technologies, such as precision fermentation, produce proteins considered sustainable alternatives to animal-derived milk proteins and are showing a greater presence in the market.

“Whether it’s plant-based, sustainable or completely devoid of negatively perceived ingredients,” Farrell concluded, “it’s clear that clean label is going to continue to play a huge part in consumer purchasing behavior, driving innovation; evolving in the space; and continuing to spur new product innovation.”

“Clean Label Trends & Consumer Purchase Behavior,” Kasey Farrell, Senior Manager, R&D, Product Intelligence, SPINS, <https://spins.com>

The staff at Global Food Forums once again thanks the attendees, speakers, sponsors, exhibitors and support services participating in the 2023 Clean Label Conference. As with all our events, we have worked hard to make this a worthwhile business activity. For current and past attendees, we hope you’ve additionally found them enjoyable as the diverse groups of participants gathered to share information, network and appreciate each other’s company.

THE SUGAR-BASED SUGAR REDUCTION SOLUTION



OVER 20 GRANTED PATENTS

NETFLIX explained

SEASON 3, EPISODE 1: SUGAR

TIME Special Mention

'BEST INVENTIONS OF 2020' BY TIME MAGAZINE



ALLOWS UP TO 50% LESS SUGAR



CLEAN LABEL



NON-GMO



SUSTAINABLE



NATURAL AND CLEAN TASTE



LEAVES ROOM FOR BETTER NUTRITION



Incredosugar Ltd. (Formerly DouxMatok)
Incredosugar.com
hello@Incredosugar.com



2023 Clean Label Technology Snapshot Ingredients

An independent advisory panel evaluates industry submissions of newer-to-the-market ingredients for each Clean Label Conference. See the sidebar “2023 Clean Label Conference Technology Snapshot Advisory Panel.” These innovative components possess benefits for formulators striving for simplified, consumer-friendly labels. This year, vendors of the selected ingredients were invited to give 15-minute Technology Snapshot Presentations in 2023. The following were presented.

AgriFiber – MFCL Multi-Functional Corn Fiber (pre-gelled) is an alternative to soluble fiber that provides body and texture, while allowing for a desired viscosity. This ingredient enables texture from milk to flan to plant-based sausage.

AgriFiber – Soluble Fibers SFC and SFO are prebiotic, clinically proven USA-made fibers. They provide functionality (smooth texture and enhanced bar shelflife) and impact satiety and glucose control, with no bloating or gas formation at 25g consumption.

Almendra Americas, LLC – System G Taste Modulators enable the formulation of non-caloric sweeteners to substantially replicate the taste of sugar in beverages, baked goods and ice cream products. They are being manufactured to permit natural flavor labeling.

Apparo, Inc. – Solistein 001 Sunflower Protein provides 2-5 times the sweetness of sucrose and is a soluble, clear solution and nutritious protein source. It’s non-GMO, gluten-free, Upcycle Certified, and produced with a proprietary natural extraction process using water, salt and filtration techniques.

Avebe – Etenia™ ES is a unique, clean label, multifunctional potato starch. Easy to disperse, it is a soluble hydrocolloid alternative that replaces milk protein/fat, modified starches and hydrocolloids.

Axiom Foods, Inc – The company’s Vegotein™ CLEAR Pea Protein and Oryzatein® CLEAR Rice Protein each have over 80% peptide content with high clarity and solubility, low molecular weight, neutral taste, and high absorbability and bioavailability. They are stable in low-PH beverages.

California Natural Color – The company’s unique Pure Brown Carrot offers a clean label solution for caramel color replacement for food, beverage and nutraceutical industries.

Ciranda, Inc. – Tapioca Syrup RS 18 is a nutritive sweetener with exceptional binding and film-forming properties. Due to its composition, it has sweetness similar to a DE40 tapioca syrup but with 38% fewer sugars. Non-GMO and kosher.

Ciranda, Inc. – Organic Agave Syrup AL40 is produced using an organic-approved enzyme that converts 40% of the fructose to allulose epimers. Used to reduce calories and total added sugars, it is certified organic, Non-GMO Project Verified and kosher.

Corbion – Produced via a proprietary fermentation process and labeled as “natural flavor,” PuraQ Arome 200 can enhance *umami* and savory notes in various food applications, including dips, refrigerated and plant-based foods.

EverGrain® by AB Inbev – EverPro® Upcycled Barley Protein is the first of its kind, demonstrating market-leading solubility, low viscosity and a taste in protein beverages that’s preferred 10-to-1 by consumers. Dive into the functionality of barley protein and see how it compares to other commercially available proteins.

Glanbia Nutritionals – UltraHi Protein is Glanbia’s newest technology for fermented products to achieve up to 25% protein in spreadable, spoonable and drinkable yogurt applications in refrigerated and ambient formats without jeopardizing flavor or label.

Ingredion Incorporated – FIBERTEX™ CF 102 502 Citrus Fibers are fruit-based texturizers with a consumer-preferred clean label derived from citrus peel. They deliver unique functionality in bakery and savory applications, enabling cost-savings opportunities without compromising on texture consumers love.

InnovoPro – CP-Pro 70 chickpea protein concentrate enables the creation of tasty, nutritious, clean label and

2023 Clean Label Technology Snapshot Ingredients

sustainable food and beverage products that offer an excellent nutritional profile; “free-from” properties; and wide usability in the food industry.

Kerry – DuraFresh UC Plus is a unique, patented blend of organic acids and peptides that can improve product quality through clean label inhibition of pathogens and spoilage in RTE poultry with more authentic taste, texture and aroma.

Kerry – Provian NDV is an effective, sodium-free preservative that shows potent inhibition of *Listeria monocytogenes* and lactic acid bacteria, helping extend shelflife and meeting current food trends, like sodium reduction and clean label.

Millbio – A botanical extract from Rowan berry, X-TRA GUARD is the latest innovation formulated by the recently merged BioNaturals and Millbo companies. The quest for a natural solution to help freshness is over.

NEXIRA – Naltive locust bean gum is a new range of natural and efficient texturizers to create the perfect sensory experience. Supported by Nexira’s expertise in ingredient sourcing, naltive possesses advanced functionalities for dairy and plant-based applications.

NuTek Natural Ingredients – NuForm® Tamarind Seed Gum is an upcycled, highly functional, process-tolerant hydrocolloid with excellent water-holding and emulsion properties for applications—and is also an alternative to other gums, including locust bean, guar and xanthan gum.

NuTek Natural Ingredients – NuSavor is a standalone, clean label *umami* flavor solution that elevates savory flavors and eliminates the need to add MSG, I+G, HVPs, yeast extracts, and costly herbs and spices.

Oregon Fruit Products – Clean Label Single Strength 100% Fruit Purees are excellent sugar substitutes, meeting the demand for reduced added sugars on consumer-packaged goods’ nutrition facts panels, allowing manufacturers to list only real fruit (e.g., “mangos”).

Osage Food Products – SolvPro Plant Protein Systems offers customized, blended plant protein systems. These systems are designed to meet customers’ needs and deliver targeted functionality, nutrition (i.e., PDCAAS of 1.0) and labeling needs.

Sensient Flavors & Extracts – TrueBoost SensaSalt, a natural, flavor-based taste technology, was created to assist with sodium-reduction desires or requirements across the entire series of applications, from wet to dry, with a proven 20-40% reduction!



Innovation in raw material sourcing and processing results in new, functional ingredients for clean label foods and beverages.

2023 Clean Label Conference Technology Snapshot Advisory Panel

- **Raj G. Narasimmon** Ph.D., Narasimmon Consulting LLC
- **Alex Woo**, Ph.D., CEO, and Founder, W2O Food Innovation
- **Stevan A. Angalet**, Ph.D., President, Angalet Group International, LLC
- **Kerry Hughes**, MSc, Ethnopharm
- **David Lafond**, Ph.D., MBA, Owner, Celesta Company, LLC
- **Webb Girard**, MSc, Culinologist, Culinex LL
- **Claudia O'Donnell**, MSc, MBA, Global Food Forums, Inc.

2023 Clean Label Conference Magazine Sponsor Profiles



For over 20 years, **Applied Food Sciences** (AFS) has inspired and innovated functional ingredients for the natural products industry.

Quality is transparent through organic farming, responsible sourcing and sustainability. AFS cares about every stakeholder, from rural farmers to the largest companies in the world. We are featuring PurHP-75™ organic hemp seed protein – 75% protein complete with all nine essential amino acids and a neutral flavor profile, perfect for plant-based, gluten-free and keto-friendly products.

<https://appliedfoods.com/ingredients/purhp-75/>



At **CuliNEX**, we are pioneers in clean label and flavor-first product innovation and development

for food industry clients of every size. Collaborative and passionately creative, we combine culinary and food science expertise to achieve your vision across ALL food categories and applications. We'll partner with you wherever our expertise is needed, from innovation to scale up. Visit CuliNEX.biz or drop us a line at marcom@culinex.biz to discover your new, favorite food development partner!



EverGrain® is a sustainable protein ingredient company created by AB InBev to harness the potential of barley by upcycling

brewers' spent grain. EverPro is the world's first upcycled barley protein ingredient commercially available at scale. EverPro's formulation delivers unmatched solubility, viscosity, absorption and digestibility. It is made using a proprietary process, thereby emitting lower carbon and using significantly less land and water. It is also one of the first ingredients to be certified by the Upcycled Food Association. www.evergrainingredients.com



Farbest Brands can help you meet the demand for clean label ingredients with a full range of high-quality dairy and plant

proteins, gum acacia, vitamins, sweeteners and natural colors, as well as USDA-certified organic and Non-GMO Project Verified ingredients. No matter your budget,

application or label claim, we guide you to the ingredients that are right for you. With our extensive market knowledge and personalized customer service, we help our customers make better purchasing decisions. www.farbest.com



Idaho Milk Products continually produces the highest quality milk proteins and milk permeate and offers the best all-around service you deserve. Our vertical

integration provides full lot traceability from the dairy to your facility. Our innovative IdaPlus products, calcium-reduced proteins, are ideal for clean labels, high-protein RTDs, yogurt, flavored milks, ice cream and replacing caseinates. With our state-of-the-art Milk Innovation Center, our experts can assist you with your formulations from concept to packaging samples. www.idahomilkproducts.com



Ingression helps you create food and beverages with cleaner ingredients and simpler labels that consumers understand and prefer. We combine our pioneering ingredient

solutions and proprietary market insights with formulation expertise to help you position your brand to win with a growing group of consumers who are willing to pay more for the clean label products that match their values—and enable you to capture tangible gains in revenue, margin and pricing. https://go.ingredion.com/citrus-fibers-ebook?utm_source=clean_label_conference&utm_medium=emagazine&utm_campaign=plant_based_protein&utm_content=citrus_fibers



Inredo® Sugar is the flagship product of Inredo LTD (formerly DouxMatok), a global food-tech company pioneering the development of efficient

nutrition and flavor technologies and enabling healthier consumption of foods. Inredo Sugar is a first-of-its-kind, sugar-based sugar-reduction solution. Made from real cane sugar, Inredo Sugar provides between 30-50% reduction of sugar in food and snacks, with no compromise to the taste or the level of sweetness. www.inredo.com

2023 Clean Label Conference Magazine Sponsor Profiles



MUNZING's
MAGRABAR® products
have been developed
for a wide range of

applications and are designed to provide exceptional initial knockdown and long-lasting defoaming during food processing. We offer both liquid and powder defoamers with options suitable for organic, non-GMO and identity-preserved processing. MAGRABAR products are allergen-free, kosher and halal and are produced in a Global Food Safety Initiative (GFSI) certified facility, operating under food GMPs and a HACCP-based food safety system.
<https://www.munzing.com/en/products/brand/magrabar/>



Nexira is a premier supplier of organic ingredients and active botanical extracts. As the world leader in acacia, Nexira offers

inavea: 90% fiber content (FDA approved), strong scientific studies on prebiotic and digestive comfort, and the first low-carbon fiber. Nexira has enlarged its portfolio and expertise with natural and efficient texturizers like carob gum, tara and specialty guar. Clean up and upgrade your label with natural and healthy ingredients! www.nexira.com



Founded in 1992 as a functional ingredient manufacturing company, **RIBUS Inc.** supplies natural and organic plant-based ingredients to companies around the world. As the Original Clean Label Ingredient Company™, RIBUS produces non-GMO, natural, organic, vegan and gluten-free ingredients for the food, beverage, pet and dietary supplement sectors. RIBUS's patented technology and ingredients can help solve production issues while bringing innovation and clean labels to a wide variety of products. <https://ribus.com/>



Sensient Technologies Corporation is a leading global manufacturer and marketer of colors, flavors

and other specialty ingredients. Sensient uses advanced technologies and robust global supply chain capabilities to develop specialized solutions for food and beverages,

as well as products that serve the pharmaceutical, nutraceutical, cosmetic and personal care industries. Sensient Flavors & Extracts innovative technologies offer optimal choices for complete flavor system development.
<https://www.sensient.com/product-solutions/sensient-flavors>



As a division of **Siemer Milling Company**, Siemer Specialty Ingredients has been working with flour and exceptional

customers since 2005, helping to make products more functional and more marketable—without loss of nutritional aspects. Reduce your raw ingredient costs by replacing chemically modified starches naturally with our Heat Treated wheat flour. Our heat treatment process extends the shelflife of germ and bran to reduce waste—meaning satisfaction for the consumer and improved product performance for you.
<https://www.siemerspecialtyingredients.com/>



Wish you could create sugar-free formulations that actually improve flavors

vs. pure cane sugar? Now you can, with the World's Only Flavor Enhancing Sweetener that is all natural, sugar-free, ketogenic certified (human blood tested) and tastes better than pure cane sugar. **SilkySweet** is a proprietary 9+ ingredient blend of non-GMO allulose, the highest purity monk fruit extract, an analog sweetener superior to stevia (zero stevia), five rare and expensive organic flavors and sweetness enhancer compounds, bitterness/sourness maskers and off-flavor modulators, plus a pinch of ancient sea salt. <https://www.silksweet.com/request-sample.php>

Global Food Forums, Inc. wishes to give a special thank you to the sponsors of this 2023 Clean Label Post-Conference magazine. We hope many product developers will find the information useful.

Taste, Performance, and Sustainability Unmatched in the Protein Industry



It's protein
redefined.



The Power of Upcycled Barley Protein: Naturally Wholesome, Delightfully Clean

EverPro upcycled barley protein delivers an exceptional combination of mellow taste, unparalleled performance, and industry-leading sustainability. EverPro sets a new standard in the protein beverage, hydration, and energy drink space for clean, nutritious ingredients—so consumers will keep coming back to your products with confidence.

For sources and to request a sample, go to evergrainingredients.com

EverPro's Nutritional Benefits

- Bioavailability comparable to or better than whey, premium pea, and soy protein.
- Optimal levels of all three Branch-Chain Amino Acids (BCAAs).
- High levels of Amino Acids Glutamine and Proline, both linked with muscle recovery.

EverPro's Functional Benefits

- Market-leading solubility.
- Water-like viscosity, even at high concentrations.
- No gelling or water holding capacity.
- Minimum flavor impact.



GLOBAL FOOD FORUMS® EVENTS

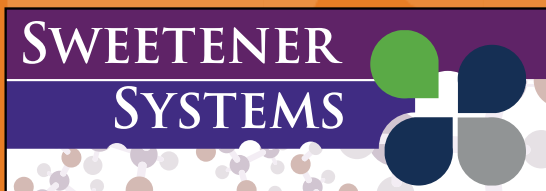
globalfoodforums.com



cleanlabel.globalfoodforums.com



foodproteins.globalfoodforums.com



sweeteners.globalfoodforums.com