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Food Technology

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Visit FeedingTomorrow.org to view the annual report

by Vickie Kloeris

Combating Food Insecurity Starts With Us

THROUGHOUT DECEMBER and January, people around the world celebrate a variety of holidays. While the traditions and celebrations may differ, holidays are generally a time of abundance and excess, especially when it comes to food. But not for everyone.

The United States is one of the wealthiest countries in the world, and yet the number of people living in food-insecure households is astounding. According to the Department of Agriculture's Economic Research Service, 38.3 million people lived in food-insecure households in 2020, including 6.1 million children. These households were uncertain of having—or were unable to acquire—enough food to meet the needs of all their members. The picture is even more bleak when you look at other areas of the world. The latest report from the Food and Agriculture Organization of the United Nations confirms that nearly 2.4 billion people—almost one in three—faced food insecurity at the moderate or severe level in 2020.

On the flip side, large segments of the population have more food than they need. They have grocery stores and restaurants nearby with a variety of options available. They can afford healthy food. They throw food away because it spoils or expires. They dine out at least once a week. Among these people, the prevalence of overweight and obesity has risen to crisis levels. For the first time in history, the World Health Organization reported the

number of people worldwide who are both overweight and malnourished equals the number who are underweight and malnourished. It's a sad and discouraging predicament.

There is general consensus on the factors that contribute to food insecurity, which include global population explosion, unequal wealth distribution, diminishing natural resources, climate change, conflict and war, food loss and waste, and shifting dietary patterns, among others. We all must acknowledge the significance of the problem and commit to finding solutions if we have any hope of bridging the food security gap.

While it may be easy to think the work you do doesn't make a difference with an issue of this magnitude, you couldn't be more wrong. Food science and innovation play an important role in solving the food security problem.

Reducing food waste is one of the most important things we can do to address food insecurity. For example, transforming discarded agricultural and food waste into added-value products via upcycling serves two needs—providing food for those who need it and positively impacting the environment.

Improving ways to provide shelf-stable foods to parts of the world where there is little to no refrigeration and identifying less costly and less resource-intensive ways to process food are additional areas of promise. By looking holistically at the food value chain, food scientists and innovators from organizations ranging from small

startups to major corporations are well-positioned to make a difference in this fight.

The science of food community can also shine a spotlight on the problem. We need to keep food inequity in mind when creating new products. Try to strike a balance between developing high-end and affordable products. Explore ways that your company can reduce waste in manufacturing processes. Perhaps most importantly, convey your concern about the equitable distribution of food to members of company leadership teams and challenge them to commit to addressing inequities in the food system.

I also challenge our community to use our collective voice to draw attention to the issue of food insecurity. As food experts, we can educate our nonscientific colleagues, family, and friends about ways they can make a difference, such as purchasing and preparing only the food they need and supporting local food banks. Whether you volunteer to sort and package food, deliver groceries to the homebound, or make a financial donation, countless people will benefit from your generosity.

It is easy to take for granted that food will always be available when you have plenty, but food insecurity is prevalent in every corner of the world. In big and small ways, we each have the power to make a difference—during times of abundance and year-round. **ft**

WHILE IT MAY BE EASY TO THINK THE WORK YOU DO EVERY DAY DOESN'T MAKE A DIFFERENCE WITH AN ISSUE OF THIS MAGNITUDE, YOU COULDN'T BE MORE WRONG.

Vickie Kloeris, MS, CFS, is IFT President, 2021–2022 (president@ift.org)

Looking Ahead to Honor Our Past

TO SAY THE world looked very different when IFT first launched *Food Technology* in 1947 would be an embarrassingly obvious understatement.

In the United States, a loaf of bread cost 13 cents, and you could buy two cans of Heinz Cream of Tomato soup for 23 cents. Test pilot Chuck Yeager had just broken the sound barrier, and the first point-contact transistor was being developed at Bell Labs.

Globally, the Marshall Plan laid the foundation for the rebuilding of Europe, while the Truman Doctrine signaled the first whispers of the Cold War. India and Pakistan both became post-colonial, independent states. And the International Monetary Fund formally began operation, charged with fortifying worldwide economic stability.

It was an era of audacious plans and massive change, the pace of which has only accelerated in the ensuing decades.

As *Food Technology* celebrates its 75th anniversary in 2022, we're proud to introduce a new publication for a new era that reflects a more global perspective, digital awareness, and active acknowledgement that today, relevance supersedes any legacy notions of loyalty to brands or institutions.

When I joined IFT 14 months ago, I was greeted by an organization that is aggressively evolving to meet the demands of an increasingly complex food system, where science, business, and society are intertwined and interdependent.

With that in mind, my colleagues and I embarked on a journey to reinvent and rediscover what *Food Technology* could and should be to remain relevant in today's ecosystem. We studied a range of data points, from membership surveys to reader assessments to digital engagement metrics, then spoke with members to gather additional insights. We studied best-in-breed publications covering multiple segments of business, science, and technology, for insight and inspiration.

This issue debuts the results of that year-long reflection and reinvention process.

The new *Food Technology* is driven by three goals: to affirm IFT's role as a thought leader in the global food ecosystem by regularly examining the issues driving the science of food, and their subsequent innovations; to celebrate and illuminate the scientists and entrepreneurs driving that change, both within and

outside the ranks of our organization; and to contextualize the entire discussion, focusing on the intersection of science, business, and product innovation.

Our new format is designed to be flexible and dynamic, with a range of topical sections and article formats that will expand or contract based on the timeliness and depth of the subject:

Omnivore, our new front section, offers quick reads of topics from consumer trends to food safety to health and nutrition.

Market Trends focuses on consumer-facing trends in food product development and distribution, from demographic research to channel marketing in retail and foodservice.

Innovations profiles companies and individuals leading new product development and examines the macro trends driving that development.

Issues & Insights offers a deeper analysis of challenges and opportunities that impact the global food system, as well as in-depth conversations with those who are embedded in addressing the trends.

Our new **Research** section previews cutting-edge food science and profiles the individuals who are driving it.

Applied Science covers a range of practical learning in ingredients, food safety, nutraceuticals, processing, and packaging.

Supplier Central offers our supply-chain partners a cohesive, integrated section to share news about new products and services that support food professionals.

Dialogue, our back-page perspective column, is designed to deliver expert opinion that spurs informed discussion and debate on critical topics in food and science.

We've also added more direct links to enhanced or supplemental content online, so be sure to check out the URLs and QR codes for quick access.

We hope you like the new direction and the new look. More important, we recognize that a redesign is a process, not a singular event, so we hope that you'll share your feedback, and your ideas for further refinements. 

Bill McDowell is editor-in-chief of *Food Technology* magazine (bmcdowell@ift.org).

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2022

IFT Achievement Awards

Professionals and organizations from every corner of the food sector make countless contributions to the science of food every day. Their breakthroughs have the potential to change the way we feed our global population. Their advancements can change the trajectory of our food system. Their accomplishments deserve to be celebrated.

Help recognize these achievements.

Nominations for the 2022 IFT Achievement Awards close on January 14, 2022. The honors will include 15 awards in five categories. Most IFT Achievement Awards are open to members and nonmembers alike. Individuals may self-nominate or nominate another person, team, or organization for an award.

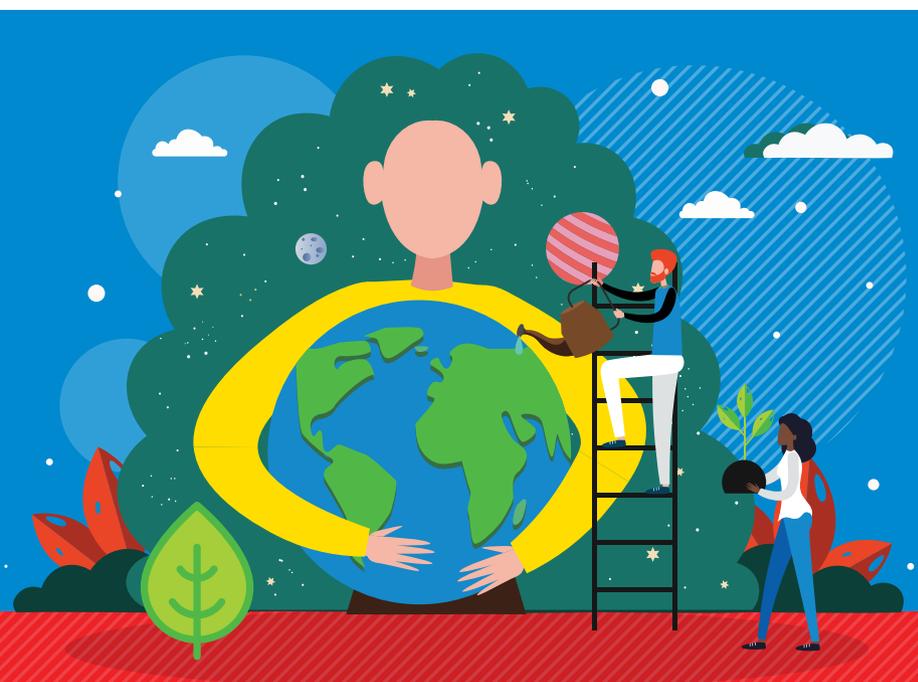
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Omnivor

INDUSTRY

Shared Planet tops 2022 trends



CONSUMERS ARE LOOKING to shape a sustainable and prosperous future by taking joint responsibility for the environment through food and lifestyle choices, according to Innova Market Insights, which named “Shared Planet” the top trend for 2022. For food and beverage companies, this requires building trust with consumers by communicating clearly and transparently, and ensuring that a product’s life story can stand up to scrutiny.

“One of the biggest shifts we are seeing is that the health of the planet is now the top concern of consumers,” said Innova Global Insights Director Lu Ann Williams in a press release. “Personal health has been the big concern for the past few years, but consumers now tell us that this has been surpassed by global issues. Sustainability is no longer just a Wall Street issue. It might not be the top purchase driver for all consumers, but for many it clinches the deal when it comes to choosing between products.”



REDUCING FOOD WASTE (43%) AND EATING IN MODERATION (32%) ARE THE TOP TWO ACTIONS CONSUMERS ARE TAKING ON THE ENVIRONMENT.

Source: Innova Lifestyle & Attitudes Survey 2021 (11 countries)

Rounding out the top five list are the following trends:

2. Plant-Based. The Canvas for Innovation.

Plant-based R&D has evolved from mimicking meat, fish, and dairy to creating innovative options that stand on their own merits. Consumers’ desire for a varied diet, as well as products that feature indulgence and premium ingredients, is also furthering interest in plant-based products.

3. Tech to Table. Advances in technology are impacting product development from conception to consumption, with innovation opportunities affecting every aspect of the food and beverage industry. In addition, consumers are using apps and other tools that support their health and nutrition needs and have indicated their openness to embracing technological change and sharing data if food companies can show benefits to personal and global health.

4. Shifting Occasions. Eating occasions have shifted since the start of the COVID-19 pandemic, with consumers becoming more aware of the comforts and possibilities of home. Food industry leaders will be challenged to find new and better ways to serve evolving consumption occasions through the creation of products that spark interest for consumers whose social habits are changing.

5. Voice of the Consumer. Food and beverage companies have never been more challenged to meet the demand for products that align with consumers’ political, social, and ethical values. In the absence of such products, entrepreneurial consumers are increasingly taking action to fill their own needs by co-creating products that satisfy specific market niches.

Other trends rounding out Innova Market Insights’ Top 10 Trends for 2022 speak to authenticity, responsibility, and the simple craving for pleasure, with the following themes predicted to drive consumer actions in the coming 12 months: Gut Glory, Back to the Roots, Amplified Experiences, Upcycling Redefined, and My Food, My Brand.

AQUACULTURE

Future of blue foods

AQUATIC FOODS CAN play a greater role in delivering healthy diets and more sustainable, equitable, and resilient food systems, according to findings by marine ecologists at the University of California–Santa Barbara’s Bren School of Environmental Science & Management. The group recently published a series of five peer-reviewed papers on the aquatic food sector in the journal *Nature*.

In their review of hundreds of studies of seafood species, the scientists found many opportunities to leverage the diversity of “blue” foods to address malnutrition, lower the environmental impact of the food system, and provide livelihoods. The researchers project a doubling of global demand for blue foods by 2050, which will be met primarily through increased aquaculture production.

From a sustainability perspective, the majority of species raised in aquaculture environments, including tilapia, salmon, catfish, and carp, were found to have environmental footprints comparable to chicken, the lowest-impact terrestrial meat. Blue foods in general were also found to rank more highly than terrestrial animal-source foods in terms of their nutritional benefits. For example, compared with chicken, trout has approximately 19 times more omega-3 fatty acids; oysters and mussels have 76 times more vitamin B12 and five times more iron; and carp has nine times more calcium.

“For the first time we got to see what more aquatic food production would mean for human health globally,” said Christopher Free, Bren School marine ecologist and assistant researcher, in a press release. “What we project is that by making aquatic foods cheaper to the consumer, there’s likely going to be a shift away from land-based foods like chicken, beef, and dairy. I think what made us really excited is knowing that aquatic food could be a useful solution to combating malnutrition, and

really showing that comprehensively for the first time.”

The five papers are the first in a series produced by the Blue Food Assessment, a group of more than 100 leading researchers led by Stanford University’s Center for Ocean Solutions & Center on Food Security and the Environment, the Stockholm Resilience Centre at Stockholm University, and the nonprofit EAT.

CONSUMER PERSPECTIVES ON CANNABIS



A recent survey by Canadian research firm SCS Consulting found that three-quarters of U.S. residents and almost 80% of Canadians now support cannabis legalization. In addition, consumer interest in edibles is growing, which suggests that the stigma surrounding cannabis is on the decline and that public policies need to change to reflect evolving acceptance of cannabis products in North America. To learn more about the survey results, scan the QR code, or visit iftexclusives.org/cannabis-survey.





Americans are consuming more ultra-processed foods

A NEW STUDY conducted by researchers at the New York University School of Global Public Health indicates that the average U.S. diet has shifted during the past two decades toward consumption of more ultra-processed foods, an eating pattern that some public health experts find concerning due to its association with a higher risk of chronic disease. Ultra-processed foods were defined as products that are industrially manufactured, ready-to-eat or -heat, include additives, and are largely devoid of whole foods.

The study, published in the *American Journal of Clinical Nutrition*, analyzed data from nearly 41,000 adults who took part in the Centers for Disease Control's National Health and Nutrition Examination Survey from 2001 through 2018. Participants reported what they ate in the past 24 hours, with foods catalogued into four categories: minimally processed (whole foods), such as vegetables, fruits, grains, meat, and dairy; processed culinary ingredients, such as olive oil, butter, sugar, and salt; processed foods, such as cheese, canned fish, and canned beans; and ultra-processed foods, such as frozen pizza, soda, fast food, sweets, salty snacks, canned soup, and most breakfast cereals.

The researchers found that consumption of ultra-processed foods grew from 53.5% of calories during 2001–2002 to 57% during 2017–2018. The largest increase was in ready-to-eat or -heat meals, such as frozen dinners. In contrast, whole foods declined from 32.7% to 27.4% of calories consumed, due mainly to people eating less meat and dairy.

Given the growing intake of ultra-processed foods and their link to chronic diseases, the researchers recommend implementing policies to reduce their consumption, such as revised dietary guidelines, marketing restrictions, package labeling changes, and taxes on soda and other ultra-processed foods. They also support programs and policies to increase the availability, accessibility, and affordability of whole foods, especially among disadvantaged populations.

"In the current industrial food environment, most of the foods that are marketed to us are in fact industrial formulations that are far removed from whole foods. Nevertheless, nutritional science tends to focus on the nutrient content of foods and has historically ignored the health implications of industrial food processing," remarked Filippa Juul, lead author of the study, in a press release.



U.S. RETAIL SALES OF PLANT-BASED FOODS GREW 27% IN 2020, BRINGING THE PLANT-BASED MARKET VALUE TO \$7 BILLION, ACCORDING TO DATA FROM THE PLANT BASED FOODS ASSOCIATION AND THE GOOD FOOD INSTITUTE.

Simplifying food fraud detection



FRAUDULENT FOOD PRODUCTION

practices, especially related to geographical origin, result in billions of dollars of economic damage every year. But a new low-cost model for determining food origin can help stem economic losses, say botanists at the University of Basel who developed the tool.

Currently, a common method of detecting food fraud involves determining the $\delta 18\text{O}$ (delta-O-18) value of a product sample to characterize the oxygen isotope ratio. Because the process requires reference data from the claim country of origin as well as data from other regions, it is both time-consuming and costly.

The model developed by the University of Basel botanists can simulate the oxygen isotope ratio in plants from individual regions, eliminating the need for reference data. The

model uses temperature, precipitation, and humidity data as well as information about the growing season of a plant, all of which are available from publicly accessible databases. After testing the model on a unique $\delta 18\text{O}$ reference dataset for strawberries collected across Europe over 11 years, it was shown to simulate the origin of the strawberries with a high degree of accuracy.

“With minor adjustments to the parameters, our model can be used to determine all plant products,” said Ansgar Kahmen, leader of the research project, in a press release.

In addition to being useful for food forensics and in investigations involving the origin of confiscated drugs, the model could prove valuable for private forensic institutes that inspect food or serve as expert witnesses in court.

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LACTOSE FACTS

- Nearly 65% of the global population is prone to lactose intolerance, according to data from the National Center for Biotechnology Information.
- Thirty million adults in the United States experience symptoms of lactose intolerance by the age of 20, according to the U.S. National Library of Medicine.

MARKET TRENDS

Lactose-free market on a growth track



THE LACTOSE-FREE PRODUCTS market is projected to be valued at \$18.4 billion in 2025, recording a compound annual growth rate of 8.7%, according to research from MarketsandMarkets. Growth will be driven by an increasing awareness of lactose intolerance as well as heightened consumer demand for products with lower or no added sugar.

Market challenges will come in the form of higher costs for lactose-free products and stiff competition from plant-based alternatives made from soy, rice, nuts, and oats, many of which have high nutritional value and are lower in fats. However, an increase in self-diagnosed cases of lactose intolerance among consumers will continue to drive significant growth in Europe and the United States.

Lactose-free products are also gaining traction in the Asia Pacific region, projected to be the fastest-growing market during the forecast period, as consumers become more concerned about their health and invest in self-diagnosis. The substantial growth of the Asia Pacific economy, rapid urbanization, an increase in demand for expensive and healthy foods and beverages, and the Westernization of consumer diets are major factors driving growth in the region.

Opportunities for innovation include products that tout health benefits, including easy digestion and lower fat and sugar content, and products that mix lactose-free ingredients with healthy ingredients, such as vitamins, proteins, and fibers, providing a wide range of choice to consumers.

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Nutrient profiling system supports healthier choices



IDENTIFYING HEALTHY FOODS

is not always easy, but a new profiling system developed by scientists at the Friedman School of Nutrition Science and Policy at Tufts University may

help consumers, food companies, restaurants, and cafeterias up their nutrition knowledge.

The system, called Food Compass, incorporates up-to-date information on how different characteristics of

foods positively or negatively impact health. Features of the system include the ability to consider both healthful and harmful factors; incorporate cutting-edge research on nutrients, food ingredients, processing characteristics, phytochemicals, and additives; and objectively score all foods, beverages, and even mixed dishes and meals using one consistent score.

“Once you get beyond ‘eat your veggies, avoid soda,’ the public is pretty confused about how to identify healthier choices in the grocery store, cafeteria, and restaurant,” said the study’s lead and corresponding author, Dariush Mozaffarian, in a press release. “Consumers, policy makers, and even industry are looking for simple tools to guide everyone toward healthier choices.”

The Food Compass system was created using a national database of 8,032 foods and beverages consumed by Americans. It scores 54 different characteristics across nine domains representing different health-relevant aspects of foods, drinks, and mixed meals. The characteristics and domains were selected based on nutritional attributes linked to chronic diseases such as obesity, diabetes, cardiovascular problems, and cancer, as well as to the risk of undernutrition, especially for mothers, young children, and the elderly.

The system was designed to allow the evolution of additional attributes and scoring based on future evidence in areas like gastrointestinal health, immune function, brain health, bone health, and physical and mental performance, as well as sustainability considerations.

In addition to helping the food industry develop healthier foods and reformulate ingredients in popular processed foods, Food Compass can help to guide local and national policies related to package labeling, taxation, warning labels, and restrictions on marketing to children.

CALCULATING FOOD SCORES

Food Compass assigns each food, beverage, or mixed dish a score, ranging from 1 to 100. Foods or beverages with a score of 70 or more should be encouraged, while those in the 31–69 range should be consumed in moderation. Items scoring 30 or lower should be consumed minimally. Across major food categories, the average Food Compass score was 43.2. Here’s a sampling of average scores:



- Legumes, nuts, and seeds (78.6)
- Fruits (73.9, with nearly all raw fruits scoring 100)
- Vegetables (69.1)
- Seafood (67.0)
- Starchy vegetables (43.2)
- Poultry (42.7)
- Beef (24.9)
- Snacks and sweet desserts (16.4).

COMMUNITY

Werblin joins Sophie's Kitchen



LESLEY WERBLIN RECENTLY joined plant-based seafood company Sophie's Kitchen as a food scientist. Werblin previously oversaw product development activities in a variety of food categories at Culinex, where she lent a science-focused culinary approach to her work.

An IFT member, Werblin is active in the Product Development Division and serves as a committee member for the Puget Sound IFT New Professionals. She is also a member of the Research Chefs

Association. Werblin holds a bachelor's degree in geology from Mount Holyoke College and a master's in food science from Chapman University.

Remembering Robert Schiffmann

LONGTIME IFT MEMBER Robert Schiffmann, a Certified Food Scientist and pioneer in microwave research, passed away on September 4.

A physical chemist with a master's degree in analytical science and physical chemistry from Purdue University, Schiffmann worked in R&D for more than a decade before turning to consulting, where he spent more than 50 years as a leading microwave heating expert and process and product developer.

In addition to his association with IFT, Schiffman was a fellow of the International Microwave Power Institute and served as president of the board for over 22 years. He held 28 U.S. patents, chaired more than 20 international conferences, including the 4th World Congress on Microwave & Radio Frequency Applications, and co-authored several books. He was also a frequent lecturer, leading international courses on microwave theory and radio frequency technology.

According to the New York Times, Schiffman's desire to show the capabilities of microwaves led him to create a variety of product innovations, including "microwaveable caramel popcorn, crust for microwaveable frozen potpies, microwaveable oatmeal, and a microwave crisper," in addition to methods for thawing frozen doughnuts and microwaving foods while still packaged.

Schiffman was a founding member of AMPERE (Association for Microwave Processing in Europe for Research & Education), an honorary member of the Microwave Technology Association of the UK, and a former vice president of the Microwave Working Group, as well as the first recipient of the Metals Microwave Pioneer Award.

**IN MEMORIAM:
IFT NOTES THE
PASSING OF
THE FOLLOWING
MEMBER: J. W.
DAVID GRAY**

Paying tribute to Louise Slade

CELEBRATED RESEARCH BIOCHEMIST and IFT Fellow Louise Slade passed away on October 7. Slade was widely recognized, along with fellow researcher and life partner Harry Levine, for pioneering a new approach to biochemistry, called food polymer science.

Slade began her career in the food industry as a research scientist at General Foods, following the completion of a PhD at Columbia University in 1974 and a postdoctoral fellowship at the University of Illinois. Later she served as a research fellow with Nabisco and Kraft Foods.

Together with Levine, Slade earned 47 granted patents that resulted in many commercial food advancements in areas such as cookies, crackers, snack chips, and soft ice cream. After her retirement from Kraft Foods in 2006, she launched a food consulting business, Food Polymer Science Consultancy, in which she and Levine advised many global food and beverage companies. Late in her career, she was honored by having a new soft wheat cultivar, "Louise," named after her by the cultivar's breeder, Kim Kidwell, and the U.S. Department of Agriculture Western Wheat Quality lab.

During the course of her career, Slade was the recipient of many honors, including, along with Levine, IFT's Industrial Scientist Award for the pair's contributions to the advancement of the food industry, and the Tanner Award from IFT's Chicago Section. Additionally, Slade and Levine were honored with a three-day symposium at the American Chemical Society's annual meeting in 2018, titled "Water in Foods Symposium in Honor of Louise Slade and Harry Levine."

At the time of her death, Slade was a member of the board of directors of the Monell Chemical Senses Center, a research organization she joined in 2008 as an affiliated scientist. "Louise was an ardent supporter of Monell, a dedicated scientist, a colleague of mine at Nabisco/Kraft and, most importantly, a friend," said Todd Abraham, chief innovation officer of The Cronos Group and chair of the International Advisory Council for Monell. "She was incredible in her ability to stay current in so many diverse fields of science and bring those insights to bear on many of Monell's activities as well as other consulting and mentoring relationships. She will truly be missed by the scientific community and her network of friends."

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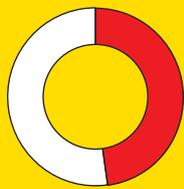
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FOOD SNAPSHOT

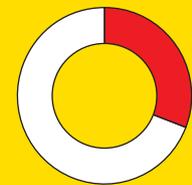
A Look at the Plant-Based Consumer

Vegans and vegetarians are not the primary drivers of the plant-based eating trend, according to research from Hartman. Consumers who adhere to a broad range of diets favor plant-based foods for their alignment with current health and wellness thinking.



48%

Consumers who say they look for products labeled “plant-based”



31%

Consumers who say they seek out plant-based proteins

How do you typically eat?



Omnivore

43%

“I eat a little of everything, with no restrictions”



Carnivore

23%

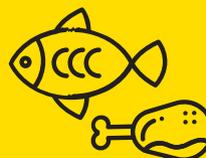
“I love meat and make a point to eat it regularly”



Flexitarian

10%

“mostly vegetarian, but eat meat on occasion”



White meat eater

9%

“no red meat, but fish and chicken/turkey are OK”



Vegetarian

6%

“no meat, but eggs or dairy are OK”



Vegan

4%

“no animal products of any kind”

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A healthy substitute for enriched white flour, Power Flour can be used for everything from pizza dough to pie crust and provides the flavor, nutrients, and fiber of 100% whole grains—no millstone required.

Kodiak's Power Flour can be found at retailers nationwide and online at kodiakcakes.com for a suggested retail price of \$5.50 for a 23-ounce bag.



Salmon skin cracklets

CHILEAN HEALTH FOOD brand Williwaw recently launched its line of Salmon Skin Cracklets to the American market. The crunchy chips are made from locally sourced salmon and provide a good source of lean protein, omega-3s, collagen, and vitamin D.

Williwaw grew out of the founders' love for a common pastime, according to company owner and founder Andrés Herrera, who explained in a press release, "As a group of friends, we enjoy going fishing in Patagonia, in the south of Chile. After fishing, we cooked out our catch in a barbecue, and we used to eat the crunchy skin."

The zero-carb, gluten-free

Salmon Skin Cracklets are shaped like triangles and come in four versions: Sea Salt, which delivers the pure taste of Patagonian salmon brushed with extra virgin olive oil and sea salt; Smokey, an intense flavor suitable for pairing with a strong malt beer; Patagonian Spice, a locally sourced blend containing traditional spices; Salsa, a combination of tomatoes and herbs accented with the sweetness of onions; and Pesto, a mix of basil and garlic along with a hint of pesto.

Salmon Skin Cracklets can be found online at Amazon and williwawfoods.com for a suggested retail price of \$26.95 for a package of five bags.

Oat drink for gut health



LIFEWAY FOODS, manufacturer of kefir and fermented probiotic products, has introduced a new dairy-free, certified vegan drink that offers the same benefits as its collection of dairy kefir products.

Lifeway Oat is made with 100% whole grain oats and contains heart-healthy beta-glucans as well as 10 live and active probiotic cultures to help promote a diverse microbiome and support

healthy digestion and immunity. The plant-based drink is available in seven flavors: Plain, Vanilla, Strawberry Vanilla, Peaches and Cream, Berries and Cream, Apple Cinnamon, and Blueberry Maple.

Available at retailers nationwide and online at lifewaykefir.com, Lifeway Oat drinks sell for a suggested retail price of \$5.99 per bottle. 

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Shoppers Seek a Farm Connection

MORE AND MORE these days, consumers' thoughts are turning to the farm as they walk the supermarket aisles. Three-quarters of consumers look for foods and beverages that are locally produced—up 5% since 2019, according to the Hartman Group's 2021 *Health + Wellness* survey. Two-thirds want products that are produced without the use of antibiotics (+6% since 2019), and the same percentage seek hormone-free products (+3%).

Hartman says that about half of adults are interested in grass-fed animal products, an increase of 8% since 2019. Sales of organic, antibiotic-free/hormone-free, and grass-fed meat and poultry accounted for 11.4% of all meat sales, up 18.1% to \$9.3 billion in 2020, according to the 2021 *Power of Meat* report from FMI—The Food Industry Association.

Consumers are increasingly concerned with animal welfare issues. Sales of foods touting humane treatment of animals grew by 21% for the year ended Dec. 27, 2020, per IRI. Cage-free egg sales jumped 15% for the year ended July 17, 2021, IRI reports.

Products with origin claims (e.g., “made in the USA,” “artisanal,” “local,” “handmade,” or “craft”) posted the highest dollar sales growth among foods/beverages carrying a benefit descriptor for the year ended Dec. 27, 2020, up 18%, according to IRI.

Organic food sales reached an all-time high of \$56.5 billion in the United States in 2020, according to the Organic Trade Association. One-third of those who buy organic products do so to avoid GMOs.

Sales of foods positioned as non-GMO grew 12% for the year ended Dec. 27, 2020, per IRI. Knowing whether a food/ingredient is bioengineered is important to four in 10 consumers, according to the International Food Information Council's 2021 *Food & Health* survey.

Well-Bred Options

New varieties and hybrids, as well as exotic produce, grains, and seeds, continue to grab consumer attention. Sales of specialty fruits rose 22% between January and September of 2021, according to IRI. Yuzu, star fruit, passion fruit, red guava, lychee, rambutan, blood oranges, and dragon fruit are growing in popularity.

Nearly four in 10 consumers want to try Del Monte's Pinkglow “pink” pineapple, 33% want to try Cotton Candy grapes, and 30% are interested in Blue Java bananas, according to Datassential. Stokes purple sweet potatoes from Frieda's Specialty Produce are poised to add excitement to holiday meals. Ube is trending in desserts and tea.



“Grains that give back” by supporting soil health and environmental sustainability, such as the perennial grain Kernza, are among the top 10 trends for 2022 identified by Whole Foods Market trend watchers.

According to data from the Oldways Whole Grain Council, quinoa, millet, sorghum, amaranth, and teff are the ancient grains increasingly being included in packaged foods. Durum, teff, quinoa, and bulgur are gaining traction on menus, per Datassential.

The Technology Trifecta

For many consumers, an interest in healthful, natural products doesn't preclude acceptance of agricultural technologies that are perceived to deliver better taste, nutrition, and a sustainable advantage.

Today, more seafood consumers prefer farm-raised seafood than in 2019 (29% versus 19%), according to FMI's 2021 *Power of Seafood* report. Less exposure to pollutants, a higher omega-3 content, and control over how the fish were raised are among the factors driving growth.

“Ultra-urban indoor farming” is Whole Food Market's top food trend for 2022. One in five consumers now prefer hydroponically grown produce, and one-third of Gen Z shoppers want more of it, according to FMI data. 

A. Elizabeth Sloan, PhD, a member of IFT and contributing editor of *Food Technology*, is president, Sloan Trends Inc., Escondido, Calif. (lizsloan@sloantrend.com).



For many consumers, an interest in healthful, natural products doesn't preclude acceptance of agricultural technologies that are perceived to deliver better taste, nutrition, and a sustainable advantage.

Savory Snack Bars Hit the Sweet Spot



Fresh ingredients, creative flavor combinations, and socially conscious marketing are transforming the savory snack bar space.

By Margaret Malochleb



Tekla Back was struggling to find a snack bar made of whole, plant-based food that satisfied her yen for savory taste. Although many bars on the market touted healthy ingredients, the majority catered to snackers with a sweet tooth, using carb-heavy ingredients, such as honey and eggs, to hold the bars together. That's when Back, a former executive at PepsiCo with a doctorate in physics from Oxford, decided to take matters into her own hands.

Three years of testing and tasting later, Back's company, KEHO (a word meaning "living human body" in Finnish), was born. An innovator in the growing savory snack bar category, KEHO boasts a line of whole food savory snack bars made with freeze-dried veggies, nuts, and healthy fats.

"We took real food and made it into real snack food," says Back. "There are four snack bites: Curry in a Hurry, Tex-Mex Moment, Pizza to Go, and Thai Me Over. Each bite is a mini-meal, made with recipes inspired by global cuisines."

Back's venture is emblematic of a growing breed of snack bar makers that are swapping out traditional sweet flavors for savory combinations that center around plant-based and meat ingredients. With the snack bar category continuing to expand and find new avenues for innovation, proponents are banking that savory bars will play heavily into the mix.

"As countries continue to gain mobility, snack bars will have a resurgence across the globe," predicts Sally Lyons Wyatt, executive vice president and practice leader at IRI Worldwide. Although the category declined in the United States in 2020 by 3% in total omnichannel dollar sales, Lyons Wyatt points out that as of mid-September 2021, omnichannel dollar sales were up 6.3% versus a year ago and 4.6% versus 2019. "This means that not only have bars found paths for growth but at an elevated status versus pre-pandemic," she says.

Ranjana Sundaresan, lead research analyst at Spoonshot, also predicts a sunny outlook for the category, especially when it comes to savory bars. "Over the next 12 months, we expect to see significantly greater buzz around savory snack bars, with projected interest in the space growing by nearly 250%, albeit from a low base," he says. "In comparison, the snack bar category as a whole is projected to see interest expand by 16% over the coming 12 months."

Something for Everyone

One appeal of savory bars is their ability to satisfy a wide range of consumer preferences, whether specific lifestyles and diets—such as keto, paleo, gluten-free, plant-based, or low-sugar—or cravings for new and innovative flavors. They're also aiming to balance post-pandemic demands for both healthier options and those centering on indulgence.

"The bars universe today, including the innovation that has hit the market recently, provides consumers with options for both indulgence and health," says Lyons Wyatt. "We see flavors, textures, and forms being key

Key Takeaways

- Health and indulgence claims will contribute to a snack bar resurgence.
- High-protein, low-sugar savory bars are marketed as mini meal replacements.
- Both plant- and meat-based bars are being produced with sustainability in mind.



Savory Embraces Sustainability

Among the wide array of savory snack bars on the market, one product attribute that crosses the spectrum is sustainability. According to the International Food Information Council (IFIC), 53% of consumers who responded to the organization's *2021 Food and Health Survey* said it is important that the foods they purchase or consume be produced in an environmentally sustainable way. In addition, "31% of consumers say that environmental sustainability is an important purchase driver of foods and beverages," says Alyssa Pike, IFIC senior manager, nutrition communications.

KEHO founder Tekla Back says that many consumers of her plant-based whole food snack bars are vegetarian and vegan as well as "socially conscious [and] working towards a better future." As a reflection of the commitment she and many of her customers have made to the environment, her products are crafted using freeze-dried vegetables, which retain nutrients without a heavy water load, thus eliminating the "food mile" impact that goes along with shipping fresh vegetables.

At EPIC, the company's meat-based bars are produced from animals raised with practices that improve soil health, biodiversity, and ecosystem function. The company actively supports organizations that help foster regenerative agriculture and strive to elevate animal welfare standards. For example, EPIC partners with The Savory Institute, an organization working to facilitate large-scale regeneration of grasslands and the livelihoods of their inhabitants through holistic management.

There's no question that the support and marketing of sustainability are important in the savory snack bar category. "Bars that tout recyclable, sustainability certified, or B Corporation are growing year to date, whether comparing to a year ago or 2019," says Sally Lyons Wyatt, executive vice president and practice leader, IRI Worldwide. "We are seeing eco-friendly certified claims emerging as well. Manufacturers and retailers need to optimize packaging, labeling, websites, and messaging to reach sustainably focused audiences most effectively."

for appealing to consumers who want indulgence. The healthy alternatives are appealing to consumers aligned to specific functional and/or dietary needs. This includes 'on trend' functional ingredients, whether positioned to address a need (e.g., after workouts) or aligned to diets (e.g., keto), etc."

For Back, social media has played a key role in identifying and responding to the needs of KEHO's customer base, which she describes as "early adopters, initiators, and doers" who "prefer real whole foods but eat packaged for ease, and so are hungry for innovation to experiment and try."

At Sheffa, co-founders Leslie Angle and Amotz Geshury take a simple but focused approach to promoting their products. Their savory bars have no added sugar, fruits, or sweeteners and are gluten-free, vegan, non-GM, and kosher. Available in four versions—Everything Savory, Sesame Savory, Rosemary Savory, and Spicy Chili Savory—the bars consist of 100% whole grain brown rice partnered with quinoa, millet, and amaranth, then boosted by chickpeas, sunflower seeds, and a touch of olive oil. The bars, which total 150 calories for a two-bar serving, can be eaten alone, paired with soup or salad, or used with hummus, spreads, cheese, chutney, or jam.

"There's definitely a plant-forward outlook to savory bar launches given the growing interest in this space, driven by health and sustainability concerns," says Sundaesan, who cites Spoonshot research that consumer interest in plant-based food and drink has grown by over 600% since 2016. In addition to vegetables like cauliflower, spinach, mushrooms, and tomatoes in KEHO's lineup, nuts and grains "translate well into the savory space," he adds, "offering significant nutrition and satiety."

Another category entrant, Slow Up, is the creation of Executive Chef Caroline Schiff. The bars are made from quinoa, chickpeas, nuts, and spices. Among the savory varieties in the eight-flavor line are Red Pepper Pesto, made from a mix of chopped basil, oregano, and rosemary along with fire-roasted red peppers; Poblano Black Bean, a mix of poblano peppers and sweet corn with seasonings like smoked paprika and cumin folded in; Sesame Ginger, made with toasted sesame seeds and fresh ginger with a pop of lime juice; and Calabrian Chili Lemon, which combines Calabrian chili peppers with honey and lemon zest.

Mini Meal Replacement

A common selling point of many savory bars is their positioning as a bite-sized meal rather than as a snack. Spoonshot's Sundaesan explains, "With ingredients



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like vegetables and herbs and spices, savory snack bars offer the opportunity for a more solid expansion into the meal replacement space in place of the more dessert flavor options.”

For Anish Vanmali, who launched a Kickstarter campaign in June 2021 to fund his company, BLD Bars, the idea of a meal in a bar was at the center of his mission. “The concept behind BLD Bars was to shake up the current bar market and create a concept that was out of the box,” he says.

Scheduled to debut in November 2021, BLD Bars are designed “to create a solution to two major problems,” says Vanmali, namely, “products that resemble candy bars but are disguised as healthy,” and to provide an alternative for consumers who “don’t want something sweet right when they wake up or for a late-night snack.”

BLD bars contain less than 2 grams of sugar per bar and are free of preservatives. The vegan meal replacements come in Country Ranch, Smoky BBQ, Margarita Lime, and Everything Bagel.



“Meat-based bars have come a long way from jerky.”

— Ranjana Sundaresan, lead research analyst, Spoonshot

Bring on the Meat

A defining characteristic of savory bars is their protein content, according to Sundaresan, who notes that “32% of all snack bar launches call out the nutrient.” And although plant-based bars can deliver protein with ingredients such as peas and chickpeas, some consumers prefer to get their protein from meat.

“Meat-based bars have come a long way from jerky,” says Sundaresan. “We’re seeing a range of premium options that focus on different meats, cuts, flavors, and protein content. Sustainability is also an emerging trend here, with a few products calling out their environment-friendly credentials for a product generally considered not great in terms of carbon emissions and resource use.”

Among the pioneers in the meat-based savory snacking space is EPIC, which features beef, chicken, bacon, bison, venison, and salmon in its line of paleo-friendly snack bars. In addition to a variety of flavor combinations, the company touts its commitment to sustainability, stating on its website: “Our



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Slow Up bars are chef-crafted from ingredients like quinoa, chickpeas, nuts, and spices to deliver an on-the-go snack that tastes like a restaurant dish. Photo courtesy of Slow Up

foods are called EPIC to reflect the mission to improve the lives of animals, support human health, and help heal the land.”

Founded by former vegetarians who struggled with a myriad of inflammatory ailments brought on by a diet high in carbohydrates and low in fat, the company has adopted a whole food approach to its snack bars, incorporating grass-fed protein, healthy animal fats, and dried

fruit, nuts, seeds, and creative spice blends. The result is an array of flavor combinations, including Bison Bacon Cranberry, Chicken Raisin Sesame, Wild Boar With Bacon + Cranberry, Beef Apple Bacon, Venison Sea Salt Pepper, and Beef Habanero Cherry Walnut.

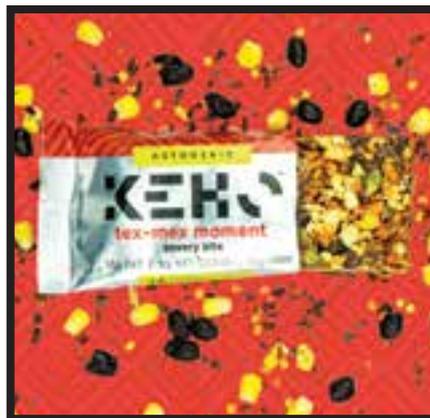
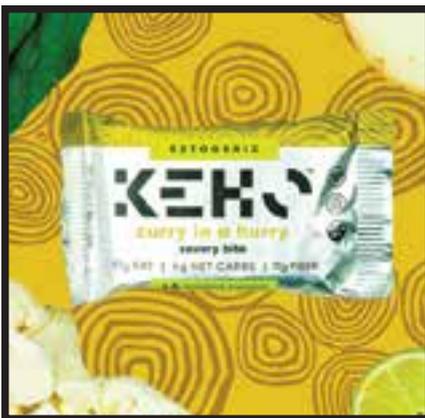
Brave Good Kind is another brand marketing mission-based claims, namely, to “responsibly nourish the world with sustained positive

energy.” Launched by K2 Ventures in the midst of the pandemic, Brave Good Kind products were designed to capitalize on the popularity of meat bars for their nutritional value and as meal replacements. Eschewing beef for chicken, the company debuted Tender Chicken Bars last spring. Available in Original, Hot Honey, and Teriyaki versions, the bars are made with antibiotic-free chicken and are positioned as a better-for-you snack that provides sustained energy.

Although many savory snack bar companies have launched within the past few years, the foundation for family-owned Jack’s Links was established in the 1880s, when Chris Link, ancestor of current CEO Troy Link, began creating sausages and smoked meats. Five generations later, the company continues to produce sausage, along with a variety of other protein snacks, including Jack Link’s Beef Strip Bars in Original and Teriyaki flavors. The bars are a keto-friendly snack that delivers 7 grams of protein per 70-calorie bar.

The Measure of Success

Although savory snack bars account for only about 2% of the snack bar category, according to data from Spoonshot, their growth potential is considerable. Not only do they have the ability to open up the category to a much wider range of flavors, including global cuisines,



KEHO’s whole food savory snack bars are gaining traction for their recipes inspired by global cuisines, as well as the brand’s commitment to sustainability. Photo courtesy of KEHO

says Sundaresan, but “they have the potential to increase the positioning of snack bars as true meal replacements.”

For whole food-based bars, however, the appeal of fresh ingredients comes with challenges, including refrigeration requirements, shorter shelf lives, and cold chain infrastructure/space in stores. “These issues point to higher costs for manufacturers and higher price points for consumers,” explains Sundaresan, “which may defeat the purpose of the compact and mobile snack bar. Given the high risk of spoilage with such fresh products, it may be rather ahead of its time.

“That being said,” he adds, “there’s probably an audience for such products, especially given shifting consumer preferences for fresh food versus overly processed foods. Placing them in and around offices, especially now that many are going back into offices, may work as a way to get consumers familiar with these



The savory recipes used to create BLD bars were inspired by breakfast, lunch, and dinner ingredients. Photo courtesy of BLD Bars

concepts. Promoting them as quick, mess-free meals to consume while at one’s desk or while on the go may also find appeal.”

In the fast-moving world of snack innovation, market responsiveness is paramount, believes IRI’s Lyons Wyatt, who sees agility as one of the keys to success. “Agility is needed to ensure the right assortment of bars are available in the right places at optimal times of day,” she explains. “Agility comes into focus when countries become more and more open because you need the ability to be everywhere consumers are to capitalize on snack occasions and impulse.”

Although savory snack bars were not able to overcome the loss of out-of-home consumption in 2020 and saw declines in the United States, Lyons Wyatt says the picture for 2021 is a bit brighter, noting that “we are seeing some segments of bars realizing growth in both small and large pack types. More communication is needed to remind people of all of the in-home and out-of-home occasions savory snack bars can be consumed.”

Differentiation is also important, observes Lyons Wyatt, especially with the wide selection of products

currently available, including diet-focused formulations, meal-focused product lines, and snack bars featuring functional ingredients, plant-based proteins, and alternative sweeteners.

But Sundaresan believes there’s plenty of room for new approaches, citing innovative agricultural practices as an example of an evolving technology that will likely factor into future product development. “Meat grown through regenerative agriculture and other sustainable practices will start being called out a lot more in the coming years,” he says, “especially as consumers look for more responsible ways to consume meat.”

Whatever the future holds, product developers must continue to evaluate and respond to opportunities taking place, globally and locally, that help to elevate flavor, taste, and nutrition in the savory snack bar space. “The wide span of innovation,” says Lyons Wyatt, “shows that bars are poised to capitalize with differentiation, but only time will tell which ones will be truly successful.” **ft**



Paleo-friendly EPIC bars combine bison, beef, venison, chicken, and bacon with nuts, seeds, and dried fruit to create unique, flavor-forward protein snacks. Photo courtesy of EPIC

Margaret Malochleb is associate editor of *Food Technology* magazine (mmalochleb@ift.org).



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Flavors for Uncertain Times

Fickle and fearful, pandemic-weary consumers crave comforting and nostalgic tastes, but they are also looking for a bit of adventure.

By Emily McCrary-Ruiz-Esparza



Since the pandemic arrived in early 2020, product developers have faced unique challenges when it comes to anticipating consumers' changing tastes. Fear of COVID-19, a strained economy, and social isolation drove consumers overwhelmingly to comfort food, and there's no indication this inclination will disappear. More likely, it will simply evolve.

"To say that the pandemic has been stressful would be an understatement," says Shannon Cushen, director of marketing for Fuchs North America. "So it also comes as no surprise that consumers have been on the lookout for foods and flavors that evoke nostalgia and remind them of simpler times. Think mac and cheese, fried chicken, and chocolate chip cookies."

Susan Albers, a clinical psychologist at the Cleveland Clinic who specializes in human relationships to food, explains that taste is an important part of our survival mechanism, one that is hardwired to protect us. "During

times of crisis, our ability to taste is often changed or altered," she says, leading to a decreased sensitivity to sweetness and salt and even a metallic taste in the mouth, which often prompts consumers to seek out strong, particularly indulgent flavors.

The need for comfort and nostalgia for easier

times paired with spiking health awareness has created a unique environment—one ready for novel food combinations, product innovation, and complex consumer tastes. All of these factors will have an impact on flavor trends.

New Comforts

References to comfort foods in the U.S. consumer media climbed by 25% during 2020, according to Kishan Vasani, CEO of food and beverage artificial intelligence company Spoonshot. And although they have started to taper off a bit, declining by 4% in the first six months of 2021, Vasani believes "nostalgic flavors will continue to pop up for a little longer," albeit with a new focus on health.

For example, consumers are no longer just reaching for ice cream, they're reaching for ice cream made

with alternative sweeteners; in place of chicken nuggets, they're reaching for plant-based nuggets. The result is a "new comforts" trend that combines nostalgic flavors with new approaches to product formulation.

"It is now a given that more consumers are looking at product labels versus any other time in history," says Mitin Rathod, global marketing director for Sensient Flavors & Extracts. Expect classic flavors like Sour Cream & Onion and Barbecue to continue their popularity, but in the form of veggie-based puffs, not traditional potato chips. Similarly, the nostalgia of orange-flavored beverages is likely to retain its appeal, provided the beverages take the form of a tonic or seltzer rather than a full-sugar soda.

Hain Celestial, the CPG company behind labels like Celestial Seasonings, Terra, and Garden of Eatin', launched a new line of Garden Veggie Puffs in classic flavors often found in potato chips and snack crackers, such as White Cheddar, Sour Cream & Onion, and Screamin' Hot. The new snacks come with the kind of clean label buzzwords consumers are looking for: baked/

Key Takeaways

- Comfort-oriented food and flavors are trending.
- Health appeal is a priority, too.
- Consumers want a taste of adventure, but nothing too extreme.



Panda Express rolled out a plant-based version of its iconic Orange Chicken as a limited-time offering in 10 states. Photo courtesy of Beyond Meat

not fried, non-GMO, and no artificial flavors or preservatives.

Similarly, Real Food From the Ground Up, a maker of alternatives to classic snack foods, has added new flavors to its line of reimagined snacks. These include Ranch Purple Carrot crackers, shaped like the classic Cheez-It, and cauliflower potato

The Sexy-Ugly Flavor Mashup

In addition to authentic yet accessible cuisines, consumers are ready for playful combos, or what Spoonshot calls “sexy-ugly flavor mashups.”



“Back in 2019, we’d predicted that ‘sexy-ugly flavor mashups’ would be a trend to watch out for in the following year in foodservice,” says company co-founder and CEO Kishan Vasani. “We put this on hold when the pandemic hit. But now, as restaurants open up and people are getting out and about, this trend has come back with a bang.” Case in

point is the **Mac & Cheese** ice cream that came out of a collaboration between Van Leeuwen and Kraft. Not only was it a wildly successful PR stunt, earning coverage by major news outlets like NPR, CNN, and NBC’s *Today* show, but the first 6,000 pints sold out within an hour, according to news reports.

“Interest in flavor or food mashups increased by 19% in the first six months of 2021 and is projected to increase by another 19% over the next 12 months,” says Vasani. “In 2022, flavor experimentation is going to really take off as consumers move away from the comfort of the familiar and want to open up their palates to novel combinations,” he predicts.

Despite frenzied excitement for the sexy-ugly mashup, products like **Mac & Cheese** ice cream are more novelty items than brand staples. Those looking to capitalize on the trend without throwing capital at research and development can take an approach like one by Mother-in-Law’s, maker of popular fermented products like kimchi and gochujang, which, in an Instagram post, suggested combining its gochujang with honey over ice cream.



Offered in classic snack flavors, Garden Veggie Chips from Hain Celestial are well-positioned for those seeking to make healthier choices. Photo courtesy of Hain Celestial

chips in **Sour Cream & Onion** and **Buffalo** flavors.

In the sweet and beverage categories, vanilla is a classic flavor that will see popularity in 2022, says Jennifer Zhou, senior director of product marketing, North America, at ADM. “Whether in a homemade treat or a store-bought splurge, vanilla is closely tied to the trending concept of purposeful indulgence to support mental well-being in times of stress, she says. “In fact, 45% of U.S. consumers associate vanilla flavor with supporting relaxation in functional food and beverages,” a feature consumers will look for in the coming year.

Though consumers will continue to crave meat flavors like chicken and beef, concerns about environmental and health risks are stoking interest in plant-based takes on comforting classics. The Good Food Institute estimates the value of the plant-based foods industry at \$7 billion in the United States alone, and industry experts do not expect consumers’ appetite for plant-based products to lessen.

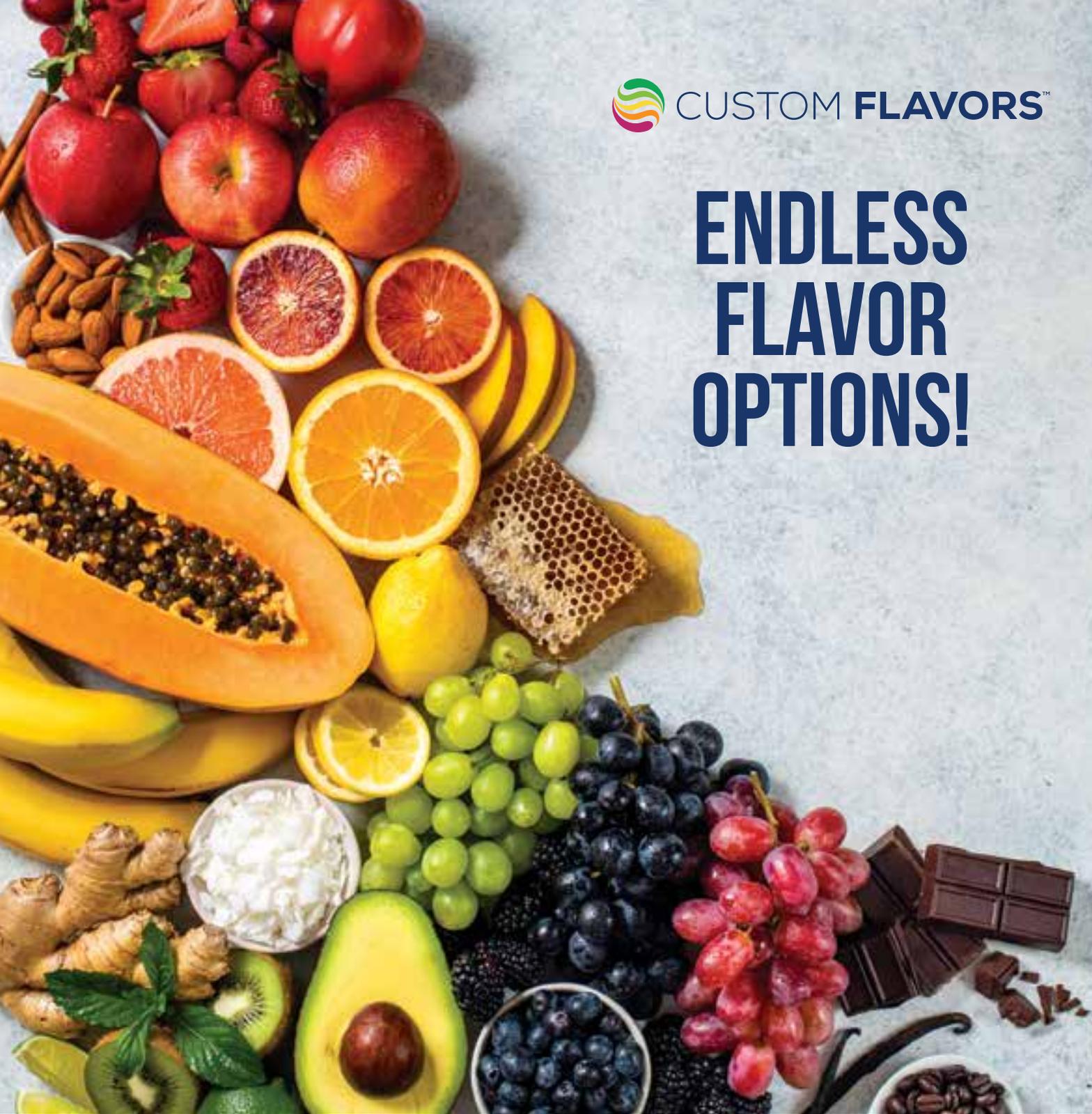
Zhou says the flavor bar for plant-based foods is high. To meet consumer expectations, ADM seeks neutral-tasting plant proteins—like black bean and pea—that minimize the need for flavor maskers and modulators. The company’s protein extraction process helps reduce off-notes, and balancing heat and moisture in the extrusion process helps create appealing texture.

Fast-casual chain Panda Express launched **Beyond the Original Orange Chicken** this year; it’s a reinvention of its classic and comforting Orange Chicken, with a plant-based protein developed by Beyond Meat, the company behind the Beyond Burger. KFC is also testing plant-based meat in some of its stores and has hinted it may roll out the new menu item nationwide. This marriage of classic, comforting flavors used in new food applications will be a characteristic of the new year.

Rathod says the fact that this category is so in demand will have a major effect on product development and innovation. Instead of new flavors, he predicts that the plant-based



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segment's growth will come from new product types (think seafood dishes and desserts), technologies that deliver exceptional taste and texture, and clean label ingredients.

The Search for Holistic Health

Effects of the pandemic have stoked an urgency to address health holistically, a movement Spoonshot calls "food as medicine." Botanicals will be popular in 2022, as consumers seek out flavors they associate with immunity, brain function, and stress relief.

According to Spoonshot research, mentions of immunity increased 97% in the mainstream media since the pandemic began, and industry experts anticipate a long tail to the trend, with citrus flavors like orange and yuzu remaining favorites. "Exotic citrus tastes, such as yuzu and calamansi, have an excellent chance to create an absolute hit in the sweet and beverage categories," predicts Leigh-Anne Vaughan, global strategic marketing director of taste at ingredients company Kerry.

ADM's Zhou expects orange and lemon will remain popular among immune-associated flavors, and will be joined by dark berries like açai, elderberry, and acerola. Ginger, a flavor consumers link with a long



Poppi beverages, billed as "prebiotic sodas," come in a variety of fun flavors. Photo courtesy of Poppi

list of health benefits and that pairs well with other botanicals like citrus, will be a standout. The challenge for product developers, says Zhou, is the metallic off-notes that often come with nutrient-dense ingredients in the category.

"Given the link between immunity and vitamin C, interest in citrus flavors grew by about 20% during [2021]," says Vasani. "This

demand for immunity boosters also saw a growing interest in botanical ingredients." He says that references to botanical ingredients went up by 20% since the start of the pandemic, and credits consumer interest in the associated health benefits, specifically sleep, relaxation, energy, and focus.

Suzy Badaracco, president of Culinary Tides, which uses analytics to study food industry trends, also believes product developers can expect growing interest in flavors associated with cognitive function as employees head back to the workplace and children return to the classroom. "Stress, anxiety, and depression, that's now taken the lead," she says. Lavender, often a key ingredient in calming teas and beverages, will shine in 2022 due to its association with better quality of sleep and decreased stress. Interest in hibiscus and turmeric is also predicted to grow, according to the Whole Foods Market Trends Council.

Consumers looking to stay healthy and mentally sharp are putting away alcohol and turning to

Ask the Flavor Experts: What Will the Most Popular Flavors of 2022 Be?

Kishan Vasani, co-founder and CEO, Spoonshot	Korean flavors like kimchi and gochujang, as well as flavors and dishes less common to Western consumers, like hangover stew, jokbal, ssamjang, jjajangmyeon, and bossam
Jennifer Zhou, senior director of product marketing, North America, ADM	Ginger, for its versatility in both flavor and function
Molly Zimmerman, innovation manager, FONA	'Approachable adventure' pairings with exotic fruits like lychee, mangosteen, lucuma, cloudberry, and jackfruit
Mitin Rathod, global marketing director, Sensient Flavors & Extracts	Turmeric, chaga mushroom, elderberry, and hibiscus in the beverage category; in desserts, flavors like green tea, matcha, black sesame, curry, saffron, and ube



botanical-inspired low- and no-alcohol beverages. Poppi, a prebiotic beverage made with apple cider vinegar and available in flavors like Raspberry Rose, Ginger Lime, and Strawberry Lemon, is attracting consumers seeking to give their gut health a boost, the company reports.

McCormick highlighted “underwater botanicals” in its 2021 *Flavor Forecast*, singling out dulce (red sea lettuce flakes), spirulina (blue-green algae), and sea grapes (soft green algae), noting their potential to infuse food and beverage products with an “earthy flavor.”

Spirulina, which has a list of nutritional benefits and is commonly consumed as a supplement in tablet or powder form, is ripe for beverage development. It already features heavily in smoothie recipes on sites like Minimalist Baker and Brit + Co.

Safe Explorations

Consumers are more comfortable than ever cooking at home, though many have exhausted family recipes and the easy weeknight backup plans. Thus, folks are stepping outside their own geography to explore international cuisines—sort of. “Consumers are looking for

excitement and are drawn toward enticing and visually impactful food and beverages to disrupt the monotony of everyday life,” Kerry’s Vaughan recently commented in a company statement. “They are exploring the world through their taste buds in order to seek adventure, with authentic yet accessible cuisine choices on the rise.”

Because lingering economic and emotional stress tempers consumer hunger for extreme flavor exploration, some are gravitating toward global foods that are considered common in their countries of origin. In other words, they are embarking on safe food explorations. McCormick described this category of flavor as “humble nosh” in 2021, and says product developers can anticipate consumer demand for Asian flavors like chaat masala, pandan kaya, and crisped chilies.

Rachel Bukowski, team leader of product development at Whole Foods Market, says that since the pandemic, consumers are seeking out “elevated ingredients and unique flavors” to bring the restaurant experience home. In response, the grocery chain has developed 365 by Whole Foods Market Bulgogi Sauce

and 365 by Whole Foods Market Thai Chili Sauce.

Spoonshot’s Vasani predicts that Korean flavors in particular will see “renewed interest” this year. “And not just kimchi, gochujang (or even gochugaru), and doenjang. We’re talking the hardcore stuff.” By this he means flavors and dishes less common to Western audiences, like ssamjang and jjajangmyeon. Evidence of the trend can be seen on menus, such as the Gochujang Crunch Salad available at fast-casual chain Chopt, developed as a collaboration with Mother-in-Law’s, a company that makes kimchi and gochujang.

Looking to the longer-term effects of the pandemic, psychologist Albers observes, “This period will likely have a dramatic and lasting impact on consumer taste. Periods of stress and trauma are imprinted on brains forever. If you ate something that you missed or craved during quarantine, it’s likely that the aroma or taste would bring back the memory at a later date.” Product developers may be wise to note such associations when developing the nostalgic flavors of the future.

Cushen of Fuchs believes the pandemic has speeded up the life-cycle of trends, putting new agility demands on product teams. “With less options in terms of traveling and social activities, the pandemic has essentially shortened consumers’ attention spans when it comes to flavors and ingredients,” she says. “The industry is cycling through trends faster than usual, meaning that what is trendy and popular—or going viral on TikTok—isn’t staying that way for long. With flavors falling out of favor and losing consumers’ interest more quickly than usual, food companies have had to adapt in order to innovate at an accelerated rate.” **ft**

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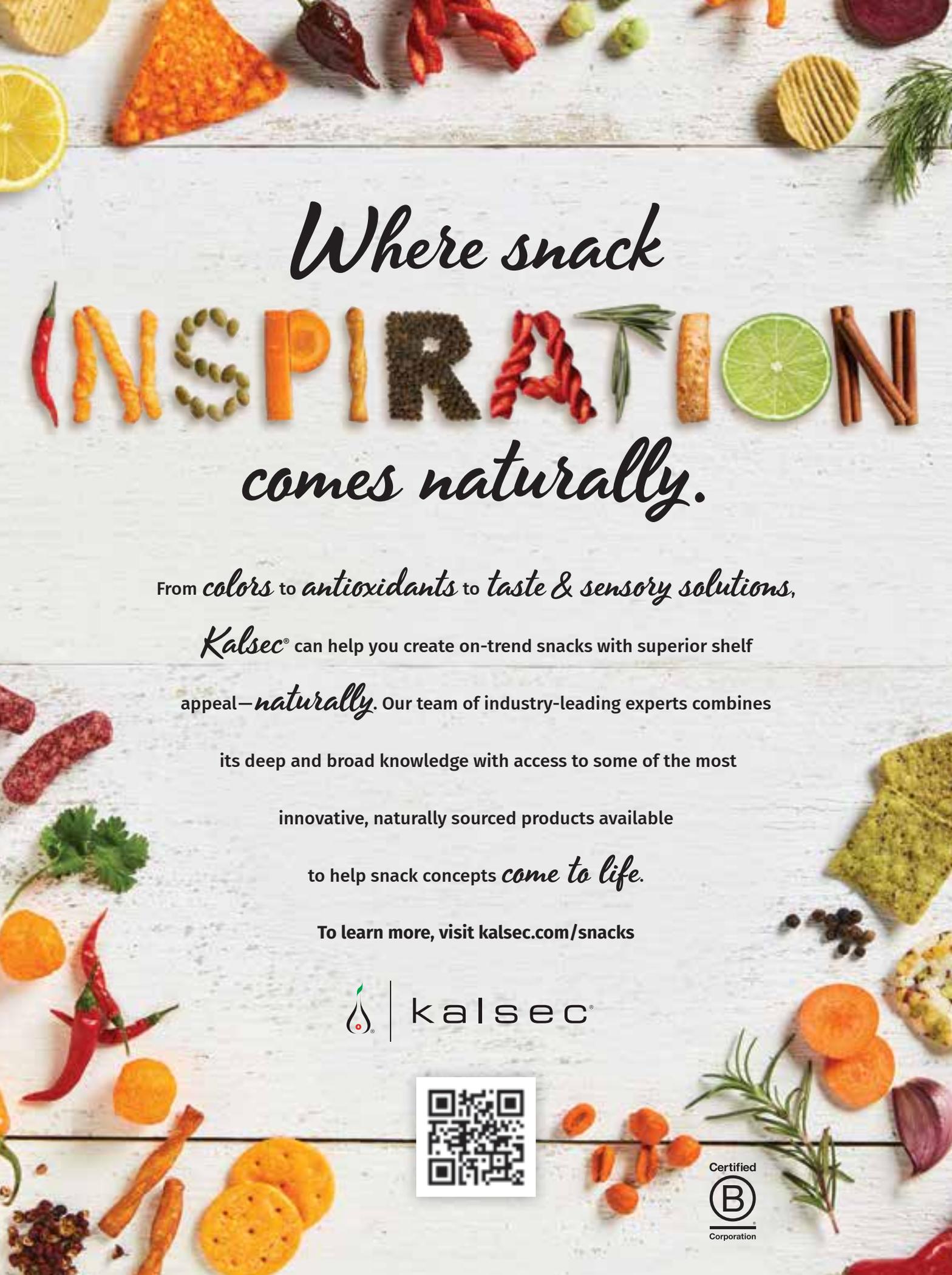
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Biomilq: Still in Its Infancy, Already Poised to Disrupt



Biomilq co-founders Leila Strickland (left) and Michelle Egger. Photos courtesy of Biomilq

SHAZI VISRAM KNOWS a thing or two about starting up a food company and making it successful. So when the founder of Happy Family Organics became one of the earliest angel investors in Biomilq in early 2020, Michelle Egger was encouraged by the capital infusion—and by Visram’s advice.

“She was one of the first people in our seed round who urged us to stick with our valuation and dictate our terms,” says Egger, co-founder with Leila Strickland of mammary biotechnology startup Biomilq. Visram, who sold her better-for-you children’s food company to Groupe Danone in 2013, told us to “show up confidently with the technology we had and [to be] clear about what we need” and that “we are not a beggar and not Oliver Twist,” Egger recalls.

That Visram is a woman also reminded Egger and Strickland of an unpleasant reality: Female entrepreneurs remain underrepresented in the food-and-beverage space so far, for various reasons. “They get set up to believe that they have to bend and be the ones that are malleable,” Egger says. “They may be willing to take whatever they can to get cash.”



Some of the world’s savviest entrepreneurs are excited about Biomilq because the company has synthesized a breast milk alternative.

Funding for Female Founders

Overall, venture capital investment in the food business is “getting a little better for women and minorities, but it’s a slow crawl to reach equality,” says Hillary Hughes, chair of the food and beverage practice for the Foster Garvey law firm. The gender balance isn’t getting any help from the fact that many food startups now have a digital component, where male-dominated Silicon Valley can be a huge factor, she says.

For female entrepreneurs, “the path to get capital isn’t a well-worn path,” contends Adam Demuyakor, founder and managing partner of Wilshire Lane Capital, which has funded two woman-led food delivery startups.

But Biomilq has access to capital. The company recently closed a \$21 million Series A financing round led by Danish life science investor Novo Holdings and clean tech financier Breakthrough Energy Ventures, the latter of which was founded by a who’s who of high-profile billionaires: Bill Gates, Jeff Bezos, Richard Branson, Alibaba founder Jack Ma, Michael Bloomberg, and Mark Zuckerberg.

Some of the world’s savviest entrepreneurs are excited about Biomilq because the company has synthesized a breast milk alternative that it is ready to commercialize within four years. It is made from cultured human mammary epithelial cells, so Biomilq calls it “human milk produced outside the body.” Biomilq claims it can produce both casein and lactose, which are important proteins in real human breast milk, and to be a pioneer in producing additional integral components of milk within the same system, using an approach that is sterile throughout.

“We’re building a pilot plant now in North Carolina for high enough quantities that we can enter safety testing,” Egger says. “That’s an important milestone and goal for us. From there, we’re working on process design to be able to scale. And in the next two to three years we’ll have a product we’ll be able to prove is safe and of high quality and nourishes the human body.”

Some of Biomilq’s signature backers also have been busy funding other would-be disruptors of the animal protein business, including plant-based alt-meat makers Beyond Meat and Impossible Foods and cell-cultured meat company Upside Foods. Egger and Strickland share their billionaire investors’

ambition to phase out animal products to reduce the carbon footprint.

Ambitions, Potential, Hurdles

In Biomilq's case, the competition includes not only moms' breast milk but also, of course, dairy-based infant formula, part of a total \$100 billion worldwide infant formula market. "Parents shouldn't have to decide between feeding their kids and doing what's best for the planet," Egger says.

But there's even more to Biomilq's ambitions. "All mammalian life on the planet is supported by mammary cells," Egger says. "So as you think about the broader animal kingdom, there is so much we don't know and don't best utilize. There are potentially huge implications for human health and development outside breast or cow's milk."

Many large companies are tracking Biomilq's progress, Egger says, precisely because its technology may have broad implications. "Everyone is interested," she says. "Not just formula producers or even dairy production companies, but also amazing numbers of technologically advanced food and personal product companies that are really intrigued because, frankly, human milk has evolved to have so much benefit for the human body, but we haven't fully utilized the potential for the infant and even beyond."

Many obstacles remain before parents might be able to purchase synthetic Biomilq the way they do infant formula. They include the fact that Biomilq technology is borrowed from expensive pharmaceutical manufacturing processes, not from the food industry. The challenge is new to Egger, a food scientist with a degree from Purdue University. She worked in product development at General Mills for most of her career and then at the Gates Foundation. Strickland was a cell biologist.

"The equipment design and costs for biologics make for an interesting challenge, compared with milk," Egger says. "The price point from pharma manufacturing doesn't match up with the downstream price we'll have to hit to be an accessible product."

The hybrid nature of a breast milk substitute—anchored in both food and medicine—also makes it difficult for Biomilq to find "expertise from the ranks of two industries that often don't intermix." What her company is doing is "pretty far outside of what innovation looks like in food," Egger says. "We have these category shifts, which make generational shifts, and so classically trained food scientists and engineers are going to have to do new tricks."

Biomilq also faces competition from at least one other startup, Turtle Tree Labs, based in Singapore. This company also aims to create a human milk replacement derived from cell-based technology and also has attracted big-name investors.



What Will Moms Think?

But Biomilq's biggest challenge may be gaining acceptance among its target customers, whatever the product's environmental bona fides. There's a unique challenge in proposing to replace something as developmentally and culturally bound as "mother's milk." Breast milk is a rich source of maternal genetic information and a key in developing infant immune systems, and there's no indication Biomilq could address that. Also, variability in real breast milk influences neonatal outcomes.

What's more, even if meat eaters eventually accept synthesized, plant-based, or cultured substitutes for real meat on the basis of taste, texture, nutrition, and the sustainability quotient—not to mention price—would that willingness necessarily translate into a casual acceptance of artificial breast milk? They'd be feeding their children, after all, not themselves.

Egger acknowledges such realities, saying, "food beliefs are deeply ingrained and held." But she notes that "societally, we sometimes have skewered technologies in the past that we now rely on heavily."

In any event, Egger and Strickland seem already to have moved their fledgling company beyond the boundaries of gender-based barriers. One reason might be how big their idea is and how well they've proven it so far.

"If you're doing something that's so innovative or cutting-edge that it's going to disrupt or transform a category, VCs like that sort of thing, and the money generally will come regardless of the founder profile," Hughes says. "An implicit gender bias doesn't trump potentially really big financial returns." 

Dale Buss is a veteran journalist who writes about the food industry from Rochester Hills, Mich. (daledbuss@aol.com).

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on at PepsiCo

By Dale Buss

Emad Jafa spent several years as a researcher with appliance and heavy equipment manufacturers such as GE Appliance, UTC Carrier, and Caterpillar. That's where he stoked his personal passion for exploring sustainable solutions for refrigerants and helping optimize energy usage.

But it wasn't until Jafa joined PepsiCo in 2007 that he started down a path that now gives him vast freedom as a researcher to develop, test, try, fail at—and go back to the drawing board for—energy conservation technologies that can make a difference in one of the world's largest applications of refrigeration: coolers and vending machines. PepsiCo's products are conveyed in millions of coolers and vending machines around the world, and anything Jafa can do to help make their energy usage more efficient and more sustainable can be hugely important.

Jafa has been able to supercharge his research since he was named a PepsiCo research fellow in 2014. "We have company goals to reduce emissions by 40% by 2030 and to achieve net zero by 2040," Jafa says. "I'm supporting the goal of the corporation. And I'm going into futuristic refrigerant systems to do it, such as possibly magnetic refrigerants or off-grid solutions. Those are areas that today are immature or too costly to be implemented."

Jafa is exemplary of a fellows program that has become a staple of advanced research efforts at PepsiCo and a major way for the beverage and snacks titan to keep its star R&D people happy and challenged.

"Our fellows are renowned experts and leading authorities in their fields," says Antonio Tataranni, PepsiCo's chief medical officer. "For this reason, they are tasked with some of the most complex projects and help to solve business challenges related to both PepsiCo and the scientific

and technical communities. Fellows are strategists, forecasters, and business partners to senior staff and global business units, advising on the critical path to achieve breakthrough innovation and cracking the code on new solutions that enable strategic efforts and give PepsiCo a competitive advantage."

PepsiCo is emblematic of many major food and beverage companies that spent the past decade reinventing their approaches to innovation. A tumultuous shift in consumer preferences beginning a quarter-century ago made it apparent that CPG giants weren't coming up with enough new stuff in the better-for-you arena, a deficit that quickly eroded their businesses.

So companies pivoted toward external sources of innovation such as acquisitions, equity stakes in inventive smaller companies,

and corporate incubators—anything to bring new creative spark, young talent, great ideas, and non-bureaucratic thinking from the outside in.

Key Takeaways

- **PepsiCo's R&D Fellows program promotes innovation by letting scientists devote time to passion projects.**
- **The GxSweat Patch, which helps gauge hydration needs, is a standout product of the program.**
- **Ajinomoto and General Mills also encourage intrapreneurial cultures but in different ways.**

Feeling the Squeeze

Meanwhile, cost and margin pressures in an industry under transformation began squeezing even core functions such as R&D. "When companies began clear-cutting their budgets, they began shifting more innovation to external resources because they could treat them as marketing expenses rather than having to deal with them in internal budgeting and accounting," says Jamie Valenti-Jordan, chief executive officer of Catapult Commercialization Services, which helps food companies develop products. "Internal programs to support long-term R&D don't deliver quarterly results."

Kraft tried the fellows approach some years ago. The company based its efforts on what it



learned from 3M, the industrial titan that produces thousands of items—and whose approach to incubating ideas became iconic with the emergence of Post-it Notes, an “accidental” innovation from a 3M scientist who was working on a completely different project.

“At that time [in the 1990s], 3M was publicizing that it gave all their scientists 10% to 15% of their time to follow their own interests,” recalls John Ruff, a former long-time Kraft R&D executive. “So we took our North American tech team for a meeting with 3M. I asked 3M a question: ‘How do you track and monitor that?’ The guy looked at me and said, ‘We don’t.’ That’s when the light came on for me: You set an environment for people who have less-direct commitments daily for the business. You encourage people to pursue an idea, to even go find someone to bounce it off of.”

But the availability of external innovation, budgetary pressures, and other factors means that “intrapreneurship” in the food business now is at no better than a simmer.

“Researchers’ freedom to pursue things that have an innovation impact still need to be targeted against business opportunities and needs,” says Todd Abraham, who led the research and nutrition organization for Mondelez International. “I used to talk [to] my group about innovation and remind them that we’re not in the car tire business. So I don’t want you spending your time making car tires.”



“I’M SUPPORTING THE GOAL OF THE CORPORATION. AND I’M GOING INTO FUTURISTIC REFRIGERANT SYSTEMS TO DO IT.”

—PepsiCo Fellow Emad Jafa

PepsiCo’s Pioneering Approach

All of this makes PepsiCo’s fellows program more remarkable. The company has been a modern pioneer in this area since the CPG giant launched its R&D Fellows Program in 2012, with the aim of “encouraging PepsiCo’s most accomplished scientists to conduct research designed to benefit consumers and society,” Tataranni says. The fellows’ mission is to “individually and collectively create value for PepsiCo through interdisciplinary thought leadership that champions and nurtures visionary research, enabling disruptive portfolio transformation for our consumers.”

The program is structured “to provide the optimal environment for the fellows to explore and think critically about their passion projects, and generate breakthrough results for the company and industry,” Tataranni says. Fellows also “effectively partner with experts in their research areas and represent PepsiCo in consortia and other professional settings.”

Fellows are encouraged to “delve into research topic areas they’re passionate about and where they have the potential to generate game-changing results for consumers.” While determined by each fellow, areas of emphasis tend to fall into one of these categories: making progress on PepsiCo’s sustainability journey; investigating ways to improve quality and reduce costs; discovering ways to deliver more functional benefits to consumers; and fortifying intellectual, technical, and equipment-based capabilities.

One result of the program is about as current as they come: the just-introduced Gx Sweat Patch, a first-to-market platform that measures and analyzes athletes’ sweat in real time and helps them understand their hydration needs at any moment. Gatorade’s legendary 35 years of research into performance hydration laid the foundation for such innovations, and PepsiCo fellow Lindsay Baker, a scientist at the Gatorade Sports Science Institute in Barrington, Ill., used her expertise in exercise physiology and sweat science to create a breakthrough that comprises PepsiCo’s first wearable. The Gx Sweat Patch is “particularly innovative,” Tataranni says.

And now, Baker is focused on next-generation wearables. For instance, she is working on different ways to capture readings further below the skin’s surface



“YOU HAVE TO HAVE A CREATIVE MINDSET AND THE ABILITY TO APPROACH A PROBLEM IN A DIFFERENT WAY.”

—PepsiCo Fellow Ajay Bhaskar

that measure hydration and electrolyte levels in the body.

Ajay Bhaskar, another of the PepsiCo fellows, says qualifications for fellows include strong problem-solving skills and intellectual curiosity. “You need to be able to think outside the box, with a passion for innovation,” he says. “You have to have a creative mindset and the ability to approach a problem in a different way, along with strong product and process knowledge.”

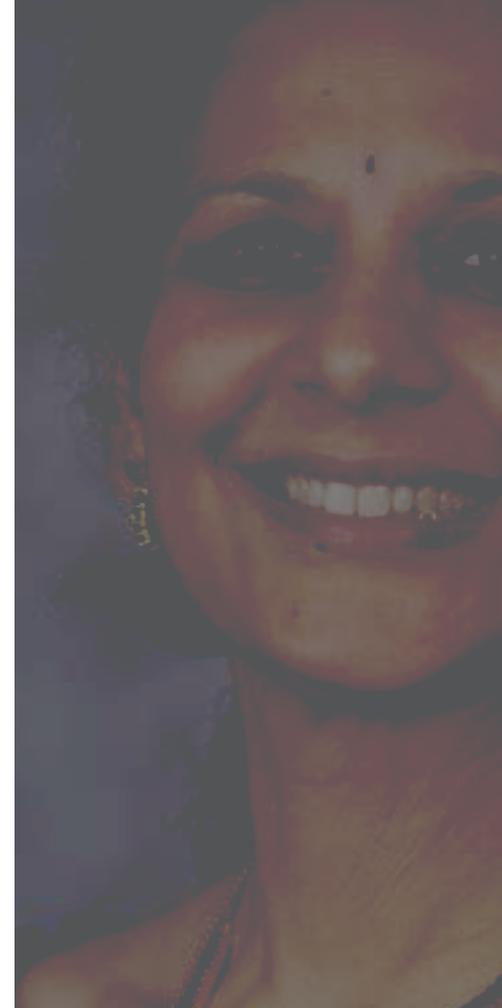
With all of this, PepsiCo’s fellows remain a rare breed even after nine years. The program currently boasts 14 fellows, but that includes three who were newly inducted this year. Fellows remain a limited population because the criteria are very demanding. The program is “highly selective, with rigorous admission and retention standards that establish premier functional excellence and build consistent scientific and technical capability globally,” Tataranni says.

Fellows must “demonstrate exceptional expertise and leadership on a company and industry level, and have a proven track record of strategically and/or commercially significant technical innovation,” Tataranni explains. Research superpowers come in handy. “They see around corners—either identifying or actually creating future food and beverage industry trends,” Tataranni says.

Typically, fellows devote about one-quarter of their work time to their research in the program. One of the most important provisions for fellows is their ability to get extra funding outside their normal work, to pursue pet projects. Requests typically amount to extra resources of \$25,000 to \$150,000 a year based on project needs and within the overall fellows group budget. “That’s a big benefit,” Bhaskar says. “With new ideas, sometimes it can be hard to get your manager to work on a new hypothesis unless you’re part of a long-term research group.”

Fellows enjoy strong platforms for internal collaboration. “We can work with other parts of the organization, such as experts in beverages, packaging, and water,” Bhaskar says. A monthly meeting “keeps our intellectual curiosity going, because it’s outside our normal areas.” He and his colleagues get passes to R&D “town halls” where PepsiCo leadership “explains what they’re looking for [in] the next three to five years,” Bhaskar says.

Under the fellows program, participants



“I HAD THE LUXURY OF A LITTLE BIT OF EXTRA RESOURCES NOT RELATED TO MY DAY JOB.”

—PepsiCo Fellow Sridevi Narayan-Sarathy

How Ajinomoto Enables A+ Innovation

An intrapreneurial mindset isn't necessarily compatible with the national philosophy of Japan, which still offers lifetime employment, albeit in a hierarchical culture noted for the rigor of its demands. But Ajinomoto is working to promote intrapreneurialism with a new program called A-Starters that allows researchers to advance their own extracurricular business ideas and even accompany them to commercialization.

The program allows employees who work for the company to promote their entrepreneurial ideas even if they aren't sure how to commercialize them. Those who pass the screening get training and support, including mentoring. And after the program ends, Ajinomoto will provide outlets for commercialization, including spinouts.

A-Starters is meant to “foster a corporate culture and improve the in-house environment for the creation of innovation,” says Kazuteru Yamada, manager of the acceleration group in the research and business planning department, and overseer of A-Starters. “We're pulling ourselves outside of our comfort zone.”

Researchers work concurrently on their regular work and their A-Starters project until their new idea is adopted, in about a year. If the idea is adopted, they're transferred to a position where they can study the business in earnest and work on commercialization and further development of the concept.

“Considering the overall Japanese culture, it is still very unique to let researchers pursue their own ideas at the cost of the company, and the company supporting this with our resources,” says Manasi Pethkar, manager of the science group in Ajinomoto's global communications department.

But Takaaki Nishii, the president and CEO of Ajinomoto Group, was particularly passionate about launching A-Starters, and today sits on the committee that helps screen applications.

Nishii understands that many younger Japanese workers no longer are satisfied with lifetime employment guarantees and are looking for challenges—even to the extent of switching companies. A-Starters is meant to give Ajinomoto researchers another reason to stay with the company.

also can develop partners to help with the research, such as a university, government agency, or NGO. “This is part of how you manage time in a fellows project,” Bhaskar says. “You work with someone and make it a nice thesis project for them, too.”

Fellows can get outside advice from consultants and others who are trend watching industry R&D. Jafa, for example, has been talking with federal researchers at the Department of Energy as well as vending machine industry associations as part of a technology group that is looking into “future hydrocarbons and how to remove the barriers of hydrocarbons,” he says. As a fellow, he also has represented PepsiCo to the United Nations Environmental Program.

Beyond the Day Job

Sridevi Narayan-Sarathy is a polymer scientist who was recruited to PepsiCo's Advanced Research Group 13 years ago, and her first assignment was to come up with value-added applications for byproducts—specifically, oat hulls and orange peels. PepsiCo generates about 100 million pounds a year of oat hulls, for example, most of them from its Quaker Oats production processes.

Soon, her early work yielded a patent. But Narayan-Sarathy also was interested in the application of new biopolymers for PepsiCo food packaging. And when she was inducted as a fellow in



**PepsiCo
Fellow
Lindsay
Baker (right)
put her R&D
creativity to
work on the
development
of PepsiCo's
first wearable,
the Gx Sweat
Patch.**





How General Mills Grows Good Ideas From Within

Some other companies are making game efforts to support internal researchers. Mars has a research fellows program, for example, although the confectionery giant declines to talk about it.

And General Mills has embraced some of the same kinds of objectives as a fellows program but has taken a somewhat different approach to sparking internal innovation, recently establishing an intrapreneurship program it calls Gworks to complement the company's external-facing venture arm, 301 Inc.

Gworks applies internal R&D resources "toward some unmet consumer need," says Jonathan Searcy, co-founder of the Innovation Lab at General Mills. "These are brands and spaces that our core established brands can't credibly play in but are future growth areas.

"We know we need world-class innovators and entrepreneurs in spaces where we don't have brands, so we're nurturing and growing our talent in Gworks," Searcy says.

2016, "I had the luxury of a little bit of extra resources not related to my day job," she says. "I thought, 'Wouldn't it be cool if you could incorporate oat hulls into [packaging] films?'"

There were challenges aplenty. For one thing, thin films have a thickness of less than 25 microns, and for oat hulls to be incorporated into them, they must not exceed 10 microns. The problem, according to Narayan-Sarathy, was that oat hulls start off at about 250 microns across.

"So I did a lot of work on that," she explains. "And then, once you reduce the particle size, you have to blend it with polymers. If we did it with conventional polyolefin polymers, that would help reduce carbon footprints. But if we also could combine it with bio-based materials, there would even be a bigger gain."

Another obstacle was that her brew of materials produced undesirable colors and odors, so it was important to reduce and minimize these characteristics for food packaging. "You don't want to have it affect the product. We have a pretty good handle on the origin of odor, but the next step, of course, is to find a definite mitigation solution. That's what's interesting about these fellows projects: You can

work on them. This is not something where someone is breathing down your neck," she says.

Bhaskar has worked extensively with chickpeas, lentils, tubers, roots (such as sweet potatoes), and other alternative ingredients in PepsiCo snacks, trying to understand how to use them to make the company's products more nutritious.

Sathya Kalambur started his professional career in the field of surfactants, and as a researcher in PepsiCo's Plano, Texas, complex for Frito-Lay North America, he has been transforming beans, legumes, and other pulse ingredients into alternative plant-based foods, supplementing the company's traditional corn and potato-based snacks.

But as a fellow since 2018, he says, "I've gotten opportunities to work in areas that are very far out compared with my day job. My day job is focused on business goals and our operating plan. But fellows has given me some bandwidth to dedicate time and energies to far-out things."

One of them is an effort to incorporate more corn hulls into chips, from the approximate 1.5 billion pounds of corn Frito-Lay uses each year. Chips taste better with minimal

"FELLOWS HAS GIVEN ME SOME BANDWIDTH TO DEDICATE TIME AND ENERGIES TO FAR-OUT THINGS."

—PepsiCo Fellow Sathya Kalambur



Good Measure snacks are a product of General Mills' Gworks initiative to foster internal R&D creativity.

Gworks selects internal researchers and others to become “co-founders” of these initiatives, which have included a low-blood-sugar brand of snacks called Good Measure that General Mills is testing at Hy-Vee stores in the Twin Cities and selling online.

“Part of the reason for that structure is to appeal to talent,” Searcy says.

“Internally there’s a lot of interest, and externally there is as well. If you can be an external entrepreneur and come into General Mills and

be able to leverage all of the people we have here and our capabilities and skill sets to grow something faster than you could outside, you can do that and have a big impact on lives.”

hulls, Kalambur says, but different corn hybrids retain various levels of hull during tortilla chip manufacturing. By developing corn hybrids that retain more hull during the process, Frito-Lay can deliver more whole grain per serving than from the current process, he says. Plus, Kalambur explains, he has used findings from other hull research, such as corn disease resistance and cellulose extraction in the paper industry, to develop hypotheses for hull retention in tortilla chip processing.

Sharing and Synergies

Bruce Linter has been part of the program since 2016. In his first five years, the expert on salt and fat reduction took advantage of his fellows freedoms to “build an understanding of what’s going on inside snack foods and understanding it right from what happens to the inside of an ingredient as it becomes a Cheetos Puff or Lay’s potato chip,” he says.

“How does the structure form, and how do you work with that to get a different structure, taste, and mouthfeel? And what happens in the mouth?” he reflects. His work focused on being able to design textures based on that understanding and providing

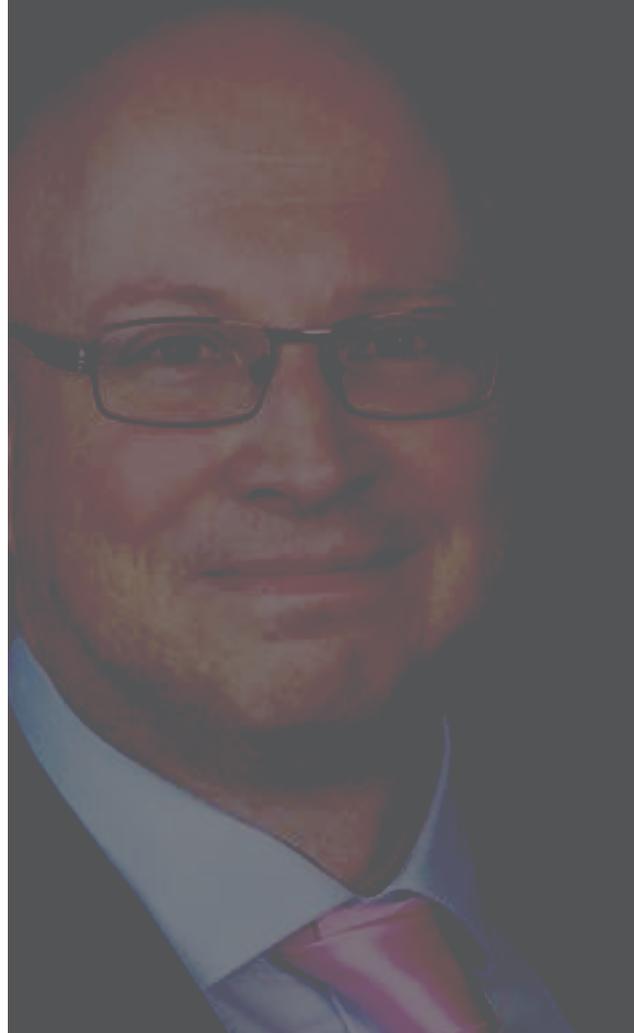
potential commercialization pathways for his findings.

Networking is a crucial aspect of the fellows program. “It’s not just about what you can do, but about the networks you have that can help the company innovate,” Linter says. To that end, PepsiCo organizes a forum for its fellows every two years, including a virtual one in 2020. Plans are still taking shape for the next forum in 2022.

“It gives our scientists a platform to share all the great work around the company,” Narayan-Sarathy says. “It’s a lot of effort, but it’s very satisfying. One of the goals of the fellows program is knowledge sharing and collaboration.”

Linter says that PepsiCo leaves no stone unturned to try to ensure that the structure of the fellows program, and its participants, create great synergies for the company. “But let’s be clear,” he says. “It’s not always going to be successful. You have to take risks. Sometimes it works, and sometimes not. It’s important that you know when to stop and go on to something new.” [ft](#)

Dale Buss is a veteran journalist who writes about the food industry from Rochester Hills, Mich. (dalebuss@aol.com).



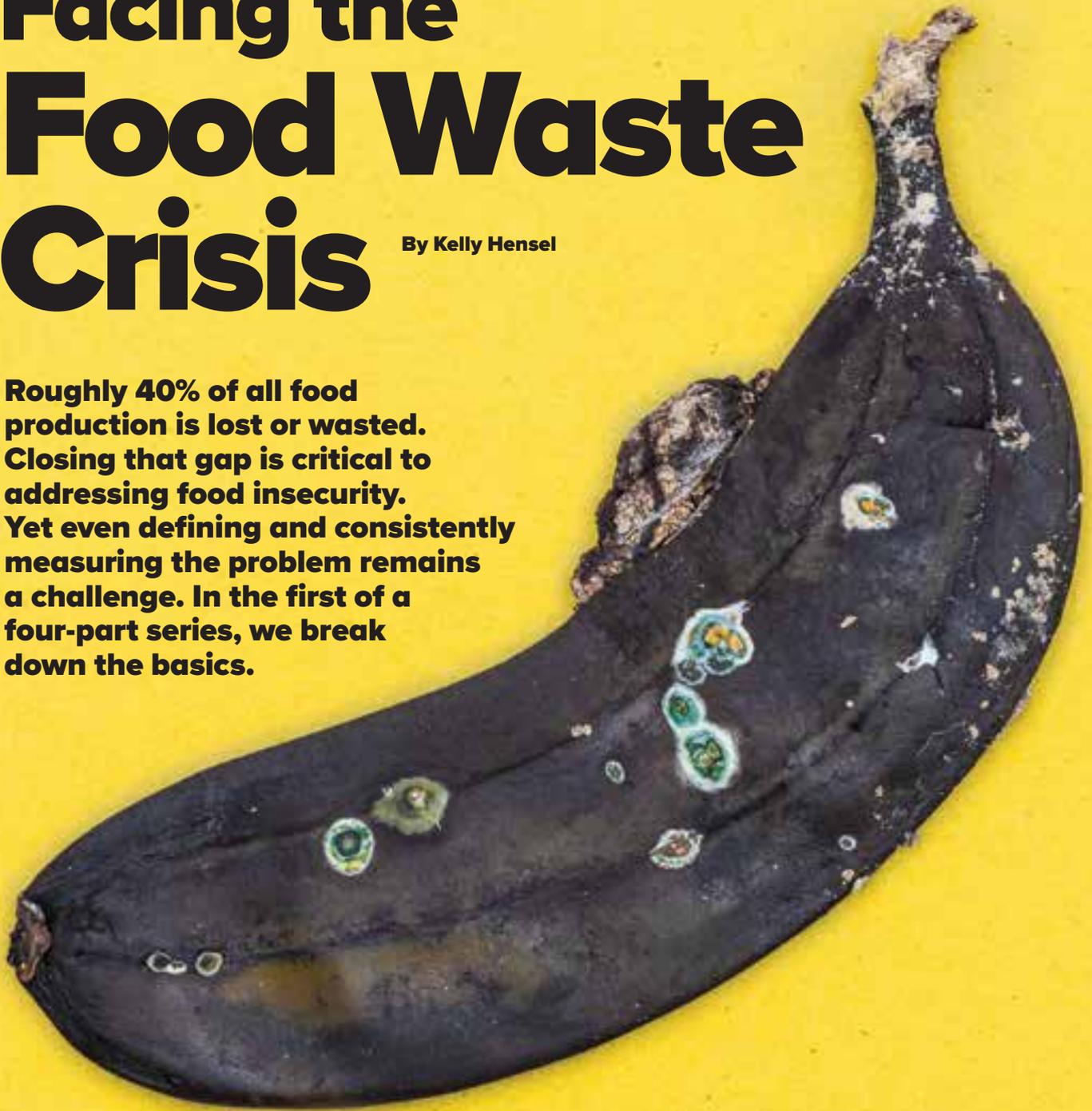
“IT’S NOT JUST ABOUT WHAT YOU CAN DO, BUT ABOUT THE NETWORKS YOU HAVE THAT CAN HELP THE COMPANY INNOVATE.”

—PepsiCo Fellow Bruce Linter

Facing the Food Waste Crisis

By Kelly Hensel

Roughly 40% of all food production is lost or wasted. Closing that gap is critical to addressing food insecurity. Yet even defining and consistently measuring the problem remains a challenge. In the first of a four-part series, we break down the basics.



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According to the United Nations Environment Programme (UNEP), household food waste—those random, expired, or spoiled items lurking in cabinets or deep within refrigerators—totals nearly 570 million tons every year—11% of global food production.

Add in 8% of food lost at or around harvest/slaughter, 14% that is lost en route to the retail market (e.g., in transit, storage, or processing), and 7% that is wasted at the retail and foodservice level, and the true scope of a massive, global problem comes into sharp focus: nearly 40% of all food produced never makes it into mouths that need it (Figure 1).

At the same time, “three billion people can’t afford a healthy meal,” said Ertharin Cousin, founder and CEO of impact investment fund Food Systems for the Future, during her keynote at IFT’s FIRST event last July. “And 250 million people are acutely hungry, living on the verge of starvation.”

While the global food system has succeeded in feeding a population that has exploded over the past 100-plus years—from 1.6 billion in 1900 to nearly 8 billion in 2020—the practices used to reach that milestone are no longer sustainable.

“It is a travesty that we lose or waste around a third of the food that is produced and at the same time, one in 10 people go to bed hungry every day,” says Liz Goodwin, senior fellow and director of Food Loss and Waste at World Resources Institute (WRI). “We must transform the food system to make it more sustainable so we can feed people with nutritious diets whilst living within planetary boundaries.

Tackling food loss and waste is a key part of that.”

In 2022, *Food Technology* will explore various aspects of the problem—from the farm through processing to the consumer—through a series of in-depth articles that seek out expert opinions, highlight novel technologies, and present strategies and solutions. But solving any problem requires defining the scope and identifying the variables.

What’s the difference between food loss and waste? What are the challenges that governments, businesses, and consumers face in reducing food loss and waste?

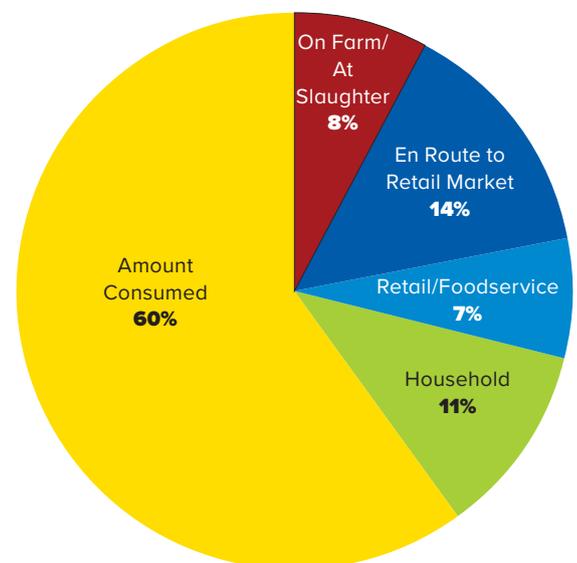
The Goal

In 2015, UN member states adopted the 2030 Agenda for Sustainable Development consisting of

17 Sustainable Development Goals (SDGs) to guide the transformation to a healthier population and a more sustainable planet. One of the goals (SDG 12.3) specifically targets cutting food waste at retail and consumer levels by 50% and reducing food losses across supply chains.

Progress toward SDG 12.3 is measured by two indicators—the Food Loss Index and the Food Waste Index—and helmed separately by the UN Food and Agriculture Organization (FAO) and UNEP, respectively. The measurement protocols for each differ in that the Food Loss Index determines the losses for the top 10 commodities by economic value for each

Figure 1. **Where Food Is Lost and Wasted** (as a percentage of global food production)



Sources: FAO, UNEP, WWF

country, while the Food Waste Index calculates total food waste by weight on a country-wide level (see Glossary sidebar).

The Current State

Food Loss. A broad estimate of food loss and waste prepared by the FAO in 2011 projected that about a third of the world’s food is lost or wasted every year. Data collected since 2011 have enabled experts to refine their calculations and revealed the problem to be even worse than previously estimated. The FAO’s first Food Loss Index estimate, published in *The State of Food and Agriculture 2019* report, concluded that about 14% of the world’s food is lost

Key Takeaways

- The amount of food lost and wasted is about 40% of all production.
- Efforts to measure food loss and waste are ramping up, but there are still large data gaps.
- The United Kingdom is the first country to get halfway to achieving a 50% reduction in food waste by 2030.

Drivers of Food Loss and Waste Along the Supply Chain

Production — Harvest, Slaughter, or Catch



Inadequate harvesting time



Climatic conditions



Non-efficient practices applied at harvest and handling



Challenges in market access



Lack of economic incentives to prevent losses



Pests and disease

Storage and Transportation



Inadequate infrastructure



Inadequate storage conditions, specifically cold or dry storage



Poor management of temperature and humidity



Prolonged storage (due to lack of transportation)



Logistical mismanagement (poor handling of delicate produce)

Processing and Packaging



Inadequate facilities



Technical malfunctioning of equipment



Lack of proper process management



Human error



Poor packaging choices or availability



Excessive trimming to attain a certain aesthetic

Wholesale and Retail



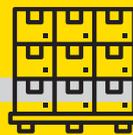
Limited shelf life



Removal of "imperfect" looking foods



Variability in demand



Overstocking



Inappropriate product display and packaging

Households and Foodservice



Poor purchase and meal planning



Excess buying (influenced by over-large portioning and package sizes)



Confusion over labels (best before and use by)



Poor in-home storing



Online Learning Opportunities



IFT Webcasts

Designing Plant-Based Proteins for Foodservice

IFT's Foodservice Division

Thoughtful design is critical for success in foodservice and this session will provide the latest consumer & industry research as well as the technology and processes used to support continued innovation.

On Demand

The Benefits of Structured Data for Food Research & Development and Quality Control Teams

Supplier Solution Webinar

On Demand | Sponsored by Uncountable



DuraShield™ Food Protection Blends for Plant-Based Alternative Proteins

Supplier Solution Webinar

On Demand | Sponsored by Kalsec



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Glossary

FOOD LOSS is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retail, foodservice providers, and consumers.

FOOD WASTE is the decrease in the quantity or quality of food resulting from decisions and actions by retailers, foodservices, and consumers.

FOOD LOSS INDEX measures losses for the top 10 commodities by economic value within five commodity groups (cereals and pulses; fruits and vegetables; roots, tubers, and oil-bearing crops; animal products; fish and fish products) for each country and across the supply chain, from farm gate up to, but not including, food retail. The United Nations Food and Agriculture Organization is its custodian.

FOOD WASTE INDEX measures food waste at the retail and consumer level (households and foodservice) for each country. The index also allows countries to measure and report on food loss generated in manufacturing processes. The United Nations Environment Programme is its custodian.

FOOD SUPPLY CHAIN consists of the following segments: 1) agricultural production and harvest/ slaughter/catch; 2) post-harvest/slaughter/ catch operations; 3) storage; 4) transportation; 5) processing; 6) wholesale and retail; and 7) consumption by households and foodservices.

FOOD SYSTEM gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation, and consumption of food along with the outputs of these activities, including socioeconomic and environmental outcomes.

Source: The State of Food and Agriculture 2019, FAO

between the farm/slaughter facility and the retail level. The amount lost varies across countries, ranging from as little as 5% in Australia and New Zealand to more than 20% in Central and Southern Asia (Figure 2).

The Food Loss Index estimates are based on total harvest weight, and for that reason, food that remains unharvested due to various factors is not included in the Food Loss Index. To account for these harvest-associated losses (e.g., anything left in the field or at the slaughterhouse), the World Wide Fund for Nature (WWF) used farm-stage food loss and waste data points for different commodities and regions collected from online databases and literature reviews. It concluded that 8.3% of food is wasted at or around harvest/slaughter. One key finding from the report is that food lost at harvest/slaughter is a problem for all countries—not just

low-income countries that might not have the technology and resources to reduce losses (see Myths Dispelled sidebar).

Food Waste. In its *Food Waste Index Report 2021*, the UNEP estimates that about 931 million tons of global food waste was generated in 2019, 61% of which came from households, 26% from foodservice, and 13% from retail. This suggests that 17% of total global food production may be wasted (11% in households, 5% in foodservice, and 2% in retail).

The most robust data set came from household food waste. Data for foodservice and retail sectors were much more limited, with the majority coming from high-income countries. While there is still not enough data to estimate food waste (on any level) for low-income countries, the range of household food waste for high-income, upper middle-income, and lower middle-income countries was much more similar than originally expected (Table 1).

“Lower-income countries haven’t had an incentive to measure or reduce food waste until now, because the global narrative has been that household food waste is a ‘rich country problem,’” says Clementine O’Connor, program officer - Sustainable Food Systems at UNEP, and co-author of the *Food Waste Index Report 2021*. “And now we are beginning to recognize that things like lack of access to refrigeration or even things like consuming more of your meals at home means that you are going to create more household food waste.”

Measurement Is Key

It’s important to stress that all these estimates suffer from large gaps in data. “Globally, the state of food waste data availability is relatively poor,” says O’Connor. “It’s improving now quite rapidly, but we don’t yet have any time series data. So, we

can’t say in the last 10 years, or in the last year, there is a trend upwards or downwards.”

And that is why measurement is vital to reducing food loss and waste. “There’s a saying—you manage what you measure,” says Dana Gunders, executive director at ReFED, a non-profit dedicated to ending food loss and waste across the U.S. food system.

To establish a baseline for the Food Waste Index, the UNEP developed a three-tiered modeling approach using both existing data points from studies measuring food waste inside member states where available, and extrapolations based on the estimates observed in other countries. For the Food Loss Index, the availability of the data on losses varied considerably from country to country, across the 10 commodities tracked, and along the food supply chain. Therefore, the Food Loss Index includes data provided

by governments and data produced by nongovernmental organizations, academia, and other institutions.

To ensure the quality and consistency of data collected moving forward, both the UNEP and FAO have developed guidelines and methodologies to measure food loss and waste at the country level. By standardizing the reporting methods, the hope is to switch from modeled estimates to data that is reliable, transparent, and enables meaningful comparisons among countries and over time.

Progress Report

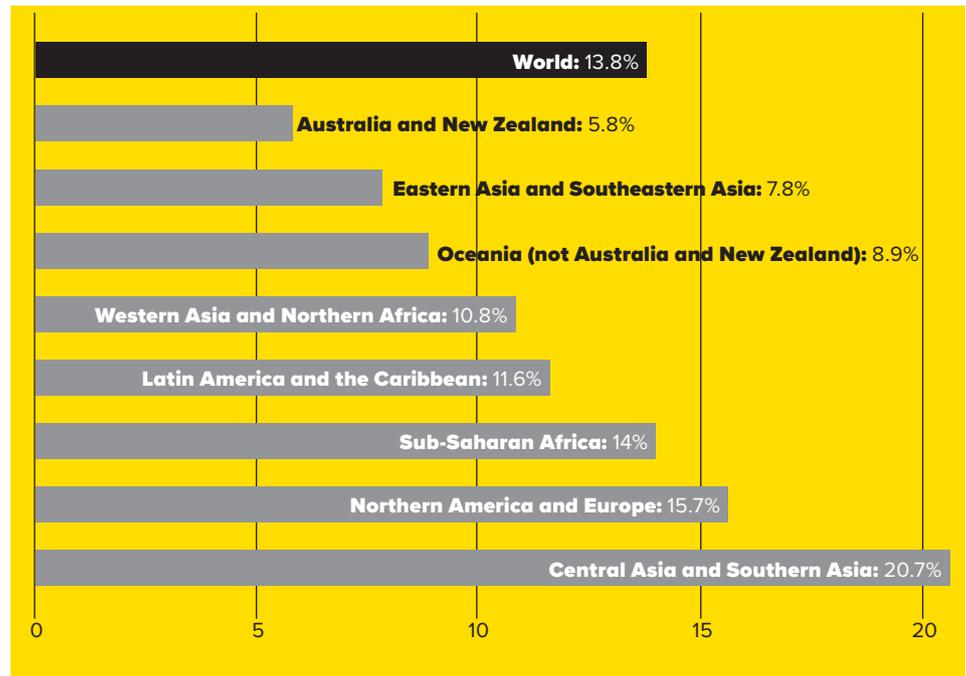
While the SDGs were agreed upon in 2015, in many ways, the journey to reducing food loss and waste has only begun. And with 2030 fast approaching, it begs the question: “Are we on track to meet the deadline?”

Experts at the FAO, UNEP,

“Lower-income countries haven’t had an incentive to measure or reduce food waste until now, because the global narrative has been that household food waste is a ‘rich country problem.’”

Clementine O’Connor, program officer - Sustainable Food Systems at UNEP

Figure 2. **Food Loss From Post-Harvest to Distribution in 2016** (percentages globally and by region)



Note: Percentage of food loss refers to the physical quantity lost for different commodities divided by the amount produced. An economic weight is used to aggregate percentages at regional or commodity group levels, so that higher-value commodities carry more weight in loss estimation than lower-value ones. Source: FAO, 2019

Myths Dispelled

The latest reports on food loss and waste have helped to invalidate some assumptions that had previously guided action or inaction. The following are just a few of the myths countered by what the data corroborate:

Myth: Food loss on farms is largely an issue in less affluent regions with lower levels of industrialization.

Fact: Per capita farm-stage waste levels are generally higher in more affluent regions. Despite having more on-farm mechanization, high- and middle-income countries of Europe, North America, and industrialized Asia, with only 37% of the global population, contribute 58% of global harvest waste (368 million tons).

Myth: Food loss mainly occurs in developing countries due to lack of infrastructure.

Fact: Losses occur in developed countries as well due to aesthetic requirements, labor shortages, and supply chain inefficiencies.

Myth: Household food waste is mainly a problem for developed countries with higher incomes.

Fact: Household food waste per capita is very similar across regions and across country income. Compare high-income countries with household food waste of 79 kg per capita per year with the 91 kg per capita per year of food waste from lower middle-income countries.



Digital Exclusive: How can reducing food loss and waste result in increased food security and a healthier planet? Read more about why reducing food loss and waste matters by scanning the QR code or visiting iftexclusives.org/food-waste.



ReFED, and WRI have mixed opinions on how to answer this question. However, they all agree that to get there, countries and companies need to ramp up their efforts significantly.

“It’s a very ambitious goal,” states Gunders. “We need a huge acceleration in efforts around this to get anywhere near that.”

Shortly after the adoption of the SDGs, a coalition of executives from governments, businesses, international organizations, research institutions, farmer groups, and civil society formed Champions 12.3 to help convert it into reality. The group, through its 10x20x30 initiative, has succeeded in getting nearly 200 companies (retailers and producers) to publicly commit to a 50% reduction of food loss and waste within their supply chains. Many have already begun measuring their food loss and waste, and some have

already taken action to achieve the 2030 goal.

“Companies are doing okay,” says WRI’s Goodwin. “They need to do far more, and they need to keep the momentum going, but you have a number of companies that are over halfway [to the goal] and a lot of the very big ones are making a lot of progress.”

Countries, on the other hand, have a long way to go. “I would say it’s too early to respond because most countries at this stage are collecting data for the first time,” notes O’Connor.

One beacon of hope is the United Kingdom. It is the first, and so far, only, G20 member to have reached the halfway mark in meeting the SDG target. The per capita reduction in wasted food in 2018 was 27% against its SDG 12.3 baseline (2007). “The UK is really the leading example because they quantified food waste a lot earlier, so they have more data across time, and having that early data created a case for actions for them,” explains O’Connor.

Despite the COVID-19 pandemic slowing efforts considerably, much progress has been made in the past two years. Publications such as the UNEP’s *Food Waste Index Report 2021* and the World Bank’s *Addressing Food Loss and Waste* report have shed light on the truth about food loss and waste through rigorous data analysis and case studies.

In September 2021, the first-ever

United Nations Food Systems Summit took place. As a part of the summit, nearly 60 Solution Clusters, each devoted to a specific aspect of the food system, developed actionable agendas and recommendations. The “Food Is Never Waste” Solution Cluster will support countries in developing a suite of context-specific interventions, ranging from policies and regulations to voluntary initiatives, to reduce their food loss and waste by 2030, building on any existing domestic programs.

What makes the goal so daunting is the sheer scope and complexity of the issue. “It’s a complex set of inefficiencies and design challenges that all happen to be leading to food being wasted,” explains ReFED’s Gunders. “There’s not just one solution because it’s not just one problem.”

“It’s such a diverse and complex area of work that you need stakeholders from a number of different backgrounds to effectively tackle the issues,” says Rosa Rolle, a senior enterprise development officer in FAO’s Nutrition and Food Systems Division. “You need the statisticians for measurement, the post-harvest experts, the plant physiologists, the pathologists, and the food scientists.

“To get us there, there is a need for action at all levels to apply coordinated and integrated evidence-based approaches that address food waste reduction, value addition, and circularity principles,” continues Rolle.

Table 1. **Average Food Waste (Kg/Per Capita/Per Year) by World Bank Income Classification, Averaging Medium and High Confidence Estimates for Countries**

Income group	Average food waste (kg/capita/year)		
	Household	Foodservice	Retail
High-income countries	79	26	13
Upper middle-income countries	76	Insufficient data	
Lower middle-income countries	91	Insufficient data	
Low-income countries	Insufficient data		

Source: UNEP, 2021

What's Next?

In September 2021, the UNEP launched regional food waste working groups in Africa, Asia, and South America. “We’re working with 25 countries across those regions to train them in how to quantify and report on food waste, to develop food waste reduction strategies, and to share their experiences with other countries in the region,” says O’Connor. “The idea is to equip countries to report on food waste in the next reporting period, which is the end of 2022.” That’s when the UNEP will send out a questionnaire with the goal to report to the SDG global database by February 2023.

The agency is also working with Champions 12.3 on a “consumer playbook to explain how government, companies, cities, different restaurants, and different types of actors can create enabling

conditions and set up the choice architecture that would help consumers to reduce their food waste,” explains O’Connor.

As called for by the European Green Deal’s new Farm to Fork Strategy, the European Commission will propose legally binding targets to reduce food waste across the European Union by the end of 2023. These targets will be defined against a baseline for European Union food waste levels set following the first European Union-wide monitoring of food waste levels.

On the food loss side, the FAO has made available online learning courses on the Food Loss Index and the guidelines for data collection, standard questionnaires, and training material. According to *The State of Food and Agriculture 2019*, the FAO plans to conduct a round of international training workshops

and support data collection in several priority countries.

In the end, it is going to take everyone implementing small and large-scale changes to move the needle on food loss and waste. “It’s not hard to convince people this is a problem,” says Gunders. “Nobody wakes up in the morning wanting to waste food. No business designs their plans around wanting to waste it either.

“It’s a journey,” continues Gunders. “I think we all need to be on it, and we shouldn’t be too intimidated by a giant, ambitious goal. We need to start with what’s in front of us. And I do believe there are some pretty straightforward things we can do today to start making progress.” 

Kelly Hensel is the senior digital editor of *Food Technology* magazine (khensel@ift.org).



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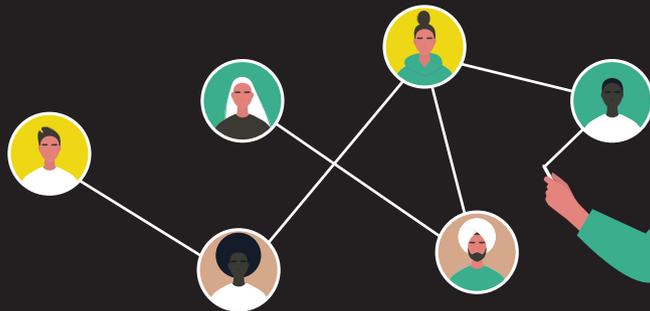
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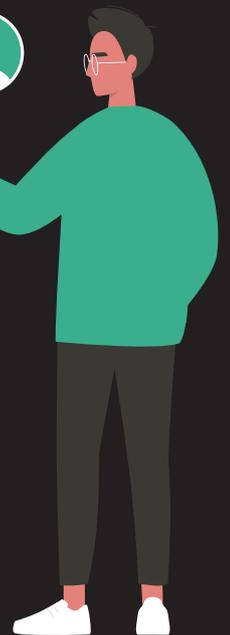
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Mission, Myths, and Alt-Meat Momentum



By Mary Ellen Kuhn

Impossible Foods' Sue Klapholz dreams of a post-animal food system. To get there, she says we should focus more on evidence-based science, and less on misinformation about processed foods.

Sue Klapholz is ready for the revolution. More than ready, really. The Impossible Foods vice president of nutrition, health, and food safety has been working to effect food system change for over a decade. And although her career trajectory has been unexpected, it's equipped her to handle the demands of her diet- and nutrition-focused role, which includes some serious myth busting about processed foods.

Like her husband, Pat Brown, who founded the groundbreaking alternative meat company in 2011, Klapholz has both MD and PhD degrees. The rigor of her training as a physician and a geneticist, coupled with early professional experience in biotechnology, fortifies her commitment to an evidence-based approach to nutritional analysis.

"We were trained as scientists to be very rigorous thinkers and to be very critical of evidence," Klapholz reflects. "And I think as MDs we know about the connection between diet and health.

"I think especially in the nutrition area, there's a lot of misinformation floating around, a lot of mythology," continues Klapholz, who worked with Brown to help get both Impossible Foods and plant-based yogurt and cheese maker Kite Hill, which Brown co-founded, up and running. "I think it's very important for us—and this is something we do—to really read the original papers on a topic, form our own conclusions, and then try to explain to the public in a very clear and evidence-based way what the story is."

Such values—along with Brown's often-stated mission of addressing climate change via a move away from animal agriculture—are implicit in the corporate DNA of Impossible Foods. Personal, planetary, and public health are intertwined, Klapholz emphasizes.

Friendly and unassuming, Klapholz spoke candidly with *Food Technology* about what's ahead for Impossible Foods, why she's not a fan of the NOVA approach to food classification, and her vision for the food system in 2035.

Q: A vocal segment of the food community, as well as a large portion of the general public, categorizes processed foods as unhealthy, and Impossible Foods has been criticized for its processed products. As a physician and a scientist, how do you respond to that?

Klapholz: I recently wrote a blog called "Unapologetically Processed" to talk about this because I feel like, yes, we are a processed food and proud of it. We would never achieve our mission if we took whole soybeans, chunks of coconut fat, whole root nodules—all the key ingredients that we use in our product—and just threw them together on a bun. It's essential that we use processed ingredients to create the replica of an animal product that really has all the authentic sensory properties.

Q: There are those who maintain that we should all stick to natural, whole foods. What do you say to them?

Klapholz: I think when people say, "Oh, you should have a green salad and lentils and rice," we're not saying don't eat your green salad and don't eat your lentils and rice; that's very important. I think balanced whole foods are key to a healthy diet. But instead of choosing a hamburger from a cow, choose the Impossible Burger. Instead of choosing a sausage patty from a pig, choose Impossible Sausage. Or instead of chicken nuggets, now choose our chicken nuggets. I think that we provide alternatives

Vital Statistics

Credentials: B.S., Biology, Cornell University; PhD, Genetics, University of Chicago; MD, University of Illinois

Specialties: Nutrition, Genetics, Psychiatry

Meaningful Pursuits: Mentoring two women at Impossible Foods

Outside Interests: Family, friends, nature photography, jewelry design, and serving as president of the Palo Alto Humane Society Board of Directors

LinkedIn: <https://www.linkedin.com/in/sue-klapholz-338074a/>

that are comparable, if not better, in nutrition.

Q: The high-profile NOVA system classifies the Impossible Burger as “ultra-processed.” What are your thoughts about this approach to evaluating nutritional quality?

Klapholz: I’m very critical of the NOVA classification. I think that it’s overly simple. I would say that there’s junk food and there’s highly nutritious processed food like soymilk. They are apples and oranges. They have almost nothing in common.

The NOVA food classification system implies that there is a direct correlation between the degree of processing and the healthiness of a food, but this is an overly simplistic and scientifically unfounded conflation. Processing does not, by definition, make a food or an ingredient less healthy.

In fact, there are countless examples to the contrary, where processing has enhanced food safety or improved its nutritional profile. Processing is used to inactivate harmful phytochemicals (for example, lectins in kidney beans) and kill foodborne pathogens.

Putting a deep-fried doughnut and a nutrient-packed plant-based burger in the same NOVA category just does not make sense from a nutrition and health perspective.

Q: Going back to the origins of Impossible Foods, did you share Pat Brown’s vision of reducing the impact of animal agriculture on the planet by advancing plant-based food consumption?

Klapholz: It really came from Pat. He was a professor at Stanford, I think, in total, about 25 years. And he loved what he was doing. And every seven years or so he was able to take a sabbatical. So one year he decided he would take a sabbatical at home, and he would try to work on what he thought was one of the most important problems facing the world, and that was global warming. And through his reading and investigation, he made the connection between climate change [and] loss of species diversity to animal agriculture. He made that connection, and I learned from him about that.

Q: One of the things that sets Impossible products apart is the meaty flavor that comes from the iron-containing molecule heme. Would you share the story of how Pat figured out how to derive it from a plant-based source?

Klapholz: During his sabbatical year, our kitchen was his lab, essentially. We live on the Stanford campus in a townhouse, and there’s a little hill behind where we live, and he would go and pick clovers, which are legumes, and he would sit at the kitchen table with little tweezers and dissect the root nodules and eventually he was able to find greater sources of root nodules to dissect and isolate leghemoglobin from.

Q: And the rest is Impossible Foods history! Is it fair to say that both of your career trajectories have

Putting a deep-fried doughnut and a nutrient-packed plant-based burger in the same NOVA category just does not make sense from a nutrition and health perspective.





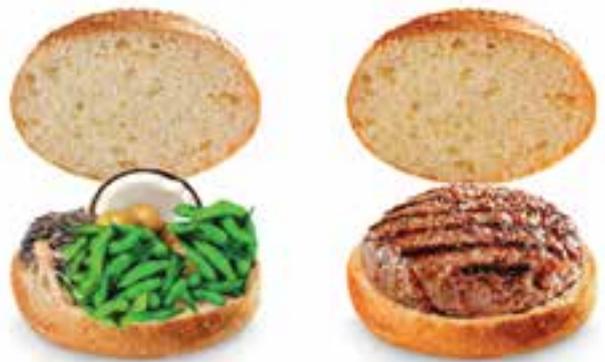
taken you in unexpected directions?

Klapholz: Mine was all over the place because I worked in a biotech company, a startup company, and then I was essentially a stay-at-home mom who did a lot of consulting, scientific editing, creative writing—all kinds of things. But I had not gone back into the lab for quite a while.

Q: How did you get started with the company?

Klapholz: Early on in the company I just was kind of a volunteer. I ordered our company's first centrifuge. And I was asked to help with the cheese project.

And so I did that part-time. I would sit at the front desk, actually, in our small first office, and I would also greet people, and then I would go and work with the cheese team. And this became a bigger and bigger job until it became full-time.



Creating the Impossible Burger from raw ingredients, including soy protein and coconut oil, requires processing—and Impossible Foods makes no apologies for that. Image courtesy of Impossible Foods

Q: So you worked for both Kite Hill and Impossible Foods?

Klapholz: In the beginning, we had two new companies working in one space, the company that is now Lyrical Foods (Kite Hill brand) and what is now Impossible Foods. The two companies shared office and lab space for about one year. I worked with a small team on the original artisanal Kite Hill cheeses. After Kite Hill moved to its own location in Hayward, Calif., I led a cheese team at Impossible Foods for another three-to-four years. That project was temporarily put on hold when we got close to launching our first product, the Impossible Burger. I then started the Nutrition and Health team at Impossible.

Q: Tell us about how health and nutrition fits into the product development process at Impossible Foods.

Klapholz: We're involved from the very beginning. We look at the animal product that we're replacing, and we look to see what nutritional positives, neutrals, [and] negatives are there. And how can we replicate or improve upon everything that's good [and] minimize or eliminate everything that's a health negative—and include or add additional nutrition or health benefits?

Q: How does the process start?

Klapholz: Usually they'll start with a prototype, and that will be built upon until we have what we consider a final product. And in that development process, nutrition is constantly changing, ingredients are changing, levels are changing. We're trying to balance all the organoleptic properties of the product with the nutrition, with the cost, with the manufacturing process and with handling properties, shelf-life properties—all that. So we're part of that team, and we help guide the process along by testing the product at various time points, and I also created a nutrition calculator.

Q: How does that work?

Klapholz: We use that to calculate how we're doing in terms of creating our final product. So we can give the team an idea: "Okay, you have 18% protein now. If your target is 20%, let's think about ways to up the protein amount." We calculate the PDCAAS (protein digestibility corrected amino acid score), and we keep our eye on that. So we're making sure that our quality is high. It's not just the amount of protein but that our protein quality is excellent as well. And it's easy to do that with soy, but sometimes we have a complex mixture and it's not as simple.

Q: Let's talk about another topic that you have strong feelings about—the relationship between animal agriculture and human health. Why is that so important?

Klapholz: As an MD, I've been very aware of the link between the way we raise animals and a lot of public health issues—for example, influenza epidemics and pandemics originating in farmed chickens and pigs. And the other is multiple antibiotic resistant bacteria that arise from feeding farmed animals antibiotics throughout their lifetime. And so some of these problems, which I think are real public health problems and that I'm quite aware of as an MD, really, to me, that's another very important aspect of our mission.

Q: I'd be remiss if I didn't ask about the role that food scientists play at Impossible Foods, as well as the role of scientists from other disciplines.

Klapholz: I think that differences in perspective,



training, and expertise—mixing people with these differences—really expands our ability to think outside the box and do groundbreaking research.

We do have some wonderful food science veterans at our company. And their industry knowledge is invaluable. I think it's also good to have people who come in fresh out of academia with no idea of how things are done in the food industry, bringing fresh ideas that might help us to innovate. I think it's good to have a combination of industry knowledge.

Maybe a physicist or a mechanical engineer would bring some great ingenuity to how do you create a structure that's different from ground beef, that has a structure that is consistent with a whole cut of steak or fish or chicken.

Q: You mentioned whole-muscle meat cuts. Is that on the product development agenda?

Klapholz: Absolutely. It's something we're exploring. We are working on whole cuts of all kinds, including steak, chicken, and fish. We are pretty good now at figuring out how to create really good flavor. I think that



This interview was edited for clarity and brevity. For more of the full conversation, please visit ift.org/food technology.

An Impossible Foods Timeline



2009 – Patrick Brown delves deeply into the problem of climate change while on a sabbatical from his job as a Stanford University biochemistry professor.



2011 – Impossible Foods is founded.



2016 – The company's first product, the Impossible Burger, debuts.



2019 – The burger's formulation is tweaked, and Impossible Burger 2.0 is launched.

for whole cuts, the challenge is very structural. Getting the texture, the appearance, even how it feels when you're cutting it, the mouthfeel—those are the challenges there. We're working on that now.

Q: What do you anticipate the future of Impossible Foods will be? There has been some talk about an initial public offering (IPO) or a special purpose acquisition company (SPAC).

Klapholz: We haven't announced any plans for an IPO or SPAC. I know that's been thrown around. Right now, we're still just really laser focused on expanding our product lineup and availability of our products globally. So that's really where our focus is. For future direction, I would love to see us realize our mission. I would love to see us—and whatever other companies join in—make this happen. I would love to see climate change stopped or reversed.

Q: You've stated that your goal is to live a balanced life that's joyful. How would you say that your work at Impossible Foods contributes to that?

Klapholz: Well, first of all, I love working at Impossible. The vibe in the office—it's an open office where nobody has a closed door—is just wonderful and very conducive to interaction and establishing friendships and connections and being able to easily get information from anybody by walking over to where they're sitting. So the environment there is very good as far as I have an amazing team, and I really enjoy mentoring them. But we also have a bunch of employee resource groups (ERGs) at Impossible. These ERGs have different focuses, and I'm a member of almost all of them, I think, and being a part of those is also very important to me.

Q: Would you share a bit about how you and your family eat?

Klapholz: Pat and I were both vegetarian when we met in grad school. So Pat and I were vegetarians for many, many years, and about 18 years ago we became vegan.

It was actually when I turned 50. I decided that I knew enough about all the ways animals were raised in agriculture that it wouldn't be consistent with my personal beliefs to consume eggs or dairy any longer. And that was harder than becoming vegetarian because



2020 – The company shares plans to double the size of its research and development team in the coming year.



2021 – Impossible Chicken Nuggets are introduced.

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giving up cheese was super hard. But I did it. And Pat immediately joined me.

Our children were raised vegetarian, and they all are either still vegetarian or vegan at this point in life.

Q: Some analysts say that it's going to take from five to 20 years for products like the ones Impossible Foods is making to reach price parity with animal products. Will alternative products always be premium-priced compared with conventional meat products?

Klapholz: No, I don't think they'll always remain more premium. We've been working very hard over the years to continue to reduce our price. We have had three double-digit price cuts in the last one-and-a-half years—two 15% reductions for restaurant distributors and one 20% cut on our retail prices. So we're providing lower prices to restaurants and grocery stores and we're able to do this because there is an increasing demand and because we're scaling up production. So economy of scale is really, I think, the key for us.

Q: Before we wrap up, let's talk more about the future of the food system.

Klapholz: We're really envisioning a plant-based world, right? We're not just thinking, "Okay, we're going

to make some food, and this is how it is now." We're thinking [that in] 2035, if we achieve our mission and there's no more animal agriculture and we're a predominantly plant-based world, we want people to be healthy and well nourished. We ultimately want to create food that is good for the planet and its people: sustainable, healthy, nutritious, and affordable.

Q: Is it possible for the food system to change that much in less than 15 years? And what role will you and Impossible Foods have played in effecting that change?

Klapholz: I hope I will be here to see that in 2035. But that's our target. It could be sooner. It's an ambitious goal, but it keeps us very motivated and very focused. I feel great about the fact that we've been a part of what I feel like is a food revolution.

I'm very excited about all the other big food companies that have gotten involved and have come out with plant-based burgers and other meat alternatives. All of this shows me that we're heading in a really positive direction, that people are accepting these plant-based foods. They want them, [and] they're buying them. **ft**

Mary Ellen Kuhn is executive editor of *Food Technology* magazine (mkuhn@ft.org).

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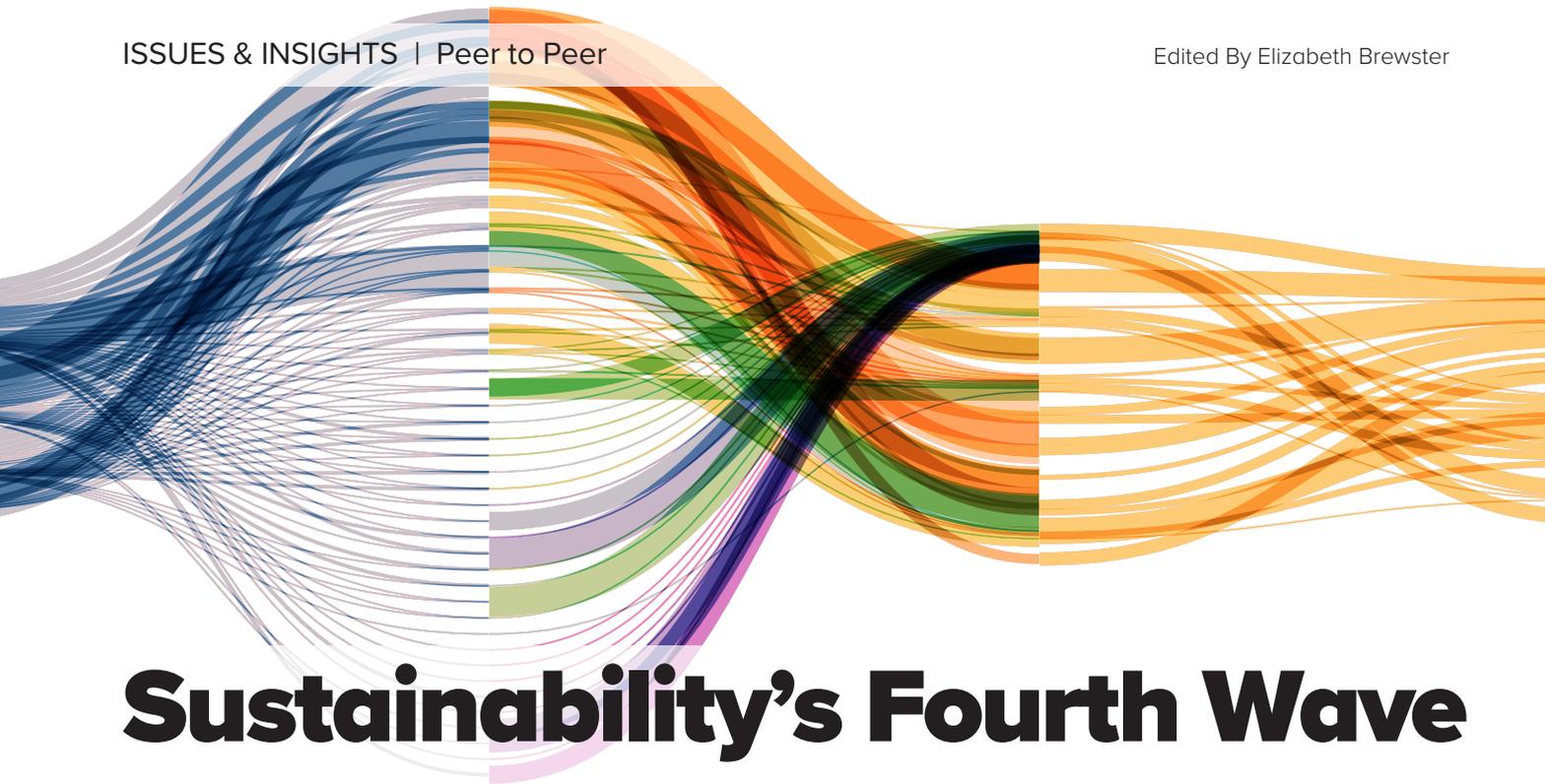
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Sustainability's Fourth Wave

Sustainability may be an overused buzzword now, but its origins date to the transcendentalism of Ralph Waldo Emerson and Henry David Thoreau in the 1830s, considered the first wave of sustainability. In the 1970s, the second wave of sustainability was characterized by Rachel Carson's groundbreaking book,

Silent Spring, and Ohio's burning Cuyahoga River, weather inversions, Earth Day, and the creation of the U.S. Environmental Protection Agency (EPA). The third wave of sustainability, in the 1990s, saw triple bottom line corporate responsibility statements, with "people, profit, planet" becoming a well-known mantra.

Figure 1. **Sustainable Packaging Development Wheel.**



Source: SPRING, 2021

In the past five years, the fourth wave has resulted in more countries and regions learning to ride the currents of sustainability, driven by both negative and positive motivation. On the positive side are food waste awareness and corporate shared values, initiatives by global retailers, brands, and packaging suppliers, and the translation of the United Nations Sustainable Development Goals (UNSDGs) into a business framework. On the negative side, however, are greenwashing, consumer confusion, lack of ethics in environmental claims, plastic bans, and competing life cycle analyses (LCAs).

Food Technology contributing editor Claire Sand recently sat down with Robert Lilienfeld, executive director of the Sustainable Packaging Research, Information, and Networking Group (SPRING), to talk about how we can explore a new frontier of sustainable packaging.

Lilienfeld works to achieve more sustainable packaging and to assist brands and packaging companies in deriving multipronged science-based solutions that address collection and sorting challenges, as well as material-based solutions to enable safe optimization, reuse, recycling, and degradation of packaging. Sand, who owns Packaging Technology and Research LLC and is also a SPRING advisory board member, focuses on preventing food waste with optimized packaging science

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and value chain-based solutions. Here's what these two experts had to say about the timeliness of today's sustainability wave, consumption trends, environmental scorecards, plastics, food waste, and more.

Sustainability in the Forefront

Sand: Why are we still having the “more sustainable packaging” conversation after all these years?

Lilienfeld: While you and I have been thinking about sustainability for 30-plus years, much of our society has not been doing so. It's hard for human beings to get concerned about something that doesn't affect them. We are concerned about issues that are close to us in several dimensions: physical distance, chronological immediacy, size and scope, and impact on family and friends. Up until now, there hasn't been a good reason for the average person to think about sustainability because it's such a big, vast problem.

Well, it's here. And everyone can participate in trying to do more with less and get involved and take responsibility. Most of the environmental issues that we face today are based upon what we as a species consume. If consumption is a human driver, then we need to make it easier for people to consume less and/or consume differently. There are three key ways to do this: financial incentives, emotional signaling, and legislative/regulatory controls.

Sand: That makes sense—linking these three issues is critical to driving meaningful change. In fact, we have seen this recently on the emotional front. As more people engage globally and learn how others interface with packaging and what solutions work, more will join the wave.

We also see tremendous achievement driven by economics. Economic incentives take many forms. For example, recently, a client of mine embarked on a more sustainable packaging initiative as a means of retaining employees, after a poll showed that employees wanted to be assured the packaging in use was as sustainable as possible. Fortunately, they employed a food system approach so that food waste was minimized, and packaging was optimized in tandem.

Source Reduction

Lilienfeld: Consumption is the primary driver of most of the environmental issues that we face today. If we're talking about the global climate, people say, “Well, our goal is to reduce carbon dioxide production.” Well, that's not really our goal—that's a strategy. Our goal is to minimize the chance that we will make our climate uninhabitable.

Sand: Consuming less means optimizing packaging specifically to prevent food waste. When this is done, our environmental footprint will decline.



“Consuming less means optimizing packaging specifically to prevent food waste. When this is done, our environmental footprint will decline.”

—Claire Sand



“In many cases, using [environmental] scorecards plants a seed. They can get people to realize that they may have to move in new directions or be open to new directions.”

—Robert Lilienfeld

What I love about source reduction is that we use fewer chemicals of concern, and the EPA estimates that source reduction eliminated up to 15 billion pounds of chemicals being used from 1991 to 2016. You saw this many years ago, Bob, and highlighted it in your 1998 book, *Use Less Stuff*. Boy, I love that title because it addresses both using less stuff and use-less stuff.

Environmental Scorecards

Sand: Environmental scorecards for packaging—such as the Walmart one developed in 2006—are increasing in popularity again. Ideally, scorecards can be used to guide industry decision-makers. Increasingly, we have seen packaging suppliers developing their own scorecards based on non-peer-reviewed LCAs. But now I would say there is an overabundance of scorecards not entirely based on facts.

Lilienfeld: I was very involved in the Walmart scorecard process. But I was not a proponent—I was an opponent. I gave the keynote address at their sustainable packaging meeting where they introduced scorecards, and I said this is going to come back to haunt you. Leadership is about telling the truth!

The problem with that scorecard was that it focused on materials, recyclability, and recycled content and not actually more sustainable packaging. What I am a fan of is accuracy.

Sand: Ah, the facts. That is what scorecards are supposed to assist with. One I do like is the section of the UP Scorecard that addresses an issue—chemicals of concern—that is ignored by other scorecards.

Lilienfeld: In many cases, using scorecards plants a seed. They can get people to realize that they may have to move in new directions or be open to new directions. It takes a while to actually grow the tree. For example, from Walmart, we now have Project Gigaton, designed to reduce carbon dioxide generation within the Walmart supply chain by 2.2 trillion pounds annually.

Disappearing Plastics

Sand: Many consumers have a strong wish for plastics to simply disappear.

Lilienfeld: I know. It is strange. If you start from the perspective of what is it that plastic material delivers, it is an amazing material. For example, polyethylene (PE) has one of the highest strength-to-weight ratios of any material in our universe. What this translates to in food packaging is that PE bags hold a lot of stuff. Plus, PE was a waste byproduct—an upcycled product from oil refining.

Sand: Material science advances in coatings, adhesives, [and] inks in packaging are advancing the

efficacy of what plastics can do. Bioderived PE from a renewable resource and recycling of flexible packaging has a lower LCA than fossil-derived PE. Making the distinction between bioderived and biodegradable is paramount.

Lilienfeld: Agreed! In theory, compostable or biodegradable packaging sounds great. But the reality is it doesn't just break down and go away. There are two types of composting—industrial composting and home composting—and the odds that a package is going to break down and go away in your home composter are almost nil. In order for the most popular biodegradable polymer, which is PLA [polylactic acid], to break down, it has to be in an environment where the temperature is at least 131°F, and that takes energy and is also not happening in your backyard in Minnesota anytime soon.

There are not a lot of facilities around that will accept biodegradable polymers. On top of that, even amongst those that do exist, a lot of them don't want PLA.

They don't want it because frankly, it is a contaminant or contains contaminants, and the only reason they accept it is because it's the cost of getting the food waste and yard trimmings they do want.

Sand: Many people immediately assume that more sustainable packaging is compostable packaging. I find this very frustrating for many reasons. First, composting packaging is just above landfilling on the EPA pyramid and often not the most sustainable option. Second, compostable packaging is not compatible with municipal solid waste compost facilities that handle only food scraps, and we have limited capacity to handle compostable packaging. Third, the standards measure a limited amount of byproducts and allow certification if the particle size is 2 mm or less. And fourth, advocates for compostability cite packaging waste in oceans and on land, and they do not address that it is likely that compostable packaging will degrade in an uncontrolled manner and contaminate our water or soil. On this last point, PFAS [per- and polyfluoroalkyl substances] were not measured by compostability standards until two years ago.

Food Waste and Food Access

Sand: I became interested in food packaging in 1984 to use packaging to prevent food waste and improve food access. Awareness is increasing: We just had the second annual [virtual] FAO [Food and Agriculture Organization] International Day of Food Loss Waste



"In theory, compostable or biodegradable packaging sounds great. But the reality is it doesn't just break down and go away."

—Robert Lilienfeld



"The key is to provide good package choices for [consumers] that allow them to take care of their other nutrient needs and not really think about the packaging being the most sustainable or not. It just will be."

—Claire Sand

Awareness in September. One point I made at the event was that we need to respect that many people have other things, such as feeding their children, to worry about rather than more sustainable packaging. The key is to provide good package choices for them that allow them to take care of their other nutrient needs and not really think about the packaging being the most sustainable or not. It just will be.

Lilienfeld: The whole underlying mechanism of food production, starting with corn and then corn being fed to cattle, significantly reduces the cost of getting that food on our plates. So we are spoiled. If we actually had to pay what it really costs to produce food, we would waste a lot less because it would be a significantly bigger portion of our disposable income.

Sand: We do see less food waste with high-value items such as meat and fish. The bottom line is reducing the total impact we have on the planet versus blindly following one solution. For example, for food with high greenhouse gas impacts, more sustainable packaging must focus on preventing that food waste. Smart brands and packaging companies are using packaging judiciously and respectfully to reduce food waste after retail, employing packaging that is more sustainable and linking the UNSDGs.

Springing Forward

Sand: Moving forward, we in the industry need to lead. Can you share details about the SPRING initiative and how it will make an impact?

Lilienfeld: SPRING stands for Sustainable Packaging, Research, Information, and Networking Group, and this is a concept that I started working on almost 10 years ago. SPRING provides transparent expertise and allows policymakers [and] business leaders to make science-based and better decisions on more sustainable packaging.

One of our goals is to help people understand the incredible complexity associated with the development of sustainable packaging. And many times, sustainability is defined by cultural and political considerations, not just scientific ones. To help people understand this complexity, SPRING has developed what I like to call the sustainable packaging development wheel (Figure 1).

Sand: A lot of young people are passionate about the environment. Right now we have a golden opportunity to harness the passion of the next generation and the experience of our generation. We just need to make the right decisions.

Lilienfeld: The packaging industry has a lot to be proud of. We do need to focus on the goal of truly reducing the environmental impact of packaging, and let expertise be our guide. **fi**

This interview was edited for clarity and brevity. For more of the full conversation, please visit ift.org/foodtechnology.

The Unsung Virtues of Cocoa Honey

THE COCOA INDUSTRY produced nearly 4.9 million tons of cocoa in 2020, most of which is used for chocolate. However, cocoa production also generates many byproducts that mostly are treated as waste. But new research from Brazil suggests some of those byproducts could be exploited as ingredients or food products in their own right.

One example is cocoa honey, which presents a novel flavor and has potential both as a stand-alone product and as an ingredient. Recent research identifies cocoa honey's potential to provide a nutritional food to help meet food security and improved nutrition as part of the United Nations Sustainable Development Goals, and help the chocolate industry improve its environmental sustainability.

Nutrients and Characteristics

According to Jacqueline Takahashi, professor in the Department of Chemistry at the Universidade Federal de Minas Gerais and co-author of a recent research paper published in *Future Foods*, cocoa honey has a unique flavor profile—sweet and slightly acidic, and a little like the taste of cocoa. It's also moderately viscous.

Cocoa honey is produced when the cocoa fruit is cut open to remove the seeds and pulp. The contact with air triggers a fermentation process, which is necessary to develop the seeds' flavors. The juice—"honey"—is from the pulp liquifying due to enzymes acting on its pectin. One estimate included in Takahashi's research puts cocoa honey amounts at 0.59 kg for every kilogram of dried seeds.

The liquid contains minerals and nutrients including calcium, magnesium, phosphorous, iron, potassium, zinc, and vitamin C. It also has carbohydrates, predominantly glucose, sucrose, and fructose, and its pH level ranges from 2.76 to 3.58. In addition, it has phytochemicals, like flavonoids.

Potential Uses and Stability Issues

Cocoa honey could be processed into a white sugar substitute, a sweetener, a beverage, and a gelling agent, says Takahashi. Local and indigenous communities in cocoa-growing regions have traditionally used it to make beverages, syrups, and jellies, among other products.

But while some of the byproduct is collected by cocoa plantation workers, and some is frozen to be transported, most of it is treated as waste, says Takahashi.

Stability over time is an issue that Takahashi and others are researching. Once fermentation begins, the



flavor changes and the honey becomes very acidic within only a few hours.

Takahashi and her colleagues have had some success using additives and other technologies like gamma radiation to improve shelf life, but she notes the artificial additives used would likely not be accepted by the natural foods market. Takahashi and her team are also experimenting with a powder form of cocoa honey that could be sold as an ingredient. The European Food Safety Authority recently approved pasteurized and frozen cocoa pulp as an acceptable food product, which could increase interest in cocoa honey and pave the way for an international market.

Improving Cocoa Sustainability

As the majority of cocoa production occurs in rural communities using manual labor and processes, Takahashi says the mass capture of cocoa honey would require some modernization to improve collection and control contamination, such as using stainless steel equipment.

But capturing and marketing cocoa honey could provide an extra source of revenue for local communities and producers—70% of the world's cocoa comes from Ghana and Côte d'Ivoire, where cocoa farmers make about \$1 and 78 cents per day, respectively. It could also help the cocoa industry become more sustainable.

And, Takahashi says, this could be the first step in putting the rest of the cocoa pod to full use. "What I see in the chemistry area is that once you have the fruit, you can use everything from it," she says. 



To learn more about the topic via a list of resources, visit iftexclusives.org/cocoa-honey, or scan the QR code.



Danielle Beurteaux is a freelance journalist who writes about science, technology, and food (@daniellebeurt).



Venkatesh Mannar pioneered fortifying salt with iron. Now, he's working to enhance it with even more nutrients to combat deficiencies.

An Endeavor Worth Its Salt

In 1980, Venkatesh Mannar was working at his family's salt factory in Thoothukudi in southern India when he got a call from UNICEF. They were beginning the drive to iodize salt in developing countries with

the goal to eradicate iodine deficiency, which can cause goiter, mental development problems, and other health issues. While iodized salt had already become established in developed economies, that wasn't the case in less-developed countries.

"Over the next 30 years, beginning in the '80s and down to today, the iodization program has really taken off, and it is now globally covering almost 85% of world salt," says Mannar.

That phone call was the start of a scientific journey for Mannar, who began to see the potential of fortifying salt with more nutrients to combat other deficiencies. He moved to Canada in the early 1990s and began working with food engineering professor Levente Diosady at

the University of Toronto, where they figured out how to add iron to salt, a long process rife with technological challenges.

Iodine, explains Mannar, is relatively easy to add to salt; it's sprayed directly onto the salt crystals, or can be mixed in with powdered salt. But iron and iodine react to each other. The iron attacks and reduces the potassium iodate to elemental iodine, which vaporizes it—no more iodine. The iodine oxidizes the iron and turns it green and brown, not colors most consumers would find acceptable in their white salt. Mannar and Diosady figured out they needed to create a barrier between the two that would keep them separate until the salt was added to food and ingested.

The duo developed the technology that solves that problem. The iron compounds are mixed with a small amount of semolina flour, which is made into a paste that's extruded through a type of pasta extruder. The long strands are then formed into tiny spheres of 300 to 400 microns each, and those are mixed in with salt. Each is coated with a 10–15 micron thick layer of starch and soya stearin, which is the barrier.

Vital Statistics

Credentials: B. Tech., Chemical Engineering, Indian Institute of Technology, Madras; M.S., Engineering, Northwestern University

Career Highlights: Recipient of the Nokia Health Award in 2010; Awarded the Order of Canada by the Governor General in 2013

LinkedIn: <https://www.linkedin.com/in/venkatesh-mannar-a361411a/>

The end product is able to withstand high temperatures and high humidity, a necessity since many developing countries are in hot or sticky climates. It also keeps for at least six months. “Over the years, that has worked well,” says Mannar. “In fact, we have samples that are several years old now.”

And that technology is now being used to further fortify salt.

Continuing Fortification

In 2017, the University of Toronto team was approached by the Gates Foundation and Grand Challenges Canada to investigate adding more nutrients. They spent two years working on adding three more: B12, folic acid, and zinc. Low levels of any of these can have serious health consequences. “A B12 deficiency and folic acid deficiency have a huge impact on women, and very low stores during pregnancy can result in children being born with neural tube defects and other problems,” says Mannar.

They finished the fortification technology in 2020, and this time they isolated the nutrients by placing the folate and B12 in the core of the tiny paste spheres. Zinc oxide is added to the coating. The result packs a multi-nutrient punch: it has 30 parts per million of iodine, 1,000 parts per million of iron, 20 parts per million of folic acid, 0.1 parts per million of B12, and 300–400 parts per million of zinc.

They’re also experimenting with alternatives to titanium dioxide, which is currently part of the coating in very small amounts. But since the European Food Safety Authority has recommended banning titanium dioxide use in food products, Mannar expects bans eventually in North America as well. “In anticipation of a total ban, then we will be precluded from even adding an eighth of a milligram. We are going to start studies on replacing the titanium dioxide,” he says.

Their new salt is scheduled for testing in two Indian states, Punjab and Andhra Pradesh, in early 2022. Christine McDonald, assistant professor in the department of pediatrics at the University of California, San Francisco, School of Medicine and director of IZiNCG, a group that works to reduce zinc deficiency globally, is leading the Punjab study. The first phase of the study included sampling the micronutrient deficiencies of 100 women of reproductive age, and a dietary assessment. They found 70% had a folate deficiency, 67% were iron deficient, 50% to 75% were deficient in B12, and 34% were zinc deficient. “The results of the biochemical and dietary analysis show that, in this study population, the prevalence of micronutrient deficiency is really high,” says McDonald.

But uptake is another challenge altogether. According to a study published in *Maternal & Child Nutrition*, acceptance of the iodized-iron salt was

impeded by lack of education and low salt quality.

Mannar says that he expects this new fortified salt to have better acceptance because the main hurdles have been overcome with the double-fortified salt, and the production facilities that produce the premix units are established (the iron coating is done at a separate factory, and that’s sold to salt producers who blend it with their salt) and the same equipment can be used. “We feel that the transition to quadruple salt will be easier,” he says.

McDonald says that it’s been invaluable to learn from Mannar’s experience with salt fortification. “It’s been cool to watch the evolution and advancement of the technology go from a double fortification system to a platform that enables other micronutrients to be included and to be able to customize the formulation, depending on the context in the population,” says McDonald.

Addressing Salt Intake Concerns

There are those pushing the World Health Organization to issue a directive that bans adding salt at any level, according to Mannar. Their concern, he says, is that fortifying salt will be perceived as promoting salt intake, and people will eat more of it. That same fear was voiced when iodine was first added. But, in fact, Mannar’s studies have shown that salt intake has decreased in many developing countries since the 1990s. “Thirty years ago, we used to measure salt intakes of 12, 13 grams a day. Today, in our latest studies done in Uttar Pradesh last year, it was 8 grams. So it’s coming down fairly significantly,” he says.

Unlike many other foods, salt is a democratic product—it’s accessible and affordable, and it’s used in consistent amounts by almost everyone, regardless of location or socio-economic status. And it is, of course, essential for survival. “Everyone consumes salt in some way, so it’s like your dream vehicle,” says McDonald. She supports programs to reduce salt in populations with high salt intake and says that doesn’t conflict with the goals of the multiple-fortified salt program. “The beauty really of the technology is that you can adjust the levels of fortification in response to the salt intake of the population,” she says.

In the developing world, says Mannar, the amounts of foods like rice or wheat consumed daily can vary dramatically between wealthy and poor populations. Thus, fortifying at appropriate amounts is extremely challenging. But the body regulates salt levels, and that’s why, for Mannar, salt is the obvious choice. “That’s why I just feel that salt is such a no-brainer, but not many people have really come around to that viewpoint.” ■



“A B12 deficiency and folic acid deficiency have a huge impact on women.”

—Venkatesh Mannar

Danielle Beurteaux is a freelance journalist who writes about science, technology, and food (@daniellebeurt).

A Heart Health Balancing Act



Consuming two servings daily of Step One products produced clinically meaningful cholesterol reduction in about two-thirds of participants in a study. Photo courtesy of Step One Foods

Recently, the American Heart Association (AHA) released updated dietary guidance to improve cardiovascular health. The scientific statement encourages balance and emphasizes the importance of “the whole package” of what someone eats over the course of a day or week (Merschel 2021). “What’s really important is the balance of everything together that has the biggest impact on cardiovascular health,” said Alice H. Lichtenstein, who led the writing committee for the AHA scientific statement.

The report advises that a heart-healthy dietary pattern includes the following behaviors:

- achieving and maintaining a healthy body weight
- eating a variety of fruits and vegetables
- choosing whole grains rather than refined grain products
- choosing healthy sources of proteins, mostly from plant sources (legumes and nuts); regularly eating fish and seafood; substituting nonfat and low-fat dairy products in place of full-fat versions; and for people who eat meat, choosing lean cuts rather than processed forms
- using liquid plant oils instead of tropical oils and animal fats or partially hydrogenated fats
- choosing minimally processed over ultra-processed foods

WITH HIGH CHOLESTEROL and high blood pressure prevalent on both the maternal and paternal sides of my family, the issue of cardiovascular health is near and dear to my heart (pun intended). According to the Centers for Disease Control (CDC), I’m one of about half of all Americans (47%) who have at least one of three key risk factors for cardiovascular disease (CVD): high blood pressure, high cholesterol, and smoking. Between 2015 and 2018, 126.9 million American adults had some form of CVD. In addition, in 2018, coronary heart disease (CHD) was the leading cause of deaths attributable to CVD in the United States (42.1%), followed by stroke (17.0%), high blood pressure (11.0%), heart failure (9.6%), diseases of the arteries (2.9%), and other CVD (17.4%).

While family genetics can’t be overcome, nutrition and diet play

Learning Objectives

1. Understand the impact of cardiovascular disease on public health.
2. List elements of the American Heart Association’s recommended dietary pattern.
3. Recognize well-researched heart-health nutrients as well as ingredients with potential cardio benefits.

integral roles in fighting CVD. For example, the Mediterranean diet, the Dietary Approach to Stop Hypertension (known as the DASH diet), and plant-based dietary patterns have been associated with lower atherosclerotic disease risk in observational studies (Kirkpatrick and Maki 2021). These eating lifestyles emphasize higher intakes of plant-based foods, lean animal protein sources, and non-tropical oils, while limiting intake of sugar-sweetened products, refined grains, and processed meats.



Plant sterols have a chemical structure similar to that of cholesterol, which means they can block cholesterol absorption and help lower total cholesterol as well as LDL cholesterol.

- minimizing foods and beverages with added sugar
- choosing foods with little or no added salt
- limiting alcohol consumption or not starting to drink alcohol
- adhering to heart health guidance regardless of where food is prepared or consumed (Lichtenstein et al. 2021).

Dietary Interventions

Elizabeth Klodas, a preventive cardiologist, founded Step One Foods, which offers a line of snack bars and breakfast products, to make it easier for patients to change their diets and reduce their risk for heart disease. Step One products are designed to help lower cholesterol levels using several well-documented cardio-friendly nutrients, including dietary fiber, omega-3 fatty acids, antioxidants, and plant sterols, and research supports the company's claim.

When Step One products were eaten twice a day as a substitute for similar items (two four-week phases with a rest period in between), a 9% reduction in low-density lipoprotein (LDL) cholesterol was observed, high-density lipoprotein (HDL) cholesterol went up slightly, and blood sugar fell slightly (Kopecky et al. 2018). Step One snacks and breakfast foods supplied at least 1,800 mg of the omega-3 fatty acid alpha-linolenic acid (ALA), 5 g of fiber, and 1 g of plant sterols per serving.

Plant sterols have a chemical structure similar to that of cholesterol, which means they can block cholesterol absorption and help lower total cholesterol as well as LDL cholesterol. Several meta-analyses show a dose-response relationship with intakes of 1.5–3 g/day of plant sterols lowering LDL cholesterol by 7.5% to 12% (Trautwein et al. 2018).

Dietary fiber, both insoluble and soluble, helps lower cholesterol as well as blood pressure. Fruits, vegetables, nuts, seeds, and whole grains are all sources of dietary fiber. In fact, Murphy and Schmier (2020) found that if whole grain intake was increased to meet recommended levels (an increase of 2.24 servings of whole grain per day), the estimated direct medical cost savings from reduced risk of heart disease in the United States was \$21.9 billion annually. Further, the researchers found that even small increases in whole grain intake can translate to substantial medical cost savings. An increase of just 0.25 servings of whole grains per day was associated with saving \$2.4 billion annually.

Omega-3 fatty acids help reduce inflammation and lower triglycerides while raising HDL cholesterol. Omega-3 fatty acids (eicosapentaenoic acid and docosahexaenoic acid) are highest in fatty fish. The AHA recommends eating two servings of fish per week to help reduce heart disease

and stroke risk. The heart association issued a science advisory in 2019 saying prescription fish oil supplements were also a safe and effective way to lower triglycerides.

The omega-3 fatty acid ALA can be found in flaxseed and walnuts. Walnuts, in particular, are unique among nuts in that they are an excellent source of ALA. Recently, in a two-year study of an elderly population, Rajaram et al. (2021) showed that eating a handful (1–1.5 oz) of walnuts daily lowered LDL cholesterol and total cholesterol among those aged 63 and up.



Photo courtesy of California Walnut Board

Heart Health Up-and-Comers

While consumers recognize the nutrients in fruits, nuts, and whole grains as heart healthy, there are some less-familiar ingredients that may also help with the formulation of heart-healthy products.

- **Probiotics.** You wouldn't normally associate probiotics with heart health, but in a pilot study, Derosa et al. (2020) demonstrated that a supplement containing *Lactobacillus plantarum* (LPLDL, OptiBiotix Health), arginine, coenzyme Q10, and vitamin B1

Glossary

CARDIOVASCULAR DISEASE (CVD): The term for all types of diseases that affect the heart or blood vessels.

CORONARY HEART DISEASE (CHD): A type of CVD that occurs when plaque (a combination of fat, cholesterol, calcium, and other substances found in the blood) builds up in the arteries.

LOW-DENSITY LIPOPROTEIN (LDL) CHOLESTEROL: LDL cholesterol is considered the "bad" cholesterol because it contributes to fatty buildups in arteries. A healthy LDL level is less than 100 mg/dL.

HIGH-DENSITY LIPOPROTEIN (HDL) CHOLESTEROL: HDL carries LDL (bad) cholesterol away from the arteries and back to the liver, where the LDL is broken down and passed from the body. But HDL cholesterol doesn't completely eliminate LDL cholesterol. Only one-third to one-fourth of blood cholesterol is carried by HDL. A healthy level is 40 mg/dL or higher for men and 50 mg/dL or higher for women.

ATHEROSCLEROTIC CARDIOVASCULAR DISEASE (ASCVD): A type of CVD caused by high levels of LDL cholesterol in the blood, leading to a buildup of plaque on the wall of arteries.

TRIGLYCERIDES: Fat in the blood. A high level of triglycerides has been linked to a greater chance for heart disease. A normal triglyceride level is below 150 mg/dL.

could be helpful in improving high normal blood pressure and hypercholesterolemia. (Normal blood pressure is less than 120/80 mmHg. High normal is in the range of 130–139 and/or 85–89.) The probiotic *Lactobacillus plantarum* (LPLDL) enhances bile

salt hydrolysis, which causes the liver to pull cholesterol from the blood in circulation, ultimately decreasing blood cholesterol and blood pressure.

In January 2021, OptiBiotix announced continued commercial developments in North America on

behalf of its subsidiary ProBiotix Health with a non-exclusive license agreement for LPLDL with Genuine Health Inc., a Canadian-based natural health company, for the development of a cardiovascular health product in Canada and the United States. Genuine Health will submit its products to Health Canada with the goal of obtaining a specific health claim for the probiotic supplement and cardiovascular health in the Canadian market.

• **Vitamin K.** Beneficial for bone and cardiovascular health, vitamin K aids in the prevention of arterial calcification. Bellinge et al. (2021) highlighted the potential importance of vitamin K (K1 and K2) for atherosclerotic cardiovascular disease (ASCVD). In the prospective cohort study, they observed the risk of ASCVD was inversely associated with diets high in vitamin K1 or K2. Compared with participants with the lowest vitamin K1 intakes, participants with the highest intakes had a 21% lower risk of ASCVD-related hospitalizations. The same relationship was seen with vitamin K2; the risk of ASCVD-related hospitalizations with the highest intakes was 14% lower than participants with the lowest vitamin K2 intake.

A balanced, heart-healthy diet with some of these whole foods and ingredients and a healthy lifestyle are so important to help take control of cardiovascular health. I can personally attest to that. A shift in my diet, as well as focusing on daily exercise, has helped keep me off blood pressure medication for the past three years. 

References cited are available via hyperlinks in the digital version of this column.

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Is Raw Milk Worth the Risk?



THE CONSUMPTION OF raw dairy is a contentious issue: Science battles myths, social media may trump reliable internet sources, and food safety shakes hands with politics. Given the “buy local” trend, the general distrust of technology and food processing, and the misinformation posted on websites and blogs, some consumers now believe raw milk is better than pasteurized milk—even in the face of testimonials about serious, life-threatening illnesses in young victims whose parents believed dubious health and nutrition claims.

“I’ve always been surprised when I hear people extol the virtues of raw milk or raw juices,” says Bill Marler, a leading litigator of foodborne illness cases. “I think there’s somewhat of a false sense of security in our food. In many respects, because we’re so good at feeding so many people safely, I think otherwise educated people

Learning Objectives

1. Understand food safety risks associated with raw milk consumption.
2. Review current raw milk sales regulations.
3. Preview new processing methods that offer a safe alternative to pasteurization.

still don’t necessarily see the risks involved in certain food consumptions.”

Health claims about consumption of raw milk either have not been substantiated or are of very low consequence in the case of vitamin loss. But there is extensive documentation showing that raw milk is a known public health risk. In fact, raw milk is one of the world’s most dangerous foods, responsible for almost three times more hospitalizations than any other foodborne disease source (Alegbeleye et al. 2018). The symptoms of raw milk

pathogen consumption range from diarrhea, vomiting, nausea, fever, and abdominal cramps to severe syndromes such as Guillain-Barré, hemolytic uremic syndrome, septicemia, meningitis, and intrauterine infections in pregnant women (Alegbeleye et al. 2018). Spontaneous abortion or even death may occur.

Between 1993 and 2012, at least 1,909 illnesses and 144 hospitalizations were recorded in the United States from outbreaks attributed to unpasteurized milk consumption (CDC 2017). A substantial number of these raw milk outbreaks involved children: From 2007 to 2012, at least one child under the age of five was involved in 59% of the outbreaks. One- to four-year-olds accounted for 38% of the *Salmonella* illnesses and 28% of the Shiga toxin-producing *E. coli* illnesses, which can cause kidney failure, long-term health consequences, and death (CDC 2017).

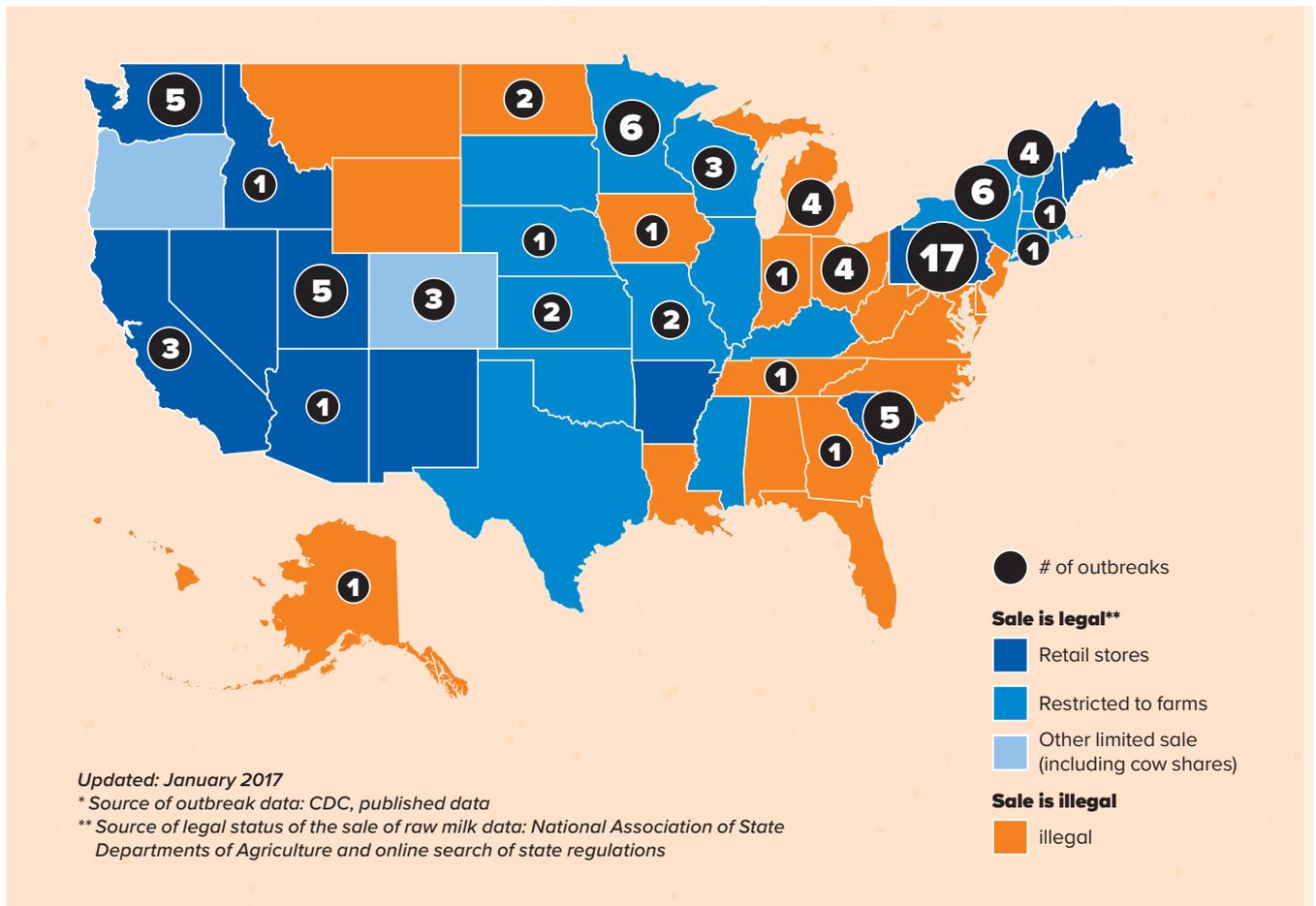
Some of the outbreaks were attributed to raw cheeses such as chevre and Mexican-style queso fresco. Even fermented products such as kefir were susceptible to pathogens. Raw milk is also a potential source of antimicrobial-resistant bacteria that can horizontally transfer resistance to commensal gut bacteria and thwart the treatment of infections in humans (Zastempowska et al. 2016).

Raw Milk Regulation

Because milk is an important part of nutrition for infants, children,

Raw milk is one of the world’s most dangerous foods, responsible for almost three times more hospitalizations than any other foodborne disease source.

Figure 1. **Legal Status of the Sale of Raw Milk and Outbreaks* Linked to Raw Milk, by State, 2007–2012.**



Source: Centers for Disease Control and Prevention

and older adults who may not be given a choice in what products they consume, raw milk consumption requires regulation. The interstate sale and distribution of raw dairy was prohibited by the U.S. Food and Drug Administration (FDA) in 1987, but this still leaves the legality of intrastate sale and distribution up to the various states.

Twenty states explicitly prohibit raw milk sales. Thirty states allow it in different situations, with some allowing retail sales and others permitting direct sales from farm to consumer or through “cow share” agreements, where buyers pay farmers a fee to care for the animals and then receive a

percentage of the milk produced.

The Centers for Disease Control and Prevention (CDC) has created a map with the various state regulations, highlighting where raw milk outbreaks have occurred and showing that outbreaks can jump state lines to states where raw milk sales are illegal (Figure 1). The FDA has sent warning letters and pursued producers who ship raw dairy across state lines (FDA 2017); between 2004 and 2016, the FDA sent out seven warning letters and filed two court injunctions against producers that have sold raw dairy across state lines. But the FDA raw milk website has not been updated since Nov. 17, 2017,

which calls into question whether the agency has the resources to police and prosecute interstate sale and distribution of raw milk.

Among the states with prohibitions, Hawaii recently set up an embargo to quash the sale of raw milk. The Hawaii State Department of Health discovered that approximately 20 pet stores were selling raw goat’s milk as “pet food,” but the product was being diverted for human consumption. According to state law, Hawaiian retailers and restaurants may purchase only pasteurized Grade A milk and dairy products. Under the embargo enacted July 1, 2021, retailers with raw

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THE MYTHS DEBUNKED

Many of the misconceptions about raw milk health benefits have been proven inaccurate by the U.S. Food and Drug Administration (FDA 2018):

1. Raw milk does not cure lactose intolerance.
2. Raw milk does not cure or treat asthma and allergy.
3. Raw milk is not more effective in treating osteoporosis than pasteurized milk.
4. There are no beneficial bacteria (probiotics) in raw milk for gastrointestinal health.
5. Raw milk is not an immune system-building food and is especially unsafe for children.
6. There are no immunoglobulins in raw milk that enhance the human immune system.
7. There are no additional proteases or lipases in raw milk that facilitate milk digestion.
8. Raw milk is not nutritionally superior to pasteurized milk.
9. Raw milk does not contain natural antimicrobial components that make it safe to drink.
10. Raw milk does not contain nisin for pathogen inhibition.
11. Folate-binding protein is not denatured during pasteurization, and folate (vitamin B9) utilization is not reduced in pasteurized milk.

milk in their possession are fined up to \$10,000 per day unless they remove and destroy the product.

In California, where retail sale of raw milk for human consumption is legal, raw goat milk was recalled and quarantined in 2021 due to contamination with *Campylobacter*. The same producer also had to implement recalls in 2019 and 2020 because of *Campylobacter* in its raw milk.

Consumer and State Legislator Education

Both the FDA and the CDC offer informative, data- and

fact-driven websites explaining the dangers of consuming raw milk. A working group of scientists, consumers, and attorneys also sponsors the website RealRawMilkFacts.com (RRMF). The site supplies data on the dangers of raw milk consumption, in addition to providing compelling video interviews with families and individuals who have experienced medical issues related to raw milk consumption. The RRMF working group lobbies legislators at the state level to discourage bills that allow the sale and distribution of raw dairy intrastate.

“State legislators tend to run a bit conservative, and one of the things they really, really, really like are small farmers who come in and rail against government intervention and regulation,” says Marler, an RRMF sponsor. “So it’s sometimes a very tough row to hoe,

trying to convince legislators to not move forward with raw milk bills.”

Milk Pasteurization Alternatives

Scientific evidence indicates that pasteurization is still the incontrovertible safeguard for dairy processing (Alegbeleye et al. 2018). But with the raw milk trend in mind, food scientists are developing new processing methods or dusting off older ones that lower the biological load of milk and dairy products while avoiding the heat treatment of pasteurization. These emerging or reprised processing technologies include high pressure processing, ultra high pressure processing, supercritical fluid technology, pulsed electric fields, microfiltration, electron beam technology, and a hurdle approach employing multiple methods (Alegbeleye et al.

2018). Ideally, consumers will find these alternatives more acceptable than pasteurization and abandon the consumption of raw dairy.

Based on the history of raw milk legislation, government alone cannot safeguard our food supply. Food safety is—and will continue to be—the responsibility of food scientists, consumer groups, litigators, food producers, growers, and educators in addition to federal and state legislators. “When people work together, [things] can go right,” says Marler. **ff**

References cited are available via hyperlinks in the digital version of this column.

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NEW PRODUCTS



Wixon adds Japanese flavors

BURGEONING INTEREST IN Japanese cuisine in the United States spurred Wixon to create new Japanese-inspired flavor systems. Taking key flavors that are commonly found in Japanese cuisine, such as shoyu, yuzu, and togarashi, Wixon taste experts created a diverse range of com-

plex flavor systems: Umeboshi Coconut, Smoky Shoyu Caramel, Smoky Tonkatsu, Yuzu Hojicha, Sudachi Kosho, Salted Caramel Miso, Japanese Whiskey Shoyu, Garlic Togarashi, Japanese Curry, and Pickled Ginger.

Dry blend MFGM

ARLA FOODS INGREDIENTS launched Lacprodan Premium MFGM-10, a dry blend version of its MFGM (milk fat globule membrane) ingredient, helping infant formula manufacturers reduce energy usage and production costs without compromising on safety or quality. Arla Foods Ingredients has also become the first supplier with the capacity for

commercial production of pure beta-lactoglobulin (BLG).

Lacprodan BLG-100 is a pure BLG ingredient that contains 45% more leucine than commercially available whey protein isolates. The company has applied for Lacprodan BLG-100 to become authorized as a novel food in the European Union.

Plant-based fat portfolio

AAK HAS DEVELOPED AKOMEL, a portfolio of clean label and plant-based fats from sustainable sources for chocolate and confectionery manufacturers that are looking to benefit from the growing popularity and premiumization of caramel. AAK has also agreed to purchase **BIC Ingredients**, the lecithin arm of BIC International Holding. The company will integrate BIC Ingredients' products into its current portfolio of specialty lecithins, sold under the Akolec brand.



SUPPLIER NEWS

Celebrating the Power of Rosemary

ROSEMARY IS RECOGNIZED alongside tocopherols as a major component in maintaining natural freshness and flavor thanks to its antioxidant and antimicrobial properties. Kemin Industries pioneered the use of rosemary molecules in ingredients in the late 1990s and is celebrating 25 years of growing its proprietary line of rosemary to create sustainable solutions for foods. Kemin's proprietary rosemary is formulated into effective clean label solutions to help keep food fresher, safer, and more flavorful.

"It took many years for the pet food and food industries to broadly accept purposefully bred rosemary target molecules as worthy additions to mixed tocopherols," says John Greaves, vice president of specialty crops, Kemin Industries. "Demand for clean label products, and the use of rosemary really increased over the last 10 years."

Prior to Kemin developing its rosemary program, the plant was

mainly wild harvested in Southern Europe and North Africa. Kemin scientists analyzed and selected the most potent lines of rosemary from around the globe and used conventional plant breeding methods to begin a continuous improvement program, which resulted in one of the largest collections of rosemary in the world.

"We operate our own proprietary, fully vertically integrated supply chain for rosemary, working very closely with our contract growers and supporting them in the field with agronomists," says Greaves. The company continues to invest in plant breeding, cropping system development, novel agronomic technologies, and certified sustainable growing practices in order to produce more of its target molecules from the same land area as a key component to a sustainable future. "We are developing new plant species as sources of complementary molecules that work in a complementary manner to rosemary," Greaves notes.



CONSUMERS

ADM Looks Ahead

THE CLOSE OF one year and the start of another almost invariably brings some future forecasting, and ADM has tapped into its proprietary *Outside Voice* consumer insights platform to arrive at its second annual list of global consumer trends.

Although COVID-19 was not on anyone's radar at the start of 2020, it definitely affected food and beverage trends, particularly moving immune and mental health to the forefront. "Consumers today continue to navigate a tumultuous environment that has uprooted every aspect of their lives. This has led forward-thinking brands to develop new solutions purpose-built to help consumers establish a sense of normality for themselves, their families, and their pets," says Brad Schwan, vice president of category marketing for ADM.

Here's a look at the trends ADM has identified.

1) Nourishment for the Whole Self: Consumers want to be more proactive about supporting their mind and body through a balanced approach to diet and lifestyle.

2) Plant-Based Lifestyles: A flexitarian approach to eating has become mainstream.

3) Microbiome as the Root of Wellness: Data indicates that 58% of global consumers are aware of the potential benefits that bacteria in the digestive system can have on their overall health.

4) Clean & Transparent Sourcing: A desire for transparency across the entire product lifecycle, from how it's made to how it's packaged, and beyond.

5) Humanization of Pets: 30% of global pet owners spent a significant amount of time researching the best food options in the last year.

6) Precise & Responsible Animal Feeding: There is an increased demand for optimized feed solutions that support human and animal nutrition in an efficient, environmentally friendly manner.

7) Sustainable Goodness: Brands are taking positions on environmental matters, aiming to reflect their commitment to increasing the sustainability of their production and distribution systems.

8) Advanced Renewables & BioSolutions: Consumers increasingly believe that companies should take greater responsibility for reducing waste and energy use from development to disposal.

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INDUSTRY UPDATE

As part of its strategy to expand the portfolio of its global Taste & Wellbeing business, **Givaudan** has reached an agreement to acquire **DDW, The Color House**, a U.S.-based natural color company. The transaction is expected to close in the fourth quarter of 2021.

ADM, a global leader in food and nutrition, has been ranked 27th on *Fortune's* 2021 Change the World list, a global ranking of the top 50 companies making a positive social impact through business practices that are integral to their core corporate purpose. The company has made large-scale investments in cutting-edge protein solutions spanning plant-based, cell-based, microbial fermentation, insects, and more. ADM also announced that it has achieved net carbon neutral status for its U.S. flour milling operations through a combination of energy efficiencies, purchase of renewable energy certificates, and sequestration of carbon dioxide at the company's commercial carbon capture and storage facility.

bioMérieux's GENEUP NUTRAPLEX PRO multiplex pathogen detection assay has achieved the AOAC Research Institute Performance Tested Methods approval (PTM 082103). GENEUP NUTRAPLEX PRO is the first-ever method to be validated as a multiplex pathogen screen and PCR culture confirmation method for USP pathogens in nutraceuticals.

Ingredion Inc. signed a strategic distribution agreement with **Batory Foods**, making Batory an authorized licensed distributor of Ingredion's Systems and Ingredient Solutions in Arizona, California, Hawaii, Idaho, Illinois, Iowa, Minnesota, Nevada, New Mexico, North Dakota, South Dakota, Oregon, Utah, Washington, and Wyoming. The distribution agreement does not include sweeteners, specialty sweeteners, polyols, stevia, or sugar reduction systems. Ingredion also entered into an exclusive U.S. stevia pilot production supply agreement with **S&W Seed Company**, which will supply



Ingredion and its **PureCircle by Ingredion** subsidiary with high-quality, U.S.-sourced stevia plants.

Kalsec has partnered with **Firmenich**, a privately owned perfume and taste company, to launch Lupulock Encapsulated Hop Oils. Lupulock is a groundbreaking natural alternative to hop cones and pellets that enables brewers to accelerate production and reduce waste while delivering consistent, authentic flavors and aromas. Kalsec provides hop extracts that have increased consistency, higher utilization, and more flavor differentiation than traditional hops. Firmenich supplies its proprietary encapsulation technology that extends shelf life.

Roquette announced the opening of a center of expertise of 2,000 square meters on its site in Vic-Sur-Aisne in Hauts-de-France, France. Fully dedicated to plant protein, the R&D accelerator will enable Roquette to support its growth ambitions. Besides extending its pea and wheat protein range, Roquette intends to introduce several new sources of protein every five years.

Pilot results showed a dramatic increase in sanitization efficiency and complete elimination of *Listeria* using **Bio-Fence** antimicrobial coatings applied to the floor and the lower part of the walls of a hot dog peeling room. Results from the proof-of-concept study demonstrated that Bio-Fence technology, when embedded in an industrial topcoat, can serve as a powerful antimicrobial solution that stabilizes and prolongs the activity of standard sanitizers, thereby helping to dramatically reduce the spread of *Listeria*.

Symrise Diana Food has organized and instituted a new training session that specifically targets farmers in the French Alps who supply fruits for baby food. The program, which focuses on best practices for soil biodiversity, aims at improving the quality and yield of the key crops used in baby foods. With this training, Symrise



PHOTOS COURTESY OF KALSEC AND SYMRISE DIANA FOOD

Diana Food agronomists can show farmers the role soil plays in producing fruits and vegetables that capture all the inherent goodness of their terroir.

Fiberstar has partnered with two new food ingredient distributors, **Accurate Ingredients** and **Gilco Ingredients**. Fiberstar sells Citri-Fi citrus fiber globally using a robust distributor network.

OmniActive Health Technologies announced that it has received Generally Recognized as Safe (GRAS) status for Gingever, a high-potency ginger extract designed to help support digestive and immune health at a low dose.

Ardent Mills, a flour milling and ingredient company, announced its intention to acquire substantially all the business assets of **Firebird Artisan Mills**, a gluten-free, specialty grain and pulse milling company that is part of operating holding company Agspring. The parties are continuing with due diligence and expect the deal to close by the end of 2021.

GNT, manufacturer of EXBERRY Coloring Foods, announced an initial investment of \$30 million to expand its operation in North America. The company's new facility in North Carolina currently features an expansive warehouse, with a technical and culinary experience center set to follow in August 2022.

IFF Health introduced a revamped website (iff-health.com) that brings together the expanded

capabilities of the newly merged IFF Health and HOWARU businesses. This resource hub is a launchpad designed to provide brand partners and co-manufacturers with deep technical insights, updated market intelligence, and comprehensive microbiome innovation resources.

J. M. Huber Corporation and **SolAmerica Energy** announced the completion of a 1.8 megawatt (DC), ground-mounted solar array located at the Huber Engineered Materials Fire Retardant Additives Marblehead facility in Quincy, Ill. The plant is now receiving more than 60% of its power from the array during daylight hours. This effort is part of the state-administered Illinois Shines incentive program supporting the development of new solar energy generation throughout the state.

PRODUCT BRIEFS

• **FrieslandCampina Ingredients**, global innovator in healthy and functional prebiotic ingredients and solutions, and **Lallemand Health Solutions**, specialists in the research, development, production, and marketing of probiotic yeast and bacteria, have partnered to launch two brand-new gut health product concepts. PRO-Digest Health Shot and PRO-Digest Bowel Support bring prebiotic and probiotic ingredients together into single concepts that will enable companies to formulate enhanced gut health products.

• Dutch health ingredients company **NutriLeads** announced the launch of its proprietary immune health ingredient, BeniCaros. Upcycled from carrot pomace, BeniCaros is developed for supplements and functional foods and beverages.

• **Fiberstar** launched a next generation of TX products called Citri-Fi TX20, which provide meat-like texture and thickening power with minimal flavor impact in meat substitute products. At low usage levels (2%–4%), this new Citri-Fi TX20 helps product developers create meat alternatives that simulate

their animal-containing counterparts. Labeling options include citrus fiber, dried citrus pulp, or citrus flour, all of which resonate well in clean label markets.

• **Glanbia Nutritionals'** new OvenPro Series provides a range of functionally beneficial ingredients that allow a variety of baked goods to contain higher levels of protein and fiber with low levels of sugar and net carbs. The OvenPro Series includes OvenPro Bread and Bread Zero Net Carb, OvenPro Cake, and OvenPro QuickBread. The benefits of the series include 1:1 flour replacement formulated for quality PDCAAS to support excellent and good source claims for protein and fiber, easy inclusion in formulations, and the fact that it is keto-friendly.

• **Cargill** launched a soluble rice flour, SimPure 92260, which exhibits similar taste, texture, and functionality to maltodextrin, an ingredient commonly used as a bulking agent and flavor carrier. The company says that soluble rice flour appeals to consumers' desire for label-friendly ingredients.

Supplier Central



PRODUCT BRIEFS

Do you have any new product or company news to share? Email suppliercentral@ift.org

• **Kerry** released Botanicals Collection ZERO 2.0, an enhanced, next-generation range of premium taste extracts for low-/no-alcohol drinks. Compared with other ethanol-free technologies, the Collection ZERO 2.0 range is more stable, with no haze or sedimentation, and a more complex botanical taste and mouthfeel.

• **Ingredion** announced a new Prista line of ultra-performance pulse-based ingredient solutions. HOMECRAFT Prista P 101 pea flour, VITESSENCE Prista P 155 pea protein concentrate, and VITESSENCE Prista P 360 faba bean protein concentrate facilitate the inclusion of plant protein into more applications, including instant and ready-to-eat products.

• **ESHA Research**, a leader in nutrition analysis and labeling software, announced the launch of REX, an online regulatory compliance documentation search portal for food and supplement labeling regulations, guidance, policy records, and more.

• **Sweegen** is expanding its sweetener portfolio in early 2022 with the zero-calorie, high-intensity sweetener brazzein. The product was developed in collaboration with long-term innovation partner **Conagen**, which has scaled it to commercial production. Brazzein is a small, heat-stable protein that is 500 to 2,000 times sweeter than regular sugar. **IFT**

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When Science Follows Technology

IFT'S HIGHEST AWARD is the Appert medal, first given by the Chicago Section in 1942. Writing in this magazine in 1952, Milton Parker suggested the impetus for the award came from Avriil Bitting, who, along with his wife, Katherine, was deeply involved in the development of the canning industry in early twentieth century America. While canning is commonplace today, for that generation of food technologists it was a paradigmatic example of the power of science to change food for the better. Canned food existed when they were young, but it was expensive and unreliable; by the mid-twentieth century it was affordable and safe. Nicolas Appert invented canning and so was an ideal hero.

The second award of the Appert medal was to the founding president of IFT, Sam Prescott, dean of the Massachusetts Institute of Technology. Prescott's first major achievement in food science occurred in 1895, when William Lyman Underwood asked his help in addressing spoilage issues in his family's canned food business. Prescott worked with Underwood to adapt new methods of environmental microbiology to identify the organisms responsible for the swelling and souring of canned peas and clams and published his results. He went on to teach the first courses in food technology at MIT and eventually founded the first food science department.

While it makes perfect sense that the Chicago Section chose Appert's name to exemplify excellence in food science, Appert

Appert invented canning without relying on established scientific theory. He was an entrepreneur and an obsessive 'tinkerer.'



This essay first appeared on ift.org. To join an online discussion on this topic, IFT members can visit iftconnect.org/technology-science, or scan the QR code below.



himself was no scientist. He worked as a brewer and a chef before setting up a confectionery store in Paris, where he was caught up in revolutionary politics. He served as an officer in the militia and even assisted in the execution of King Louis XVI before being arrested; he was only released when the revolutionary government fell in 1794. He went back into business, working on a plan to preserve food in glass bottles and by about 1795 hit on the process he described later: *"first, to enclose in the bottle or jar the substances that one wishes to preserve; second, to cork these different vessels with the greatest care because success depends chiefly on the closing; third, to submit these substances thus enclosed to the action of boiling water in a water-bath for more or less time according to their nature and in the manner that I shall indicate for each kind of food; fourth, to remove the bottles from the water-bath at the time prescribed."* (Appert published his methods in 1810 as *The Book for All Households*, which Katherine Bitting translated into English.)

Appert invented canning without relying on established scientific theory. He was an entrepreneur and an obsessive "tinkerer" over decades. His measure of success was not scientific but practical and economic.

Although Appert was not successful in business (his workshop was damaged by foreign soldiers after the fall of Napoleon), his ideas spread rapidly—first to England and then to America

and the rest of the world, where people adapted them to local conditions. We can identify some of the major inventions that improved canning through the nineteenth century and beyond (metal cans, the can opener, the pressure retort, the double seam), but there are countless "micro-inventions" by unknown food technologists looking at a process, imagining a better way to do it, and then making their idea work in practice. These large and small improvements allowed the success of many canning businesses by the time Underwood walked into Prescott's office at MIT. Indeed, only an established industry could expect to attract the attention of the scientists. The canners already knew how to process foods, but Prescott and his scientific peers developed systematic explanations of why it worked, and by sharing that knowledge in publications and in classes, they built a generally agreed upon understanding. This was important, but the science didn't lead to the technology—the technology led to the science.

The growing list of Appert medalists provides an inspiring story of how scientific excellence has continued to improve food processing over the past 79 years, but the example of Appert's life should also make us think of the power of tinkering. What can we do better to develop and recognize these practical and essential skills? **ft**

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