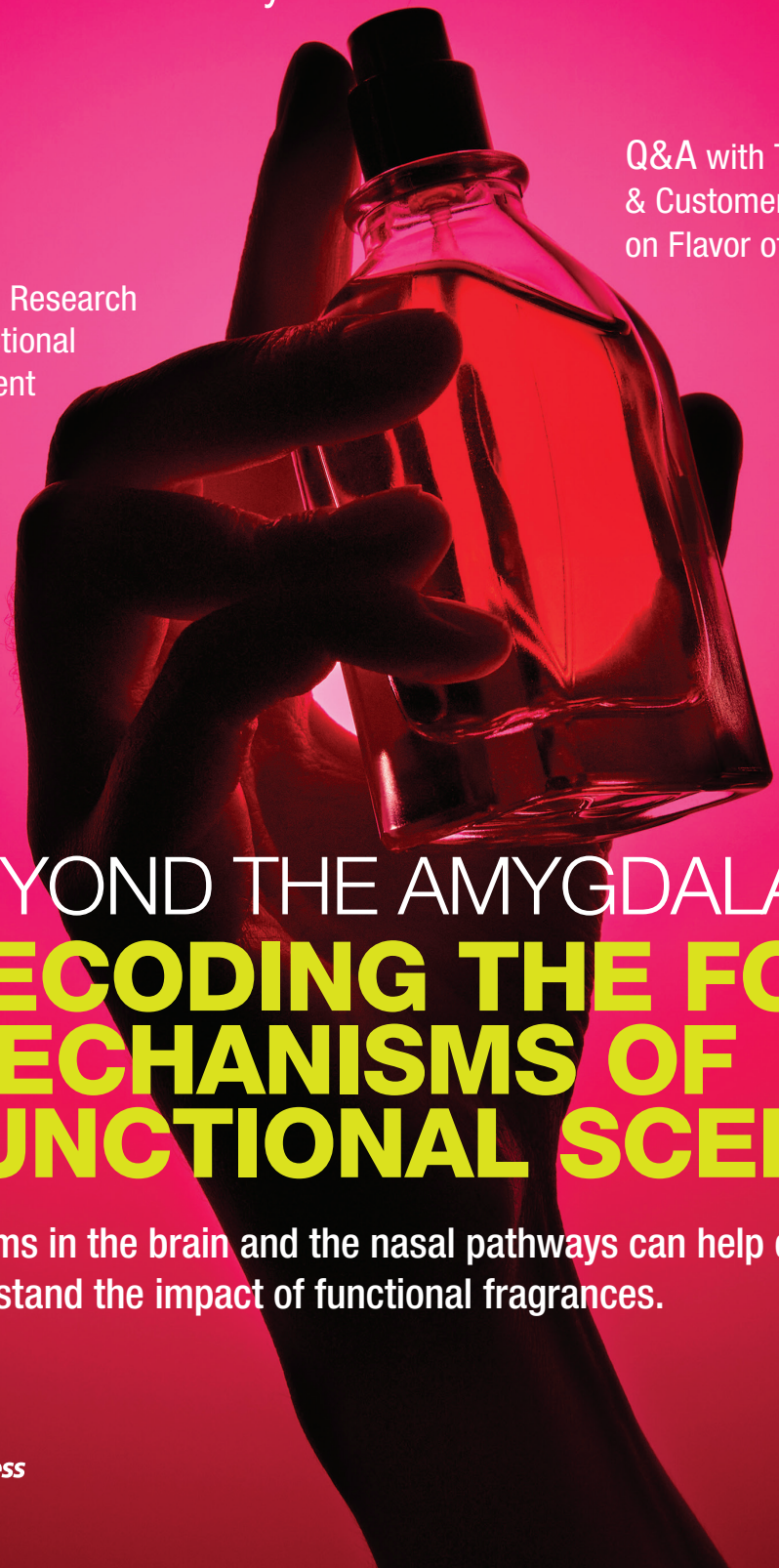
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Q&A with Torani's Consumer & Customer Market Manager on Flavor of the Year

Tech Roundup: How Neuroscience Research is Driving the Functional Fragrance Movement

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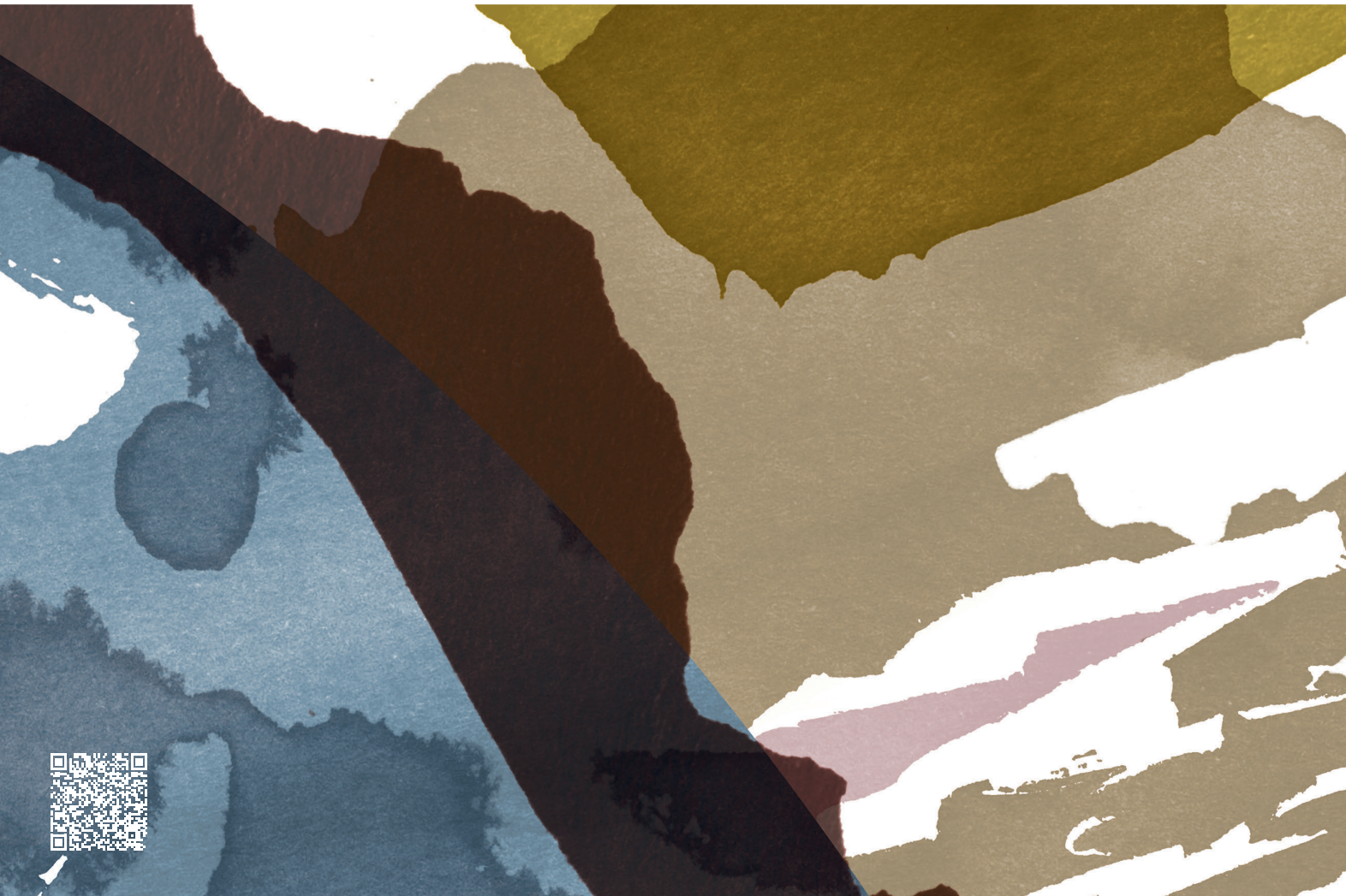
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More is More



We're in an era of maximalism.

I'm always looking to get the most bang for my buck out of my purchases. I want to get the full value out of what I've bought, whether it's a body wash with a delicious smell and hydrating ingredients or a new coffee flavor with added caffeine and a caramel flavor. Sometimes more is more, and we want our products to give us more of an experience.

WIth every trend report I've read this year, the term "sensorial experience" appears. Consumers want all five of their senses to be activated with their purchases. Aspects like scent, texture and sound are becoming more and more appealing. We're in an era of maximalism; why can't I have a candle with a gourmand scent that also helps me relax at the end of a long day?

Flavor and fragrance developers have embraced this more-is-more mentality, and we're seeing so many new product launches that reflect the demand for sensory stimulation. They are finding ways to get more value out of these products and create functional formulations. For this month's issue, I did a deep-dive into neuroscience-informed fragrance tech and learned about how to use scent as a way to regulate emotion. Perfumers are using neuroscientific research to make intentional formulations that not only smell good but provide an added functional benefit.

Consumers are asking their products to do more for them because, let's face it, value is still a key concern. Disposable income is limited, and they don't want to spend money on anything too superfluous. Several major companies have seen dips in their sales this year for this exact reason. So that's why it's important to look at this concept of value and maximize what can be packed into that product.

And it's not just limited to the fragrance category. Flavorists are working on incorporating functional ingredients and adaptogens into their formulations as well. Specifically, the beverage category is seeing constant innovation and new product releases with functional claims. I'll be curious to see how other categories will come up to speed with this trend. Maybe we'll see potato chips that help with sleep or ice cream to reduce stress.

I'm certainly not immune to the functional ingredient trend; I will try a perfume mist that claims to boost mood or a new beverage with calming properties. If I can kill two birds with one stone, that seems like a good deal to me.

Emily Little



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Ingredients



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Natural 2-Octen-4-One (FEMA #3603; CAS #4643-27-0) is recognized for its intense yeasty, jammy and tropical fruit top notes. At low levels, 2-Octen-4-One brings a complex mix of mushroom and bready nuances with hints of pineapple and earthy horseradish warmth. In flavor applications, it delivers a distinctly green, earthy and fermented character that supports mushroom, onion, musty, horseradish, fishy and yeasty profiles. Its ability to connect fruity notes with savory depth makes it especially useful in baked goods, savory broths, plant-based meats, tropical fruit flavors and fermentation inspired creations.



Hyacintal

Symrise AG

https://www.symrise.com/scent-and-care/aroma-molecules/perfumery-ingredients/#Hyacintal

Hyacintal, our partly biodegradable and versatile fragrance ingredient, imparts green, hyacinth, leafy and bell-pepper facets. It enhances floral-green compositions, vegetable notes, and adds crisp, bitter green tones to tea and petitgrain accords. Suitable across categories, it boosts freshness and naturality.



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Penta Fine Ingredients

http://www.pentafineingredients.com/

This material is a refined aroma ingredient known for its warm, fatty animalic scent. It has a distinct note of coconut that adds a creamy, sweet nuance and earthy, root-like notes. It is widely used in fine fragrance applications.



Bacon Dithiazine

Avant Organics

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Bacon Dithaizine (FEMA #4017, CAS #74595-94-1) imparts a rich, savory aroma profile that closely mimics the distinctive, smoky essence of cooked bacon. Characterized by its complex balance of meaty, sulfurous and umami notes, this dithiazine compound provides depth and authenticity in savory flavor applications. It brings a mouthwatering, slightly fatty warmth with subtle hints of grilled pork, toasted fat and a whisper of sweet smokiness. Ideal for enhancing plant-based meats, snack seasonings and savory sauces, Bacon Dithiazine delivers the craveable, hearty backbone associated with real bacon flavor. Avant Organics provides this material in DILUTIONS ONLY as EU Natural, Kosher, non-GMO and Halal. For your free sample please email info@avantorganics.com.

Images courtesy of the manufacturers

Stanford-Trained Biologist and Surgeon Introduces Science-Backed Fragrance House



SIX7 designs its formulas using a proprietary process that combines olfactory neuroscience, psychophysiology and memory engineering.

On October 30, 2025, Dr. John Zannis announced the launch of SIX7, a new fragrance house built at the intersection of neuroscience, molecular biology and high art. The house hopes to create "chemical identity codes" to activate memory and trigger attraction, according to the company's press release.

"Fragrance is not just a cosmetic," said Dr. Zannis. "It's an access code to memory and behavior — a molecular interface between the self and the world."

According to the house's press release, SIX7 designs its formulas using a proprietary process that combines olfactory neuroscience, psychophysiology and memory engineering. The house's debut line of scent-based compounds are categorized by their bio effect, such as increasing attraction, enhancing focus, unlocking emotional memories or amplifying individual personality.

"We design for outcome, not just aroma," Zannis explained. "Scent is just the surface. The real story is happening in the brain."

SIX7 worked with a combined team of neuroscientists, chemists and sensory designers to develop its compounds, called "codes." The company claims its formulas have been tested in controlled environments using fMRI, biometric tracking, and AI-driven emotional analytics.

Collection Highlights

CODE MEMORY LOCK: Anchors emotional memory

CODE ATTRACTION BIAS: Heightens interpersonal magnetism

CODE SYMPATHETIC DRIVE: Sharpens mental focus and heightens physical readiness

CODE REWARD CIRCUIT: Triggers indulgence, craving, satisfaction through reward system activation

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Courtesy of SIX7

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PAYAN BERTRAND Invests €12 Million in New Industrial Site



The new site will comprise 2,800 square meters of highly automated spaces for the company's fragrance business.

Aromatic product company PAYAN BERTRAND announced the construction of a new industrial site dedicated to fragrance compounds in Le Plan-de-Grasse. The new site is scheduled to open at the end of 2026.

According to the company's press release, the €12 million investment will provide PAYAN BERTRAND with a state-of-the-art, high-performance and sustainable production facility. The site will comprise 2,800 square meters of highly automated spaces to bring together the company's fragrance creation and evaluation departments, as well as application and quality control laboratories. PAYAN BERTRAND's new facility will serve the perfumery, cosmetics, personal care, hygiene, home fragrance and various industrial sectors.

"This new site embodies our commitment to combining tradition and innovation while reinforcing our development in Grasse, the historic birthplace of perfumery," said Dominique Prowl, chairwoman of PAYAN BERTRAND's supervisory board.

The company plans to operate through two distinct yet complementary business units by 2027: the new "Pacome" site in Grasse, dedicated to fragrances, and the historic "1866" site refocused on the production of natural aromatic ingredients for the perfumery and flavor industries. Company officials hope this strategic reorganization will enable PAYAN BERTRAND to continue its growth while strengthening its identity as an independent Grasse-based company.

Courtesy of PAYAN BERTRAND



Symrise Expands Symvision AI to Proprietary Taste Development Tools



Symvision AI can offer customers optimized taste, tailored solutions and a faster go-to market.

Flavor and fragrance company Symrise announced a major addition to its award-winning Symvision AI foresight platform to enable accelerated innovations. The platform will now feature a powerful suite of AI-assisted tools for formula prediction in addition to its trend prediction capabilities.

"Our Symvision AI design toolbox predicts the impact of formula changes, guides taste development and enables us to respond rapidly and precisely to market changes," said Leif Jago, global marketing manager of food and beverage. "Evolving consumer expectations, sudden price shifts and supply chain events drive the need for innovation and swift formula adjustments. Symvision AI delivers exactly that – it empowers us to innovate faster and smarter."

According to the company's press release, Symvision AI can offer customers optimized taste, tailored solutions and a faster go-to market. The platform uses a multistep process to identify ideal formulation options fast and reduce trial-and-error:

1. Ingredient Selection: Choosing the most promising raw materials from Symrise's portfolio
2. Design of Experiment: Narrowing down prototypes via statistical modeling
3. Sensory & Consumer Testing: Validating sensory characteristics and building predictive models
4. Flavoristic Creation Refinement: Combining deep flavorist expertise with model outputs to deliver solutions with optimal market fit.

"This unique way of taste development and design, as part of our Symvision AI offering, provides a clear example of Symrise's forward-thinking and sensory-driven approach," said Conor Delahunty, Symrise's vice president of global insights for food and beverage. "It enriches our Symvision AI market foresight capabilities with formula optimization strength. Hence, it equips our customers to navigate the complexities of today's food and beverage market with greater agility and success – today and in the future."

Senior vice president of research and technology at Symrise Food & Beverage Gerhard Krammer added, "We combine the profound expertise of our specifically trained flavorists with machine learning. This approach shortens development cycles and unlocks exciting possibilities in taste creation. We are supporting our customers to meet evolving consumer demands with speed and confidence. By combining deep flavorist expertise with machine learning, Symrise empowers its customers to lead in a dynamic market where creativity, precision and speed are essential, thereby accelerating customers' innovation advantage."

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Courtesy of Symrise

Givaudan Unveils “Groundbreaking Discovery” in Scent Receptor Research



With this new innovation, Givaudan’s officials hope to accurately pinpoint which odor molecules fit which receptor in the human olfactory system.

Flavor and fragrance company Givaudan announced the development of a new breakthrough methodology to help decode how consumers’ noses detect and recognize scent.

According to the company’s press release, this innovation helps activate previously unresponsive olfactory receptors, enhancing receptor sensitivity by up to 100x. The new methodology “unlocks” 20 specific human odor receptors and reveals which natural scent molecules they can detect.

“This process turns receptor science into a creative edge, enabling olfactory experiences that are powerful, unique and precisely crafted,” said Jeremy Compton, global head of science and technology for Givaudan’s fragrance division. “This pioneering research marks a turning point where smell science becomes a direct creative advantage, allowing Givaudan to lead the way in impactful, distinctive and targeted fragrances that stand out in the market.”

With this new innovation, Givaudan’s officials hope to accurately pinpoint which odor molecules fit which receptor in the human olfactory system, thus creating more targeted scents.

“For the first time, we have been able to match specific human odor receptors to the natural scents they detect, revealing that in some cases a single receptor is enough to signal a complex odor to the brain,” explained Agnes Bombrun, head of ingredient research. “This insight rewrites what we know about olfaction, making possible the recreation of nature’s most recognizable notes with perfect fidelity, and to imagine entirely new molecules and formulations.”

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Image by Syda Productions at Adobe Stock

Eurofragance Expands Asia Footprint with New Jakarta Creative Center



(Left to right) Edy Chandra, country manager for Eurofragance Indonesia, Santiago Sabatés, chairman and Balwinder Rolley, APAC general manager.

Spanish fragrance house Eurofragance opened its first creative center in Indonesia, strengthening its presence and capabilities across the Asia Pacific region.

The new creative center is located in South Jakarta's Arkadia Green Park and represents a €1 million investment. The Jakarta Creative Center will serve as a regional hub for co-creation, formulation and customer collaboration across fine fragrance, home and personal care categories.

"Indonesia sits at the heart of Southeast Asia's fragrance landscape, a market brimming with creativity, cultural diversity and increasing consumer sophistication," said Balwinder Rolley, general manager of APAC at Eurofragance. "Establishing a creative and technical hub here allows us to collaborate more closely with our partners, reigning concepts from idea to shelf faster and designing fragrances that reflect local tastes and preferences."

According to the company's press release, the new center spans over 770 square meters and integrates Eurofragance's proprietary technologies. Further, the Jakarta facility will use eco-conscious practices across formulation, sourcing and operations, including renewable raw materials and energy-efficient processes.

"Jakarta is a natural choice for our expansion," said country manager for Eurofragance Indonesia Edy Chandra. "It's where trends begin and evolve. Having a creative center here allows us to immerse ourselves in Indonesian culture and craft scents that are not only high-quality but also truly meaningful to local customers."

The Jakarta center will also serve as a training and talent hub for the company, supporting recruitment and skills-building in Indonesia's growing fragrance industry.

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Courtesy of Eurofragance

Namaa Flavors & Fragrances Launches Egypt's First Natural Aroma Isolation Unit



The site will use advanced vacuum fractional distillation technology to separate and purify natural compounds from essential oils.

Egyptian ingredient manufacturer Namaa Flavors & Fragrances (NFF) announced its strategic investment of EGP 250 million to establish Egypt's first natural isolation unit. This investment is expected to expand the company's production capacity by approximately 40%.

NFF's new facility is located in the 10th of Ramadan Industrial Zone and responds to rising global demand for natural aromatic isolates. According to the company's press release, the site will use advanced vacuum fractional distillation technology to separate and purify natural compounds from essential oils.

"Designed with sustainability and efficiency in mind, the unit utilizes locally sourced raw materials and energy-optimized controls," the company stated in its press release. "NFF continues to focus on innovation, regulatory compliance and quality assurance as cornerstones of its long-term growth plan."

NFF's new facility meets ISO 9235 and IFRA standards for regulatory compliance.

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LVMH Luxury Ventures Invests in Minority Stake of BDK Parfums



BDK Parfums is known for its scents such as Gris Charnel and Rouge Smoking and has collaborated with several master French perfumers.

On December 1, 2025, LVMH Luxury Ventures Fund acquired a minority stake in French niche fragrance brand BDK Parfums. Exact financial terms of the deal were not disclosed.

BDK Parfums was founded in 2016. The brand is known for its scents such as Gris Charnel and Rouge Smoking and has collaborated with several master French perfumers. The brand's product range spans fine fragrance, candles, hair perfumes and laundry care.

"The idea of this minority stake was to be able to develop the brand," said David Benedek, founder and chief executive officer of BDK Parfums.

According to company officials, the minority investment will include international and retail expansion, new products and sustainably growing the brand's Paris-based team. BDK Parfums' sales rose 45% compared to 2024 according the WWD.

"We are delighted to support BDK Parfums, whose high-quality compositions we hold in high regard, in its new phase of development, particularly internationally," said LVMH Luxury Ventures chief executive officer Julie Bercovy. "We are confident that the brand, led by David, will continue to maintain its unique know-how and expertise, and continue to create distinctive new fragrances that stir powerful emotions.

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From top: Image by KAHAR at Adobe Stock; Courtesy of BDK Parfums

Griffith Foods Launches Versaterra Plant-Based Protein



Versaterra is non-GMO compliant, allergen-friendly, shelf-stable and free of saturated fat.

Global product development company Griffith Foods announced the launch of Versaterra, a new plant-based protein that meets clean-label and sustainable goals in the food industry.

According to the company's press release, Versaterra is a nutrient-dense protein that performs well across formats and cuisines. The ingredient has a neutral flavor and "satisfying texture" and is compatible with other Griffith Foods flavor solutions. Further, Versaterra is non-GMO compliant, allergen-friendly, shelf-stable and free of saturated fat.

"The launch of Versaterra represents an important step forward for Griffith Foods and our partners," said vice president of marketing Rochelle Schaetzl. "Versaterra isn't just a product; it's a commitment to developing solutions that deliver on consumer expectations while supporting the long-term health of people and the planet. With Versaterra, Griffith Foods opens a new chapter in sustainable protein innovation where care, creativity and culinary excellence converse to shape the future of food."

Versaterra is made from plant-based ingredients like pulses and vegetables recognized for improving soil health and using less water and energy. Company officials hope this will position the new ingredient as a more sustainable choice for food product developers.

Image by Pete at Adobe Stock

IFF Unveils Hydrogen Production Facility for Sustainable Fragrance Ingredient Manufacturing



The production site's system can make 100 tons of hydrogen annually using renewable energy and includes a built-in compressor to store the hydrogen on site.

On November 6, 2025, IFF announced the installation of a nature-based hydrogen production facility at its scent R&D manufacturing plant in Benicarló, Spain. According to the company's press release, this innovation makes IFF the first company in the fragrance industry to rely on renewable electricity for hydrogenation reactions used in manufacturing key fragrance ingredients.

IFF partnered with Iberdrola, one of the world's largest producers of renewable energy. The production site's system can make 100 tons of hydrogen annually using renewable energy and includes a built-in compressor to store the hydrogen on site.

"The Benicarló site's new hydrogen production capability is a major shift from the traditional 'gray hydrogen' production methods like steam methane reforming, which relies on fossil fuels and offsite production," said Jaime Gomezflores, senior vice president of operations at IFF. "This is the first step to providing technology and expanding production to reduce emissions in the future."

The new production facility is part of IFF's 10-year renewable hydrogen energy agreement with Iberdrola. Further, this new site helps address the company's sustainability goals of net zero emissions by 2040.

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Courtesy of IFF



CIRANDA Announces Partnership with Incredo for Clean-Label Sugar Solutions



CIRANDA will offer Incredo Sugar to customers looking to formulate products for bakery, bars, snacks, confectionery, nutraceuticals, spreads and fillings, among other applications.

North American ingredient supplier CIRANDA announced a new partnership with Incredo to develop new clean-label sugar solutions at Supply Side Global in Las Vegas, Nev.

Incredo is the creator of Incredo Sugar, a clean-label sugar reduction solution. According to the company's research, Incredo Sugar allows for up to a 70% reduction in sugar content while maintaining taste. The patented technology is made with real cane sugar and helps food manufacturers develop delicious, better-for-you formulations.

"We see an exciting market opportunity today in the clean-label sugar reduction space," said Doug Audette, chief executive officer of CIRANDA. "Consumers want simple, recognizable ingredients in their food. Incredo Sugar delivers on those demands and exemplifies the forward-looking, clean-label solutions we strive to deliver to our customers."

According to the company's press release, CIRANDA will offer Incredo Sugar to customers looking to formulate products for bakery, bars, snacks, confectionery, nutraceuticals, spreads and fillings, among other applications.

"Our companies' missions are well-aligned and we recognize CIRANDA's stellar reputation for serving purpose-driven brands, many of whom are on the cutting edge of developing products that are better for people and our planet," said Incredo's chief executive officer Aldo Uva. "We look forward to further building the momentum of Incredo Sugar in the U.S. and Canada through our partnership with CIRANDA."

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Image by Luis Echeverri Urrea at Adobe Stock

Lionel Hitchen Publishes 2026/2027 Flavor Trends



The trend report outlines how the trends will influence flavor innovation in the food and beverage industry.

British flavor house Lionel Hitchen published its flavor trends report for 2026-2027. The trend report outlines how the trends will influence flavor innovation in the food and beverage industry.

"As consumers navigate a world full of cultural fusion, wellness consciousness and sensory exploration, flavor sits at the heart of every food and beverage experience," the report states. "The modern palate seeks both excitement and reassurance — flavors that comfort, connect and surprise in equal measure."

2026/2027 Flavor Trends

The World on a Plate: Global consumers are embracing "no rules" cooking — celebrating hybrid formats that cross borders and traditions. (Example flavors: Umami-rich pairings, tropical & tangy accents, spice fusions, sweet meets savory)

The New Language of Wellbeing: People are seeking harmony between body, mind and flavor, turning to botanicals, herbs and florals for natural balance and emotional uplift. (Example flavors: fresh & aromatic, floral & calming, earthy & restorative, uplifting citrus botanicals)

Nostalgia Meets Comfort: Comfort dishes, nostalgic treats and familiar formats are being reimagined with gourmet flair. (Example flavors: Comfort-driven notes, heritage ingredients, retro puddings)

Elevated Indulgence: Consumers are redefining "treats" with elevated bakery, dessert, indulgent sodas and snacking experiences — combining nostalgic comfort with gourmet craft. (Example flavors: Pistachio, hazelnut, almond praline, salted caramel, dulce de leche, maple, fruit-forward indulgence, spicy fusions)

Snackification: Consumers favor small, flavor-packed meals throughout the day, and this fuels innovation across both sweet and savory snacks. (Example flavors: savory indulgence, sweet-savory hybrids, global inspiration, healthier snacking)

Image by Drobot Dean at Adobe Stock

Sensient Introduces 'The Pipeline' for Beverage Creation



The Pipeline has a flexible process to tailor to specific customer needs and a vast network of resources.

Sensient Flavors & Extracts announced the introduction of "The Pipeline," a beverage product development hub. This program brings together the expertise of scientists, manufacturing experts, marketing professionals and product developers to improve new beverage product launches.

"Challenges require solutions, not head shakes and shrugs," said Pat Hanson, general manager of the company's sweet and beverage business unit. "We recognized a gap in service within the industry and chose to step up to help beverage creators get the support they need to bring new products to market more easily and intentionally to increase their chances of success."

According to the company's press release, The Pipeline has a flexible process to tailor to specific customer needs. Customers can use the platform to get strategic guidance for all steps in the beverage launch journey, partner with Scensient experts and gain access to a vetted network of packaging, production, distribution, sales and marketing partners.

"This structured process is ideal for any beverage creator, ranging from startups just getting to know the industry to more experienced product developers, thanks to the highly personalized approach and ability to access the entire spectrum of resources in one place," the press release states.

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PROFILE: MANPREET KAUR

Kaur explains how she used her mentors and continued learning about her craft to expand her knowledge as a flavorist.

What led you to the flavor industry?

When I was studying for my MSc. Food Science and Technology, one of my seniors shared their experience of working as an intern with a leading F& F company. The way she described her work and learnings about flavor and its application was fascinating. It was a new field of work for me and I wanted to learn more about it.

The more I researched the flavor industry, the more my curiosity deepened. I began learning about flavors through every available resource I could access at the time.

Soon after completing my master's degree, I joined NIFTEM, Sonepat, as a junior research fellow on a one-year contract. I had always felt a strong inclination toward research, but this role truly solidified my belief that I could thrive in a research-driven environment.

Throughout this period, I was consistently working toward my goal of entering the flavor industry—connecting with professionals, expanding my knowledge, and staying updated with industry trends. As a result of my consistent effort, I finally secured the position I am in today, an opportunity that truly aligns with my long-term career goal.

Can you share a defining moment or breakthrough in your career as a flavorist?

One moment that stands out in my journey as a flavorist is an internal competition where different departments had to showcase some of their best work. While I did not win the competition, the experience was incredibly valuable. It encouraged me to think more creatively and be more innovative in my approach.

I received some very insightful feedback that helped me look at my formulation from a different perspective. This experience was both challenging and helpful in shaping my growth as a flavorist.

What were some of the biggest challenges you faced when entering the industry, and how did you overcome them?

One of the biggest challenges I faced when entering this industry was a high level of competition. Since this is a niche field, opportunities are limited. Employers look for both creative mindset and technical expertise.



Name: Manpreet Kaur

Title: Assistant Flavorist

Company: Flavaroma Flavours and Fragrances Pvt Ltd

Location: Gujarat, India

It was a difficult task to find the right opportunity where I could showcase my potential beyond my academic background.

I had to stay persistent and committed in my search for the opportunity. I kept expanding my network, learning about flavors, improving my understanding of the industry and its demands. Eventually my patience paid off when I secured my current job.

Can you describe a time when a formulation didn't turn out as expected? How did you address the issue?

One time I was working on a project where the goal was to create a "cola-type" flavor. The brief seemed straightforward at first: sweet, fizzy, citrus and slightly spicy. But when I started working on it and trying to create it, I realized that the composition was rather

Courtesy of Mantreet Kaur

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complex and harder than I thought it would be. The top notes and some subtle key notes were not easy to balance.

After many trials, iterations and analytical comparisons under the guidance of my mentor, Samyak Varia, I was able to create a slightly different version of the cola flavor that performed well in internal applications.

Although the flavor was not identical to cola that is popular in the market, it was well received internally and we kept it in our library for future reference.

Even though I was not able to match the target completely, this experience taught me a lot about experimentation and managing expectations and how to remain patient when trying new formulations and raw materials.

How do you find the right balance between artistic expression and the technical limitations of flavor formulation?

As a flavorist, you always want to create something that has a lasting impression, but you are faced with some or the other technical constraint. For me technical limitations gives the flavorists an opportunity to think out of box and innovate.

I might start with a bold idea – say a fruity profile with floral and creamy undertone, but I also have to consider how it will perform in applications; is it heat stable, or shelf-life stable, etc. All these questions push you forward to think more creatively. Maybe use new raw materials, try different combinations, research more about shelf life studies and so forth.

For me, the magic happens when you find that sweet spot where your flavor delivers the sensory experience that you envisioned while also remaining practically feasible.

Are there specific skills or knowledge areas you believe are crucial for a flavorist to master?

I believe the role of a flavorist is both multifaceted and interdisciplinary. One should build a good sensory memory by understanding smells and tastes of different raw materials for starters. Alongside that, knowledge of regulatory guidelines and basic chemistry is essential for this role.

That being said, there are certain elements that remain at the core of this job, mainly curiosity, patience and willingness to learn. These are the qualities that will take you a long way. I believe with the right guidance, patience and consistent practice you can truly master this art. p&f+





Citral normally occurs in nature as a mixture of two isomers, neral and geranial.



BY JOHN WRIGHT
johnwrightflavorist@gmail.com

Flavor Bites: Citral in Citrus, Fruit and Other Flavors

Learn about the diverse range of flavor applications for citral.

Citral (3,7-dimethyl octa-2,6-dienal) normally occurs in nature as a mixture of two isomers, neral and geranial. It is FEMA GRAS#2303 and COE#109. The odor of citral is strongly lemon and it has a range of obvious uses within the broad citrus family. It is less obviously compatible with flavors outside the citrus category, but it can actually be useful in quite a smorgasbord of wildly varied flavors.

Note that the dose rates given throughout this article are the levels suggested for use in flavors intended to be dosed at 0.05% in ready-to-drink beverages or in a simple bouillon.

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Citrus Flavors

Citron: Citron flavors are even more powerfully lemon than lemon flavors. Fourteen thousand ppm of citral is a typical level.

Clementine: In contrast, clementine flavors are at the opposite end of the citrus spectrum and only need around 40 ppm of citral. At this level the citral combines well in profile with a similar level of perilla aldehyde.

Daidai: Daidai is a relative of bitter oranges, with a higher level of linalyl acetate, heading a little in the direction of bergamot. One hundred ppm of citral is a good starting point.

Grapefruit: Citral brightens all types of grapefruit flavors. Levels can vary, but 200 ppm works well.

Kalamansi: Kalamansi taste as acidic as limes but the profile heads more in a tangerine direction. One hundred ppm of citral lifts the profile.

Lemon: Citral is central to all lemon flavors. Levels as high as 10,000 ppm work well, enhanced by the related notes of nerol, geraniol, neryl acetate and geranyl acetate.

Lime: Fresh lime flavors and flavors based on cold pressed lime oil have much in common with lemon flavors. Flavors based on distilled lime oil are very different, with much lower levels of citral, around 100 ppm.

Mandarin: Mandarin flavors also only need moderate levels of citral to enhance their impact. Levels between 100 and 150 ppm are ideal.

Orange: All types of orange flavors, blood, juice and peel, are enhanced by added citral. Levels range from 300 to 400 ppm.

Pomelo: Pomeloes are the ancient ancestor of many modern hybrid citrus fruits and have the closest relationship to grapefruit because of its high nootkatone content. The profile is brightened by high levels of green notes, which are enhanced by around 300 ppm of citral.



Pomeloes are the ancient ancestor of many modern hybrid citrus fruits and have the closest relationship to grapefruit.

Tangerine: Tangerine completes the lineup of citrus flavors. Citral freshens and lifts the profile at levels of addition in the region of 200 ppm.

Fruit Flavors

Blueberry: Citral is less dominant in most non-citrus fruit flavors but it is, nevertheless, effective. Blueberry flavors need a contrast to the lavender notes. This raw material is very effective at 50 ppm.

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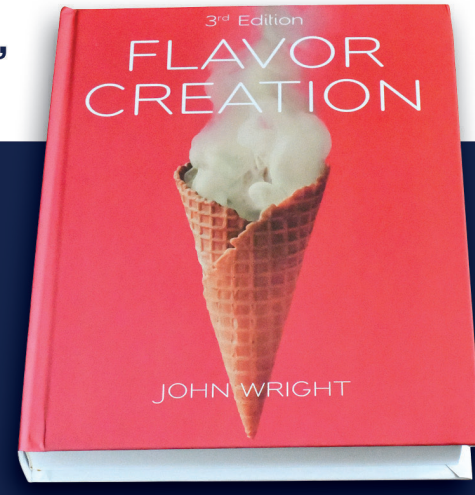


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Citral can play an interesting role in cream soda flavors.

Cranberry: Cranberry flavors all benefit from at least a hint of freshness to offset the dried character. Citral provides this at levels of addition around 500 ppm.

Guava: Guava flavors can also gain from extra freshness. Here the level of addition is a little lower, around 100 ppm.

Kiwi: Citral fits in well to the delicate character of kiwi flavors. Levels of addition vary, but up to 300 ppm enhances without being intrusive.

Lychee: Lemon and rose notes also blend harmoniously. Citral is effective in lychee flavors at levels around 100 ppm.

Tamarind: The citral note is much more important in tamarind flavors than in other fruit categories. Up to 1,000 ppm provides a sound foundation to the profile.

Watermelon: Citral brightens the more realistic category of watermelon flavors at around 200 ppm. This level can also work well in the, more common, fantasy category but, really, the sky's the limit.

Other Flavors

Cream Soda: Cream soda flavors are an interesting fantasy category, and vary more than most fantasy flavors. Citral can play an interesting role in lifting an otherwise heavy profile. Two hundred ppm is a good starting point.

Ginger: Creating an entirely artificial ginger flavor sounds easy, but it is not. Citral makes an interesting contribution, even at low levels, around 50 ppm. Australian ginger has a much stronger lemon character and much higher levels can be used.

Honey: The addition of citral helps almost all the many different types of honey flavors, even those with an obvious floral profile. Levels vary, but 1,000 ppm is a typical level of addition.

Peppermint: Citral is not really an ingredient that would seem to fit naturally into the profile of peppermint flavors. Just a touch, around 20 ppm, actually has a very subtle, but uplifting, effect.

Rose: Citral plays a significant role in rose flavors, especially those intended for confectionery applications. Five hundred ppm hits the spot.

Tea: This raw material only plays a small part in most tea flavors, but it can be helpful in authentic, Japanese style, green tea flavors at 50 ppm.

Tomato: Processed or dried tomato flavors do not gain from the addition of citral. Fresh style flavors, on the other hand, gain enhanced freshness from levels of addition ranging from 100 to 200 ppm.

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HOW NEUROSCIENCE RESEARCH IS DRIVING THE FUNCTIONAL FRAGRANCE MOVEMENT

Learn about the intersection of perfumery and neuroscientific research in this technology roundup.

BY EMILY LITTLE, Associate Managing Editor, *Perfumer & Flavorist+*



Emily Little

Image by Juan at Adobe Stock

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Scent is inherently personal; it has the power to shift mood, elicit memories and boost self-esteem. So why not craft fragrance formulations that take advantage of these neuroscientific links?

"Wellbeing has become one of the strongest drivers of innovation in fragrance and beauty," said Loïc Bleuez, director of innovations for consumer goods and fine fragrances at MANE. "Once limited to 'feel-good' personal care rituals, it has expanded into the home, where consumers seek comforting, multisensory environments."

Mintel's data shows that fragrances that improve mood are growing in online conversations. They've been mentioned over 2,200 times online in the last year, a growth of 39% compared to the previous year. Further, Mintel's analysts predict that by 2030, beauty and home fragrance care products will actively regulate mood and emotions, not just enhance them.

Functional fragrances are not just a trend, but the latest evolution of intentional wellbeing. Whether it's a perfume mist with mood-boosting effects or a home scent diffuser with relaxing properties, these products are helping people take care of themselves using positive sensory experiences.

Perfumer & Flavorist+ reached out to three companies that have developed new fragrance technology informed by neuroscience research. These industry experts explained how neuroscience knowledge can be a competitive advantage in fragrance to create innovative, functional and good-smelling formulations.



Functional fragrances are not just a trend, but the latest evolution of intentional wellbeing.

Turning on Emotions at dsm-firmenich

dsm-firmenich's emotiOn program is right at the intersection of fragrance innovation, advanced technology and wellness research. The company has invested in neuroscientific research for over 30 years, contributing to more than 50 peer-reviewed publications in the fields of perception, cognition and emotion.

"Our long-term collaboration with the Swiss Center for Affective Sciences at the University of Geneva began in 2005," said Christelle Porcherot, principal scientist, perception and cognitive neurosciences at dsm-firmenich. "We co-funded the Brain and Behavior Laboratory in 2009, followed by the launch of the Firmenich Cognition and Behavior Laboratory for R&D in 2018. This research has paved the way to understanding how molecular signals transform into odor, flavor and emotions."

dsm-firmenich's emotiOn program works in three steps: identify, create and certify. Researchers use the ScentMove database, which includes 40,000 fragrances tested by consumers, to identify the most appealing emotions, moods or wellness benefits. From there, a proprietary AI model can generate a list of fragrance materials that match the desired benefits, making it easy for the perfumer to develop their formula. These formulations are then tailored to prove the benefit with a neuroscientific validation.

"The role of the perfumer remains central and essential in the creative process," Porcherot explained. "The creation rules are broad enough to allow perfumers' creativity to express itself. All these help our perfumers in their work and complement their talent, intuition and experience. Perfume creation is an art that provokes emotion and requires human sensitivity and creativity."

Company officials at dsm-firmenich say they hope to have a fully benefits-driven fragrance design platform in the future to cover new wellness territories, such as spiritual and social wellness. In 2025, the company launched its emotiOn social connection platform based on this idea of social wellness and helping consumers feel more connected.

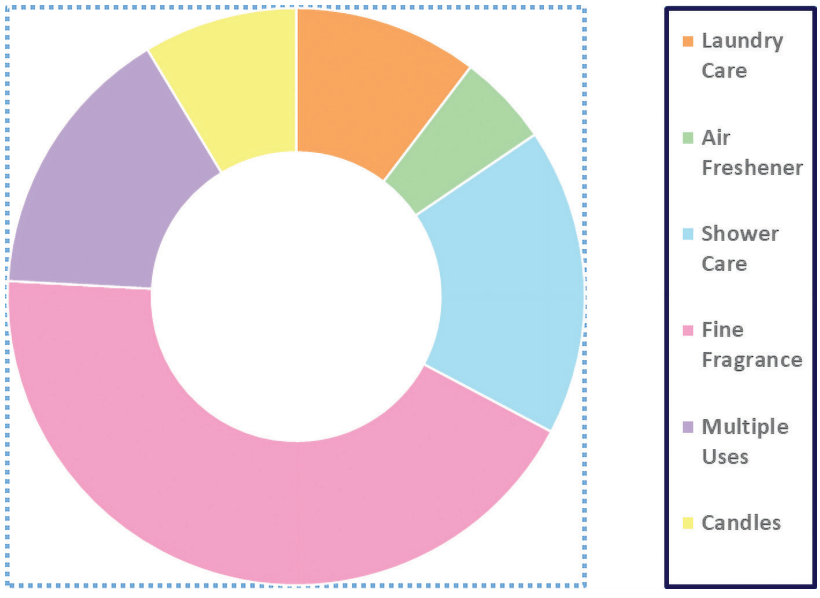
Iberchem's Wavemotion Measures the Unmeasurable

Iberchem introduced its latest neuroscientific investigation program, Wavemotion, at in-cosmetics 2023. Designed to scientifically evaluate the impact of fragrance on human psychology and physiology, Wavemotion unveils insights into how scent can influence positive neural responses to transform the emotional landscape of consumers and elevate consumer wellbeing.

"The Wavemotion technology integrates electroencephalography (EEG), electrocardiography (ECG), galvanic skin response (GSR) and facial expression analysis (FEA) into a single measurement point to capture the brain activity that a fragrance evokes," explained Manuel Serna and Gemma Martínez, members of Iberchem's neuroscience team. "The signals are processed with a machine learning algorithm that learns robust patterns associated with emotional and cognitive states, distinguishing the actual effect of the fragrance composition from that of expectation."

With this program, researchers at Iberchem have made subjective elements of scent measurable. In one example study, the team created a "freshness score" to capture panelist perception of various liquid laundry detergents. This score helped product developers identify markers of both the emotional engagement to the fragrance and the functional efficacy. Another study measured panelist response to fabric softeners throughout the use experience, from in-store selection to damp fabric to fully dry fabric, to develop an "emotion pathway" of the consumer.

Iberchem's Wavemotion program has been applied to several fragrance categories, including laundry care, air fresheners, candles and fine fragrances. Researchers on the neuroscience team said this allows



Iberchem's Wavemotion is used in a variety of fragrance applications.

Courtesy of Iberchem



MANE's WELLMOTION platform measures emotions in real time through physiological testing.

perfumers to have an accurate understanding of the emotional attributes of the formulation, backed by robust data.

"The capability of this technology provides an emotional narrative for each fragrance and establish the rules for future innovation in the field of neuroscience," Serna and Martínez concluded.

Innovating through Collaboration at MANE

In May of 2025, flavor and fragrance company MANE announced the launch of WELLMOTION, a new platform that analyzes and decodes emotional responses to scent. This platform is rooted in peer-reviewed science and powered by artificial intelligence to address wellness trends in the fragrance industry.

"With WELLMOTION, we are entering a new era where we design fragrances that evoke emotions with intention and precision," said Caroline Dubourg, director of R&I, consumer goods.

WELLMOTION was developed in collaboration with the French National Center for Scientific Research (CNRS) and French biotech company SkillCell. The platform measures emotions in real time through physiological testing.

"Consumers now seek products that delight the senses while supporting wellbeing, helping them feel relaxed, energized or uplifted," said Loïc Bleuez. "With WELLMOTION, by combining olfactory expertise with scientific research and non-invasive salivary biomarker innovation, we demonstrate how fragrance influences mood, emotion and physiology, creating measurable wellness experiences and aligning scent with emotional and sensory balance."

The WELLMOTION platform uses two complementary tools: one to anticipate and evaluate the emotional impact of fragrances, and one to measure physiological responses using biomarkers. Further, this system allows researchers and perfumers to continue adding new data to the model, allowing the tools to continue to evolve.

MANE's salivary biomarker technology, protected by a patent, combines four markers with a single, rapid and non-invasive test to give an analysis of emotional responses to olfactory stimuli. Company officials believe that this technology helps take the uncertainty out of the formulation process and helps design fragrances that meet consumers' exact wellbeing needs.

"Neuroscience and cognitive sciences offer a competitive advantage in the fragrance industry by helping brands measure and understand how people respond to scent," Bleuez said. "We could imagine using these insights to design fragrances that are more personalized, impactful and aligned with people's daily moods and behaviors."

Courtesy of MANE

Sixty Years of Safe Scents:
Q&A with RIFM's President

Anne Marie Api discusses some key milestones in the organization's history and how it ensures safe and effective fragrance use.



Anne Marie Api, president, Research Institute for Fragrance Materials



The Research Institute for Fragrance Materials (RIFM) was founded in 1966 as an independent, non-profit organization.

From top: image courtesy of RIFM; image by JPC-PROD at Adobe Stock

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It started with a letter in 1964. A. L. Amerigen, board chair of International Flavors & Fragrances wrote to seven fragrance industry leaders requesting a meeting about fragrance safety. That meeting took place a year later, where key decision makers from across the fragrance industry discussed the potential to pool scientific resources for maximum safety impact. This meeting led to the founding of the Research Institute for Fragrance Materials (RIFM).

RIFM celebrates its 60th anniversary in 2026, with over 30 active member companies and a robust framework of safety guidelines. The organization's data is open access, allowing more perfumers and professionals to learn about safe materials. Their mission is simple and clear: build international trust in an acceptance of the safe use of fragrance materials.

RIFM's president Anne Marie Api spoke with *Perfumer & Flavorist+* about the history of the organization, its milestones and how the organization is helping create innovative and safe fragrances for all to use.

For readers who may not know, what is RIFM, and how did it start?

The Research Institute for Fragrance Materials (RIFM) was founded in 1966 as an independent, non-profit organization with a clear mission: to ensure the safe use of fragrance ingredients. At that time, the fragrance industry recognized the need for a dedicated scientific body to study the health and environmental effects of fragrance ingredients and to share that knowledge transparently.

From the beginning, RIFM has led the way in fragrance safety, conducting and reviewing research, evaluating risks and making data accessible to scientists, regulators and industry partners worldwide. This work establishes the Maximum Acceptable Concentrations (MACs), which are published in all safety assessments for ingredients requiring risk management, and which form the scientific foundation of the IFRA Standards, providing evidence-based guidance for the safe use of fragrance ingredients.



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RIFM has expanded its focus on transparency and collaboration.

This year marks RIFM's 60th anniversary. What milestones have had the greatest impact on the fragrance industry?

Several stand out. The independent Expert Panel for Fragrance Safety, established in 1967, remains one of RIFM's most important achievements. Composed entirely of academic scientists with no ties to the fragrance industry, the panel reviews all available data on fragrance ingredients, including toxicology studies, exposure assessment, and published literature, and provides independent, science-based conclusions about safe use.

Another major step was the development of the RIFM Database in the 1980s, now the world's largest and longest-maintained repository of fragrance safety data. More recently, the adoption of realistic, aggregate exposure-based safety assessments has greatly enhanced accuracy and relevance by examining how fragrance ingredients are actually used in products.

Throughout its history, RIFM's research program has been efficient, strategic, and adaptable, focusing increasingly on animal-free New Approach Methodologies (NAMs) that represent both scientific and ethical progress.

Which of these had the biggest impact on perfumers specifically?

Exposure-based safety assessments have made the biggest difference. By understanding how people use fragranced products in real life (how often, how much and where on the body) RIFM establishes Maximum Acceptable Concentrations (MAC values) that reflect actual conditions rather than theoretical extremes. These MAC values provide the scientific foundation for the IFRA Standards, ensuring that fragrance ingredients are safe, compliant, and available worldwide.

Because MAC values are based on decades of rigorous, peer-reviewed data and validated by independent experts, perfumers can rely on them with confidence. This science safeguards their palette, protecting access to both cherished naturals and innovative new molecules, and preserves creative freedom for generations to come.

How has RIFM's mission changed as the science, regulations and fragrance industry have evolved?

RIFM's mission, which is to build international trust in and acceptance of the safe use of fragrance ingredients through science and research, remains unchanged. What has evolved is the method by which that mission is achieved.

When RIFM began, safety evaluation relied largely on traditional animal studies. For more than 13 years, RIFM has not conducted any animal testing for human health endpoints. Today, its approach combines in vitro, in silico, and exposure-based methods that are more human-relevant and efficient.

RIFM has also expanded its focus on transparency and collaboration, publishing data and working closely with regulators and scientists worldwide. In doing so, its role has grown from evaluating safety to helping shape the science that underpins modern risk assessment.

Were there any turning points where RIFM had to rethink its approach?

Yes, two major ones. The first came as the scientific community and regulators began prioritizing alternatives to animal testing. RIFM anticipated this shift and invested early in developing reliable non-animal methods.

The second came with the move toward understanding real-world exposure. Earlier assessments often focused on what an ingredient could do at high doses in laboratory settings, without considering actual exposure in daily life. By integrating exposure science, RIFM made fragrance safety evaluations more accurate and relevant, ensuring that conclusions reflect how people truly use fragranced products.

What makes RIFM's approach to fragrance safety different from other organizations?

RIFM uniquely integrates science, transparency and independent oversight. It focuses on real-world risk, specifically how people are actually exposed to fragrance ingredients, rather than on hazard alone. This distinction allows RIFM to develop practical, evidence-based conclusions.

Every RIFM safety assessment is reviewed and approved by the independent Expert Panel before publication in peer-reviewed journals. These assessments form the basis for IFRA Standards, which protect both perfumers and consumers. Without RIFM's MAC values, there would be no IFRA Standards.

Built on decades of peer-reviewed data and expert evaluation, MAC values ensure that IFRA Standards remain scientifically robust and recognized by regulators worldwide. This structure maintains the independence of science while ensuring it guides responsible industry practices and consumer protection.

How does your work help perfumers push creative boundaries while keeping products safe?

RIFM's science provides the framework that allows perfumers to create safely and confidently. By defining MAC values for each ingredient across various product types, RIFM provides perfumers with a scientifically grounded foundation that supports innovation and responsibility.

We also help ensure that long-used ingredients with important olfactory value remain available by generating new data and refining exposure estimates. In many ways, safety science and creativity are closely intertwined. The better we understand fragrance ingredients, the greater the freedom to use them effectively.



One key challenge Api mentioned will be achieving global acceptance of non-animal methods.

How do you measure fragrance exposure in the real world, and why does that matter?

We use the Creme RIFM Aggregate Exposure Model, which incorporates data from thousands of consumers and products to estimate daily exposure to fragrance ingredients. It considers product type, frequency of use, application area and population differences.

Understanding exposure is critical because it determines actual risk. Two ingredients with similar hazards may pose vastly different risks depending on their use. RIFM's exposure-based approach reflects how people truly use fragranced products and shows that exposures are consistently low and risks are negligible. This real-world evidence underpins RIFM's MAC values, ensuring accurate, protective conclusions while avoiding unnecessary restrictions. It also helps preserve both safety and creative freedom.

RIFM is a leader in avoiding animal testing. What new methods make that possible?

RIFM uses a combination of in vitro assays, computational modeling, read-across techniques and physiologically-based kinetic modeling. Read-across predicts the properties or effects of one ingredient based on data from similar ingredients, providing scientifically reliable predictions without the need for new animal studies.

These tools allow RIFM to anticipate how ingredients behave in the human body and assess potential effects using human-relevant science. Many of these methods are now recognized by regulators as credible, and RIFM's use of NAMs has saved more than half a million animals.

How do perfumers benefit from these new methods beyond meeting regulatory requirements?

New methods generate data more quickly and efficiently than traditional testing, helping bring new ingredients into use sooner and supporting the continued safe use of existing ones. They also deepen our understanding of how fragrance ingredients work at the molecular and biological levels. That insight helps preserve important ingredients, expand the creative palette, and strengthen confidence in safety decisions across the industry.

What are the biggest challenges for fragrance safety in the next 10 years?

One key challenge will be achieving global acceptance of non-animal methods, enabling modern science to be applied consistently across regions. Although fragrance exposures are known to be very low, ensuring that risk-based approaches are recognized worldwide remains essential.

Another ongoing challenge is building public understanding and trust in the science supporting fragrance safety. Clear and accessible communication, both within the industry and beyond, will remain vital to maintaining confidence in the safety of fragranced products.

If you could share one message with perfumers worldwide on RIFM's 60th anniversary, what would it be?

As RIFM marks its 60th year, my message to perfumers is simple: The legacy of safety we have built together ensures that you can continue to create with confidence, knowing that fragrance ingredients are used safely and responsibly, today and for decades to come.

Image by AnnaStills at Adobe Stock

Beyond the Amygdala: Decoding the Four Mechanisms of Functional Scent

Systems in the brain and the nasal pathways can help developers understand the impact of functional fragrances.

BY ALINA ROSU, perfumer and founder, NEUNÉRE



Alina Rosu, perfumer and founder, NEUNÉRE

There is no sense more peculiar and more fascinating than the sense of smell. We are already deeply familiar with its connection to emotion, yet few of us consider the neural and physiological architectures that create this link and how these very features could be employed in the question of functional and emotion/mood-modulating fragrances.

In this article, I would like to show the complexity and the different ways a scent can influence how we feel and act. I will start by explaining arguably the most popularized mechanism, the emotional loop. But we also need to consider the trigeminal effects, the bioavailability, and finally, the psychological effects of expectation.

The sense of smell is unique among the senses because of the way its signals are transmitted and the neural pathways they follow. Unlike vision or hearing, olfactory information bypasses the thalamus, one of the most important areas in the brain responsible for conscious perception. The thalamus typically decides which information will be processed and which will not[21]. However, in the case of olfaction, sensory input travels almost freely to brain regions involved in memory, emotion and behavior. We often say that a scent goes directly to the "brain" or to the amygdala, but allow me to trouble you with a bit more detail.

From the moment a molecule binds to an olfactory receptor, it takes only a couple of synapses for the signal to reach the limbic structures. While the amygdala is the most cited destination, it is just one of several regions, and this is a crucial detail, as the signal engages a much broader network.

That said, the direct connection to the amygdala remains critical. This structure acts as a central hub for encoding emotions and emotional responses. This means that odors we have encountered before will always have a valence; they will not be neutral, but instead will be associated with the emotional experience that accompanied the smell[4].

Moreover, when we encounter the scent again, there is no decision about whether to trigger the associated emotional response or not, because we do not have a gatekeeper like the thalamus to regulate it. Odor-emotion interaction happens automatically and involuntarily, and this characteristic may be key to modulating emotions and mood.

From the amygdala, the signal is then projected to the hypothalamus[19], and here is where things get physiological. Through its regulation of hormones, the hypothalamus produces chemical changes in the body, and this mechanism is central to how it shapes desire, mood, behavior, motivated action and stress responses[16].

Olfactory stimulation can modulate hypothalamic activity and, in turn, our internal physiology related to stress[22]. Certain odors can induce stress[8] while others

Courtesy of Alina Rosu

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The sense of smell is unique among the senses because of the way its signals are transmitted and the neural pathways they follow.

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While the olfactory system allows us to "smell" a scent, the trigeminal system allows us to "feel" it.

can reduce it[6]. Several studies have demonstrated physiological changes associated with reduced stress biomarkers, such as decreases in salivary cortisol and chromogranin-A, following exposure to certain odors. For example, the smell of rose oil or the aroma of black tea has been shown to lower stress levels[15].

But this is still not the whole story. Within our nose, we actually rely on two distinct systems for chemical detection. Besides the emotional mechanism of the olfactory system, we also possess a trigeminal system[3].

While the olfactory system allows us to "smell" a scent, the trigeminal system allows us to "feel" it. Originally evolved to detect potential threats like smoke or ammonia, the trigeminal system plays a significant role in regulating arousal, alertness and attention. Because it functions as an automatic safety mechanism, it engages the body's involuntary control center in a way that pure smell does not[9]. Consequently, its stimulation can produce rapid physiological effects like increased heart rate, respiration changes, skin conductance, and very specific P300 brain waves associated with focus and decision making.

Unlike olfactive preferences, trigeminal sensation doesn't require social learning or semantic conditioning to produce basic responses. Because these reactions are innate rather than learned, the research data on the topic is remarkably consistent, making the functional effects of this stimulation far less subjective and more replicable than those of pure smell.

Research has identified specific molecules to stimulate the trigeminal nerve and elicit functional effects. A landmark example is menthol from peppermint oil, found to be stimulatory and able to increase alertness and memory speed[17]. Similarly, cinnamaldehyde from cinnamon oil can significantly decrease fatigue while increasing alertness[20].

Eucalyptol, found in eucalyptus or rosemary oils, however, presents a more complex physiological profile. While it acts as a mild trigeminal irritant, evidence suggests its primary effects on cognitive performance may come from its direct absorption into the bloodstream[18].

This brings us to the third mechanism of how fragrances can influence us. While we still perceive their scent, some molecules have the ability to cross from the lungs to the blood, and even the blood-brain barrier, effectively acting as pharmacological agents.

A prime example of a molecule acting as a systemic drug is linalool, present in lavender, coriander seeds and

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rosewood oils. Once it crosses the blood-brain barrier, it has antidepressant-like, mild sedative and anxiety-reduction effects coming from its interaction with serotonin pathways[7]. The strongest proof that linalool acts as a therapeutic agent in humans comes from studies on Silexan, a standardized lavender oil preparation used as an oral anti-anxiety medication.

Two other notable molecules are the *alpha*- and *beta*-pinene. Researchers wanted to scientifically isolate the impact of the scent component from the visual and physical sensations of the forest bathing practice. To do this, subjects were exposed to vaporized hinoki oil, consisting mainly of *alpha*- and *beta*-pinenes, in a controlled hotel room environment. The analysis of urinary biomarkers revealed a significant reduction in stress hormones like adrenaline and noradrenaline as well as a simultaneous boost in immunity cells[13].

In contrast, (R)-limonene delivers a dual effect with a sharp trigeminal activation for immediate alertness[10], followed by a pharmacological activity where it interacts with neurotransmitters to boost dopamine and create a motivating and mood-lifting effect[5]. Given its high abundance and safety profile, (R)-limonene is considered a favorable candidate for development as a nutraceutical to help with anxiety, but also curb the onset of neurodegenerative diseases like epilepsy or multiple sclerosis.

However, the emotional loops and biology are not the only drivers. To fully understand how scent affects us, we must look at a fourth mechanism, the power of cognitive expectancy. It is the way our beliefs about a scent changes how it affects our body.

A revealing study[1] explored how our beliefs modulate our physical reaction to odors. The researchers used lemon oil, which typically triggers physiological arousal and alertness as mentioned previously, and a strawberry scent, which is considered relaxing. They then told participants that the lemon oil was relaxing, instead of the truth that it is actually stimulating. As an effect, the physiological arousal usually caused by lemon was significantly lower.

Another study[14] found that when participants were exposed to heat pain while smelling lavender oil, those who were explicitly told that lavender oil relieves pain showed significantly lower pain ratings and stress markers compared to those told it was a neutral odor. Although the chemistry remained constant, the cognitive expectancy significantly boosted the analgesic outcome. This confirms that our brain's expectation has the power to inhibit or amplify the effects of a scent, even if they are based on a biological mechanism.

And perhaps most surprisingly, the trigeminal system can be tricked too. Phenylethyl alcohol (PEA) has minimal action on the trigeminal system and is usually used as a neutral control odorant. However, in one of the studies[2], researchers administered PEA to subjects and warned them that it would be irritating and would sting. The EEG saw a sharp increase in P300 brain wave activity, indicating a state of high alertness, while subjects reported feeling an actual physical sting. Essentially, the brain "hallucinated" the stimulation to match the expectation. This mechanism is, of course, highly exploited in marketing communication.

Up to this point, we have looked at results obtained in controlled environments and with strict protocols. Moving this into practice is exactly what big companies are currently trying to solve, by launching research programs to generalize these effects, ensuring they hold true outside the lab for people in different cultures and countries.

Yet, the functional claims require transparency. Just as the skincare market transitioned to a more informed,



Linalool, found in lavender, has anxiety-reduction and mild sedative effects.

Image by New Africa at Adobe Stock

dermatological approach where consumers look for the active ingredients, fragrance buyers are evolving, too. It is crucial to distinguish between genuine biological impact and the psychological power of suggestion.

By embracing a more open scientific approach with peer-reviewed publications, we can minimize the exploitation of "label power", both in research and marketing communication, and better respond to a more demanding and smart consumer.

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Inside Torani's Gold Standard to Crown a Flavor of the Year:

Q&A with Consumer & Customer Market Manager

The company's consumer market expert explains how Forest Pine was chosen for 2026 and gives a peak behind the curtain of the selection process.



Forest Pine is described as a fusion of pine, ginger and sage.

Courtesy of Torani

There are several consumer trend reports that come out this time of year, each with their own insights into what will drive purchases in the flavor and fragrance categories. But how do you distill that insight into a single flavor of the year?

In November 2025, flavor company Torani announced Forest Pine as its 2026 Flavor of the Year. The "bold, balanced and delightfully unexpected" flavor joins the company's lineup of over 400 sauces and syrups. Forest Pine is described as a fusion of pine, ginger and sage. The new flavor is part of Torani's Premade syrup collection, made with pure cane sugar and colors from natural sources.

"Forest Pine isn't just a breakthrough in flavor innovation," said chief executive officer Melanie Dulbecco. "It also embodies our belief that flavor can create opportunity. Through this launch, every bottle sold helps open doors for people to build brighter futures."

Perfumer& Flavorist+ spoke to Torani's consumer and customer market insight manager Andrea Ramirez about the process for selecting a flavor of the year and other flavor trends she expects to see in the coming year.



Andrea Ramirez, consumer and customer insight manager, Torani

Courtesy of Torani

How do you begin the process of selecting a "Flavor of the Year"? Does it start with consumer research or sales data?

Selecting Torani's Flavor of the Year is a year-long, cross-functional effort rooted in understanding how people are eating, drinking and discovering new experiences. While consumer insights and sales data play a role, the process begins much earlier and more broadly. Our goal is to anticipate where flavor curiosity is going—not simply mirror what's already trending.

We continuously track emerging flavor signals across global menus, retail launches and adjacent categories like confection, pastry, frozen novelty, cocktails and wellness beverages. What first appears in one category often foreshadows what will take hold in beverages. This aligns with Step one of our four-step Gold Standard Flavor Development Process, which begins by identifying the behavioral "why" behind consumption.

Throughout the year, teams across insights, R&D, culinary and consumer engagement contribute ideas. We evaluate these against criteria such as:

- Consumer appeal and cultural relevance
- Connection to adjacent, fast-growing flavor spaces
- Menu versatility
- Operational usability

Once we've identified promising directions, we enter Gold Standard development. We identify a flavor "north star," evaluate real products and define the descriptors that will guide R&D. Our scientists then iterate through 15–20 versions (sometimes far more) until the flavor meets our quality target and performs well across beverage platforms.

Why was Forest Pine the choice for 2026?

Forest Pine stood at the intersection of several macro-trends: the rise of botanicals and wellness ingredients, continued consumer love for lavender (70% awareness and steady growth), growing interest in foraged and nature-derived flavors and a cultural pull toward sensory wellness and outdoor escapism. Its grounded, resinous, calming character felt both adventurous and deeply familiar, and its versatility across coffee, tea, matcha and refreshers made it a strong candidate for real-world adoption.

By the time we choose a Flavor of the Year, the concept has undergone months of trend evaluation, cross-team vetting, sensory refinement, operational testing and narrative development. Forest Pine rose to the top because it captured a story, a signal and a moment in consumer curiosity.

The press release mentions the rise of botanical flavors. How do you see this trend continuing over 2026?

Botanical flavors have become one of the most emotionally resonant territories in beverages, and all signs

point to continued acceleration into 2026. The appeal stems from their unique ability to deliver both novelty and comfort. Lavender, for example, has grown 42% over the last 3.5 years within our own portfolio because it offers a calming, artisanal, sensorial experience while remaining familiar.

We're now seeing a shift within botanicals—from florals into more grounding, earthy, nature-evoking profiles. Forest Pine represents this next evolution. It carries recognizable herbal qualities found in sage, thyme and rosemary, but it also invites consumers into new sensory territory.

This progression is supported by broader cultural patterns:

- A growing fascination with foraged and wild ingredients
- Desire for sensory wellness and moments of calm
- Increased comfort with botanical flavor vocabulary due to adjacent categories like craft beer and non-alcoholic spirits
- Younger consumers actively seeking artisanal, nature-connected flavors

Pine feels meaningful precisely because it is still novel on U.S. beverage menus. It signals where botanical exploration is headed: toward flavors rooted in the outdoors, grounding and sensory escape.

Can you describe, in your own words, the Forest Pine flavor?

Forest Pine is a crisp, aromatic botanical profile anchored by pine as the hero note. What makes it distinctive is the way complementary botanicals enhance and balance it. Ginger brings a warm, gentle lift and subtle spice, while sage adds an earthy, herbaceous depth that strengthens the flavor's connection to nature.

Together, these notes create a profile that is refreshing yet grounding—invigorating but still soothing. It performs beautifully across hot and cold formats: coffee, tea, matcha, sparkling refreshers, lemonades, mocktails and craft cocktails. In colder months, it adds cozy, woodsy character; in warmer seasons, it offers a clean, crisp freshness. This year-round versatility is a hallmark of the flavor.



Torani's Forest Pine syrup can be used in a variety of applications, including cold and hot coffee, tea, mocktails, cocktails and sparkling refreshers.

Courtesy of Torani



Selecting Torani's Flavor of the Year is a year-long, cross-functional effort rooted in understanding how people are eating, drinking and discovering new experiences.

Courtesy of Torani

How can product developers use a flavor like Forest Pine to add an unexpected twist to their formulations?

Forest Pine is both adventurous and approachable, making it ideal for creators who want to innovate without overwhelming consumers.

A great introductory approach is toppings, such as Forest Pine cold foam or whipped cream. Dairy softens the pine's resinous edges, making it an easy bridge for consumers exploring botanical flavors for the first time.

Because Forest Pine shares a sensory lineage with lavender, it also functions well as a botanical swap in existing lavender builds—lattes, matchas, spritzes, and more.

Pairing it with creamy or sweet flavors can enhance balance:

- Vanilla, marshmallow
- Pistachio, almond, macadamia
- Cookie-inspired flavors like shortbread

These pairings soften the herbal qualities and create multi-layered, inviting beverages.

Its seasonal flexibility also opens strong menu opportunities.

- In cold months: baking spices, chocolate, caramel, toasted notes.
- In warm months: citrus, green tea, sparkling water, herbal refreshers.

For more adventurous developers, Forest Pine pairs beautifully with other aromatics like rosemary, thyme and juniper, and also with emerging citrus like bergamot, yuzu, kabosu or Seville orange. These create standout concepts in zero-proof cocktails, refreshers and modern craft coffee drinks.

What other flavors were in consideration this year? And how did Forest Pine rise above the rest?

We begin each Flavor of the Year cycle with 100+ submissions sourced from trends, cultural insights, operator feedback, and internal ideation. From there, we narrow to about five finalists that enter full Gold Standard evaluation.

Some concepts make it far but ultimately don't deliver the boldness or differentiation needed for Flavor of the Year. Sakura (salted cherry blossom) is a good example: elegant and globally meaningful, but too subtle to anchor a marquee platform. Others—like Bergamot or Elderflower—are beautiful flavors but not quite strong enough narratively or sensorially to serve as the annual flagship, and may still be commercialized separately.

For 2026 we additionally explored concepts tied to major cultural moments:

- U.S. 250th Anniversary — "Firework" (strawberry lemonade with Szechuan peppercorn), strawberry shortcake
- Milano–Cortina Olympics — saffron, panettone
- 2026 World Cup — maple–mango–orange, triple berry

While compelling, Flavor of the Year must offer something meaningfully new to the beverage world.

Forest Pine ultimately stood apart because of its depth and balance. During Gold Standard tasting, it quickly evolved beyond single-note pine into a dimensional, craveable profile thanks to the addition of ginger and sage. It felt adventurous yet approachable, grounded yet refreshing—a rare combination that made it the clear choice for 2026.

Any other major flavor trends that you foresee influencing consumers in the coming year?

Several powerful forces are shaping how consumers will drink in 2026:

1. **Broader Flavor Exploration Through Global Accessibility:** As global ingredients become easier to access, consumers' palates have expanded dramatically. Our 2024 Dragon Fruit Syrup is a perfect example of how vibrant, globally inspired flavors can quickly become mainstream favorites.
2. **Personalization as a Core Behavior:** Customization continues to surge, especially among Gen Z. "Dirty sodas" and build-your-own drink formats reflect this desire to craft highly individualized beverages. This drives demand for mix-and-match flavors, botanicals, playful pairings, and layered flavor builds.
3. **Elevated Seasonality and Limited-Time Exploration:** Consumers want flavors that set a mood or tell a story: hygge, nostalgia, outdoor adventure, camping, wellness—not just traditional holiday markers. This shift is one reason Forest Pine resonates across both warm and cold seasons.
4. **Cross-Border Flavor Fusion:** Today's consumers are comfortable with globally influenced combinations. Flavors like Dubai Chocolate, citrus + spice pairings, and botanical + fruit hybrids reflect this cultural fluidity.
5. **Fruit Innovation Expanding Into New Categories:** Fruits are moving into spaces where they historically weren't common—such as coffee—while continuing to anchor refreshers, energy drinks, and sparkling beverages.
6. **Continued Demand for Cold Matcha Innovation:** Cold matcha remains a fast-growing platform, and consumers want "news" in the form of new flavors, textures, and botanically driven pairings.

Across all these trends, the common thread is clear: consumers crave beverages that spark discovery but still feel emotionally resonant.

What's on the horizon for Torani for the upcoming year?

We're focused on understanding where consumer desires are headed and ensuring our innovation pipeline keeps pace and further helps guide the industry forward. Our recent launch, Torani Liquid Drink Enhancer, has been a standout success and reflects key themes shaping our future: personalization, portability, and creative empowerment.

Looking ahead, we're investing in:

1. **Breakthrough Flavor Innovation:** Continuing to explore grounded botanicals, global fruits, and cross-category combinations that deliver emotional and sensory richness.
2. **New Formats That Support Personalization:** Developing products that make it easy for consumers to craft their ideal beverage - through concentrated forms, modular components, or new delivery systems.
3. **Operator-Focused Versatility:** Providing menu-flexible, season-agnostic, and flavor-forward products that help operators differentiate with minimal complexity.
4. **Aesthetic and Emotional Flavor Experiences:** Innovating around flavors tied to calm, nostalgia, nature, travel, and visual appeal.
5. **Purpose Through Flavor:** With Forest Pine, 100% of profits through 2026 support nonprofit partners preparing young people and adults with developmental disabilities for meaningful employment, a model we intend to continue and expand.

In short, Torani's future is shaped by curiosity, empathy, and a belief that everyone should have the tools to explore and personalize great-tasting beverages.

















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TRANSLATING VIRAL TRENDS INTO FLAVOR EXPERIENCES

OSF Flavors' managing director gives tips on capturing a viral moment using it for flavorful innovations.

BY PIERRE BATTU, managing director, Asia, OSF Flavors



While traditional approaches relied on purchasing expensive marketing data and trend reports, the landscape is shifting thanks to artificial intelligence.

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As seen with Dubai chocolate, and most recently angel hair chocolate, viral social media trends are increasingly impacting flavor innovation.

But these trends present a challenge for food and beverage products more broadly that want to leverage the interest and demand such viral videos create. Namely, how do you translate what is primarily a visual, aesthetic appeal – in the case of angel hair chocolate, the delicate fibrous texture of Turkish cotton candy filling within the chocolate – into a flavor experience that works for other product categories?

OSF Flavors recently undertook developing an angel hair chocolate flavor that can be applied to a broad array of food and beverage categories beyond chocolate.

Here's what we learned.

Listening programs for early detection of trends are key.

We first began to notice the angel hair chocolate trend from social media listening programs we had established. Our teams are based on four continents, allowing us to monitor emerging trends in real time from different cultural perspectives. This perspective is critical as it enables quick evaluation of the global relevance of a trend once it is spotted—whether through social media chatter, local influencers, or in conversations with clients, experts or media— and to assess its potential to resonate across markets.

Once a trend is spotted, acquire all associated available products in a variety of forms and assemble a tasting panel – in our case our in-house flavorists - to determine the products' organoleptic profile.

From there, move into flavor development. Based on our library, we created a first flavor featuring all identified notes from the profile of angel hair chocolate. Once formulated, our flavorists' panel tasted again to make sure that the formulation developed was in line with the tasting of the final product. Adjustments were then made until reaching the perfect balance.

Getting the flavor right so that it is evocative and representative of the original product driving the trend is, of course, critical, but brands will also need to build a full sensory experience by bridging flavor with texture and creative packaging to truly convert the experience consumers enjoy in these videos.

For example, the soft pastel color palette (white, pink) of angel hair chocolate and seasonal associations of the trend offer a rich canvas for marketers to create limited editions or themed launches that drive excitement without diluting core offerings.

But the key is to act quickly.

While traditional approaches relied on purchasing expensive marketing data and trend reports, the landscape is shifting thanks to artificial intelligence (AI). The real advantage now lies in the ability to react quickly and translate insights into products fast. With AI and digital agents democratizing access to information, the difference between companies is less about who can buy the most data, and more about who can react, adapt, and implement at speed.



Pierre Battu, managing director, Asia, OSF Flavors

Our ad hoc project teams (bringing together marketing, R&D, and sensory experts) made it possible for us to move rapidly from identification to concept development and testing, shortening the innovation cycle and increasing the odds of successful launches.

Finally, creating a trend-inspired flavor is about blending creativity with scientific expertise—understanding what makes a trend appealing, and how to translate that into a flavor experience that feels authentic and exciting.

Angel hair chocolate is a clear example of how social media virality is reshaping flavor innovation. Visually engaging formats like Angel hair chocolate are no longer just dessert novelties—they're opportunities for brand storytelling and product diversification. But the rate at which these viral trends are emerging is rapidly increasing. So stay on top of trends as they develop and be prepared to move quickly to translate social media popularity into full flavor experiences – before the next trend emerges.

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Courtesy of OSF Flavors

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- NATURAL BUTYL BUTYRATE
- NATURAL BUTYL CAPROATE
- NATURAL BUTYL BUTYRYL LACTATE
- NATURAL BUTYL CAPROATE
- NATURAL CAFFEIC ACID
- NATURAL CAPSAICIN
- NATURAL CARAMEL FURANONE
- NATURAL DELTA-3-CARENE
- NATURAL ALPHA-CARYOPHYLLENE
- NATURAL 1,4-CINEOLE
- NATURAL CINNAMIC ALCOHOL
- NATURAL CINNAMYL CINNAMATE
- NATURAL CINNAMYL ISOBUTYRATE
- NATURAL CINNAMYL PROPIONATE
- NATURAL DAMASCENONE
- NATURAL BETA DAMASCONE
- NATURAL T2, T4 DECADIENAL
- NATURAL TRANS-2-DECENOL
- NATURAL DIHYDROCARVONE
- NATURAL 2,3-DIMETHYL PYRAZINE
- NATURAL OCIMENE
- NATURAL 2,6-DIMETHYL PYRAZINE
- NATURAL TRANS-2-DODECENAL
- NATURAL DODECYL BUTYRATE
- NATURAL ETHYL CAPRYLATE
- NATURAL ETHYL CYCLOPENTENOLONE
- NATURAL 2-ETHYL-2-HEXENAL NATURAL
- NATURAL ETHYL-3-HYDROXYBUTYRATE
- NATURAL ETHYL-2-HYDROXYCAPROATE
- NATURAL ETHYL ISOVALERATE
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- NATURAL ETHYL LEVULINATE
- NATURAL ETHYL LINOLEATE
- NATURAL ETHYL-2-METHYL BUTYRATE
- NATURAL 2-ETHYL-3-METHYL PYRAZINE
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- NATURAL FURFURYLIDENE ACETONE
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- NATURAL 3-HEPTANOL
- NATURAL TRANS-2-HEPTENAL
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