First Person: The Evolution of the Perfumer's Palette

Thirteen perfumers and natural and synthetic ingredient experts give their insights into the creative, technical, regulatory, social, environmental and other factors reshaping the fragrance ingredient landscape

The factors shaping today's perfumery ingredient palette include fragrance trends, regulations and technical challenges, said Dirk Braun, vice president, senior perfumer, Symrise AG, on stage during the 2012 World Perfumery Congress (*wpc.perfumerflavorist.com*). For instance, he continued, the increase in the level of aluminum salts in APDO (antiperspirant/deodorant) bases alone has changed formulation strategies.

"Those base changes have a huge impact on stability, and performance of materials," Braun said. "So the materials we use today have to be very stable and very powerful. For some delivery systems you need very specific molecules with specific properties."

Braun spoke as part of a 2 ½ day program comprising numerous fragrance industry experts, including perfumers and ingredient specialists, all focused on the evolution of the industry and formulations.

Fragrance project briefs change, similar to how fashions change, which affects ingredient needs, added Rodrigo Flores-Roux, senior perfumer, Givaudan. "Briefs call for certain materials and the absence of others. The brief is the mold for the perfume."

Braun added, "There's a growing volume of briefs that are calling for all naturals. So one's palette shrinks from, say, 1,500 materials to about 150. If it's a hypoallergenic project, essential oils are difficult to use. So then you are left with isolates or biotech products."

Similarly, when creating high-dosage perfumes for products such as air fresheners, the volumes required can cause conflicts with compliance with various regulatory requirements around the world, concluded Anthony Reichert, perfumer at Firmenich.

Shrinking, or Right-sizing, the Perfumer's Palette

During the discussion, it became clear that when it comes to reducing the range of materials on the perfumer's palette, there are upsides and downsides.

"Many companies are trying to manage their complexity and so the palette is shrinking," said Reichert. "In most cases this is done for commercial reasons without taking the creative and olfactory aspects into consideration." For example, he said, the value of certain low-volume materials is not always obvious to commercial people within a fragrance house, despite that they may drive creativity and provide the deciding factor in customer wins.

"Our products are delivering substantivity, complexity and signature."

—Naturals panelist Bernard Toulemonde (IFF-LMR)

Perfumers on Quality, Time Constraints

It is crucial that fragrance project briefs be based on a realistic sense of how cost allowances for formulas affect quality, noted Rodrigo Flores-Roux (Givaudan) during a panel discussion at the 2012 WPC. He added that consumers recognize quality. "People in the street know when something is good … if it smells expensive, it is. People cannot be fooled; they are very sensitive to quality by the nose."

Time, too, is a precious resource that, like the ingredient palette, is shrinking. "I remember when I started making perfumes … the briefs were very fast-paced, but we were talking about 14 months," said Flores-Roux. "Now we have to deliver beautiful, inexpensive, performing and revolutionary modifications in two to three hours. This is not realistic. I think we need to sit down and literally smell the roses, and pause. Time allows something that is good to become better.

"If you nurture a product and support it and it's launched with a lot of care it will be a cherished product and people will not be blind to it. The paradigm is Thierry Mugler's *Angel*, something that happened on a small scale and grew to a global success."

Consumer goods companies are constantly reassessing and "right-sizing" their fragrance holdings, said Rafael Trujillo (P&G). "The good news is that consolidation leads to growth. So instead of launching 10 line extensions, you focus on the two, three or four that you put your money behind. There's an opportunity for growth."

"We have to please the consumer with a palette that is robust," said Rafael Trujillo, research fellow and senior perfumer, The Procter & Gamble Co. "We are losing materials, but as one door closes, another one opens. Those that join the palette, such as new musks, have created new possibilities in creation."

"We're retraining ourselves all the time," said Reichert. "We have to learn how to create with new technologies."

"We as perfumers value our materials and when we lose one [from the palette], it becomes difficult to replace it in an existing formula, but it's not the end of the world moving forward," said moderator Dennis Maroney, perfumer at IFF, during a separate synthetic ingredients panel. "We've survived losing musk ambrette and musk ketone. I think we're creative enough as a group to overcome these obstacles and limitations."

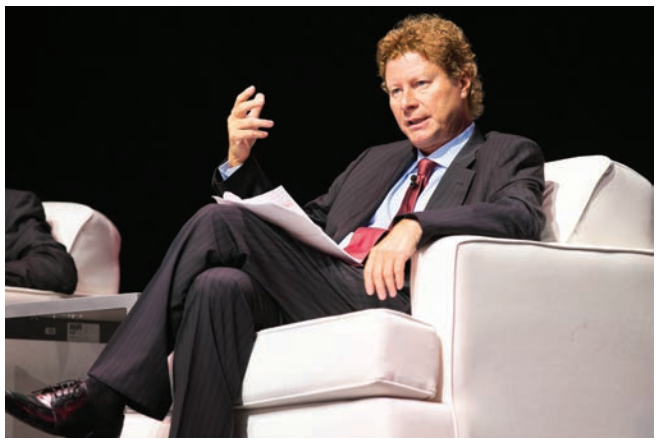
"We as perfumers are constantly evolving," said Trujillo, noting that the development of new delivery technologies is perhaps the most revolutionary technical shift in the fragrance industry. "The matrices—the products—which we're developing fragrances for are changing," he explained. "The forms of the products that we develop products for are changing … and demand to be formulated in a different way. The explosion in a category like air care and the arrival of new devices to deliver fragrance to the consumer has changed the way I formulate. The traditional triangle of a perfume that we learned [in training] with base notes, middle notes and top notes has been inverted for air care. We have technologies that allow us to deposit materials on fabrics that the consumer had never experienced before. We have perfume microcapsules, polymer-assisted delivery systems, cyclodextrin, starches—we have a number of tools available to us as perfumers to deliver benefits at the different touch points that the consumer never experienced before. That has forced me to think differently. Where do I put the money? Where is it going to give the most impact to my perfume and meet the consumers' needs? I'm always trying to learn the new materials [coming onto the palette] to deliver the benefit."

Many of these new materials may be reinterpretations of existing ingredients or high-impact ingredients that require deft handling by perfumers. "Those materials allow you to do different things; not to just use less for more effect, but to create new contrasts, new hedonic areas," said Braun.

Maroney appeared to agree. "As a perfumer, reducing the catalogue puts more importance on each material. Each material has to have a signature and an individuality—a reason to be. [In the past], you could have four or five materials that were all similar and performed the same."

Braun, echoing these sentiments, said, "The challenge is to know your palette extremely well, to know 'this is my perfect material for *this* request.' "

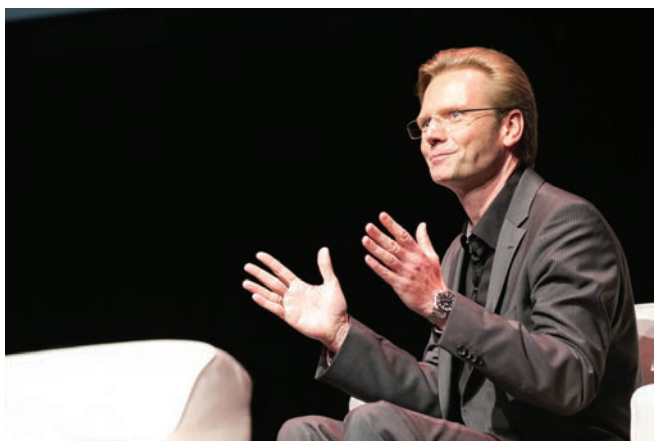
"We as perfumers know how to put together a fragrance, but do we really know what each material is doing?" Trujillo asked the audience. "I think the technology developments in delivery systems have forced us perfumers to really go back and understand what each ingredient is doing. 'Do I really need it here when I have



Ahmet Baydar (IFF)

Bob Bedoukian (Bedoukian Research)

Kim Bleimann (Berjé)



Dirk Braun (Symrise)

this delivery system? What is the interaction of this material with this matrix?' It has forced us as perfumers to go back and really understand why each of our ingredients are in a formula." This level of understanding, he added, will be crucial for the perfumers of tomorrow.

Pursuing New Ingredients

Since the age of *Chanel No. 5*, new synthetics have led to the creation of classic fragrances, said Robert Bedoukian, president of Bedoukian Research, in comments presented during the WPC synthetic ingredients panel. Even as the need for new materials has continued, so too have increasing price and performance expectations, he added.

Meanwhile, important ingredients used by today's perfumers may not be around in the future, impacting important odor categories, noted panelist Ahmet Baydar, senior vice president, global research and development, IFF. The technical demands, too, are increasing. "Fragrances must be hedonic, but must also have malodor activity," he explained. "For encapsulation it's difficult because you have different polymer systems and microencapsulates. We're looking for high-impact, low volume ingredients made in a sustainable way." This sustainability will be supported by adapting green chemistry, catalysis, biotechnology and other key R&D spends, he continued.

Working Backward: Development of New Materials

Good communication with perfumers is crucial in the development of new fragrance materials, said Bedoukian. "Today, chemists will try to figure out why they think [an ingredient] is good, then run it by perfumers and accept their viewpoint."

Success, said Baydar, means "exposing [perfumers] at an early stage and proactively working with the them, showing them all the technologies that are going to be coming, and preparing signature notes for the bases that are coming—in R&D we will know them before the perfumers."

Ingredient developers must identify perfumers' challenges and pursue "consumer-facing" solutions, said Laurent Mercier, vice president, global sales, Firmenich. At the same time, sometimes the best ingredients come from laboratory breakthroughs. "You might have a genius in the lab who might find something," he said. "You can create a need or serve a need. The best stories might be pushes not pulls. There's not one right answer."

Filling Gaps, New Effects and Sustainability

"When we lose an ingredient for any reason I think it's likely that a synthetic would fill the gap," said Bedoukian. "There's a lot more flexibility in what one can do with synthetic ingredients. The same is true for new and novel effects, obviously for sustainability, production volume and cost pressure. Molecules can be found, developed or even to some extent designed to give particular odor characteristics and performance characteristics. They can be modified to change their volatility, their biodegradability and improve the safety profiles of the materials."

Bedoukian and his fellow panelists conceded that the industry's history of responsible ingredient evaluation and

Perfumer Insights: Ingredient Wish Lists, Advice to Suppliers

"I'm always jealous when I talk to a prestige fine fragrance perfumer who … can use all those beautiful naturals," said Symrise perfumer Dirk Braun. "For my areas—home care and fabric and beauty care—unfortunately I'm pretty convinced in the near future naturals will not so much be part of my palette anymore. Are there any materials out there that will give you the volume and richness of naturals? Can we further unlock nature to look at trace materials that really give that great and unique character? Is there a way to make this available at a lower cost and secure supply for perfumers who work on larger volumes and lower cost fragrances?"

Meanwhile, Firmenich perfumer Tony Reichert focused on the need for new volatile musks. "In some areas where your fragrance needs to go in the air, it's very difficult to use heavy ingredients—musks, vanillas—and get them in the air and have them perform."

Braun added, "Every year when we brainstorm about what we really need, we say 'can we have a vanilla that doesn't discolor?' "

Advice to ingredient suppliers: Before discussing what ingredient suppliers could do to make perfumers more successful, Reichert acknowledged the great cost and time involved in the development of new fragrance ingredients.

Flores-Roux added, "We are asking suppliers to give us every single beautiful characteristic in one product. Our suppliers are definitely listening, but at the same time we have to be realistic."

"The [ingredient suppliers] that are proactive, the ones that are ahead of the curve in developing materials, those are going to be the ones that will thrive," said Rafael Trujillo (P&G). "I want my raw material suppliers to start developing now the molecules that we know are likely to be gone for whatever reason. We don't want to be caught by surprise."

Meanwhile, Braun explained, less is more. "Don't bring in too many materials [to demonstrations]," he suggested to ingredient suppliers. "Benchmark your products against what else is in [the customers'] palettes. Really make sure on cost parity that there's an advantage to this material—is it more long-lasting, is it more radiant, does it bloom, does it have better stability? As perfumers we are so busy, with so many projects every day. There's no time to really validate. It's a very good selling point when you come in and say 'Look, this is the benchmark, this is what my material can do, and this is how you profit from it.' Even one material is fine."

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—Perfumer panelist Rodigro Flores-Roux (Givaudan)

safety testing would continue and that concerns raised by ever more sensitive analytical technologies and emerging endpoint questions will keep regulatory specialists busy for the foreseeable future.

"We are probably one of the most transparent industries in terms of showing the testing of ingredients," said Baydar. "There's a lot of proactive work that goes on in improving our testing technologies."

Stress on the Equation: Cost Incentivizing Innovation and Discovery

"The true incentive for coming up with new synthetics is to provide creators with a competitive advantage, something new in the palette to delight the end users," said Mercier. "When you develop a new molecule, you don't think value or return on investment. You think how is the perfumer going to use it to make something new—that's the true incentive."

The return-on-investment equation varies depending on whether a new ingredient is replacing a material with an existing market or represents a new olfactory area for which there is no precedent. With a novel material, Mercier said, "You may be awarded the business, but you don't know what it will be like. If you get awarded business on an existing variant, the first day you're going to be delivering quite a lot of product. If you open a new territory it's going to take time."

In the past, companies may have had years—or even decades—to optimize an ingredient's functionality and price. Today, however, successful new ingredient development requires rapid adoption onto palettes to take advantage of patents. The pressure on development technicians is immense, particularly as many fragrance departments are looking to subtract, not add, ingredients to the palette.

"As a perfumer, reducing the catalogue puts more importance on each material in that catalogue," said Maroney. "Each material has to have a signature and an individuality—a reason to be. Before, you could have four or five materials that were all similar and performed the same."

Baydar noted that as ingredients find decreasing use, they tend to become unavailable industry-wide. Meanwhile, Bedoukian said, cost pressures can push companies toward single-sourcing materials, which can create some fragility in the supply chain.

"Even though there's a lot of pressure to reduce the number of ingredients [on palettes] there's also the pressure to create new and novel fragrances," added

Richard Burlingame (Allylix)

Jean-Pierre de Mattos (Mane)

Christine Gladieux (Robertet)

Synthetic ingredient panel moderator Dennis Maroney (IFF)

Bedoukian. "So there is still room for a lot of new materials. Fortunately, with low-volume materials with very high impact, the pressure to succeed is not quite as bad."

These dynamics, coupled with margin pressures on ingredients, have led many organizations to take a harder look at the incentives for investing in new materials and development facilities. In tough economic times when revenues take a hit, reluctance to invest may be an issue.

"This puts a lot of stress on the equation," Mercier concluded.

Ingredient producers' development of new molecules is increasingly demanding, the synthetic ingredient panelists agreed, with regulations acting as the single biggest game-changer. Regulations are not going away, they noted, and are becoming increasingly sophisticated, necessitating ever-growing regulatory departments, testing capabilities and the know-how to meet country-specific requirements. (This is a challenge faced by natural ingredients, too.)

Potential Fallout of Green Innovations

Many products used in the flavor and fragrance industry are byproducts of other industries, noted Baydar. As those upstream industries begin to adopt green chemistries and biotech solutions that remove byproducts from the equation, availability of starting materials can be threatened. The industry must be prepared for this evolution, Baydar said. Alternate sourcing of key starting materials must be a priority. Otherwise, he noted, new chemistries adopted by other industries could make many low-cost intermediates scarce.

A Molecule is a Molecule

"We know that any perceived difference in the safety of naturals versus synthetics is false," said Bedoukian. "People might think naturals are safer because they're natural, people might think synthetics are safer because they're more clearly defined, but the [perception] problem is a lot bigger than this industry. The public needs to be educated that a molecule is a molecule wherever it comes from. We're a long way from that." If consumers were more aware of the benefits of fragrance they might warm up to synthetics, he concluded.

"What's needed is a united approach to measuring and communicating the sustainability and safety of synthetics," Mercier added.

The Future

Looking ahead, Baydar noted that fragrance ingredients are being developed that signal the benefits of products such as antiperspirants. R&D resources around the industry are being directed toward structure-odor relationship modeling, malodor coverage, antimicrobial activity, hedonic malodor-covering materials and ingredients with ever-greater substantivity for cued release. Materials will also have to be optimized to ensure survival in today's bases.

"A lot of that knowledge is used in generating molecules," he noted.

"You have to be creative in so many ways—it's not just about the scent. The challenge is to know your palette extremely well, to know 'this is my perfect material for *this* request.' "

—Perfumer panelist Dirk Braun (Symrise)

Bedoukian added that the industry will continue to look at the chemical structures produced by botanical sources, which may offer chemical structures with valuable functionality.

The Promise and Complexities of Naturals

The tension between price and customers' desired natural ingredient aspects were highlighted by Kim Bleimann, chairman and CEO of Berjé, during the WPC natural ingredients panel. Perfumers, he said, while saddled with limited budgets, are looking for natural ingredients that are powerful, unique, IFRA- and REACH-compliant, sustainable, easily scaleable, allergen-free, organic, free of agricultural residues, supply-stable, and of consistent quality season-to-season. To this list, Bernard Toulemonde, general manager of IFF-LMR, added customers' demand for transparency and traceability.

Despite these complexities, natural fragrance materials offer unique and indispensable benefits. Toulemonde noted that these ingredients—the historic DNA of the fragrance industry—deliver "the dream, the quality, the richness, the naturality," in addition to complexity, performance, substantivity, signature and relatively small carbon footprints.

Natural materials deliver passion, added Christine Gladieux, deputy director, raw materials division, Robertet. "When you speak to customers, you don't speak of phenylethyl alcohol or maltol or something like that. It doesn't 'speak' to them. You speak to them of the reminiscent scent of the rose in the garden. Naturals are especially tied to earth, to humanity. This is something that is universal. Creativity is already in nature and we should take the benefit of that."

New Natural Ingredients and Sustainability

As highlighted by Bleimann, perfumer and CPG needs for newness often runs counter with regulatory and cost realities. "We need to provide accessible innovation," explained Jean-Pierre de Mattos, vice president, ingredients and marketing, fragrance consumer goods, EMEA, Mane. This will require low-energy production, new extraction technologies and solvents, renewable feedstock and other factors. At the same time, he said, "Perfumers want low- or no-color materials that are also easy to use. To do that we have to go to tailor-made solutions. For those we're talking about limited volumes."

Truly sustainable natural ingredients require long-term investments in order to withstand the volatility of price

and availability, noted Gladieaux. Orris, for instance, requires a six-year process to produce an optimum product. New products and sources cannot be developed, she noted, without "commitment at the origin."

"We all understand that there is a market price target," said Gladieaux. "We have to understand that we have to commit ourselves together, not just one side. We're busy putting out fires, instead of looking ahead."

Securing the Supply of Naturals

Essential oil crops are the ultimate sustainable material, Bleimann explained. However, with food and other crops such as rubber competing with often less profitable aromatic crops, farms have little incentive to commit to the flavor and fragrance industry, creating an ongoing fight for acreage. Aromatic crops are labor-intensive, driving a significant portion of the crops' prices (in some cases, by 60–80%), and will only continue to rise, creating unsustainable cost levels that make many naturals impractical for application in detergents and other household products.

"The cost of labor is not going to decrease in the future," said Toulemonde. "We have two answers to this … improve the vegetal itself [via selection and hybridization] and develop mechanization. Bringing extra education to those countries, could aid this."

De Mattos noted that mechanization can be difficult in some developing producer countries, and so increased mechanization may come on a case-by-case basis.

"The issue is that farmers have been squeezed repeatedly," said Bleimann. These farmers, working on a subsistence level with narrow-at-best profit margins would gladly produce more aromatic plants. Currently, the fragrance industry is doing too little to compete with more attractive five-year farmer contracts to produce crops such as corn. The more prices are driven down, the more sources are threatened.

At the same time, said Toulemonde, the reality is that most aromatic plant producers, excepting categories such as citrus or mint, work on a small scale. The materials produced by these farmers represent some of the few sources of income. However, globalization has provided alternate "assurances of revenue," he warned.

"If you don't support these communities they might move on to other alternatives," said Toulemonde.

"It's up to us that it changes, or we won't have a lot of these oils," Bleimann added. "If we want good juices, we have to pay for it."

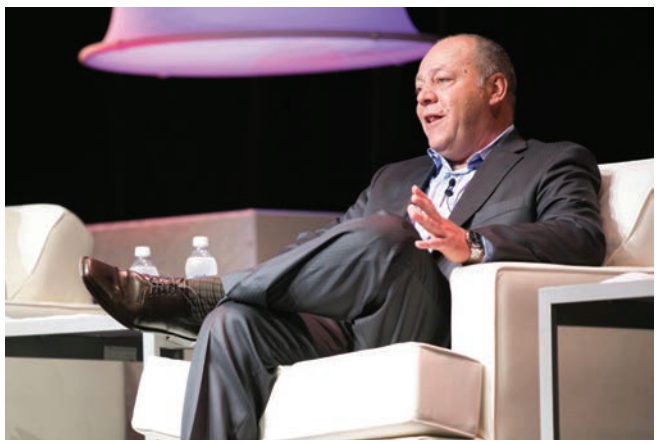
Gladieaux added that the fragrance industry is quite small, relatively speaking, and so there is little reason for natural material availability to be an issue. Many of today's shortages could in fact be viewed as artificial, or self-inflicted.

"But," she said, "people have to be motivated to produce for perfumery. We have to think of what is of value for producers."

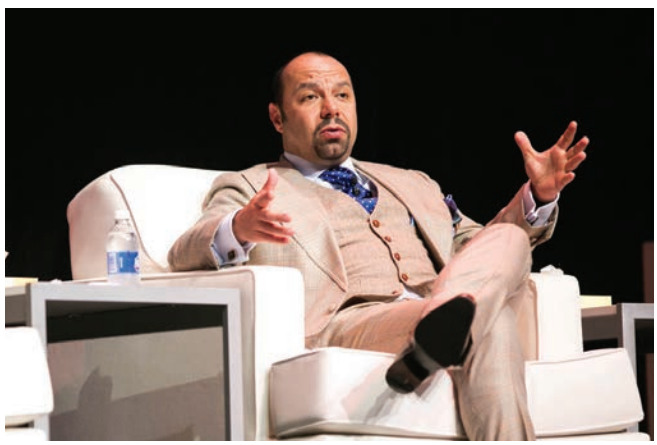
What Biotech Means for the Fragrance Industry

The objective of biotech processes for the production of fragrance ingredients is to produce rare and traditionally

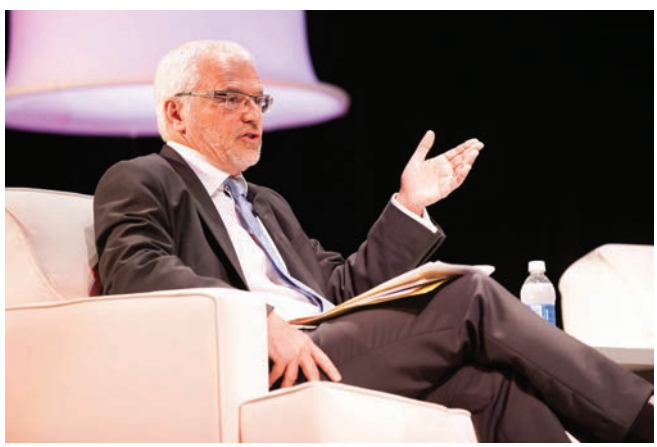
Laurent Mercier (Firmenich)



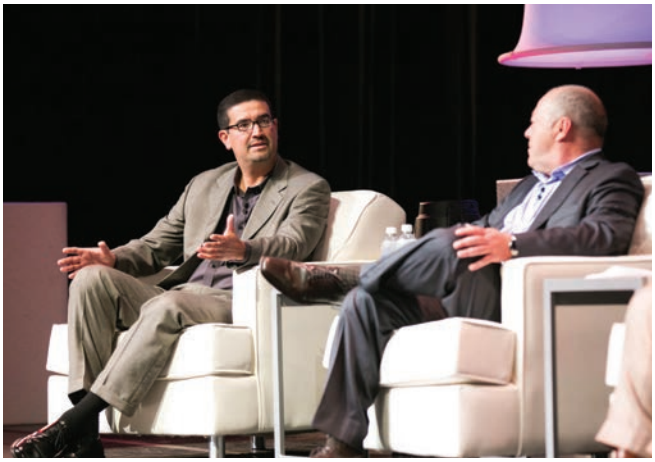
Anthony Reichert, (Firmenich)



Rodrigo Flores-Roux (Givaudan)



Bernard Toulemonde (IFF-LMR)



Rafael Trujillo, left, (Procter & Gamble)

costly ingredients from abundant and inexpensive raw materials such as corn syrup or sugar, noted Richard Burlingame, vice president, research and development, Allylix. If a compound can be found in nature it is likely that a fermentation process can be discovered to create it by biotech means, he added, though this is not always easy. The process, Burlingame said, is not unlike brewing beer and requires a relatively small amount of starter material acreage compared to corn agriculture for food or biofuel. One calculation he offered was instructive: One large-scale valencene fermentation can produce as much product as processing 1 metric ton of oranges. Biotech processes such as this are scaleable and sustainable.

However, Burlingame was quick to add that biotech firms likely won't attempt to produce every chemical—only those that will most benefit from scaled-up production. And, he said, materials derived from biotech will lack the desirable impurities of some traditionally extracted materials and won't replace the great complexity of essential oils. The ultimate goal, he said, is to alleviate cost constraints and the supply limitations of limited or disappearing materials.

"[We] have a number of tools available to us as perfumers to deliver benefits at the different touch points that the consumer never experienced before. That has forced me to think differently. Where do I put the money? Where is it going to give the most impact to my perfume and meet the consumers' needs? I'm always trying to learn the new materials [coming onto the palette] to deliver the benefit."

—Perfumer panelist Rafael Trujillo (P&G)

"Some of the most desired oils come from endangered or over-harvested plants," said Burlingame. And while the technology does not offer a complete replacement, it could potentially take pressure off natural ingredient markets.

"If the pricing puzzle isn't fixed, biotech may take up more and more of the palette," Gladieaux said.

The Future

The panelists were overall very positive regarding the future of naturals, yet remained focused on addressing the challenges of climatic effects on crops, the reduction of agricultural residue, further innovations in production and extraction, and security of supply.

"If we do nothing, our products will disappear," said Toulemonde. "We can face this challenge with innovation."