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*These statements have not been evaluated by the FDA*
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What Will FDA Define as a “Natural” Sweetener?

In this issue, we turn to the always-hot topic of natural sweeteners. With certain stevia producers now purportedly on the cusp of bringing fermentation-derived stevia ingredients to market, as opposed to sweetener extracted solely from the stevia leaf, it’s an opportune time to revisit the debate over whether such fermented sweeteners are still considered natural.

With no real definition for the word natural, for now the conclusion is that natural-product consumers, leveraging their dollars, will ultimately vote on whether there is demand for fermentation-derived stevia, natural or not. If consumers like the price, taste, and sustainability benefits fermentation-derived stevia ingredients bring to the table, regardless of natural distinction, it will be a huge win for companies like Cargill who are hoping to kick off this new segment of the stevia market.

But if FDA finally decides to officially define natural, and that definition ultimately somehow excludes fermentation production, what then? Would fermentation-derived stevia no longer be able to wear the “natural” halo so integral to the marketing of plant-derived sweeteners like stevia and monk fruit?

Well, FDA has been moving toward a definition and for the past half year been accepting comments on the use of natural in food labeling. An FDA definition would provide clarity so sorely lacking in the ongoing flood of class action and private-party lawsuits over whether companies can call their food and beverage products “natural.” Unsurprisingly, the agency says it received numerous citizen petitions and requests from federal courts to assign a regulatory definition. By the time this article goes to press, the comment period, ending May 10, will be over.

Would FDA exclude fermentation from the definition of natural? On its website calling for comments, the agency mentions its longstanding view of the term: “The FDA has considered the term ‘natural’ to mean that nothing artificial or synthetic (including all color additives regardless of source) has been included in, or has been added to, a food that would not normally be expected to be in that food.” It adds, “this policy was not intended to address food production methods, such as the use of pesticides, nor did it explicitly address food processing or manufacturing methods, such as thermal technologies, pasteurization, or irradiation. The FDA also did not consider whether the term ‘natural’ should describe any nutritional or other health benefit.”

According to Chris Tower, president of monk fruit and stevia ingredients supplier Layn USA Inc. (Newport Beach, CA), FDAs statements are “telling.” Ultimately, however, there’s just no way to know for sure whether the agency is likely to embrace fermentation. Aside from that, Tower says that where the average consumer will end up drawing the line “is the billion-dollar question.”

Please turn to page 18 to read more.

Before I sign off on this issue, I’d also like to turn your attention to an important initiative that we at Nutritional Outlook are taking on together with our partners and readers: supporting the children of the water crisis in Flint, MI.

You’ve likely seen the news coverage: Flint’s change of water source in 2014 to the Flint River corroded plumbing, allowing lead to leach into tap water. With an estimated $1.5 billion price tag and 30-year time frame for pipe replacement, there simply is no quick or easy fix. But for affected adults and children, life goes on.

Nutritional Outlook wants to team up with the nutraceutical industry to come together in support of the Flint community. Can you help? Your generous tax-deductible donation to the Flint Child Health & Development Fund, established by the Community Foundation of Greater Flint, is an investment in the chance for Flint’s children to enjoy healthier lives. Nutritional Outlook’s parent company, UBM, and its nonprofit arm will match the funds that we raise together, according to the scale of our response. For more information, visit www.nutritionaloutlook.com/helpflint. Please help.

Jennifer Grebow
Editor-in-Chief
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*IT'S IN THE DETAILS.*
CRN to Create Industry-Wide Product Registry for Dietary Supplements

The Council for Responsible Nutrition (CRN; Washington, DC) now has plans underway to create an industry-wide dietary supplement product registry, which it expects to launch by the end of the year.

At its March meeting, the CRN board of directors unanimously authorized creation of the registry, which will be developed and managed by a third-party vendor.

“This is one step we’re making to take back our industry from the lawbreakers, from the renegades, from the companies that spurn regulation,” said Steve Mister, president and CEO, CRN, in the announcement. “Our member companies have turned a corner and are fully engaged in efforts to separate the legitimate manufacturers marketing healthful products from the hit-and-run, fly-by-nighters selling quick fixes and illegal drugs wrapped with a supplement label. We need all companies who care about our consumers and the sustained growth of this industry to join us in this initiative.”

CRN has formed a working group to resolve specifics of the product registry, including the selection of the third-party vendor. Findings are expected to be presented back to the CRN board at its June meeting, Mister said.

“We’re moving in a deliberate, step-wise fashion and layering initiatives that, when combined, will address transparency, ingredient verification, and GMP compliance,” Mister said.

What about ODS?

April’s supplement-registry announcement came nearly three months after CRN announced that all its members, as a condition of continued membership, would be required to submit supplement product labels to the National Institutes of Health (NIH) Office of Dietary Supplements (ODS) Dietary Supplement Label Database (DSLD) by the end of 2016.

That requirement hasn’t changed, Mister told Nutritional Outlook, but there is a chance the deadline will be extended.

“We expect to have a report back to the board in June as to how we’re progressing with that database, and I think there is a possibility that the board may push back that deadline because of the way the two databases will interact with each other,” Mister said.

There is also the possibility that, depending on what the working group finds, participation in the new registry could also become mandatory for CRN members, explained Mister. CRN is looking at ways to create the new registry so it interfaces “in some way with the [ODS] label database so companies will not have to engage in duplicative efforts.”

While CRN continues to support the ODS database, the board ultimately decided it didn’t go far enough for the purposes of an industry-wide registry.

“It’s intended to target the research community, to be a research tool, so the consumer face of it really wasn’t what we were looking for if retailers or even consumers wanted to look for products,” Mister told Nutritional Outlook. The ODS database also lacked a unique identifier for products, such as an alphanumeric code, and it only included information available on product labels, he added.

“We intend for our registry to include information that goes beyond what’s on the product label,” said Mister. “That will get a larger, more robust kind of registry than what ODS is currently doing.”

Two Tiers in New Registry

One defining aspect of the new registry will be multiple tiers of information accessible to different audiences. The first tier, which will be open to the public and allow participating manufacturers and marketers to add their products at no charge, will largely be limited to information on the product label. Meanwhile, the second tier will include indicators of product quality and it will be more exclusive, accessible only to specified audiences such as regulators and retailers.

“It will include third-party certifications, if you’ve had an FDA inspection of your plant, if you’ve submitted your 30-day structure-function notices for your products, if you’ve had a GMP inspection by a third party like NSF, USP, or UL,” Mister said. “Are you kosher? Are you certified organic? All of that kind of information will be in tier 2.”

CRN’s hope is that retailers “will use that [information] to make decisions about what products they want in their stores,” Mister said.

Correction: In Nutritional Outlook’s April 2016 issue, page 48 of the article “Vitamins: Reinventing a Favorite” stated, “CRN’s survey showed that 85% of supplement users trust multivitamins’ safety and effectiveness.” CRN’s survey did not measure the trust consumers have in multivitamins’ safety and effectiveness but rather the confidence Americans have in the safety, quality, and effectiveness of vitamins/minerals. The correct wording is: CRN’s survey showed that 85% of Americans have overall confidence in the safety, quality, and effectiveness of vitamins/minerals. Nutritional Outlook apologizes for the error.
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Little Kids, Big Market

The children’s category is flourishing.

BY INNOVA MARKET INSIGHTS

In an increasingly competitive food, drinks, and supplements market, children are just one of the demographics gaining increased attention from manufacturers. Parents generally drive the healthier choices, with particular interest today in clean-label claims such as organic, no additives/preservatives, GMO- and hormone-free, and low and light alternatives—particularly reduced sugar.

While the majority of parents buy products for their children, they still do consider input from the younger generation with regard to product and brand choice. For assured success, then, supplement manufacturers must aim to satisfy both parents and their children in order to win loyal customers and repeat purchases.

Supplements: A Growing Market

The market for children's supplements has seen strong growth in recent years, in line with growing sales of dietary supplements as a whole and reflecting increasing consumer interest in using supplements for additional nutritional support. For children, parents tend to focus on areas of general health, immunity, closing potential dietary/nutritional gaps, and boosting cognitive development.

The United States drove new-product activity in supplements in 2015, with North America accounting for over 40% of global children's supplement launches recorded by Innova Market Insights in 2015—reflecting the highly developed nature of the market (the largest in the world). Europe came next with just under 30% of global launches, trailing the United States despite Europe’s large number of countries.

The United States was responsible for over 34% of supplements targeted at children aged 5 to 12 years. (This 34%, however, equates to just 2.6% of total U.S. dietary supplement introductions over the same period.)

Graphic Appeal

Character licensing is a longtime marketing approach to capture children’s interest, and it’s no different in the kids’ supplement aisle. Character introductions in 2015 included Thomas & Friends from Health Science Labs, Marvel Ultimate Spider Man from Sundown Naturals, and Nickelodeon Spongebob Square Pants and Viacom Nickelodeon Teenage Mutant Ninja Turtles from International Vitamin Corp. Meanwhile, supplements brand NatureSmart licensed a range of Disney themes, including characters from movies like “Frozen,” “Finding Nemo,” “Cars,” and “Mickey Mouse.”

Nutrients for Kids

Multivitamin and mineral formulations continue to dominate the children’s supplements market, but kids’ supplements are also branching out to encompass more specific types of supplementation, such as DHA/omega-3 fatty acids, calcium and calcium with vitamin D, probiotics, and fiber. Examples includes Kids First Fiber from Nature Made, Solgar’s U Cubes Calcium with vitamin D3, and Olly’s Lil Olly’s Kids Multivitamins plus Probiotics.

At this year’s Natural Products Expo West trade show in Anaheim, CA, omega-3 brand Nordic Naturals introduced two new kids’ products: Probiotic Gummies Kids (containing 1.5 billion live cultures and probiotics) and Vitamin D3 Gummies Kids, in “merry berry punch” and “wild watermelon splash” flavors, respectively. Like all of the brand’s kids’ gummies, the products are non-GMO and free of gluten, milk derivatives, and soy, and they contain no artificial colors, flavors,
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sweeteners, or preservatives. (To read about nutrition research for kids, turn to page 56.)

**Delivery Systems**

Methods of delivery have also changed in the kids’ supplements sector, with a move away from tablets and capsules and toward alternative, easier-to-consume formats such as powders and liquids. There is still a fairly widespread move into the gummy format, as well as wider availability of chewable options. Plus, there is rising interest in products that straddle the boundary between supplements and foods, such as fortified confectionery drops, chews, and gums, as well as supplement-type beverages.

**Hide the Veggies**

It’s often easier to get kids to eat more fruits; not so much with vegetables. In response to this, cookbooks have increasingly focused on ways to increase children’s veggie intake by disguising the vegetables in popular dishes—a trend that’s carried over into the packaged food market. Now, a wide range of children’s meals feature “hidden vegetables,” pureed and blended with other ingredients so that their presence is not immediately obvious. Smaller, specialized baby and children’s food brands are highly active in this area—such as children’s brand Kidfresh, which adopted the concept for all of its recipes.

The dried-pasta market has incorporated vegetables for some years, with ConAgra’s leading pasta brands, including Golden Grain, Mueller’s, and Ronco, all featuring a range of Hidden Veggie options, all with the color, texture, and taste of standard lines. Mueller’s, for example, has a range of spaghetti and pasta shapes with added vegetables such as carrots, sweetcorn, and squash comprising one full serving of the daily requirement of vegetables per portion. Similarly, there is ongoing hidden-vegetable activity in pasta sauces—especially using a tomato base with additional vegetables mixed in.

In the snacks space, similar activity includes Funley’s All Natural Super Crackers range: the Cheddar n’ Stuff line (with hidden broccoli), Pizza n’ Stuff (hidden carrot), Ranch n’ Stuff (hidden spinach), and Cornbread n’ Stuff (hidden sweet potato).

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The stars are aligning for zero-calorie natural sweeteners stevia and luo han guo (or “monk fruit”). Sales of natural products show no sign of slowing. Scientific bodies and regulators, too, are pushing citizens toward healthier choices—ones that could benefit zero-calorie sweeteners big time.

Case in point: Here in the U.S., FDA’s recent proposal to specify added-sugar content on U.S. nutrition facts labels has manufacturers of zero-calorie natural sweeteners rejoicing because their sweeteners, unlike sugar and other nutritive sweeteners, add nothing to the caloric bottom line. And, for the first time, the 2015–2020 U.S. Dietary Guidelines for Americans set official sugar-intake targets to help Americans cut the added sugar.

But that’s not the end of the happy news for stevia and monk fruit. Breeding, processing, and formulating innovations are yielding new-generation uses of these plant-based sweeteners. If these advances gain market acceptance, it all points to a very lucrative future.

The Stars: Stevia and Monk Fruit
Stevia (Stevia rebaudiana) and monk fruit (Siraitia grosvenorii) are the two strongest sellers in the zero-calorie natural-sweeteners space—for now, at least. Both sweeteners check key boxes: zero calories, a natural plant source, commercial availability, and enough flexibility for formulators.

According to May 2015 Mintel estimates, sales of products containing stevia in U.S. natural supermarkets (excluding Whole Foods Market) were $19.6 million in the 52 weeks ending February 22, 2015. Sales of products containing stevia blends clocked in at $17.7 million during the same period. That puts stevia’s share of the overall alternative-sweeteners market (in natural supermarkets) at 17%, and stevia blends’ at 15%. (Mintel also notes that some of these stevia products may be blends of artificial and natural sweeteners.)
Monk fruit’s share of the alternative-sweeteners market is smaller, sitting at 2.2% in natural supermarkets; monk fruit sales during that 2014–2015 period were $2.6 million in natural supermarkets. Monk fruit’s market share is smaller because monk fruit supply is smaller, making its cost in use higher compared to stevia’s.

“Monk fruit extract is just not as plentiful as stevia,” says Thom King, president of Steviva Ingredients (Portland, OR), which supplies both monk fruit- and stevia-based ingredients. “There are a smaller number of [monk fruit] orchards as well as extraction facilities compared to stevia.” Until this changes, he says, “monk fruit will still have challenges scaling up in comparison to stevia. Once this is in place, there will be greater supply, which will start driving down price.”

“It’s a lot more expensive to grow [monk fruit] than it is to grow leaves on a [stevia] shrub,” explains David Thorrold, general manager, sales and marketing, of Illinois-based monk fruit extract supplier Guilin GFS Monk Fruit Corp. Still, he adds, “there are no issues with scaling up monk fruit to meet projected demand.”

The fact of the matter for stevia and monk fruit is that these are the only two commercially available natural, zero-calorie, high-intensity sweeteners, says Chris Tower, president of monk fruit and stevia ingredients supplier Layn USA Inc. (Newport Beach, CA), a subsidiary of Guilin Layn Natural Ingredients. “I don’t see a third entity arriving onto the commercial scene within the near-term future,” he says, defining near-term as the next two to three years.

**Natural-Sweetener Advancements**

Even as sales grow, both stevia and monk fruit each have challenges that ingredient makers and agronomists are toiling to solve.

For monk fruit, the main challenge at present is the existing supply. As such, a lot of the innovation going on right now in the monk fruit industry focuses on scaling up. “We are continually innovating around our agronomy and our process to improve yields while building a sustainable monk fruit industry that ensures a fair return to our growers,” Thorrold says.

For Monk Fruit Corp., Thorrold says, future projects will involve increasing fruit quality and yields, and these will be done largely through traditional plant breeding and agriculture. “What we won’t be doing is any kind of genetic modification for either the fruit or synthetic production of mogrosides [the sweetening glycosides in monk fruit],” he says.

Many stevia suppliers are also sticking to this traditional approach. PureCircle (Chicago), for instance, has long credited the headway of its agronomy team in making the firm’s next-generation stevia ingredients possible. Specifically, the team focuses on breeding stevia plants with higher concentrations of desirable steviol glycosides. For instance, the company’s new Zeta ingredients “are the result of breakthrough advancements of our PureCircle Stevia Agronomy Program, which have enabled us to grow proprietary stevia varieties that contain over 20 times the amount of rare steviol glycosides versus other leaf available on the market,” says Faith Son, vice president, global marketing and innovation. (Read more about the Zeta line on page 20.)

But while PureCircle and many other stevia suppliers swear a commitment to stevia ingredients solely extracted from the stevia leaf—just as the monk fruit suppliers I interviewed say their ingredients will continue to focus strictly on plant-derived extraction—some stevia firms are branching out into methods of stevia production that go beyond traditional agriculture.

As Nutritional Outlook reported years ago, stevia suppliers like Cargill (Minneapolis) and Stevia First (Yuba City, CA) are beginning to use fermentation as a means of producing rare, better-tasting steviol glycosides in a way that is more cost efficient, requires fewer resources and less land to produce, and is easier to scale up. By solely producing the best-tasting glycosides, fermentation sidesteps the need to grow a lot of stevia leaves to net the same quantities of those desirable glycosides.

Cargill, it seemed, was closest to bringing commercialized, fermentation-derived stevia to market. Just this March, the company finally made its long-anticipated EverSweet fermentation-derived sweetener available for sampling, containing the steviol glycosides Reb M and Reb D. As Scott Fabro, global business development manager, Cargill, says, “EverSweet sweetener is an expansion, not a replacement, of Cargill’s steviol glycoside portfolio; it is meant to open new market opportunities where stevia leaf extract does not play today.” Importantly, he stresses, “We will continue to offer our Truvia and ViaTech stevia leaf extracts as they are made from the stevia leaf.” (Read more about ViaTech on page 20.)

Cargill has not definitively indicated when it expects to see EverSweet on market shelves. News from the company, however, hints that the firm is not quite ready to go commercial. This April, Fabro told Nutritional Outlook, “As for the official rollout of EverSweet, we are waiting to commercialize because production costs are currently above where we want them to be for a launch. This is a result of a combination of factors, including strain characteristic, fermentation and downstream processing costs, facility conversion costs, production scale, and current consumer indications on pricing. However, our work is actively continuing and has been accelerated to ensure this delay is as short as possible.” He points out that EverSweet does have self-affirmed Generally Recognized as Safe (GRAS) standing and that the company has also submitted its GRAS notification to FDA in order to seek a no-objections letter.

**By solely producing the best-tasting glycosides, fermentation sidesteps the need to grow a lot of stevia leaves.**

CONTINUED ON PAGE 24
Whether used as a food/beverage ingredient or directly as a tabletop sweetener, both monk fruit and stevia have unique advantages. How do these natural sweeteners stack up in formulation? It depends on the application and who you ask.

Right up front is the cost difference. “While monk fruit has significant advantages over stevia in terms of taste and ease of formulation, stevia has a much lower cost in use, and this is the reason that stevia has a larger market share than monk fruit,” says David Thorrold, general manager, sales and marketing, for Illinois-based monk fruit extract supplier Guilin GF Monk Fruit Corp.

Stevia and monk fruit have equal sweetening capacities. “On a weight-to-weight sweetness level, we know stevia (e.g., 95% Reb A) and monk fruit (e.g., 50% mogroside V) are equal in strength, each credibly purported to be about 200–250 times sweeter than sugar,” says Chris Tower, president of stevia and monk fruit ingredients supplier Layn USA Inc. (Newport Beach, CA).

Still, there are times when one ingredient may work better than the other due to its flavor profile. “Stevia works better in a citrus environment, while monk fruit and/or a stevia–monk fruit blend may work better in vanilla and flavors similar since the off-notes are more ‘melon rind’ in nature,” says Thom King, president of Steviva Ingredients (Portland, OR). Layn’s Tower says, “Monk fruit extracts in general deliver the maximum sweetness potential when formulated into foods and beverages containing neutral to high pH levels—e.g., low-acidic beverages and sodas, most dairy products, protein powder mixes, cereals, and bakery items.” Conversely, if added to low-pH products like highly acidic beverages and fruit juice, “monk fruit’s sweetness potential and efficacy is reduced on a relative basis,” Tower says, and that’s when it may be necessary to blend with other sweeteners.

As for off-notes, Tower says, “At very high usage levels, monk fruit may impart a fruity, ripe-fruit, or fermented-fruit off-flavor.”

Still, monk fruit suppliers say monk fruit is relatively easy to formulate with. According to Thorrold, monk fruit extracts lack the bitter aftertaste conventionally associated with stevia extract, so “it is much easier to formulate with and better tasting. This also gives it a broader range of applications than stevia,” he says. “There are a number of applications that already have some bitterness—for example, protein-based beverages—where the formulator wants to mask the bitterness. The bitter aftertaste of stevia only compounds the problem, whereas monk fruit is effective at both adding sweetness and masking bitterness.”

STEVIA AND MONK FRUIT IN APPLICATION: HOW DO THEY COMPARE?

CONTINUED ON PAGE 22
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But stevia suppliers have made great strides of their own in improving the taste—and aftertaste—of stevia. Cargill (Minneapolis), for instance, developed its ViaTech system, which is the company’s platform for determining the best ratio of the stevia leaf’s more than 40 steviol glycosides in order to provide the best taste per application. And there are products in which stevia’s sweetness holds up better—such as in acidic beverages—compared to monk fruit. Cargill says ViaTech can achieve a remarkably high calorie reduction, between 30%–70% or greater, all while meeting product taste targets.

Sweet Green Fields (Bellingham, WA) says it has also found a “very unique blend of steviol glycosides from the stevia leaf” that, particularly for beverage formulators, provides an “indistinguishable” sugar taste while enabling high levels of sugar reduction, says Mel Jackson, PhD, vice president of science. The ingredient is called Intesse.

In fact, for alternative-sweetener suppliers in general, the goal is always an ingredient that is as sugar-like in taste and performance as possible, but not in calories. Cargill calls its EverSweet stevia ingredient, comprising Reb M and Reb D steviol glycosides, more sugar-like than Reb A stevia sweetener, making calorie cuts up to 100% possible in a carbonated soft drink, for example. Meanwhile, Faith Son, vice president of global marketing and innovation, PureCircle (Chicago), says the company’s new Zeta stevia line, focusing on ideal glycoside blends per application, “can achieve the deepest level of calorie and sugar reductions while delivering a clean, sugar-like taste profile.”

While stevia producers are continually working to breed better-tasting glycosides from the stevia leaf, Thorrold says that monk fruit is a different story. “While we are constantly innovating and investing in R&D and our supply chain, we don’t really look at monk fruit as a high-tech ingredient where there will be a breakthrough, next-generation product. I suppose it’s a bit like asking an apple producer what’s the next generation of apple ingredients,” he says.

“We celebrate the fact that monk fruit has a long history as a traditional food, and we’re happy that it already tastes great straight from the fruit,” he continues. “We think it’s a positive that, unlike other natural sweeteners, monk fruit doesn’t need a lot of science to figure out how to make it taste acceptable.” Tower agrees, saying that monk fruit’s biggest technical advantage is that it “does not require complicated taste modulation often needed for stevia.”

Also, there’s no reason why stevia and monk fruit can’t be friends. In fact, one of the reasons stevia/monk fruit blends exist is that both ingredients work well together. “We have found that a combination of the two cancel out each other’s off-notes,” says King. One example is Stevia’s MonkSweet LS, marrying monk fruit and stevia.

“Formulating monk fruit together with stevia has proven to deliver an ideal flavor profile by providing pleasant sweetness and mitigating astringency, bitterness, and herbaceous notes normally associated with stevia alone at the same sugar equivalence,” Tower adds.
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There are some nice synergies there, depending on the product, and people like having both on their labels, so they’ll actually use both products,” said Cargill’s Andrew Ohmes, global commercial manager, Corn Milling, North America, at this year’s Natural Products Expo West trade show. However, he added, “our ViaTech stevia leaf extract is able to achieve great sensory results on its own at a lower overall cost.”

There is, however, one category in which stevia is the clear leader: tabletop. It’s a point even monk fruit suppliers concede. “With respect to the tabletop-sweetener category, monk fruit has not held its own against stevia, and I don’t see that changing,” says Layn’s Tower. “I think stevia performs more ideally in the coffee matrix/environment, a large conduit for tabletop usage. It is what it is. You can’t win them all, and that’s okay,” he says.

Fermentation versus Enzymatic Production

When we talk about fermentation (such as Cargill uses) and enzymatic production (another process that ingredient makers use), PureCircle’s Son reminds readers that “fermentation derived” and “enzymatically derived” are different processes. “The two are not the same,” she says.

Several of the stevia and monk fruit firms interviewed for this article confirm they have used some kind of enzymatic process in order to improve the flavor profile of their ingredients.

PureCircle is one of those companies. “Within our portfolio, we also have leaf-based ingredients that are glycosylated,” Son says. “These ingredients start with a traditional stevia leaf extract that’s purified to 95%, and with the use of natural enzymes, add glucose or other sugar molecules to improve taste.”

“We are very transparent about how these products are made and how they differ from our other leaf-based products,” she adds.

Steviva’s King says monk fruit suppliers are also doing the same. “There are some enzymatically treated monk fruit extracts making their way to the market that have been able to reduce some of the perceived off-notes,” he says.

Fermentation-derived stevia involves a different kind of technique because it may not begin with leaf-derived stevia materials. Cargill’s Fabro describes the “age-old process of fermentation” by which EverSweet is made: “Reb M and Reb D are the best-tasting steviol glycosides found in the stevia leaf, but they make up less than 1% of the actual leaf. By adding a few genes to baker’s yeast, we enable the yeast to produce the same type of enzymes used by stevia plants. We feed our yeast some simple sugars, and the yeast transforms the simple sugar into the very sweetest steviol glycosides, identical to what is found in the stevia plant. The yeast is then filtered away, and the remaining sweet steviol glycosides are concentrated and purified. These sweet steviol glycosides are identical to Reb M and Reb D that are naturally formed in very small quantities in the stevia leaf.”

Fabro underlines that Cargill remains transparent in conveying how EverSweet—“and, in fact, all our products”—is produced, including clear statements on the company’s website.
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Is It Natural?
The farther away we get from sweeteners that are traditionally extracted from the plant, and the more we advance into enzymatic and fermentation processing, some questions come to mind. First, however, it’s important to remember that, in exchange, we are getting some better-tasting, more affordable—and perhaps environmentally sustainable—sweeteners. It’s not possible to ignore the obvious benefits sweeteners like Cargill’s EverSweet propose. The need to provide the world with easily scalable, safe, effective, and affordable low- and zero-calorie sweeteners is undeniable, especially as growing populations struggle with serious health conditions stemming from high sugar intake. It’s also a fact that our planet’s resources are limited and that there is a great need for sustainable production of not only sweeteners but all food ingredients for humans and animals.

But in moving to fermentation and enzymatic production techniques, are we also moving farther away from sweeteners that are considered natural? Talk about natural-ness does matter because there is a growing subset of consumers specifically seeking sweeteners that are natural. In its aforementioned “Sugar and Alternative Sweeteners US 2015” report on approximately 1800 adults, Mintel found that 61% of those customers surveyed wished there were more natural sugar substitutes available; moreover, 18% said they would be willing to pay a premium for natural sweeteners, in the following breakdown: Millennials (25%), Generation X (17%), Baby Boomers (11%), and older customers aged 70-plus (9%).

Do processes like fermentation and enzymatic treatment still produce a natural ingredient? It depends on who you ask. Some of those interviewed say that stevia, when derived via fermentation, for instance, is no longer natural. Others ponder more complicated issues.

“The question of GMO comes into play any time enzymes and fermentation are employed, and as more legislation pops up regarding GMO, it slows the market penetration of these enzymatically treated glycosides,” says Steviva’s King. When asked if enzymatically enhanced stevia ingredients would be considered natural, he says, “In some cases, yes. It would depend on the enzymes being used.”

The opinion of Monk Fruit Corp’s Thorrold is this: “As soon as you synth-size mogroside by enzymatic production, you have a food additive that is not monk fruit and is not natural.”

He continues, “While there might be a place for synthetic mogroside in the future as a food additive to replace aspartame or sucralose, we don’t see this replacing the demand for our natural, fruit-derived ingredient.”

PureCircle’s Son wonders how fermentation-derived stevia would list on ingredient labels compared to leaf-derived stevia, which currently labels as ‘stevia leaf extract.’ “As for how fermentation-derived products are positioned and labeled, that is not entirely clear,” she says. “What we do know is that only products that come from the stevia leaf can be described as ‘stevia leaf extract.’ Logic would say that any ingredient referred to as ‘stevia’ should be from the stevia plant. There’s even a question as to whether products from yeast via fermentation even warrant being called ‘steviol glycosides’, as the root of the word, steviol, is stevia.”

According to Cargill’s Fabro, EverSweet would label in the United States as ‘steviol glycosides’ or as ‘Reb M and Reb D’.

What about Blends?
Another point of contention is whether stevia and monk fruit’s combination with other sweeteners still renders the resulting sweeteners natural.

Stevia and monk fruit extracts are commonly blended with other sweeteners for many reasons. Blending high-intensity natural sweeteners like stevia and monk fruit with other sweeteners is a way to balance off-notes. Also, by using other low-intensity or bulking sweeteners, manufacturers are able to build back the volume that food formulators need that’s otherwise lost with high-intensity sweeteners like stevia and monk fruit. Finally, using blends offsets the cost of higher-priced sweeteners.

The zero-calorie sugar alcohol erythritol is very commonly paired with stevia and monk fruit because of its ideal sugar-like taste and texture, as well as its easy digestibility. Cargill’s market-leading Truvia tabletop sweetener, for instance, is a blend of stevia leaf extract, erythritol, and natural flavors. And on monk fruit’s pairing with erythritol, Layn USA’s Tower explains, “erythritol is more water soluble and thus provides a quicker sweetness onset, which can minimize the relative delayed onset of monk fruit.”

A bulking sweetener like erythritol, however, may not always be considered natural, as it, too, is generally most often produced via fermentation. When combined with sweeteners like stevia and monk fruit, which are considered natural, what, then, is a manufacturer left with?

“There is a great debate over whether erythritol can be considered natural,” says Mel Jackson, PhD, vice president of science for leaf-based stevia supplier Sweet Green Fields (Bellingham, WA). “Until the FDA makes a definitive statement on the issue [on the definition of natural], this will continue
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al-derived products such as erythritol.” For what it’s worth, just 3% of consumers Mintel surveyed considered erythritol natural.1 (In U.S. news related to erythritol and natural labeling, Cargill recently announced that the Flavor and Extract Manufacturers Association recently granted GRAS status to Cargill’s Zerose erythritol when used as a flavor in non-alcoholic beverages. When Zerose is used as a flavor modifier at levels of 1.25% or lower, companies can label Zerose simply as a “natural flavor.” This rule does not, however, apply to Zerose’s use as a tabletop sweetener or at levels higher than 1.25%—for instance, as a bulk sweetener.)

Numerous food-industry lawsuits have centered on questions over whether some sweeteners on the market can be marketed simply as “stevia” or “monk fruit,” both of which carry natural connotations, if they are blended with other, questionably natural ingredients. Examples include lawsuits over Johnson & Johnson’s Nectresse monk fruit–based sweetener (containing erythritol), and Merisant’s PureVia stevia sweetener (containing PureCircle stevia as well as iso-maltulose or dextrose). Cargill has also faced class actions for Truvia on similar grounds.

The question of erythritol’s naturalness is far from settled. Stevia’s King, whose company sells a blended stevia, monk fruit, and erythritol ingredient called MonkSweet+, says, “We are aware of these lawsuits, but erythritol is considered natural. It is derived from the natural fermentation of glucose. We have not run into any issues with our natural claims nor the natural claims of our customers.” Moreover, he says, the company is “very clear about the exact blend of glycosides and polyols that are being used.”

Meanwhile, says Monk Fruit Corp.’s Thorrold, “The bar is definitely being raised all the time for what consumers consider natural. There are consumers who don’t consider a product natural if it contains sugar alcohols, and also some consumers—for example, in Germany—who have claimed that stevia extracts cannot be considered natural because they are highly purified substances made up of nearly 100% single chemical compound.

To answer your question, yes, some consumers are concerned that not just sweeteners but food and beverages generally are being labeled ‘natural’ when they contain some ingredients that the consumer doesn’t consider natural.”

**Natural: Does It Matter?**

FDA, as we know, has yet to assign a regulatory definition to the word natural. (See page 10.) Until that day, it’s the consumer who will decide what’s natural or not—and what’s acceptable for purchase. But do consumers know enough about natural sweeteners to come to a verdict?

Mintel’s aforementioned report1 on sweetener alternatives was revealing. In particular, it unveiled a key finding—that consumers have trouble telling which sweeteners are natural to begin with. Mintel asked consumers which sugar substitutes they considered to be natural. While many selected agave (34%)—followed by coconut sugar (31%), stevia (29%), and then monk fruit (17%)—a full quarter of those surveyed did not consider any of the sugar substitutes on Mintel’s proposed list to be natural, including agave, coconut sugar, stevia, monk fruit, high-fructose corn syrup, sucrolose, erythritol, aspartame, xylitol, sorbitol, mannitol, saccharin, etc.

“This aligns with the general concern that it is difficult to know which substitutes are natural and which are not,” Mintel stated. Two-thirds of those Mintel surveyed agreed there are so many types of sweeteners, it’s hard to know the difference between them, and 65% said it’s difficult to tell which sugar substitutes are natural and which are not. What’s more, 60% said they wished they knew more about how sugar substitutes are made.

If fermentation-derived stevia does go commercial, there’s a good chance, based on industry interviews, that leaf-based-stevia suppliers will try to distance themselves from fermentation-based stevia. If consumers question the naturalness of next-generation stevia ingredients such as those produced through fermentation, suppliers not using those techniques may begin to compete on the message that leaf-derived products are inherently plant-based—and, therefore, more natural. It’s happening already.

“Our consumer insights and experience tell us that consumers love the fact that stevia comes from a leaf and is sustainable and beneficial to farmers around the world,” says PureCircle’s Son. “This is the foundation of what makes stevia desirable as a zero-calorie sweetener. Fermentation-derived products use genetically modified yeast without the use of stevia plants, which is quite a different approach.”

There is also some worry about preserving the net impression of stevia as a natural ingredient. Speaking as a leaf-based supplier, Sweet Green Fields’ Jackson says, “If the stevia industry does not go to great pains to show why leaf-derived stevia should be considered natural, then yes, the ‘natural’ stevia industry would be in peril” altogether, she says.

Monk fruit suppliers have an easier story to tell, says Monk Fruit Corp.’s Thorrold, because “monk fruit has been consumed for hundreds of years as a very simple ingredient that requires no special processing—just hot water and a sieve—and this makes its natural credentials very strong.” But he agrees that when it comes to natural sweeteners, “it’s very important that the natural claim continues to resonate with consumers.”

As more options come on line, food and beverage manufacturers will have their chance to weigh the choices. Cargill’s Fabro says, “Our customers, ultimately, will decide how they will label their products for their consumer.”

For now, any concerns about the naturalness of the stevia and monk fruit ingredients on the market haven’t been significant enough to keep consumers from buying these natural sweeteners. Stevia and monk fruit are on the way up, and still for the same reasons: As Fabro says, “Stevia and monk fruit are the way up, and still for the same reasons: As Fabro says, “Stevia and monk fruit are currently the most commercially successful plant-based, zero-calorie sweeteners, and both have a positive image with consumers.”

**Reference**

Over the years, Americans have lost none of their interest in losing weight. Unfortunately, if Centers for Disease Control and Prevention (CDC) data are to be believed, they haven’t lost much of their weight, either. Fully 78.6 million American adults—that’s more than a third of us—are obese, CDC says, costing the nation’s healthcare system an estimated $147 billion annually.

But one thing Americans do seem to be losing is their faith that some magic weight-loss pill can help them win this losing battle. Mintel’s “Diet Trends U.S. 2015” report found that 91% of Americans favor a well-rounded diet over weight-loss products for shedding pounds—a back-to-basics tilt that USDA merely reinforced with its 2015-2020 Dietary Guidelines for Americans, which emphasize whole foods and healthy lifestyles over wacky weight-loss schemes.

And who knows? The shift in thinking may catch fire and launch a new era of weight management. If it works, the results would be a triumph for public health. But they’d also be a turning point for the supplement and functional foods industries. For if consumers lean increasingly toward “old-fashioned” approaches to weight management, where does that leave a sector whose purpose is to innovate products that manage weight?

Getting Burned
The extent of consumers’ skepticism toward weight-management products is striking. According to Mintel, sales of diet pills fell almost 20% in the year ending July 2015, which jibes with the report’s finding that consumers aren’t convinced such products are as healthy as they claim to be.

Both conclusions coincide with Chase Hagerman’s observations. “All too often,” says the brand director for Chemi Nutra (Austin, TX), “consumers’ wallets—not their excess fat—are what get burned by weight-loss products.” If that sounds surprising coming from the representative of a company that markets its own weight-management product, it shouldn’t, for Hagerman concedes that specious “magic-pill” promises still plague the category. But consumers are growing wise.

“At this point in the health-and-wellness sector,” Hagerman says, “consumers are more discerning, and with the rise of the Internet, their apprehension related to a topic can rise at the point of sale.” Though shoppers may know that diet and exercise are linchpins...
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in their success, they also know that "a truly useless formulation," as he puts it, is, well, truly useless. The result, invariably, is "consumer dissatisfaction and lower sales."

In the Crosshairs
Mitch Skop, senior director, product development, Pharmachem Laboratories Inc. (Kearny, NJ), agrees. While stopping short of calling weight management a Wild West, he acknowledges that "as long as there are supplement cowboys out there promoting their foo-foo dusts and proprietary blends, there’ll be fraud, which hurts consumer confidence every time."

Exaggerated claims from personalities like Dr. Mehmet Oz don't help, either. "He had so much influence on how millions of Americans could lead healthier lives," Skop reflects. But by overstating the efficacy of the products he touted, Oz and his ilk "attract negative media attention and give the whole industry a black eye."

That black eye really got throbbing as the FTC, FDA, and states’ attorneys general began taking action against weight-management targets—like, for example, makers of the green coffee beans about which Oz was so bullish, who wound up facing an FTC lawsuit in 2015. And though the weight-management category has attracted "fringe players" and "bad actors" who generate unflattering headlines, admits Shaheen Majeed, marketing director, Sabinsa (East Windsor, NJ), he believes that FTC’s "concentrated education and enforcement program" against them "has had a positive effect in toning down claims like ‘eat pizza and lose weight while you sleep.’"

Their Own Worst Enemy
Still, fantastical claims seduce consumers who’ve learned the hard way—and perhaps many times over—that losing weight is simple in theory but confounding in practice. For example, Skop doesn’t dispute Mintel’s finding2 that most Americans would prefer to lose weight via healthy eating alone. But, he says, "If only it were that simple."

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Weight Management

Metabolic health “is quickly becoming a new approach that encompasses weight wellness and healthy carbohydrate and fat metabolism,” says OmniActive’s Lynda Doyle.

one magic bullet to the next with the hope that something will eventually work.” Shoppers are “becoming better informed about their supplement choices and relying more on science-supported facts and less on television pundits.” The category is still “huge,” she says, “and consumers are willing to pay a premium for products as long as they work.”

Forest for the Trees
As well they should, for the dividends may accrue not just to industry or them personally, but to public health writ large. Why? Because far more concerning than the occasional weight-management scandal is the obesity epidemic and its costs.

Hagerman cites a Center for Food Safety and Applied Nutrition (CFSAN) study1 showing that most adverse events involving supplements relayed to poison-control call centers in 2006 were minor, “and of the more significant events, caffeine and yohimbe-containing products were the primary culprits,” he says. By contrast, and for perspective, he points to CDC’s verdict2 that “obesity is a public health priority because obesity is correlated with excess morbidity and mortality.”

So if safe and effective supplements can help bend that curve, industry experts believe they should. Says Majeed, “Not every person is the same, so adding a well-designed weight-management supplement, for some, can help get results they may not be getting from diet and exercise alone.”

Metabolic Methods
Smart formulations focus “not just on losing pounds,” Doyle adds, “but, rather, on a longer-term view of health that encompasses other endpoints important to consumers.” Take metabolic health, which she says “is quickly becoming a new approach that encompasses weight wellness and healthy carbohydrate and fat metabolism.” This approach, if successful, leads not just to lost pounds, but to improved cholesterol, triglycerides, and blood-sugar levels—and to lower blood pressure, too.

Her company has developed a class of “metabolic synergizers” that includes its new Salacia extract, OmniLean. Ongoing studies have examined OmniLean’s effect on reduced carbohydrate and fat absorption, satiety, and healthy glucose maintenance, among other endpoints, Doyle says, and the product is the first to go through the company’s “rigorous” PlantActive Verification program, which “specifically characterizes both bioactive compounds and bioactivity” using DNA analysis and high-performance thin-layer chromatography (HPTLC). “This ‘fingerprint’ of actives and their activity in the body reflects the advantage of providing the multiple benefits of a healthy metabolism in a single ingredient,” she says. (For more on OmniLean, turn to page 34.)

Skop adds that an extract of white kidney bean (Phaseolus vulgaris) his company markets as Phase 2 Carb Controller also acts on metabolism. By temporarily binding alpha-amylase, the enzyme that digests starch, the ingredient allows “a portion of the carbs to pass through the system undigested,” he says. Undigested carbs translate into less caloric impact and, the thinking goes, weight loss. Though the ingredient isn’t new, its tenure on the market is evidence of its dozen-plus human studies demonstrating safety and efficacy. Consumer research also indicates that Phase 2 introduces no taste or texture differences compared to a control in a variety of carbohydrate-rich foods. Skop adds that the company now offers stick packs of the product in a sprinkle-on format marketed as DietSpice, which he describes as “a unique and tasty” blend of the extract with natural herbs and spices.

Another product that targets metabolic balance is a proprietary blend of citrus flavanone-O-glycosides from bergamot and eurypeptides from Eurycoma longifolia that HP Ingredients (Bradenton, FL) calls CitruSlim. According to Annie Eng, the company’s CEO, the product promotes anabolism, reduces the stress hormone cortisol, and activates the enzyme AMP-activated protein kinase (AMPK), which itself stimulates ketogenesis and fatty-acid oxidation in the liver and skeletal muscle. Other benefits Eng lists include inhibition of adipocyte lipolysis,lipogenesis, and cholesterol and triglyceride synthesis; proper uptake of glucose in muscles; and modulation of insulin secretion by the pancreas. In an unpublished study involving 50 moderately overweight men and women who participated in a six-week program of stress management, nutrition intervention, exercise, and supplementation with either 200 mg of CitruSlim or a placebo, the experimental group not only displayed a higher program completion rate than the placebo group—95% compared to 80%—but also showed significant loss of body weight averaging 2.7 kg, of which 2.4 kg was fat. Compare...
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“METABOLIC SYNERGIZER” IS A NEW CATEGORY IN DIETARY SUPPLEMENTS, FIRM SAYS, AND IT’S NOT WEIGHT MANAGEMENT

At the recent Natural Products Expo West trade show in Anaheim, CA, OmniActive Health Technologies (Morristown, NJ) offered a sneak peek at its newest ingredient, OmniLean. OmniLean, a Salacia extract, addresses multiple facets of metabolic health, including glucose and lipid management. And while the ingredient provides weight-loss benefits, the company says it is not calling this a weight-management ingredient. Instead, the company has coined a new term that it hopes will give birth to a new dietary supplement category: metabolic synergizer.

“We created this term, metabolic synergizer, to represent a class of ingredients that support multiple facets of metabolic health,” says Lynda Doyle, vice president, global marketing, OmniActive.

Instead of focusing on a singular approach to weight management, such as addressing satiety, carbohydrate metabolism, or lipid management, OmniActive says its ingredient takes a more holistic route to overall health that encompasses not just weight management but also metabolic health.

“Weight management has essentially become a stagnant term,” says Brian Appell, marketing manager, OmniActive. “More people aren’t necessarily looking for solutions to be healthier as they’re starting to lose weight, because while their immediate concern is, ‘Yes, I’m overweight,’ they also understand that there’s a constellation of other conditions that are associated with being overweight. There are long-term consequences. Those long-term consequences include insulin resistance, low HDL cholesterol, high blood pressure, high triglycerides, and visceral fat.

According to OmniActive, OmniLean is being studied for its effects on all of these parameters. The company says it targets reduced carbohydrate and fat absorption, satiety, healthy glucose management, and cholesterol management and heart health. “Traditionally, the way most people look at managing these various aspects of health is by taking multiple ingredients,” Appell says. But OmniLean is “a single ingredient to really address these multiple issues.”

“Weight management is a side benefit of this product,” Doyle adds. So far, Doyle says the ingredient has shown significant weight-loss effects in animal studies and that the company also has in vitro evidence. In addition, the company is getting ready to present and publish one human study that showed the ingredient was efficacious at doses of 300–500 mg. She also claims that this dose of Salacia extract is much lower than doses used in other studies on Salacia extracts, which often range between 0.5–2 g. “We’ve created a very highly potent bioactive compound so that you need a lower dose,” she says.

For now, OmniActive isn’t publicly disclosing the exact species of Salacia in OmniLean. Doyle says it isn’t Salacia oblonga, nor is it Salacia reticulata. She does say, however, that the company screened more than 80 different extracts and that OmniLean was the final choice.

Appell says the company doesn’t see OmniLean as competing with other weight-management ingredients such as thermogensics, including OmniActive’s own Capsimax capsicum extract: “They’re really targeting different demographics.” Capsimax, he says, is for active individuals who are looking to “enhance their performance.” By contrast, OmniLean is for individuals “who are struggling but who need help with their diet,” Doyle says. “It’s more for a general platform of long-term health and wellness.”

OmniActive says OmniLean reflects a shift in how today’s consumer is looking at weight loss. “People are not so much looking at, ‘I need to lose 10 pounds;’ now it’s more like people are saying, ‘I need to lose 10 pounds, yes, but I also understand that my blood sugar might be out of whack, my cholesterol might be high, and, yes, it might be because of my weight, so I need to address those as well as losing weight,” says Doyle.

from Fat to Lean

C. forskohlii might also improve body composition by promoting lean body mass, if several clinical studies are to be believed. Forskolin, a labdane diterpenoid occurring naturally in C. forskohlii roots, increases both the cellular concentration and function of cyclic AMP (cAMP). Notes Sabinsa’s Majeed, cAMP is “a very important secondary messenger” that regulates the body’s thermogenic response to food and increases its basal metabolic rate. “Since thermogenesis is preferentially
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“Many traditional weight-loss brands have migrated to a healthy-lifestyle positioning,” says DuPont’s Greg Paul.

fueled by fatty acids derived from body fat and/or food,” he says, the body sacrifices some of its fat stores to keep the process going and is left with a relatively higher proportion of lean tissue.

Getting the body to use more of its stored fat and improve its lean-to-fat ratio is a sound weight-management strategy, says Joseph Moritz, PhD, science manager, BASF Nutrition & Health (Florham Park, NJ). “Typically, those on low-calorie diets will lose both fat and muscle,” he notes, “causing them to reach a plateau of slowed metabolism at around 10%-20% of body weight and leading to a rebound effect in weight when the diet ends.” But because muscle is a “metabolically active organ,” he continues, maintaining muscle while losing weight sets up the body for better long-term success.

Enter conjugated linoleic acid (CLA), which clinical and laboratory studies show both inhibits fat storage and increases activity in skeletal muscle cells, the furnaces that burn fat for energy. Moritz says that his company’s Tonalin CLA reduces body fat by up to 10% while increasing lean muscle mass. He adds that its “unique isomer composition developed from a patented purification process” yields “an ultra-high percentage of active isomers.” In clinical trials, subjects taking Tonalin CLA sustained fat loss “over the duration of the trials,” Moritz notes. “Compare that to the yo-yo dieting effect in which weight loss isn’t sustained.”

Are You Satisfied?

With more consumers hoping to manage weight through old-fashioned diet and lifestyle changes, “the opportunity for satiety-promoting foods and beverages is greater than ever,” notes Greg Paul, marketing director/global consumer segments, DuPont Nutrition & Health (St. Louis).

Satiety is a complex process that ropes in feedback from the gut to the brain, with—among other signals—higher glycogen stores in the liver telling the central nervous system (CNS) that energy is present and satiety is achieved. Majeed’s company, Sabinsa, markets a product, GarCitrin, that spurs fat metabolism in the liver, thereby stimulating gluconeogenesis and hepatic glycogen storage. Made from the fruit of Garcinia cambogia, it contains the active (−)hydroxy citric acid (HCA), which, Majeed says, is a “potent” linear competitive inhibitor of the ATP citrate lyase enzyme. “This leads to the reduction of both fatty-acid synthesis and lipogenesis,” he notes, adding that HCA also facilitates fatty-acid oxidation through activation of L-carnitine acyltransferase, “which meets the energy requirements of the body.”

The product, which contains 50% HCA and 5% garcinol, “has been found to reduce appetite levels compared to an HCA-rich natural extract,” Majeed notes. In a study of 46 overweight healthy women who took a 500-mg HCA-rich natural extract or 500 mg of GarCitrin for 12 weeks, significant differences in total body weight and composition, self-assessed appetite, and energy levels emerged between the two groups, with the GarCitrin group showing a higher activity, Majeed says.

Hagerman notes that his company’s PhosphoLean N-Oleoyl-PE + epigallocatechin gallate (NOPE + EGCG) acts as a lipid mediator, with its active compound oleoylethanolamide (OLA) binding cell-receptor class peroxisome-proliferator-activated receptor alpha (PPAR-alpha) sites in the intestine to suppress appetite.

But if that sentence alone 1) triggers bad memories from college o-chem lectures and 2) makes simply eating less and exercising more look like a better weight-management route, DuPont’s Paul notes that old-fashioned protein is a reliable and strong satiety inducer. “Specific hormones from the gut are released in the presence of protein,” he explains. “These hormones signal an area in the brain associated with food intake, creating a fullness feeling that slows and, ultimately, stops food intake.” As if that weren’t appealing enough, protein has “a very positive health halo with consumers,” Paul adds, allowing it to position a product as being friendly to weight management without limiting its reach to one segment.

As Paul puts it, “Many consumers now realize that it takes more than just a change in diet to lose weight; it takes a lifestyle change.” Savvy marketers realize this, too. “That’s why many traditional weight-loss brands have migrated to a healthy-lifestyle positioning,” he says. “Those who’ve held steadfast to a weight-loss positioning are competing for a smaller consumer base. Though there are still some winners in this market, those finding success are far fewer than in the past.”

Kimberly J. Decker writes for the food and nutrition industries from her base in the San Francisco area, where she enjoys eating food as much as she does writing about it.

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When the food and dietary supplement industry thinks of probiotics, it should think less about a "digestive health" banner and more about the myriad ways bacteria influence our bodies. The seemingly endless relationship between bacteria and good health hints at just how limitless a future probiotic market could be, and not just for humans.

Scientists have published hundreds of studies on probiotics and health. The following are just some of the latest.

**Digestive Health**

But first, if history is any guide, probiotic research will continue to focus on digestive-health disorders. A wealth of such research has already taken place, with many positive outcomes, and more is underway. In recent years, government bodies have even granted a few related health claims.

Back in 2014, DuPont Nutrition & Health (Madison, WI) earned Europe’s first probiotic health claim for HOWARU Bifidobacterium lactis HN019, in Switzerland specifically. Here, manufacturers can promote the ingredient as "supporting digestion by reducing [stool] transit time." Meanwhile, DuPont Nutrition & Health continues its probiotic research in this and other health fields, with still much to learn.

More recently, Lesaffre Human Care (Milwaukee) got the okay from Health Canada for a health claim for Saccharomyces cerevisiae, known commercially as ibSium. A single-capsule dose of ibSium can label locally as "Helps to reduce abdominal pain and discomfort associated with irritable bowel syndrome [IBS]." The claim is backed by a 2015 clinical trial on 179 IBS sufferers, in which eight weeks of ibSium consumption was linked to greater improvement in abdominal pain than placebo, and without stool modification. A more recent trial, on more subjects and a higher probiotic dose, found a higher number of bowel movements and a trend towards softer stool with ibSium use, compared to placebo, within a subset of constipated subjects. In an interview with Nutritional Outlook, Lesaffre said it’s considering another ibSium study only on IBS sufferers with constipation, and it should be implemented very soon.

While probiotics are showing signs of digestive utility on their own, another option is to combine them with doctor-recommended pharmaceutical drugs, where situations arise. Sabinsa Corp. (East Windsor, NJ) presents this possibility in a study published last December on Bacillus coagulans MTCC 5856, a probiotic strain better known as LactoSpore. When 36 subjects with diarrhea-predominant IBS were assigned to 90 days of LactoSpore or placebo, alongside pharmaceutical drugs domperidone and esomeprazole, LactoSpore users reported significant decreases in bloating, vomiting, diarrhea, and abdominal pain, as well as improved stool frequency, compared to subjects using the drugs alone. The result is complemented by a rat study, published this February, linking this good bacterium to anti-diarrheal activity.

While studies continue to churn out, with various durations and doses of probiotic consumption, Chr. Hansen (Hørsholm, Denmark) recently finished what it says is now “the largest dataset ever” published on probiotics and bowel function in healthy subjects. In the study on more than 1200 subjects who reported low defecation frequency and abdominal pain but who were otherwise healthy, Bifidobacterium animalis subsp. lactis, or BB-12, was linked to improved bowel regularity in just four weeks, compared to placebo. The research for Chr. Hansen continues and, as with most probiotics, requires further elucidation of the mechanisms of action.

**Metabolic Health**

How gut bacteria may affect weight gain and metabolism is a subject less understood, but a fascinating one, nonetheless. With the continual rise of obesity and metabolic disorders among consumers, this particular area of research could be a boon for probiotic ingredient suppliers and product manufacturers. A few probiotic strains are already exhibiting potential in the category.

DuPont Nutrition & Health is exploring probiotics and diabetes management with a bacterial strain known as Bifidobacterium animalis subsp. lactis 420, or B420. After a 2014 study on obese mice linked B420 consumption to decreased fat mass and weight
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gain, and improved glucose tolerance, the company established a human study in hopes of corroborating that result. More than 200 overweight adults were assigned to consume B420, with or without a polydextrose prebiotic, or placebo for six months. The B420 human study is now complete, and DuPont Nutrition & Health plans to communicate the results this spring.

Another probiotic making headlines in weight gain and metabolism research is Lactobacillus reuteri SD5865, a strain cultivated by Nutraceutix (Redmond, WA). In a 2015 study published in Diabetes Care and previously covered by Nutritional Outlook, glucose-tolerant subjects consumed L. reuteri SD5864 in yogurt for four weeks daily. While the duration of probiotic consumption may not have been enough to yield noticeable changes in body mass or composition, it was linked to a marked stimulation of factors relating to glucose metabolism and insulin secretion, such that may be of benefit to those with glucose intolerance or type 2 diabetes.

Could studies like these be just the tip of the iceberg for probiotic research on metabolism? “I think we will have to wait and see,” says Tony Blanch, QA and corporate services director for Nutraceutix, “but as diabetes is so related to digestive and absorptive metabolism functions, I believe it is likely we will continue to get new and surprising findings in this field.”

Women’s Health
Beyond mother’s milk, good bacteria help women in other gender-specific ways, and probiotic consumption may be a part of many solutions.

Chr. Hansen already has a handful of studies in the books for Urex, its oral-dose combination of Lactobacillus rhamnosus GR-1 and Lactobacillus reuteri RC-14. Throughout the last several years,
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**PROBIOTICS FOR…ANTIBIOTICS?**

Antibiotic use is often associated with short-term side effects, including digestive issues. But what about potential for long-term side effects? If antibiotics have any chance of disturbing the balance of bacteria in the body, for instance, might this warrant concomitant use of probiotics when antibiotics are absolutely necessary?

Researchers in the Netherlands are trying to figure this out, with infants as their subjects. In a currently recruiting study (ClinicalTrials.gov identifier NCT02536560) planned for 450 infants, 150 will be exposed to antibiotics (by hospital protocol, due to “high suspicion of perinatal infection”). Over a year’s time, researchers will assess each infant for coughing, wheezing, rash, food allergy, and various other symptoms that might indicate a compromised immune system, as well as differences in fecal microbiota. If infants exposed to antibiotics exhibit inferior outcomes, this might warrant consideration of probiotics alongside antibiotics in infants and other developing humans.

“These findings can be important,” write the researchers in their outline, “since there is evidence that manipulation of the infant microbiota, by using pre- or probiotics, can restore the ecological balance of the microbiota and may mitigate potential negative effects on the developing immune system, when use of antibiotics cannot be avoided.”

Urex consumption in women has been associated with better-than-placebo recovery from vaginosis, alone or alongside drugs, and increased efficacy of antifungal drugs prescribed for yeast vaginitis. By increasing counts of healthy bacteria in the vagina, particularly *Lactobacilli* species, the vaginal microbiota is getting an added defense against pathogenic bacteria.

This Urex logic and science was enough for South Korea to give Urex a probiotic claim for women's health in 2014. Still, ongoing studies on the probiotic combo are expanding into other areas of female sexual health, like urinary tract infections, bacteriuria, and even pregnancy.

Maj Britt Larsen, a scientific advisor at Chr. Hansen, says that increasing knowledge has shown that probiotics may assist in preventing pregnancy complications, such as preterm birth. “Prior to initiating these clinical studies,” she adds, “it was important to link the documentation of safety, as well as efficacy, in non-pregnant women.”
Elsewhere in Lactobacilli findings, scientific posters presented at this year’s Probiota conference link consumption of Lactobacillus fermentum CECT5716 to reduced incidence of mastitis in lactating women, and SymbioVag, a suppository of Lactobacilli and inulin, to a lessening of vaginosis over 10 days of use.

Anyone interested in the ongoing science on female health and probiotics should explore the upcoming event “Women and Their Microbes,” a scientific conference on female health and probiotics taking place in Amsterdam this June.

**Immune Health**

Since a considerable amount of the human immune system resides in the human gut, researchers are actively exploring whether probiotics can, from the gut, influence very general immunity. Logically, some have centered on the illnesses that humans are mostly familiar with, including the common cold and flu.

Although a few trials have linked probiotic consumption to reduced incidence of respiratory illnesses, such as one using a strain sourced from Japanese pickles12, other trials have provided more modest results, like reduced duration of cold or flu. In June 2015, a Chr. Hansen study on 1104 adult subjects found that flu-vaccinated subjects who consumed milk with a probiotic ingredient (Lactobacillus casei paracasei subsp. paracasei 431, or L. casei 431), compared to placebo, experienced an average shorter duration of upper respiratory illnesses, such as one using a strain sourced from Japanese pickles12, other trials have provided more modest results, like reduced duration of cold or flu. In June 2015, a Chr. Hansen study on 1104 adult subjects found that flu-vaccinated subjects who consumed milk with a probiotic ingredient (Lactobacillus casei paracasei subsp. paracasei 431, or L. casei 431), compared to placebo, experienced an average shorter duration of upper respiratory illnesses. All of these factors increase the temperature in cow rumen, reducing the temperature in cow rumen, which would reduce the stress and labor associated with resulting health evaluations.

Although so much about probiotics is still left to uncover, these are telling indications of what they can do for man and animal.

**Exercise**

The notion that probiotics may benefit exercise is not as steeped in research as some other health-related areas, but small signs suggest probiotics may have an impact here, especially since exercise and immunity are closely related. When 16 resistance-trained men were assigned to consume a capsule containing probiotics (Bifidobacterium breve BR03 and Streptococcus thermophilus FP4) from Probiotical Spa (Novara, Italy) or a placebo for 21 days prior to “muscle-damaging exercise,” probiotics “likely attenuated” performance losses at 24, 48, and 72 hours post-exercise. The results were presented at the Probiota probiotic conference held earlier this year.

More recently, results of a study published online by Applied Physiology, Nutrition, and Metabolism suggest that the probiotic strain Lactobacillus helveticus Lafti L10, from Lallemand–Institut Rosell (Montréal), reduced the duration of respiratory infections in athletes better than placebo, over 14 weeks. Self-reported athletic vigor was also higher in probiotic users compared to placebo users at the end of the study.

**Fermented Dairy Beverages**

Understandably, not all consumers want to swallow a probiotic pill. For these cases, fermented dairy drinks, such as kefir, offer alternatives for ingesting probiotics. Science on these drinkable products is ongoing, albeit still somewhat limited.

A systematic review of skin-health studies on fermented dairy products, published last summer, found “early and limited evidence” that these products may improve skin health when ingested or applied topically. Months later, an isolated clinical trial on 67 adults linked consumption of a kefir beverage to a reduction in inflammatory C-reactive protein after exercise.

**Livestock**

As useful as probiotics may be for humans, livestock can also benefit, and not just with increased performance. Chr. Hansen’s newly acquired livestock probiotics, through its purchase of the U.S.-based Nutritional Physiology Company, reportedly increase chicken egg output, among other uses, and experts with Phileo Lesaffre Animal Care’s “The Farm” research initiative, announced last summer, say their probiotic-containing yeasts increase milk yields and feed efficiency while also helping livestock digest their food (primarily fiber). Probiotic ingredients can improve the welfare of livestock in multiple other ways, like requiring less antibiotic use, and, according to a recent Lallemend study, reducing the temperature in cow rumen, which would reduce the stress and labor associated with resulting health evaluations.

Although so much about probiotics is still left to uncover, these are telling indications of what they can do for man and animal.

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**Robby Gardner** is the former associate editor of Nutritional Outlook magazine.

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Will cocoa flavanols be the key to good health?

BY MAUREEN KINGSLEY

consumer media have, for the past couple of years, been hailing chocolate (particularly dark chocolate) as offering such health benefits as lowered body-mass index and improved mood. Unfortunately for chocolate lovers everywhere, these claims for chocolate itself have not yet been sufficiently borne out by scientific research. What is coming to light, however, are some of the effects cocoa flavanols, bioactive compounds naturally present in the cacao bean, have on the human body.

The amount of flavanols in a cocoa-based product depends on various factors, including plant genetics, the method used for harvesting it, how the cocoa itself is processed, and how the final product is prepared. (For more on this, turn to page 78.)

The effects of cocoa flavanols on human health may include improved vascular function and cholesterol levels in the general population, improved blood-vessel function in patients with kidney failure, and improved memory and cognition.

It is important to keep in mind, however, that the studies to date on these effects of cocoa flavanols have been small, and further evidence is needed to support them, in the form of large-scale randomized trials. To this end, the Cocoa Supplement and Multivitamin Outcomes Study (COSMOS), based at Harvard University–affiliated Brigham and Women’s Hospital and in collaboration with Mars Inc., is enrolling 18,000 participants and is the first large-scale, long-term randomized trial examining cocoa flavanols’ benefits. For this study, women 65 or older and men 60 or older will be randomly assigned to consume either 750 mg of cocoa flavanols per day in capsule form or an identical capsule containing a placebo.

JoAnn Manson, MD, chief of the Division of Preventive Medicine at BWH and co-leader of the COSMOS study, stated in press statements about COSMOS that the trial “builds on a decade of scientific evidence indicating that cocoa flavanols improve blood-vessel function, metabolic health, and cognition. The depth and breadth of this innovative trial are unprecedented.”

The following sections summarize three of the more promising potential benefits cocoa flavanols may offer.

COSMOS is the first large-scale, long-term randomized trial examining cocoa flavanols’ benefits.

The researchers will follow the participants for four years and compare the numbers of heart attacks, strokes, and deaths in each group. Ancillary studies will be centered on potential benefits of cocoa flavanols on brain health, including memory, decision-making skills, mood, and cognitive performance, and on metabolic health.

Cardiovascular Benefits

Most studies on cocoa flavanols’ effects on cardiovascular health indicate that the flavanols can improve vascular function and blood pressure and raise HDL (“good”) cholesterol levels. For example, studies published recently in Age and the British Journal of Nutrition demonstrated that consuming cocoa
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flavanols significantly improved vasodilation in both young and older men (Age) and improved blood-cholesterol profile, blood pressure, and vasodilation in healthy men and women (British Journal of Nutrition).

Results from the COSMOS trial, expected in 2019, will likely shed additional light on cocoa flavanols’ benefits on cardiovascular health.

**Improved Blood-Vessel Function in Kidney-Dysfunction Patients**
The American Society of Nephrology reported in December of last year the results of a study investigating the effects of cocoa flavanols on patients with kidney failure. The study, led by Tienshu Rassaf, MD, of University Hospital Essen (Germany), found that consuming a beverage containing cocoa flavanols improved blood-vessel function in patients with kidney failure.

Rassaf’s team randomized 57 dialysis patients to drink either a cocoa-flavanol–rich beverage or a control beverage free of flavanols (but that otherwise matched the nutrient profile of the test beverage) every day for 30 days. After those 30 days, the investigators found that the cocoa flavanols were tolerated well by patients and improved their blood-vessel function and reduced diastolic blood pressure.

**Memory and Other Cognitive Improvements**
Cocoa flavanols may improve memory and offer additional cognitive benefits. Results of a study published in the journal *Nature Neuroscience* just over a year ago suggest that consuming cocoa flavanols reverses age-related memory decline in healthy older adults. A press release issued by Columbia University Medical Center (New York City), where the research originated, stated that this study “provides the first direct evidence that one component of age-related memory decline in humans is caused by changes in a specific region of the brain [the dentate gyrus] and that this form of memory decline can be improved by a dietary intervention.”

When research subjects’ brains were imaged, the research team found “noticeable improvements in the function of the dentate gyrus in those who consumed the high-cocoa–flavanol drink,” lead author Adam M. Brickman, PhD, is quoted as saying in the press release. This group performed better on memory tests.

Senior author Scott A. Small added that the team’s findings will need to be replicated in a larger study.

Maureen Kingsley is a freelance writer, editor, and proofreader based in Los Angeles. She covers a variety of industries, including medical technology, food-ingredient manufacturing, and cinematography.
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Of all the benefits plant proteins offer, sustainability might just be the most crucial.

BY KIMBERLY J. DECKER

According to the United Nations Department of Economic and Social Affairs, the current global population of 7.3 billion is on track to reach 9.7 billion by 2050. With that many more mouths to feed, the Food and Agriculture Organization (FAO) calculates that food production will have to grow by 70% just to keep up.

But what foods to produce? Assuming we want all those new humans to grow up strong, smart, and productive members of society, we'll need to supply them with sufficient high-quality protein to stave off the physical, cognitive, and metabolic damage that protein malnutrition wreaks.

So does that make flank steak a human right? Not if we know what's good for us or our planet, says Alan Rillorta, director of branded ingredient sales, AIDP Inc. (City of Industry, CA). "Production of every kilogram of meat protein takes an input of 7 kilograms of plant protein," he explains. "Not a very efficient conversion, right?" If the UN's population projections bear out, "Imagine what the resulting food production would do to our world if we continued with the same habits as we have now?" he asks. "It's simply not sustainable for our future."

That future may be a way off, but its portent puts the present vogue for plant-based proteins in a new perspective. The celebrity diets, lifestyle features, and breathless marketing that surround the phenomenon may carry the whiff of a fleeting fad, but for those taking the longer view—like Rillorta—plant protein is serious stuff. Don't call it a "passing trend," he insists, because "a passing trend is something that implies freedom of choice." With more people exerting more pressure on the earth's limited resources, "I don't think we're left with much choice but to continue seeking more sustainable and environmentally friendly solutions," he says. In other words, we're left with plant protein.

Protein Prominence

That's not a bad thing to be left with in today's nutrition environment. Fully 78% of consumers consider protein in general to be an important part of a healthy diet, and more than half of adults claim to want more of it, according to "Protein Perceptions and Needs," a 2014 report from The NPD Group (Chicago). And whether those consumers are on the "Paleo" plan or just looking for an excuse to call burgers health food, Rillorta traces their preoccupation back to the usual suspect: the Internet.

"We're in an information age where information spreads quickly," he says. "Within a short amount of time, the idea of needing more dietary protein has really taken off." The upshot: the entry into the market of entirely new segments of consumers "who never really consumed supplemental proteins before," he says.

Rikka Cornelia, product manager, BI Nutraceuticals (Long Beach, CA), agrees. Just look at demand for protein powder. "Once only popular amongst bodybuilders," she says, "it's now gone mainstream with a broad range of consumers, from those aiming to maintain a healthy lifestyle to vegetarians seeking protein supplementation."

Bumper Crop

Not long ago those vegetarians were limited mainly to soy-based options. But the variety of plant-sourced proteins available to them...
and others has shot through the roof. The boom reflects a more general shift in American diets to plant-based eating, notes Yoko Difrancia, public relations and marketing manager, House Foods (Garden Grove, CA), who cites a recent survey that her company conducted with Wakefield Research finding that 55%—“more than half”—of Americans plan to eat more plant-based foods in 2016 than in the prior year.

Fifty-five percent of Americans cannot all be vegetarians, so even meat eaters must be finding something to love about the plant kingdom. And indeed, "In the last few years, flexitarians have become a new market" for plant proteins, making up an estimated quarter—and growing—of the total, notes Udi Alroy, vice president, marketing and business development, Hinoman Ltd. (Tel Aviv, Israel).

What drives them all to plant proteins is a collection of qualities encompassing plant proteins’ perceived labeling cleanliness and “natural” bona fides, compatibility with allergen-free diets, and "pleasing organoleptic properties” compared to earlier protein generations, says Danielle Black, product manager, Glanbia Nutritionals (Fitchburg, WI). And don’t discount the novelty factor, either. Adds Alroy, “Vegetarian-source proteins are viewed as innovative and have a lot of appeal among ‘early adopters,’ who are becoming key opinion leaders.”

Beyond that, Cornelia believes that plant proteins are unique in providing two paired properties that mindful consumers increasingly seek: nutrition from a cruelty-free source. “Nutrition speaks to the population’s concerns about health, and cruelty-free speaks to their concerns about ethics,” she says. “And these concerns aren’t passing fancies. As consumers learn more about foods and their supply chains, the stronger their stances on these issues become.”

Sustainability Stories
Which is where plant proteins’ sustainability story really shines. Notes Tyler Lorenzen, president, proteins and ingredients, World Food Processing (Minneapolis), plants produce more protein per acre—“in some cases, nearly 1,000 pounds of protein per acre”—than other sources. “One acre of peas can feed over 9,000 humans,” he points out, “where one acre of beef can feed approximately 500.”

Plant protein can feed more people with a smaller energy input, as well. Research by David Pimentel of Cornell University’s College of Agriculture and Life Sciences calculates that animal-protein production requires more than eight times the fossil-fuel energy of plant-protein production—and all for a yield only 1.4 times more nutritious than a comparable quantity of plant protein. Animal agriculture is also a leading consumer of water, Pimentel adds, with production of 1 kg of grain-fed beef requiring 100,000 liters, while soybeans need only 2,000 liters per kg produced.

And from a marketer’s standpoint, plant proteins have a compelling financial sustainability story to tell relative to animal-based options. For whether those options come from egg, dairy, or meat, their costs “are always fluctuating,” Rillorta says. The price of whey, for example, “has dramatically increased over the past few years” while the amount consumers pay for a tub of whey powder “hasn’t been increasing at the same rate.” That cuts into margins and increases the appeal of comparatively affordable proteins sourced from plants, beans, or grains.

“If marketers prefer to remain healthy, profitable businesses,” Rillorta says, “they need to adapt.”

And they are. “Most companies that we reach raise sustainability as one of their key factors in making decisions about new and future ingredients, and this is pushing them toward plant-protein solutions,” says Alroy.
Consumers, however, don’t always feel the same pressure. To be sure, plant protein’s sustainability advantages are, “to a certain degree, on consumers’ radars,” Difrancia says, but mainly “among those who are conscious about current practices, where so many resources are wasted.”

For now, sustainability doesn’t hold as much sway as hypoallergenicity, clean labeling, and simply being plant based. And, Rillorta adds, “I think that the majority of consumers are still primarily driven by the numerical protein content on the label.” His advice: “Let’s give this a bit more time to develop, as with each passing generation and increasingly easier access to information, society is becoming more environmentally conscious of its actions.”

The Tried and the Trending

Until then, look to industry to advance the field—and for good reason. Notes BI Nutraceuticals’ Cornelia, “Sustainability pulls food and beverage processors more toward plant proteins than it does consumers because they’re more aware of how sustainability directly affects their businesses. If an ingredient isn’t sustainable, it negatively affects their profits; they’d have to reformulate, change labeling, and more. So sustainability also mitigates supply-chain risk.”

In the plant-protein category, “soy has traditionally been the bell ringer,” Glanbia’s Black says. And as its functionality, sensory properties, and application versatility have grown, its nutrition and sustainability still drive its popularity. Difrancia notes that 67% of tofu consumers participating in her company’s poll choose it for its health benefits. And as for the soybean itself, it’s “proven to be a more favorable and environmentally sustainable source of protein because of its high-quality protein and nutritional value, coupled with the efficient use of land, water, and energy involved in its production,” she says. With all nine amino acids, soy qualifies as complete; moreover, soybeans’ protein-digestibility corrected amino acid score (PDCAAS) of 0.9 “is equivalent to beef,” she says, and the PDCAAS for soy protein isolate, like those for milk and egg, is 1.0—the maximum a protein can attain.

But while soy still dominates the plant-protein segment, “We see more interest in non-soy options,” Hinoman’s Alroy says. Options like…duckweed? Yes, Hinoman’s proprietary, high-protein strain of this aquatic...
plant (subfamily *Lemanceae*), called "mankai," is "getting buzz" as a vegetarian protein, Alroy says. Less specialized strains have thrived in Southeast Asia for generations, but his company harnessed a sustainable hydroponic technology—developed, along with the strain itself, over years of research and development—to grow the protein source rapidly year-round, at higher volumes, without pesticides, and using 10 times less water than might go into cultivation of an equal amount of, say, spinach. The process guarantees the mature plant a minimum protein content of 45% on a dry-weight basis and an amino acid profile that nearly matches animal proteins, with all the essential amino acids, a high proportion of branched-chain amino acids, and a PD-CAAS of 0.89. That makes it “more potent than super vegetables such as spinach, spirulina, and kale,” said Ron Salpeter, Hinoman CEO, in a press release. And it also makes mankai a protein to keep an eye on.

Rillorta is bullish on hemp, “if we can ever get beyond our negative stigma.” Once a top industrial crop until the anti-marijuana movement snuffed it out in the middle of the last century, hemp “is a very sustainable plant,” he says. It grows rapidly and in a variety of climates, soil types, and tightly spaced plots, and it’s naturally resilient to pests, producing high yields with less acreage. “Also,” Rillorta adds, “many different parts of the plant can be used in an array of applications, so very little of the plant is wasted.”

And he still hasn’t “given up on rice.” Processors already use the starch in everything from noodles to desserts, and because starch and rice protein are processed together, “The more rice starch produced, the more rice protein produced, and all this protein will need to find a home somewhere,” Rillorta says. Rice protein offers processing advantages, too, including a lighter color and cereal-like flavor that “help dilute the beany notes of pea and soy proteins.” And its “strong presence” of sulfur-containing amino acids balances the amino acid profiles of pulse proteins where such amino acids are lacking.

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and legume-sourced proteins are enjoying a rapturous reception—a warm welcome that World Food Processing’s Lorenzen believes is merited, as such proteins often address many of consumers’ concerns about clean labeling, GMOs, organic certification, chemical processing, allergenicity, and, yes, sustainability.

For example, his company insists on using non-GMO seeds to produce its pea proteins and highlights the fact that peas “give nitrogen back to the soil and convert that nitrogen to useable fertilizer,” he says. Leguminous plants like seeds and beans house symbiotic bacteria in their roots that produce nitrogen. When the plants die, this “fixed” nitrogen gets released into the soil and fertilizes it. “Whether it’s pea, soy, or other pulse, high-yielding, proficient seeds that fix nitrogen are good for farmers’ crop systems,” Lorenzen says. And as with rice and hemp, peas yield several coproducts beyond protein, Glanbia’s Black notes, adding that “both the protein and oil components are used” as ingredients. And as an agricultural crop, she says, flaxseed “delivers on sustainability.” Her company’s HarvestPro line of ingredients taps pea, flax, chia, and ancient grains like quinoa, amaranth, and sorghum as sources for individual and blended vegan proteins for use in everything from bars and beverages to baked foods and cereals. Black says that the company’s EasyFlav technology “ensures a neutral-tasting pea protein ingredient with significantly less green/pea, green/pyrazine bitterness and fewer ‘cardboard’ and nutty notes than straight pea protein.”

As consumers demand more and better plant proteins, Black believes, “there’s room for growth and improvement in the sector—enhancing the nutritional and organoleptic attributes even further, as well as improving processing efficiencies.”

Lorenzen shares her optimism. “Through industry’s commitment to high-yield, high-protein seed technologies, manufacturing close to the source, and innovative ingredient processing, plant proteins are the future in both sustainability and economics,” he says. [1]
Children’s Health

Starting Strong

BY KIMBERLY J. DECKER

As much as we’d like to think of them as miniature adults, children and their nutritional needs are unique. It’s an ill-conceived notion that by simply halving the dose, adding tutti-frutti flavor, and tableting pills in the shape of cartoon characters, we can transform adult supplements into kids’ multis.

If only. Like children themselves, formulating supplements to satisfy their singular nutritional needs is far more complex. Just consider what a child faces during those first few years: The body is building a foundation of bone, muscles, and other structures; the brain and neural connections are knitting patterns that persist for a lifetime; and a naïve immune system grows wiser as it faces assault from all sides. These and other developments demand nutritional mediation, and if the growing child doesn’t get the right substances in the right amounts at the right windows of opportunity, the effects could reverberate well down the line.

But which substances, in what amounts, and when? The answers lie in the field of child nutrition research, which remains a reliable source of scientific ferment. Notes Duffy MacKay, ND, senior vice president, scientific and regulatory affairs, Council for Responsible Nutrition (CRN; Washington, DC), “The influence of nutrition on childhood health and disease continues to be an ongoing area of research that reveals new information on a daily basis.”

In fact, he says, “The federal government announced plans to include guidance on infants, from birth to two years, as well as on women who are pregnant as a group, in the 2020 Dietary Guidelines for Americans.” This would be a government first in providing such guidance, and it’s happening in no small part because “the available scientific evidence is sufficient to support science-based dietary recommendations,” says MacKay. And here’s a look at just what nutrition researchers have to teach us.

Let the Sunshine Vitamin In

Vitamin D, the sunshine vitamin, has enjoyed a degree of celebrity status among adults who, either because they spend too much time indoors under a coat of SPF or don’t drink enough fortified milk, aren’t getting enough of it.

But the implications of insufficient intake on children are perhaps more alarming. “Vitamin D is very important because it plays a key role in bone development by helping the body to absorb calcium,” MacKay explains. “Thus, it’s crucial that kids, especially as they grow and develop, get enough vitamin D.”

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Children’s Health

frequently below quota, especially during winter. In response, Johns Hopkins Children’s Center recommends that pediatricians and healthcare providers screen all kids for vitamin D deficiency and order tests for those who could be at higher risk. “Increased screening of children would really help to avoid prolonged vitamin D deficiency and the health complications it can cause,” MacKay notes.

And if stronger bones aren’t selling point enough, a 2016 study\(^1\) published in *JAMA* found that supplementation with 4,400 IU/day vitamin D in pregnant women lowered the incidence of asthma and recurrent wheezing in their children—although not to a statistically significant level—compared to the reductions seen in children of women who supplemented with only 400 IU/day.

**Iodine IOU**

The vitamin D study affirms how important maternal nutrition and supplementation are to health outcomes in children. Such is also the case when it comes to iodine supplementation. Though iodine is crucial for normal cognitive development in utero and in infants, MacKay explains, it’s “largely dependent on sufficient maternal intake.” Unfortunately, many women of childbearing age in the United States and abroad have a mild iodine deficiency. That leaves their children’s cognitive function at potential risk and has prompted CRN and other organizations to identify iodine deficiency as an emerging public-health crisis.

Groups including the American Academy of Pediatrics, the Endocrine Society, and the American Thyroid Association now recommend that pregnant and lactating women receive a daily supplement of 150 mcg of iodine. What’s more, says MacKay, “CRN developed voluntary guidelines to recommend that its members ensure multivitamin/mineral supplements intended for pregnant and lactating women in the U.S. contain at least 150 mcg of iodine.” The deadline for CRN member compliance with these guidelines is January 2017.

**In for the Long Haul**

According to Harry B. Rice PhD, vice president of regulatory and scientific affairs, the Global Organization for EPA and DHA Omega-3s (GOED; Salt Lake City), one area of child-nutrition research that remains “very active” is on the role of omega-3 fatty acids—particularly the long-chain polyunsaturated fatty acids EPA and DHA—in childhood health.

The reason is elementary: these PUFAs support the growth and function of children’s brains—and, as a result, their cognitive development and performance. Yet “cognition is a difficult area to study,” Rice concedes, and in the wake of equivocal research results in recent years, we’ve seen some questioning of the cognitive benefits long attributed to omega-3s.
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But, maintains Rice, “as with most things, the devil’s in the details.” Rather than a lack of beneficial effect, he believes, the so-so studies more likely reveal “a failure to detect an effect.” That might be because current methods for measuring cognition are insufficiently sensitive—Rice has hope that fMRI scans will be a more potent tool in the future—or because EPA+DHA’s benefits might not be detectable in young children and instead emerge only later in tests of “more specific tasks,” he says. “If true, then, this means that studies on omega-3’s benefits might not be detectable in young children and instead emerge only later in tests of ‘more specific tasks,’ he says. “Several studies have explored the role of prebiotics and probiotics in reducing the risk for allergic disease, such as asthma and eczema.”

A 2013 Cochrane review evaluating the effect of prebiotics in infants for the prevention of allergic disease and food allergy found “strong evidence” that certain prebiotics can prevent eczema in children during the first two years, MacKay says. “This is an area of research that’s building quickly and may expand into other allergic conditions, as well.” And while the review’s authors did caution that “further research is needed before routine use of prebiotics can be recommended for prevention of allergy in formula-fed infants,” MacKay remains bullish: “We’re really looking forward to seeing what becomes of this research and its potential effects on childhood nutrition.”

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Production Challenges, Equipment Solutions

Today’s nutraceutical challenges are no obstacle for sophisticated machinery.

By Melissa KvidaHL

The nutraceuticals industry is in a constant state of evolution, marked by innovative ingredients, products, and trends. Bearing the brunt of all this growth, though, is often the production line, which can easily find itself outdated or underperforming in such a dynamic environment. Here are the top five production challenges proposed by brands, manufacturers, and equipment suppliers, along with the new processing techniques and equipment that can mitigate these challenges and propel quality products into the market.

CHALLENGE #1: Complex Products

Today’s educated supplement consumers are not only demanding complex formulations, but also innovative delivery formats. As an example, says Neftali Tosado, director of global softgel continuous improvement and technology at Catalent Pharma Solutions (Somerset, NJ), “two active nutritionals that were earlier standalone products are now being combined into one multivitamin complex, such as B12 with another supplement, or a triple-ingredient fish oil complex.” And things aren’t much simpler on the delivery side. For example, says Ralf Klotz, sales manager at Uhlmann Packaging Systems (Montville, NJ), “a few years ago, no one had gummy supplements, but now they represent a significant share of the market.”

At Pharmachem Laboratories Inc. (Kearny, NJ), senior director of product development Mitch Skop has noticed a demand for unit dosing, “whether it’s stick packs or a formulation in a screw cap.” Pharmachem has also been challenged to reduce tablet sizes, he says, so consumers have smaller and fewer pills to take.

For Charles Ravioli, managing director of Romaco North America Inc. (Hamilton, NJ), the delivery challenge that comes to mind is demand for effervescent, which “tend to be very sensitive to air, light, and humidity, as well as fragile and highly friable,” he says. “These factors have to be considered at all stages of manufacturing and processes adapted accordingly.”

SOLUTION:
New Technology, New Partnerships

At Charles Ross & Son Company (Hauppauge, NY), sales manager Bill Alhofen is seeing companies make the decision to move from an outside contractor to an in-house approach, where they have better perceived control. To that end, the company offers equipment solutions like Ross Ribbon Blenders, new technology designed to “make blending operation faster, more nimble, more reliable, and easier to clean,” Alhofen says. For those seeking solutions to the effervescent challenge, strip-packaging machines in Romaco’s Siebler HM 1E series are capable of filling fragile effervescent tablets as well as handling small, thin, and fragile tablets.

That said, contract manufacturing remains a solution for many other brands, since many partners are already equipped to meet delivery and formulation demands. Regarding the stick pack trend, Pharmachem recently installed a state-of-the-art stick pack line at its Ogden, UT, plant. Catalent recently onboarded a new rotary die process for its Vegicaps softgel capsules in which the outer capsule shell is created, filled, and sealed in one continuous process.

CHALLENGE #2: Outdated Equipment

It’s no secret that the nutraceuticals industry is being held to ever-higher standards, often rivaling those in the pharmaceutical industry. According to Matt Bundenthal, communications manager at Fette Compacting America (Rockaway, NJ), this means that processors must “carefully monitor and document each step of their manufacturing process in order to prove their products are safe and consistently reproducible.”
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The problem? “There are many rotary tablet press machines being used in the nutraceutical industry that are completely outdated,” says Ryan Keefer, North American sales manager of Elizabeth Companies (McKeesport, PA). “Most of them are manually operated with no production information available, such as compression forces, pressure readings, tablet ejection force monitoring, or any data feedback.”

In an industry where transparency demands are at the forefront, this just isn’t going to work.

**SOLUTION:**
**Affordable Upgrades**

“Relative to tablet compression, nutraceutical manufacturers are no longer content to utilize presses having little or no control for critical tablet parameters, such as weight, thickness, and hardness,” explains Bundenthal. Fette Compacting offers a variety of presses across three different series, the newest of which is the FE75. This high-speed, double-sided tablet press includes three manufacturing modes: mono-layer manufacturing with double-sided discharge, direct compression, and double-layer manufacturing with single-sided discharge. From Elizabeth Companies is a new tablet press line called the Eliza-Press Series, which is economically priced and geared towards nutraceutical manufacturers.

Still, if cost is a hurdle, Keefer recommends discussing with suppliers the option to refurbish and upgrade existing equipment. “This option is usually much cheaper and can extend the life of a specific older machine, while newer equipment options can be reviewed and budget planning can occur for future equipment upgrades,” he says.

**CHALLENGE #3:**
**High Speed, High Quality, Low Cost**

“The biggest challenge is to meet the customer’s demand of manufacturing an innovative product, sometimes with aggressive timelines, while also maintaining appropriate quality standards,” says Sridhar Krishnan, vice president of global operations at Catalent—all while keeping costs low.

**SOLUTION:**
**Optimizing Efficiency**

In developing softgels, Catalent relies on its proprietary end-to-end continuous manufacturing process, as well as a proprietary efficient drying process, which Krishnan says has resulted in a 60% reduction in drying time, better speed to market, and lower cost.

Further, by integrating its services, Catalent has been able to improve supply lead time and even extend product shelf life as a result, he adds. “For instance, Catalent added new coating and blister packaging equipment at its 360,000-sq-ft Eberbach, Germany, softgel manufacturing facility, expanding the integrated softgel solutions available,” he says. “The new coating equipment, designed to coat softgels for controlled, enteric, and targeted release, is capable of processing more than 300 million capsules per year.”

New technology is also streamlining processes at Uhlmann Packaging Systems. Its Integrated Bottling Center, for example, offers format-independent electronic counters which, according to Klotz, “can drive down costs, decrease setup and changeover costs, and increase output based on getting to product runs faster,” all because it does not include format-specific change parts.

**CHALLENGE #4:**
**Ingredient Authenticity**

“Procurement of raw materials generally runs into large quantities,” explains Shaheen Majeed, marketing director of Sabinsa Corp. (East Windsor, NJ). “A very common practice is the adulteration of dried plant materials with other species, or even in some cases, with synthetics.” Some raw materials may also carry high levels of pesticides or metals.

**SOLUTION:**
**Fingerprinting**

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authentic and also contaminant-free.

According to Majeed, authenticity can be confirmed with DNA fingerprinting; additional analytical instruments can detect contaminants (heavy metals, pesticides, etc.) at even very low levels—to the tune of parts per billion or even parts per trillion.

“It is necessary to upgrade analytical tools from time to time,” adds Majeed. “A recent inclusion has been a trinocular microscope with photographic capabilities, equipped with fluorescent polarizer analyzer and phase contrast. This instrument not only helps in identification and authentication of raw materials, but also plays a role in characterization and purity analysis of final products.”

CHALLENGE #5: Maintenance

Like any equipment, nutraceutical processing equipment demands its share of maintenance and cleaning. Without it, particles and dust can cause jams, obscure sensors, or even produce faulty products.

“Dust is one of those seemingly minor issues that, if not properly managed, can exponentially affect an entire operation, particularly by necessitating unacceptable duration or frequency of downstream cleaning,” explains Nic Michel, general manager, North America, at Pharma Technology Inc. (Piscataway, NJ). Further, if the issue isn’t corrected in house, final products with unsightly dust at the bottom of the bottle, or rough edges or logos, can diminish consumer confidence.

The catch? “Traditional vibration-and-vacuum deduster designs are no longer sufficient for optimal dedusting performance,” Michel says. And, explains Charles N. Kettler, PhD, director of Natoli Scientific, a subsidiary of Natoli Engineering Company Inc. (St. Charles, MO), tooling for modern tablet presses capable of minimizing product dusting represents a significant manufacturing cost.

SOLUTION: Compacting and Cleaning Technology

When it comes to tooling, Kettler recommends inspecting after cleaning, addressing training challenges (like issues related to lubrication or alignment), and, when all else fails, knowing when to discard and replace. Natoli’s NP-500 tablet press “offers an industry-leading 1,500-in. depth of fill and can compress with a force of up to 10 tons,” says Kettler. This means it’s equipped to deal with the low bulk densities demanded by nutraceuticals, the dosage of which often require a deep fill option. “The press uses the Natoli 328 45 station tooling that offers a large heat flat for additional dwell time to ensure compaction of problematic powders,” he says.

In the area of cleaning, Pharma Technology recently introduced the PharmaFlex iSeries Deduster, which offers upgrades over its predecessor, including an output increased by up to 20%, a more efficient dedusting process, and enhanced resistance to prolonged heat, alcohol, and industrial detergents exposure, says Michel. It also offers enlarged tablet inlet and outlet ports for higher output, a self-regulating vibratory base with accelerometer, direct sight lines to tablets, and a spiral tower that can be easily exchanged for a clean tower (or tower of a different height) in under three minutes.

Melissa Kvidahl is a freelance journalist and copywriter specializing in the health and wellness industry.
“We Make Ingredients Work”™

“We Make Ingredients Work.”™ Here at Pharmachem Laboratories, our tagline isn’t just short, sweet, and clever; it’s an honest and complete representation of who and what Pharmachem is. We are not merely a supplier or a contract manufacturer, but an authentic solutions provider to help any customer innovate a launch or renovate an existing natural health product.

Our custom approach is the cornerstone of our company. We can manipulate the physical properties of your ingredient while maintaining desired taste, flavor, and nutrition profiles—and, at the same time, ensure they have the necessary third-party and clean-label declarations.

Every day, customers bring us their most perplexing extraction problems, custom manufacturing challenges, and small-to-stubborn processing issues.

A Mission to Add Value
In 1979, Stanley Blackman Laboratories employee David Holmes purchased the company, giving it a new name, direction, and future: Pharmachem Laboratories Inc.

Holmes made his first venture into the nutraceuticals marketplace after discovering that many of the existing companies were indistinguishable, commodity-type businesses. He felt there was a great opportunity in the marketplace for a young company focused on providing value-added products and services. That formula turned out to be the perfect prescription for the company’s growth and future success.

From its humble beginnings with just one production facility and nine employees, Pharmachem Laboratories grew into a major supplier of custom and specialty nutritional ingredients, as well as process services. Today, Pharmachem is a family of companies operating 11 facilities across the U.S. and Mexico, each a leader in its own field.
Throughout the 1980s, Holmes led Pharmachem to invest heavily in new technology and equipment to improve its granulation techniques and to make its ingredients easier to form into tablets, the primary delivery system preferred by consumers.

After the passage of the Dietary Supplement Health and Education Act (DSHEA) in 1994, which freed the industry from cumbersome pharmaceutical-style regulation, Holmes quickly recognized the potential of the young industry and made several thoughtfully strategic acquisitions.

In 2003, the company purchased AVOCA Inc. (Merry Hill, NC), the largest botanical extraction facility in the Eastern U.S. This acquisition was followed by purchases of American Ingredients, with West Coast distribution, warehousing, and customer-service base; Avoca BioProcessing (Menomonie Falls, WI), a dairy ingredient and natural-product processing facility; Alix Technologies (Dallas, TX), a hot- and cold-fill bottling facility; Improve USA, a fully integrated Aloe vera manufacturing company with facilities and farms in Mexico; and Powder Processors Inc. (Ogden, UT), a manufacturer of a wide range of nutritional ingredient powders, including tablet- and capsule-ready blends.

Complete Vertical Integration
As a result of these acquisitions, Holmes created a vertically integrated company capable of adding value to ingredients at every step in the production process—from extraction to encapsulation—so neatly captured in the company’s slogan: “We Make Ingredients Work.”

Holmes was also instrumental in developing a quality-control staff, enabling Pharmachem to achieve several important industry certifications, including: NOP-Certified Organic, NSF cGMP, HACCP, AID Superior, Kosher and Halal.

Every product begins its life as an idea. But turning an idea into something not only tangible, but safe and effective, is quite a long journey. Pharmachem Laboratories has long focused on being one of the industry’s top-tier, one-stop houses of innovation. Vertical integration and expert employee leadership give Pharmachem the capability to develop custom solutions that meet the specific needs of its customers. More than anything else, developing distinguished custom solutions—as opposed to cookie-cutter products—sets Pharmachem apart from other companies.

Ingredient Processing
At Pharmachem, we offer ingredient-processing services, from farm to finished product. We grow it, extract it, granulate it, blend it, instantize it, agglomerate it, synthesize it, and crystallize it. Imagine the possibilities! We do, every day.

Services:
- Spray drying
- Spray chilling
- Extractions and fermentation
- Agglomeration
- Plating
- Encapsulation
- Particle sizing
- Purification
- Granulation
- Liquid-to-Powder
- Powder-to-Liquid
- Esterification
- New ingredient development
- Value-added ingredients

Custom Powder Blending
Consumers are craving delicious and healthy powdered nutritional supplements. Others just love the convenience of a quick-swallow tablet or capsule. We create, formulate, process, and package a variety of edible powder systems for food, beverage, flavor, and nutritional applications. We specialize in custom, multi-ingredient systems and multi-step processes that meet the specific needs of our customers.

Services:
- Premixes
- Fortification (Soluble solutions)
- DTH (Drum-to-Hopper)
- Particle sizing
- Granulations
- Compressible
- Liquid + Powder
- Instantize
- Flavor systems
Contract Manufacturing
No matter the type of product—food and beverage, dietary supplements, personal care and cosmetics, or nutritious pet foods—we can make it for you. At Pharmachem, we produce custom ingredient systems and consumer products with a just-in-time approach. We manufacture products in a variety of forms, from drink powders to stick packs to flexible packaging. We support new process development and optimization of ingredients, from benchtop through commercialization. We will make your product competitive!

Services Encompass:
- Stick packs
- Jars with scoops
- Direct-to-mouth
- Liquids (RTD)
- Sachet
- Food and drink powders
- 2-oz shots to 64-oz bottles
- Rigid canister
- Flexible packaging

Custom Extraction
Yes, we can extract that! We have 16 cGMP processing and manufacturing facilities strategically situated throughout North America, one of which is the largest custom extraction facility on the continent. This facility has a daily extraction capacity of 2 to 240 metric tons, and a universal annual extraction capacity of 90,000 tons.

Specifically, our daily tonnage includes:
- Counter-Current Rotocel Extractor — 204 tons per day
- Continuous-Flow Crown Extractor — 5–10 tons per day
- Continuous-Flow Crown Extractor — 18 tons per day
- Batch Slurry Extractor — 1–2 tons per day
- Water Extraction System — 5 tons per day

Pharmachem operates the world’s premier botanical solvent extraction facility under food-grade GMPs where we process ground and extracted botanical products, standardized extracts, and custom isolation and purification. Our unique footprint offers bi-coastal warehousing for quick service, all supported by a proactive customer-service team.

This means that you get all of what you need in rapid time. No excessive waiting and no limitations.

Other Facilities’ Capabilities and Resources
- Benchtop to scale-up
- Pilot and commercial operations
- Onsite full-scale analytical and micro laboratories
- Custom fermentations and downstream purifications
- Several certifications, including organic and NSF cGMP
- Blending, concentration, crystallization and process chromatography technologies

Beverages
We can source, blend, and manufacture any type of beverage to give you the competitive edge—from 2-oz shots to 64-oz bottles.

Beverage Capabilities:
- Three filling lines with HTST tube-in-tube pasteurization
- Cooling tunnels for hot-fill products
- Trim cool capabilities for cold-fill applications
- 5,000 to 15,000 gallons daily processing capability

Packaging
Make no mistake—the right packaging arrests eyes, causing the curious consumer to pick up and explore your product. Pharmachem provides expert product development and packaging capabilities with pharmaceutical-grade cleanrooms for personal care, cosmetic, and OTC filling.

Fully Integrated Aloe vera Production
A perennially popular botanical for skin as a topical, and for overall health and wellness as an ingestible, Aloe vera remains a top choice for millions of Americans.

We can provide our customers a ready supply of pristine-quality Aloe vera products because we’re in control of the entire production process. We have three production facilities, as
well as multiple farming operations in Mexico, where our Aloe vera is organically grown and carefully hand-harvested to reduce oxidation and contamination. The International Aloe Science Council certifies all of our aloe products for purity.

**Research and Development**
After the “big idea,” research and development ensues. We are known for creative problem solving, innovation, and unlocking breakthrough discoveries.

Our team of expert R&D scientists and engineers explores the problems, tests new theories, and delivers inspired solutions. We are well known for incorporating the newest ideas and the most up-to-date features in our on-site full-scale analytical and micro laboratories. We can and will make your big idea work!

**Specialty Ingredients**
We love finding and marketing ingredients with powerful research that address the most widespread health concerns. Our branded ingredients are backed by solid science to ensure safety and efficacy. Our ingredients are clinically proven, cGMP, certified U.S.-made, fully traceable, and more.

Here are summaries of ingredients that we can make work for you:

**Phase 2 Carb Controller** is the original and still number-one researched white kidney bean extract. Phase 2 has more than a dozen clinical studies demonstrating clear ability to help reduce the impact of starchy foods.

**Probiotical** probiotics feature Microbac® microencapsulation technology. The strains include high-quality, allergen-free probiotic strains as well as proprietary formulations for the nutraceutical, dietary supplement, functional food, and beverage industries.

**Prenulin®** for natural glucose support is a patent-pending ingredient that functions effectively as a “Sugar Blocker.” Prenulin is a combination formula of L-arabinose and Pharmachem’s patented FoodBound® Chromium yeast, or Chromax™ Chromium Picolinate from Nutrition 21.

**Lactium®** is a milk protein hydrolysate containing a bioactive peptide for stress management. Studies show it helps alleviate the symptoms of stress and synergistically promotes restful slumber.

**Celadrin** is an all-natural proprietary ingredient designed for joint health, composed of esterified fatty acid carbons and other active synergists. Studies show it helps support mobility.

**Cran-Max®** is a clinically studied, all-natural, whole-fruit cranberry extract. Studies show it has powerful bacterial anti-adhesion properties, supporting healthy urinary tract function.

**Reducol™** is clinically proven to significantly lower low-density lipoprotein (LDL) when consumed in different foods and dietary supplements.

Further, Pharmachem provides a wide array of specialty ingredients—vitamins, minerals, amino acids, botanicals and nutritionals such as Aloe vera and chia.

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Astaxanthin
Promising early research on astaxanthin looks toward a slew of new health areas.

By Michael Crane, Associate Editor

For one of the world’s smallest organisms, microalgae pack a big punch. One freshwater species in particular, *Haematococcus pluvialis*, is among nature’s most abundant sources of astaxanthin—an ingredient that has climbed up the dietary supplement sales charts in recent years.

Synthetic and natural-source astaxanthin combined may account for a worldwide market value of $1.1 billion by 2020, according to a 2015 report from Research and Markets, with much of that demand coming from the nutraceutical and cosmetic markets.

Part of the growth is likely due to astaxanthin’s antioxidant benefits, as well as high-profile endorsements on The Dr. Oz show and elsewhere, but astaxanthin has also been steadily amassing a solid research profile in a variety of health areas. Microalgae-based astaxanthin is now marketed for benefits to heart health, brain health, joint health, and skin health on the strength of recent studies, and the list continues to grow.

Astaxanthin supplier AstaReal (Tokyo, Japan) recently shared some of the latest research behind its astaxanthin ingredient at the AstaReal Symposium 2016 in Tokyo. Between recently published studies and the preliminary findings of soon-to-be-published research, the diverse range of health areas covered at the symposium speaks to the remarkably broad potential of astaxanthin in the dietary supplements market. Here are a few of the most notable findings.

**Insulin Resistance and NASH**

Vitamin E has become one of the most well-researched ingredients for its potential beneficial effects on insulin resistance and nonalcoholic steatohepatitis (NASH)—both of which occur frequently in people suffering from obesity or type 2 diabetes. But a recent animal study\(^1\) suggests astaxanthin may be an even more effective option for these health areas.

Writing in *Scientific Reports*, researchers administered a variety of astaxanthin- or vitamin E–based diets to mice with diet-induced NASH for 12 weeks. Both astaxanthin and vitamin E have been found to inhibit lipid peroxidation in past research, which otherwise may lead to insulin resistance and NASH.

Researchers found that astaxanthin was more effective than vitamin E at suppressing lipid accumulation, reducing inflammation and insulin resistance, and preventing and reversing hepatic fibrosis—all of which suggest beneficial effects on NASH.

Additionally, in mice with advanced-stage NASH, astaxanthin decreased plasma triglyceride, total cholesterol, non-esterified fatty acid, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and insulin levels, without affecting body and liver weight. Vitamin E, by comparison, “had little effect on these metabolic parameters.”

“Collectively, these results suggest that astaxanthin is similarly or more effective at preventing and treating NASH than is vitamin E,” researchers concluded.

**Neurogenesis**

Another study\(^2\), published in the March issue of *Molecular Nutrition & Food Research*,

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\(^1\) Reference

\(^2\) Reference
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explores astaxanthin’s effect on adult hippocampal neurogenesis and spatial memory in mice. Though past studies have suggested astaxanthin’s potential neuroprotective effects, little was known about its effect on hippocampal plasticity and cognition.

The study involved mice whose diets were supplemented with 0%, 0.02%, 0.1%, or 0.5% astaxanthin. Using a DNA microarray analysis, researchers found that 0.1% and 0.5% astaxanthin doses improved cell proliferation and survival. Astaxanthin doses of 0.5% were also associated with higher levels of newborn mature neurons, which may be linked to enhanced spatial memory.

The researchers concluded, “[Astaxanthin] supplementation enhanced [adult hippocampal neurogenesis] and spatial memory, and a DNA microarray approach provided, for the first time, novel molecular insights into [astaxanthin] action.”

Vocal Cord Healing

Also at the symposium, Shigeru Hirano, PhD, shared his research into the potential benefits of astaxanthin on vocal cord injuries, including a study of rats that found astaxanthin may “prevent vocal fold scarring by regulating oxidative stress during the early phase of vocal wound healing,” according to the study.

For one day before and four days after vocal folds were artificially injured, rats were given either 100 mg/kg per day of astaxanthin or olive oil by oral gavage. Researchers then harvested rat larynges on days 1, 3, 5, and 56 post-injury for histological and immunohistochemical examinations. Additionally, quantitative real-time polymerase chain reaction (PCR) was conducted on the larynges on post-injury days 1 and 3.

Researchers found that expression of 4-hydroxy-2-nonenal, a marker of oxidative stress, was significantly reduced in the lamina propria connective tissue of rats consuming astaxanthin compared to olive oil. The astaxanthin group also had significantly less tissue contraction with favorable deposition of hyaluronic acid and significantly upregulated mRNA expression of basic fibroblast growth factors, compared to the olive oil group.

Hair Loss and Skin Health

Beauty is another health area where astaxanthin is showing promise, with new preliminary research supporting the ingredient’s potential for hair and skin health.

At the symposium, Hiroko Sugino, PhD, presented findings from two soon-to-be-published studies that found ingested astaxanthin paired with a topical skin cream may improve skin appearance and blood markers of oxidative stress. Between the two studies, a combined 54 women aged 20–71 took a 12-mg dose of oral astaxanthin in addition to applying a topical astaxanthin beauty cream on the face daily for three months.

Using a VISIA skin-imaging analysis device, researchers observed a reduction in brown spots and the number of pores, as well as several areas of skin improvement noted in subjective participant questionnaires. Participants also showed improvements in antioxidative activity in the blood, which may have an effect on skin health, explained Sugino.

A separate preliminary clinical trial, presented by Nalinee Sutthipisal, MD, found that astaxanthin may offer benefits to men suffering from hair loss. For 12 weeks, 15 men aged 25–65 consumed an oral astaxanthin supplement and used scalp lotion that contained astaxanthin.

Compared to baseline, researchers observed a 9.4% increase in terminal hair count at 4 weeks after beginning administration, and a 22.5% increase in terminal hair count at 12 weeks. No adverse events were reported, and there was 84.6% patient satisfaction at 12 weeks. Researchers intend to publish full findings of the study soon, according to AstaReal.

The AstaReal Symposium 2016 also featured previews of ongoing studies in even newer health applications, including sarcopenia and pet health. Where will astaxanthin go next?

References

1. Yinhua Ni et al., “Astaxanthin prevents and reverses diet-induced insulin resistance and steatohepatitis in mice: a comparison with vitamin E,” Scientific Reports. Published online November 25, 2015.


Haematococcus pluvialis, a species of microalgae that offers one of nature’s most abundant sources of astaxanthin, is shown here progressing through the different stages of its life cycle.
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Spreading the Word
Chocolate makers are betting big on cocoa flavanols, but are consumers tuning in?

BY MICHAEL CRANE, ASSOCIATE EDITOR

As if consumers didn’t have enough reasons to love chocolate, mounting research behind the health benefits of cocoa flavanols has many looking at the famously decadent category in an appreciative new light. As reported on page 46, cocoa flavanols are performing well in recent studies on cardiovascular health, cognition, and other health areas.

We can already picture shoppers jumping with joy at the thought that chocolate may actually be healthy, but before they do, they should digest some key facts about flavanols—facts that will help them make smarter decisions when choosing a cocoa-based product.

Painstaking Production
Not all cocoa is created equal, and it takes a delicate production process to ensure high-flavanol content makes it into the finished product. Those invested in the cocoa flavanol category are hoping to bring to light the differences between a high-flavanol chocolate and your average chocolate.

High-flavanol content starts with careful selection of the right cocoa beans. “There are great differences in flavanol content between beans from different cocoa-growing countries, which depend on bean characteristics (genotype, or cocoa variety) and on external influences such as climate, soil, and pre- and post-harvest practices,” says Leen Allegaert, clinical researcher, Barry Callebaut (Zurich, Switzerland). Kerry Cavanaugh, brand director, Mars Chocolate, agrees that sourcing “fresh, high-quality cocoa beans” is one of the biggest challenges in creating high-flavanol cocoa.

But even that means little without a mild production process to ensure the flavanols arrive in the finished product intact.

“Cocoa flavanols are abundant in the fresh cocoa bean. Unfortunately, most traditional processing of cocoa—fermentation, roasting, and alkalization—destroys these flavanols,” says Cavanaugh. He adds that Mars works to protect and preserve cocoa flavanols through its Cocoaapro production process, which was instrumental in creating Mars’s new Goodnessknows chocolate snack squares. The squares launched across the United States in the summer of 2015 and contain 100 mg of cocoa flavanols.

Barry Callebaut’s high-flavanol Happy Chocolate brand, which first hit U.S. shelves in 2013, is also carefully processed to maintain up to 80% of the cocoa flavanols that could be destroyed as a result of conventional chocolate-making, says Allegaert.

Building Awareness
Unfortunately, despite all the work it takes to achieve high-flavanol content, consumers may just assume all chocolate offers the same health benefits, regardless of the flavanols within.

“There has definitely been more buzz in the press during the past few years regarding the potential health benefits of dark chocolate, but it is often difficult for consumers to differentiate between chocolate with high and low percentages of cocoa solids, which are key indicators of flavanol content,” says Debra Music, cofounder and chief marketing officer, Theo Chocolate (Seattle).

While it can be difficult to succinctly unpack the science behind flavanols, Theo is confident “that as consumer knowledge grows, so will demand for cocoa flavanols,” Music explains. Theo launched Quinoa Coconut 75% Dark Super Chocolate bars in 2015, which include 150 mg of flavanols per serving.

Another marketing strategy may be to tap into more familiar messaging, rather than waiting for flavanol awareness to grow.

“Often it is easier to talk about things that consumers are familiar with,” says Barry Callebaut’s Allegaert. “Cocoa flavanols, the typical polyphenols in chocolate, are not well-known by consumers. Hence, it’s easier to talk about ‘bursting with antioxidants.’”

Whatever the strategy, it’s clear from the number of high-flavanol cocoa products coming to market that we’re beginning to build consumer and scientific understanding of all that cocoa flavanols bring to the table.
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NAVIGATING the Road Ahead
Where is the sports nutrition market heading? p. 8
my forskolin should **be toxic**
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my forskolin should **be clinically unsubstantiated**
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my forskolin should **only be ForsLean® by Sabinsa**
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Which consumer bases are driving the sports nutrition market?
Calling All Customers

As today’s sports nutrition market diversifies, sports marketers have endless opportunities to reach new consumers with performance, recovery, and other athletic products. But is it really possible for one company to please all customer types: hardcore bodybuilders, casual exercisers, men and women, and even senior athletes?

One place where these consumers meet is the food aisle, as writer Robby Gardner points out on page 8. Sports shoppers of all types are turning to “real food.” In this way, sports nutrition customers are no different from consumers generally who are embracing functional food and drinks. There is also common ground in “clean” nutrition and plant-based ingredients, as marketers describe on page 22.

At the Natural Products Expo West trade show in March, I interviewed one company, Vega, who exemplifies a brand that’s been able to craft a sports nutrition strategy to reach both ends of the consumer spectrum. Avid athletes are fans of the company’s Vega Sport Performance Protein powder, built for “next-level performance;” at the same time, the company caters to the masses with its Vega Clean Protein, viewed one company, Vega, who exemplifies a brand that’s been able to craft a sports nutrition strategy to reach both ends of the consumer spectrum. Avid athletes are fans of the company’s Vega Sport Performance Protein powder, built for “next-level performance;” at the same time, the company caters to the masses with its Vega Clean Protein, which Paige Snyder, Vega’s regional educator, described as targeting “lifestyle” consumers. The two plant-based products are similar in terms of “core values [and] same methods of production,” Synder said—only Clean Protein is sold at a lower price point. The ingredient lists reflect the differences. Clean Protein provides 23 g of protein, 4 g of glutamine, and 4 g of branched-chain amino acids (BCAAs), while Vega Sport Performance Protein contains a higher 30 g of protein, 6 g of BCAAs, 6 g of glutamine, plus specialty add-ins tart cherry, turmeric, and probiotics. Of the mass-market formula, Synder said, “The idea of Clean Protein is making clean, plant-based nutrition available to everybody of all demographics and incomes. This consumer is somebody who relates more to the protein and a simpler formula.”

Finding a way to court new users while still serving loyal, hardcore athletes is one of the keys to success. Do not discount the importance of attracting new fans. “There is increasing use of supplements by consumers not previously influenced by sports products, including runners, golfers, weekend warriors, etc.,” says Tim Mantel, executive vice president and chief merchandising officer for GNC. As he points out, “casual users are growing at a rapid rate compared to the consistent, ‘hardcore’ space.” So, are you ready to play?

Jennifer Grebow
Editor-in-Chief
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Is Egg Protein Poised for a Sports Nutrition Comeback?

When most of us think eggs and sports nutrition, the prototypical image is of a bodybuilder cracking an egg—whites, yolks, or both—into his or her morning drink. Well, one egg supplier believes it can bring eggs to the workout masses in a much friendlier format. Egg-commodity supplier Rembrandt Foods (Spiral Lake, IA) explains why formulators should consider egg-white protein for their sports nutrition products.

The company is targeting the sports and general nutrition markets with Rempro 8000, an egg-white protein powder comprising 80% protein that disperses in cold water in less than one minute (10 g of Rempro 8000 in 100 ml of water). The powder can add 10 to 15 g of protein per 100-ml serving of a beverage. Rempro 8000 has the “aroma, color, and taste typical of dried egg whites.”

Considered by many to be a “gold standard” protein source, eggs have a lot going for them. Eggs score among the highest in terms of biological value (BV), net protein utilization (NPU), and protein efficiency ratio (PER), out-performing beef, chicken, and soy in these areas—one of the reasons why bodybuilders are so keen on egg protein. Importantly, eggs are a complete source of essential branched-chain amino acids (BCAAs). And egg protein is easily digested, with a protein-digestibility corrected amino acid score (PDCAAS) of 1.

How does egg-white protein stack up against whey protein, which itself is touted as a complete source of BCAAs? The ratio of BCAAs differs between whey and egg-white protein. Egg-white protein, for instance, is lower in leucine compared to whey, but higher in other BCAAs, says Mindi McKibbin, new product development manager, Rembrandt Foods. Combining egg-white protein with other protein sources, including dairy and plant protein, can help round out BCAA content, taking it higher overall, she adds.

Egg-white protein’s easy digestibility also makes it a good fit for protein blends, McKibbin says. Egg-white protein is a medium-digesting protein compared to whey (fast) and casein (slow). “Having a fast-digesting protein, a medium one, and a long-term one lets you get that full, sustainable energy throughout the day, which is why people look toward protein blends,” McKibbin says.

At Natural Products Expo West, the company previewed Rempro 8090, its next-stage instant egg-white protein isolate, which will be commercially available in Q1 2017. With Rempro 8090, Rembrandt was able to boost the protein content even higher, to 90%.

“Historically, egg whites are about 80% protein, but if we de-mineralize and further purify the protein, we can reach 90% protein, the isolate level,” McKibbin says. And there are other benefits, as well. “We’ve also de-flavored the protein, so where I think formulators may not have wanted to use egg whites before because of the sulfur, ‘eggy’ notes, with this isolate product, there’s no saltiness; there’s no sulfur or egg taste to it.”

And while eggs, just like whey, may “have their allergy issues for some people,” McKibbin believes that egg-white protein shows a lot of promise in a market where protein demand is skyrocketing.

“Our big focus this year so far has been in powder protein blends and then nutrition bars,” McKibbin says. “But with the 8090, we found that it has less coagulation properties. The protein doesn’t gel as much, so we are trying to run some ready-to-drink beverage trials. Egg whites traditionally couldn’t be used because they would gel in the beverage, but as we’ve developed these new egg-white isolates, we’ll be looking at a version that has no gelling properties.”

Chemi Nutra Launches Water-Dispersible Phospholipids

Chemi Nutra (Austin, TX) is rolling out two new water-dispersible versions of its phospholipid ingredient compounds, designed for use in functional beverages and created in collaboration with 3i Solutions (Wooster, OH), a specialist in nanodispersion technology.

The first new water-dispersible compound, SerinAid Disperse 3.0F, is made from Chemi Nutra’s patented phosphatidylserine (PS), which is marketed for benefits to cognitive health, including maintaining and improving concentration, learning, memory, and mood.

The other new compound is Mediator Disperse 7.5F, which contains Chemi Nutra’s patented, water-dispersible phosphatidic acid (PA). The compound has been researched for its ability to regulate muscle protein synthesis and muscle protein breakdown by activating the mechanistic target of rapamycin (mTOR) signaling pathway, according to Chemi Nutra.

The two new water-dispersible phospholipid compounds are appropriate for applications including ready-to-drink beverages, shots, and gels.

Scott Hagerman, president, Chemi Nutra, says “we began working with 3i Solutions to perfect a stable, highly bioavailable, water-dispersible, liposomal PS. With 3i Solutions’ demonstrated capabilities and our combined application knowledge in functional drinks, we are very excited that SerinAid Disperse PS and Mediator Disperse PA can now be easily and effectively added to functional beverages, a rapidly evolving segment in the functional foods and sports nutrition arenas.”

Charles Brain, president of 3i Solutions, says Chemi Nutra “is first to market with true, high-quality, water-dispersible PS and PA ingredients.”
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Staying Ahead of the Game
A look at today’s sports nutrition trends

BY ROBBY GARDNER

Within the complex world of sports nutrition, there is rapidly increasing change, not just in who consumes sports products but in how they do it and what retains their buy-in. So, where is this market heading?

Sporty Foods Welcomed by All
Sports supplements and related health products are not just for trained athletes. Inevitably, a growing number of everyday people consume these items on the daily as part of their pursuit of a healthy lifestyle. But even as sports nutrition manufacturers win over these non-niche consumers, the category’s more-traditional clientele—bodybuilders, elite athletes, and so on—shouldn’t be forgotten.

The converging point for both types of consumers appears to be, according to several market analysts and manufacturers, a trend towards more “real food” products in the sports nutrition category. As Innova Market Insights says in its “Top 10 Trends for 2016” report, “Rather than consumers opting for these [traditional] sports nutrition products, manufacturers are reaching out to them with better-tasting sports products that are presented in a friendlier way so that sports nutrition can be truly suitable for all.”

One example of this tendency is the multinational brand Myprotein, which now sells jerky, nut pastes, oats, and cookies alongside traditional supplement products, with all of these products positioned on their protein content. A more unique example is the European food brand Backaldrin, which last year launched a whole-grain sports bread—yes, sports bread—called Actipan. Reportedly developed in accordance with recommendations from the German Olympic Sports Confederation, the whole-grain loaf, made with particular selections of grains and sprouted legumes, delivers carbohydrates, vitamins, and trace minerals that, when
Food Bars
Evidence of a move to sporty foods is easily found in the food bars category. According to a report from the market research group Mintel, U.S. sales of all bars (snack, nutrition, and protein) grew 30% between 2009 and 2014, to $6.2 billion. In an already saturated market, Mintel says the promotion of functional claims on bars, in combination with whole-food ingredients, will meet consumer demand and help stave off competition.

An advantage of food bars over other products is that these items can and tend to be consumed without much restraint. A recent Mintel online survey suggests that food bars, and even “performance bars” in particular, are frequently consumed as meal replacements, as snacks in between meals, and in multiples during a single eating session.

Food bars are also convenient when it comes to protein fortification. Alongside food bars, items like cereals, breads, and other grain products remain strong suitors for protein claims, real-food ingredients, and other sports-related values.

The Rise of Ready-to-Drink
As with bars, beverages continue their own market ascent, but with an increasingly “natural” bent. Virginia Lee, a beverage analyst at market research firm Euromonitor, says that natural formulations and reformulations are penetrating the sports ready-to-drink (RTD) beverage category, not only in the form of coconut water—which she says is “frequently marketed as ‘nature’s sports drink’”—but with a notable uptick in natural colorants and sweeteners, too.

GROWING DEMAND FOR SPORTS CERTIFICATION
Within the sports nutrition category, a subset of extreme athletes or “core users” may respond positively to “natural” call-outs and real-food ingredients, but it’s even more important that they have access to clean products—as in products that are free from substances banned by sporting organizations.

“We’re finding that people are looking for more clean labels and ingredients to help them simplify the product-selection process,” says Andrew Haplner, PhD, vice president of product development for the Klean Athlete brand of sports supplements. For this reason, the company’s products are certified by the NSF Certified for Sport program.

NSF International (Ann Arbor, MI) implemented NSF Certified for Sport to give sports nutrition consumers the trust that certain dietary supplement products have been tested to verify what’s on the label and to verify an absence of banned substances. The program is used by sports organizations such as the National Football League, the National Hockey League, and Major League Baseball. What’s more, the program continues to expand.

Cheryl Luther, DC, general manager of dietary supplements and beverage quality at NSF, says that NSF-certified products doubled in 2014. Now, the Certified for Sport program specifically is expanding into ready-to-drink beverages and functional foods. Medical devices, like skin patches and inhalers, for which interest is limited but growing, may also be targets for future certification, but they would require their own separate protocol for product testing, the firm adds.

The Female Athlete
While male consumers may have relatively stable needs as sports nutrition consumers, reports indicate a big shift in female exercise patterns towards muscle strength and fitness rather than maintaining a slim figure. This revolution, according to Bill Levi, vice president of strategy and business development at Nutrition 21 LLC (Purchase, NY), is creating a growing market for “dedicated female health products within the sports nutrition space.”

Aside from products geared to women, co-gender marketing for many sports nutrition products is now all the more important, at least for certain products.
Another demographic change in effect globally is an increase in elderly consumers who want to incorporate sports nutrition in their diet.

According to Euromonitor, while many brands still don’t directly target older athletes, this could change—in Europe, anyway. The EU’s European Food Safety Authority recently permitted a health claim for creatine and muscle strength for adults over 55 years of age.

Regardless of where they live, senior consumers will likely opt for “active nutrition” brands like Ensure High Protein rather than intensive “sports nutrition” brands.

World Markets

Thanks to the growing global population, the sports nutrition market has a rapidly increasing consumer base. Predictably, a lot of it’s in the United States. According to Innova Market Insights, the United States accounts for 63% of global sports nutrition consumption, with an overall retail value of $5.9 billion. Australia and the United Kingdom follow in second and third place, at estimates of $479 million and $471 million, respectively. All three countries are forecasted for more growth throughout the next several years.

While so much of the world’s sports nutrition consumption is in the United States, this doesn’t mean the U.S. market can’t be penetrated by outsiders. In fact, Euromonitor says it’s seeing more foreign companies launch in the United States—a reverse, says Chris Schmidt, of “the age-old trend of brands getting big in the United States and then conquering the world.” At the same time, some smaller countries are seeing rapid sports nutrition growth locally, such as in Thailand where sales of sports drinks reportedly grew last year alongside an increasing number of sports enthusiasts.

Robby Gardner is the former associate editor of Nutritional Outlook magazine.

In its January 2015 “Nutritional and Performance Drinks—U.S.” online survey, Mintel found that many adults use sports drinks even when they are not exercising. This makes the overall beverage experience, including flavor and texture, very important.
Natreon, Inc. is an 18-year-old company located in New Jersey with a state of the art R&D facility in Kolkata, India, and is focused on developing and marketing Ayurvedic ingredients backed by extensive research, multiple clinical & safety studies, and intellectual property.
Competition breeds innovation, and nowhere in the ingredients industry is this more evident than with proteins. As the consumer base for protein foods and supplements continues to grow, protein-ingredient manufacturers and finished-product marketers are exploring every possible avenue to stay current and open to new trends on the market.

In particular, the booming popularity of plant proteins has formulators looking for the best way to combine different proteins to achieve the optimal nutrient profile, taste, and texture for a given application. Now that consumers are looking beyond traditional dairy, egg, and soy proteins to a growing roster of plant-based proteins, there’s an almost dizzying array of options to choose from. Within just the past few years, there has been a tremendous surge in the popularity and availability of plant protein sources on the market, such as pea, rice, sacha inchi, hydrolyzed wheat, hemp, coconut, sunflower, pumpkin, cranberry, quinoa, chickpea, potato, and algae, just to name a few.

Whether the product is a powder, gummy, clear beverage, bread, or yogurt, knowing how to select proteins with compatible characteristics is an essential step in any successful product development. How does a finished-product manufacturer begin to navigate the many options to determine the best ingredient for a consumer product?

Finding the Balance
One of the first things to keep in mind is that formulating a protein product requires a juggling act. Selecting the right protein or combination of proteins involves a compromise between the benefits and drawbacks of each ingredient’s flavor, smell, texture, visual appearance, and marketability—all while meeting a target price of goods. A plant protein can be a terrific option to satisfy many of these formulation challenges.

Keeping the target consumer in mind helps narrow down protein choices. For example, the bodybuilding and sport markets tend to favor animal-based proteins. These demographics were around long before the rise of plant proteins and have therefore been exposed to many years of marketing focused on animal proteins. The good news is these groups tend to appreciate new scientific research, including recent studies suggesting plant proteins can be just as effective as animal proteins for hardcore athletes.
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Results from a 2013 double-blind study at the University of Tampa indicated that rice protein and whey protein have identical benefits to muscle building and retention. Similarly, research conducted on pea protein supported its ability to improve muscle thickness when compared to whey protein.

From a price perspective, co-formulating with lower-priced plant proteins like pea and rice can counterbalance the higher cost of whey and other dairy proteins. Another angle to consider is that consumers committed to whole, “natural” foods tend to gravitate toward plant proteins primarily due to their cleaner and more environmentally sustainable image. Incorporating plant proteins into formulations allows the manufacturer to offer its consumer a perceptively “healthier” product.

Sprouted brown rice protein, for instance, hones in on two hot-button marketing trends: sprouted grains and whole grains. Many plant proteins, such as pea and sacha inchi, are also offered as certified organic, non-GMO, and gluten and allergen free. Additionally, plant proteins like hemp and algae can offer an environmentally friendly image, and they are no longer considered fringe ingredients.

Flavor Rules

Ideally, the perfect protein ingredient would be flavorless, as this would allow the most versatility in custom flavor applications. However, real foods, from which natural proteins are derived, have distinct flavors. Even whey, arguably the king of proteins, still tastes like dairy. Soy protein has plant-like, beany notes, as one would expect from a legume. However, over the years formulators have learned to work with these flavor challenges and have developed some marvelous innovations.

In many circumstances, proteins make up a larger percentage of a finished product compared to other functional ingredients, so their characteristics can have a major impact on the final flavor and texture. For example, pea protein has a thick mouthfeel, and it can impart nutty, earthy, and savory flavors. Rice protein has a milder, cereal-like taste, but it can be slightly gritty and render a poor mouthfeel. Hemp, sacha inchi, sunflower, and pumpkin seed proteins all have varying degrees of seed-like nutty and green flavors.

Many of these proteins can also impart varying degrees of bitterness. These inherent flavor characteristics can either work to the advantage or disadvantage of the formulation, depending on the target flavor of the finished product. Unfortunately, more often than not these base protein flavors can be challenging when featured in a neutral flavor base, such as vanilla.

One way to overcome this is to find a congruent flavor that works with the flavor of the base protein. Earthy or beany notes work well with nut flavors such as peanut butter, with baked flavors like caramel pretzel, or with chocolate flavors. Astringency complements citrus flavors, as it enhances the flavor, while bitter notes can blend into chocolate or coffee flavors. Green notes can enhance jam-like berry flavors that lack greenness to create a balanced strawberry flavor.

Alternatively, bitterness can be muted by increasing the intensity of the sweetener system or modulating the perception of sweetness through suggestively sweet aromas. This works because the human brain is hardwired to taste sweet over bitter. A little salt can also aid in overcoming some bitterness, or more advanced technologies can actually block the tongue’s bitter receptors. Partnering early with a good flavor house that’s familiar with protein formulation can tremendously speed up the formulation process.

Flavor “fade” is one more protein-formulation challenge to stay aware of. Proteins are good at binding or absorbing flavor; the protein folds around another flavor in the formulation and hides it. In this scenario, adding more flavor can help compensate for any lost flavor, but flavor adjustments should be given some time to rebalance a few days before tasting. Protein flavor binding can also continue well into the product’s shelf life.
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Texture can be as much of a formulation challenge as taste, but thankfully plant proteins offer a variety of available textures and mesh-size options. Typically, less gritty and smoother-texture plant-protein options are available, though they can be priced higher due to added processing.

Ideal protein texture often varies depending on the application. For instance, a high-protein, ready-to-mix powder formulation for the bodybuilder, sport, or whole-food consumer may compromise by prioritizing lower-cost options over smoothness to keep consumer price at a tolerable level. On the other hand, formulations targeting taste-conscious mass consumers interested in a smaller protein serving size might be able to absorb the higher cost of smoother-protein options.

“Mixing whey protein with plant proteins can smoothen out texture from gritty plant proteins,” Rillorta says.

Ready-to-drink beverage formulations pushing above 8 g/8 oz per liquid serving can also benefit from an extra-smooth protein due to the texture of the protein, which has a higher impact on a formulation at higher concentrations. Likewise, at low concentrations, a protein’s texture may not be as readily discernable. Certain types of bars and cookies might benefit from a coarser-mesh protein to achieve a certain mouthfeel.

Finished-product manufacturing conditions can also affect the final texture. Formulating around a protein’s isoelectric point, the pH level at which protein molecules have a zero net charge, can help proteins stay in solution. Otherwise, there may not be sufficient electrostatic repulsion between the protein molecules to keep them apart, causing them to aggregate and possibly introduce additional grittiness into the formulation. Salt can have a similar effect. Low concentrations of salt can help with solubility because salt ions interact with the protein molecules’ ionic charge and keep the proteins from interacting with each other and aggregating. However, overly concentrated salt ions can overpower a protein’s interaction with water and cause the proteins to interact with each other, often to the detriment of the formulation. Excessive heat can also denature the protein molecules, causing them to aggregate and fall out of solution.

Generally, a large majority of the available plant proteins are not entirely soluble in water. Using stabilizers such as hydrocolloid gums or modified starches can help suspend protein molecules and any other non-protein ingredients for a smoother mouthfeel.

Mix It Up, Play with It

There’s also an argument to be made for combining different proteins to minimize unwanted off-flavors and grittiness. Mixing whey protein with plant proteins can smoothen out texture from gritty plant proteins, while plant proteins can balance out unwanted off-flavors and grittiness. Mixing whey protein with plant proteins can smoothen out texture from gritty plant proteins, while plant proteins can balance out unwanted off-flavors and grittiness.

Beyond the main protein sources, adding additional functional ingredients is an easy way to create product differentiation and enhance marketability. For instance, collagen, also a form of protein, can add an angle for cosmetics with a key electrolyte, and some magnesium forms have even been shown to help with cognition. Zinc affects protein synthesis and helps to maintain energy levels.

Juggling the right plant-based proteins to produce a successful formulation is certainly full of challenges, but with a flourishing market, the opportunities for finished-product manufacturers make the effort well worth it. Digestive health is extremely popular right now as well. Adding in a probiotic or, better yet, a prebiotic, can help build a healthy gut to effectively digest and benefit from all that added dietary protein. There are also highly bioavailable forms of both zinc and magnesium to consider because heavy exercise may deplete both of these minerals. Magnesium is a key electrolyte, and some magnesium forms have even been shown to help with cognition. Zinc affects protein synthesis and helps to maintain energy levels.

Alan Rillorta is the director of protein and branded ingredient sales at AIDP (City of Industry, CA). He is responsible for the development of innovative ingredients and collaborating with formulators to use these ingredients in successful new product launches.

References

Flint Families Need Our Help

You’ve likely seen the news coverage – Flint’s change of water source in 2014 to the Flint River corroded plumbing, allowing lead to leach into tap water. With an estimated $1.5 billion price tag and 30-year time frame for pipe replacement, there simply is no quick or easy fix. But for affected adults and children, life goes on.

*Nutritional Outlook* wants to team up with the nutraceutical industry to come together in support of the Flint community. Can you help? Donating to the **Flint Child Health & Development Fund, established by the Community Foundation of Greater Flint**, is an investment in the chance for Flint’s children to enjoy healthier lives. *Nutritional Outlook*’s parent company, UBM, and their nonprofit arm will match the funds that we raise together, according to the scale of our response.

For more information, to donate, and to learn about other ways to help the Flint community, visit www.nutritionaloutlook.com/helpflint.

Please be sure to enter the term **NO2016** where the donation form asks “How did you learn about the fund?” so that UBM/Nutritional Outlook can match your donation.
Nutrients of interest, from grass-fed whey to plant-based caffeine

BY ROBBY GARDNER

The dietary supplements industry is no stranger to evolving consumer demands. With each passing year, shoppers obtain new information that alters their purchasing preferences.

Within the sports nutrition category, companies must make sure to answer to general trends, but they must also compete for customers seeking bold results—all the while ensuring the safety of their ingredients. All of this makes designing a successful dietary supplement product a bit challenging.

The following is a brief look at the changing sports ingredient landscape. Some ingredients are just now capturing consumer intrigue, and others might present new opportunities for improving athletic performance and/or reducing time to recovery after exercise. Fortunately, these ingredients are all backed by growing collections of positive and peer-reviewed science.

Grass-Fed Whey
Whey protein products continue to sell strong, but they are also diversifying. A number of manufacturers are now sourcing (and promoting) whey protein from grass-fed cows.

While the industrial convention of grain-fed cows saves money and may even have a lower environmental footprint, allowing cows to pasture can earn the favor of socially conscious consumers and anyone complying with grain-averting Paleo or Bulletproof diets. And in a time when plant proteins are on the rise, making animal protein seem just a little bit greener should help retain customers.

The “grass-fed” trend is already evident in a number of different products, including protein powders, sports bars, and cookies.

Plant-Based Caffeine
Plants like green tea, coffee, and yerba maté are poised for growth in today’s increasingly clean-label, natural-driven marketplace. In the sports category, they’re suitable alternatives to synthetic anhydrous caffeine and give a product better label appeal.

As standalone products or additives to larger formulas, caffeine may help amateur and seasoned athletes improve performance outcomes. In the last half year alone, studies on caffeine supplementation suggested better performance with caffeine over placebo for Division I collegiate athletes, Brazilian Jiu-jitsu athletes, and handball professionals. A review of studies on coffee supplementation found benefits over placebo for endurance cycling and running.

For the manufacturer seeking a more exotic caffeine source, guayusa (Ilex guayusa) is...
relatively new to market. If a long history of use in South America isn’t enough to assure you of its safety, scientific studies on guayusa toxicology are now being published.

**L-Carnitine**

Although it’s less familiar to the average consumer, L-carnitine is gaining popularity in the sports market. Because this amino acid helps transport fatty acids for energy, L-carnitine is increasingly used in pre-workout formulas. The benefits of L-carnitine, however, are more for workout recovery, as published studies suggest potential anti-inflammatory and muscle-protective benefits with L-carnitine supplementation in both men and women.

At the end of last year, Bodybuilding.com gave its “New Product of the Year” award to a pre-workout supplement containing L-carnitine touting benefits such as boosted energy, focus, and fat loss. But manufacturers aren’t the only parties interested in this ingredient. In January, the U.S. Pharmacopeial Convention (USP) said it plans to include a functional ingredient monograph for L-carnitine tartrate in its upcoming *Food Chemicals Codex, First Supplement to the Tenth Edition*. The organization is especially interested in figuring out how to limit contamination of such products with D-carnitine, an ingredient that antagonizes L-carnitine.

Manufacturers interested in L-carnitine for their product portfolios have a variety of options. Beyond dietary supplements, the GRAS-approved ingredient can be used in fruit juices, fruit-flavored drinks, carbonated soft drinks, food bars, and meal-replacement products.

**BCAAs**

Without a doubt, branched-chain amino acids (BCAAs) represent one of today’s most popular sports supplement ingredients. A significant amount of published research suggests that BCAAs can support muscle recovery and the immune system after exercise. Since the market is already saturated with BCAA products, manufacturers with vested interest in this ingredient would be wise to have a strong understanding of the BCAA market and its nuances. Fortunately, a BCAA market report compiled by the United States BCAA Industry is now available for purchase. The 137-page report is replete with market analysis, product application basics, supply chain figures, regional market breakdowns, ingredient manufacturer profiles, and upcoming trends.

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Robby Gardner is the former associate editor of *Nutritional Outlook* magazine.


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Sports Nutrition Ingredient Velositol Doubles the Power of Protein, Firm Says

Nutrition 21 (Purchase, NY) is sharing more details from its recent study on new sports nutrition ingredient Velositol, introduced late last year. Velositol combines a highly soluble amylopectin polysaccharide and a modified-release version of chromium. The company says that when added to whey protein, Velositol can increase muscle protein synthesis (MPS) significantly more than when whey protein is taken alone, according to the study.

On its own, whey protein is effective at increasing MPS...to a point, explains Sara Perez Ojalvo, scientific affairs manager, Nutrition 21. “When you start taking 20–30 g of whey protein, the amount of MPS you get out of it levels off,” she says.

With this in mind, Velositol looks toward other avenues to keep muscle building. “We hypothesized that the mechanism of action of Velositol is that we’d stimulate uptake of leucine and other amino acids and stimulate the pancreas”—by way of Velositol’s chromium component—“to release insulin, which also helps increase the amount of amino acids, along with glucose, taken into muscle cells during exercise,” Ojalvo says.

In the 10-subject, double-blind, single-dose, crossover study (not yet published), the researchers used 6 g of whey protein isolate. The control group took the whey protein alone, while the test group took whey protein plus Velositol.

At two hours, the researchers performed a baseline muscle biopsy on the subjects to look for a specific amino acid marker, phenylalanine, which is active during the muscle-building process. (Muscle biopsies are a standard protocol in MPS studies.) At four hours, researchers again performed a muscle biopsy and measured the level of phenylalanine.

Subjects were then asked to perform eight sets of leg extensions; four hours after that, the researchers took a final muscle biopsy. Researchers also measured blood insulin and glucose levels throughout the study.

“We measured MPS two ways, both plasma and intracellular, as a double-check,” Ojalvo says. "What we found was that when you add Velositol to whey protein, you significantly double the MPS when compared to whey protein alone.”

In the sports nutrition market, where consumers are clamoring for protein—and whey protein especially—Velositol can give protein products an edge. Nutrition 21 says that thanks to this study, marketers can use claims that Velositol “doubles the increase in MPS when added to whey, versus whey alone” and that Velositol “doubles the power of protein after a single dose.”

“This is the first time that something has been able to shake up the protein market like this,” says Dorothy McEntee, marketing director, ingredients, Nutrition 21.
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There is no longer a singular sports nutrition shopper. Here are some of the key audiences market leaders are courting today.

Gone are the days when hardcore athletes dominated the market for sports foods, beverages, and dietary supplements. Although there is still plenty of innovation today aimed at the most dedicated sports consumers, sports brands are broadening their reach by targeting mainstream consumer bases and, for instance, turning to ingredients besides protein.

_Nutritional Outlook_ interviewed several industry experts to get their take on the different consumer bases and ingredients that are driving the sports market. Here's what they had to say about reaching female consumers, tapping into demand for plant-based ingredients, and more.

**What are some surprising areas of growth you’re seeing?**

_Tim Mantel, executive vice president and chief merchandising officer, GNC:_ “There is a clear shift towards healthier/cleaner options. That includes vegan, plant-based, and natural sports offerings. We are also seeing growing acceptance of items previously deemed as niche or hardcore-channel, such as pre-workouts, [testosterone] boosters, creatine, thermogenics, etc., into more mainstream and mass channels. At the same time, brands founded in edgier sports innovations are expanding into softer, more approachable sub-brands to capitalize on the broadening mainstream appeal. Established sports nutrition brands are adding wellness options such as fish oils, joint health, [and] probiotics into their assortments. And of course there are more specific sports offerings for women.”

_Tricia Griffin, senior marketing manager of technical content, CytoSport:_ “The growth of sports nutrition products has always been steady, and now we, the Muscle Milk brand, are seeing success with a cleaner label...and organic and vegan products crossing over into this space.”

**Besides protein, what ingredients do you notice appearing in sports products?**

_Paige Snyder, regional educator, Vega:_ “I know that a lot of other companies might be starting to add a probiotic or something for anti-inflammation or hormone balancing. It’s something that we’ve been doing in a lot of our products for years. If you look at our Recovery Accelerator, we’ve always thrown in astragalus, zinc, and maca, but now other people are starting to catch on and realize there’s so many other components to recovery than just protein synthesis.”

_CytoSport’s Griffin:_ “The sports supplements with other ingredients than protein typically live in the specialty market world where individuals are seeking solutions beyond the basics. The ingredients with years of evidence-based research to support a specific benefit are creatine, beta-alanine, amino acids, leucine, branched-chain amino acids, and caffeine. Other newcomers show promise, but there is always the question of if there is enough of an active ingredient to actually work.”

_Have you seen a shift in overall consumer preference or market segmentation between hardcore and casual consumers?_**

_Trevor Ellestad, PR specialist, Vega:_ “You’re definitely seeing more of a trend toward the mass consumer approaching plant-based protein. You’re definitely seeing more plant-based proteins in mass retailers like Target, Costco, or Walmart.”

_CytoSport’s Griffin:_ “There is certainly some fragmentation, and those that are more hardcore are typically looking for supplements with added benefits. It appears that more casual consumers are looking for a convenient source of high-quality protein for health, satiety, and weight management purposes. We offer a range of products to help appeal to the active lifestyle, with a strategic focus now on the active female.”

_GNC’s Mantel:_ “There is increasing acceptance of sports nutrition products by more mainstream users...A key part of that trend is a shift towards healthier/cleaner options, which is widening gaps between the ‘softer,’ cleaner, and healthier end of the spectrum and the intense, edgy aspects...The decreasing emphasis on bodybuilding and muscles with increasing messaging regarding fitness, health, and performance has changed the image of the prototype sports consumer.”
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