

# EDITOR'S PICK

## Deanna's column GLOBAL PERSPECTIVE: Advances in Microbiome Beauty Science



**Deanna Utroske, Beauty Industry  
Public Speaker**

**EURO COSMETICS**  
THE MAGAZINE FOR COSMETIC INDUSTRY LEADERS



**September 2022  
Vol. No. 30**

Deanna Utroske is one of the most well-respected critical thinkers in the cosmetics and personal care industry today. An editor, writer, and beauty industry commentator, she contributes to trade and business media publications around the world. As a consultant, Deanna develops business content for suppliers and manufacturers, helping them grow in key B2B markets. And as a public speaker, she enjoys presenting to company teams, higher-education classrooms, and event audiences internationally.

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### **Editor's Note:**

With her column *Global Perspective*, Deanna Utroske, Beauty Industry Public Speaker and one of the most well-respected critical thinkers in the cosmetics and personal care industry, takes up current topics from the personal care industry and talks about them with industry experts. She continues her column with this article on *Advances in Microbiome Beauty Science*. As Deanna notes, we are only at the beginning of the sophisticated world that is the human microbiome. She talked about it with experts from research and development. Elsa Jungman PhD, Founder and CEO of HelloBiome, Éile Butler, Senior Technical Research Manager at Labskin, Dr. Kristin Neumann, Founder of MyMicrobiome, Dr. Rishabh Kala, Director of Research Service at Genemarkers, Dr. Beatrix Förster, Founder of Holiko, Allison Garlet, Technical Service Specialist of Bioactives at BASF, Charlotte Vedel, Founder and COO of Lactobio, Pascal Yvon, SVP of Commercial Strategy and Sales of S-Biomedic, Luc Monbourquette, Director of Global Business Development of LAC2Biome, Oliver Worsley, Co-Founder and CEO of Sequential Bio.

*“The skin microbiome holds a wealth of knowledge and wisdom within its labyrinth ... It is made up of trillions of bacteria, fungi, viruses; [and] these busy little organisms work together in epic cohesion to ensure your skin is functioning at its best,”* explains **Elsa Jungman PhD, Founder and CEO of HelloBiome**, a tech platform dedicated to researching the skin, scalp, and vulvar microbiomes.

And while she sees that, *“today ... beauty science has come to realize the amazing contribution our microbiomes offer our skin,”* **Jungman** also acknowledges that *“the research within the world of the microbiome is still very early.”* All of the experts I spoke with for this column agree. Even as long as we've been studying and discussing biome beauty, what we know today about the human microbiome is only the beginning.

What the experts that I spoke with – across claims, certification, clinical testing, ingredient innovation and brand formulation – don't agree on is how cosmetic and personal care suppliers, manufacturers, and brands should address the microbiome. But, when viewed collectively, their strategies sort neatly into three overarching approaches to biome beauty: 1) Leave it alone and learn more, 2) Help it function smoothly, and 3) Modify it for the moment.

# Microbiome Beauty Science

## Leave it alone and learn more: the microbiome-friendly beauty movement

Over the past several years the cosmetic and personal care industry has become a very friendly place: products and ingredients have been described as vegan-friendly, menopause-friendly, oncology-friendly, Instagram-friendly, and of course, eco-friendly. But one friendly beauty movement that seems to be really taking hold is microbiome-friendly beauty.

HelloBiome is a good example. **Founder and CEO Elsa Jungman PhD**, explains that her data and insights company has its origins in the consumer products sector and that today her work is dedicated to “providing customers and businesses alike with the tools they need to test and create microbiome-friendly products and solutions.”

“In 2020,” she says, “we launched Dr. Elsa Jungman skincare, the first certified microbiome-friendly skincare [brand] in the US with an objective to propose the first minimal line of skincare that would rebalance the microbiome. In 2021, we launched the Skin Microbiome Kit, the product of 2 years of internal clinical research, which allowed our customers to test their microbiomes at home and receive personalized recommendations based on their skin profile. These products and test kits opened a new door for us and customers with the ability to feel confident and empowered by products that are aimed at restoring and balancing the microbiome.”

And before long, she tells me, “HelloBiome ... will offer companies the ability to offer branded test kits to their customers and receive high-precision microbiome data and insights supervised by scientists and developers within the team.” Her venture aims to do for consumer microbiomics what companies like 23andMe and AncestryDNA have done for consumer genomics. Anyone interested can sign up to learn more at [www.hellobiome.com](http://www.hellobiome.com).

Other clinical and consumer microbiomic testing companies are taking a similar data-gathering approach to microbiome care, including Labskin, which “bridges the gap between pre-clinical and clinical studies ... our expertise lies with evaluating the effect of products on the skin microbiome,” according to **Éile Butler**, whose role as **Senior Technical Research Manager at Labskin** has her providing technical support to the company’s sales and service team, and designing studies so clients can investigate their products in relation to the skin microbiome and skin itself. “We are seeing a lot of interest in microbiome-friendly testing or rebalancing the skin microbiome,” **Butler** tells me.

Labskin, as you’ve likely reasoned, conducts testing on lab-grown human skin. Their particular “model is composed of two different cell types (keratinocytes and fibroblasts) differentiating into the top four layers of the dermis and epidermis. Unlike other models, it can produce its own collagen which allows for great barrier differentiation and a dry stratum corneum, thus allowing for effective microbe colonization and analysis of the host-microbe interaction. Although standard broth and agar testing is beneficial for investigating antimicrobial activity of products against different microbes, being able to investigate the host-microbe interaction is critical when thinking about the skin microbiome,” **Butler** explains.

The company (headquartered in North Yorkshire, England) offers clients a Microbiome Friendly+ Seal of Approval. “If a product does not influence the microbes outside of our validated range, the products are certified Microbiome Friendly+ according to our protocol,” she says.

“For our microbiome-friendly test ... we have strict guidelines and use only a small snapshot of the skin microbiome ... *S. epidermidis*, *Cutibacterium acnes*, *Corynebacterium striatum*. These make up over 90% of the majority of skin sites and, although not specific, provide our clients with a standard non-specific testing method that has been validated.”

“As well as this, we are able to test the effect of different test items on rebalancing or protection by including an opportunistic or pathogenic microbe onto the Labskin, and assessing the effects of the products. In both cases, we measure the effects through bacterial enumeration techniques, and can also include other endpoints such as cytokine analysis or barrier function through gene expression or immunohistochemistry,” says **Butler**.

Similarly, the concept of microbiome friendliness is at the very center of everything that **MyMicrobiome**, a biotechnology research startup based in Liechtenstein, does.

**Founder Dr. Kristin Neumann** tells me that, “MyMicrobiome has the vision of a better, microbiome-friendly world,” which means her company is dedicated to providing scientific education to the public and “to helping companies develop products that work with the microbiome.”

MyMicrobiome is best known the cosmetic and personal care industry for its certification program available for both consumer goods brands as well as beauty ingredient makers. “Our seal,” explains **Dr. Neumann**, “is the world’s only registered certification



MyMicrobiome – Certification-Science

mark for ‘microbiome-friendly’ products. Having the seal registered as a certification mark gives our clients and customers the confidence that we are always working independently, transparently, and according to the highest scientific standards.”

And, she spells out the thinking behind the concept of microbiome-friendly beauty, saying that historically, “the cosmetics industry did not take the microbiome into account when formulating products; the focus was on making products stable and good smelling instead of [on making them] minimal and mild.”

“This is changing now,” she says, as Western societies adopt a more holistic approach to skin health and skincare. Like other human microbiome experts I spoke with, **Dr. Neumann** knows that we are only beginning to understand the microorganisms and their functions in this tiny yet critical environment. And she emphasizes that as we get started, regulation is lacking and claims are often unsubstantiated.

“Right now,” **Dr. Neumann** recommends that “products should be formulated in a way that it does not interfere with the existing microbiome, using milder and fewer ingredients.” Acknowledging that “stability may become a challenge,” she points out that “it is possible to find the right balance between stability and microbiome-friendliness. Besides mild preservative systems, one can also use alternative packaging,” she says.

At Genemarkers, a United States – based company that “has been offering genomic biomarker discovery to consumer products’ companies for the past 15 years,” microbiome-friendly beauty is more about how the skin microbiome functions in the presence of ingredients or product formulas than it is about simply not disrupting it.

The company’s “testing is most often utilized for validating efficacy and determining the mechanism of action for raw materials,

formulations, and finished products,” **Dr. Rishabh Kala, Director of Research Service at Genemarkers**, tells me, adding that so far as microbiome beauty is concerned, “Our clients are primarily interested in determining if their products or ingredients are microbiome friendly (i.e., produced a change in a specific microbial population) or understanding how changes in microbial composition correlate with specific skin conditions like acne or psoriasis.”

Microbiome-focused work is a new addition to the Genemarkers portfolio. And “the testing,” explains **Dr. Kala**, “is performed on clinical samples either using a shotgun sequencing or 16S RNA sequencing. A typical study design would involve applying a test product to the face or forearm every day for 14 or 21 days. Throughout the test period, microbiome samples are collected at 3 different timepoints using Sequential Bio’s proprietary collection strips. These collection strips are superior in that they allow for analysis using only a single tape strip. Changes in the study participant’s microbiome are quantified compared to the baseline (initial – time point) assessment.” More on Genemarkers’ recent partnership with Sequential Bio later in this article.

### Help it function smoothly: supporting the skin microbiome with prebiotics and quorum quenching

Startup beauty brands and independent small businesses are a good place to look to find the latest technologies and ideas. These ventures are often fueled by creativity, unconstrained by the way things have always been done, and in touch with emerging consumer expectations. So when we’re trying to picture the future of biome beauty, this is a good place to look.

Gallinée, a brand launched in London, England, in 2016, was an early innovator in the microbiome space and continues to grow in

popularity as well as through innovative product launches. The brand now spans skincare, body care, hair and scalp care, supplements for skincare and another supplement for oral microbiome care in addition to a conventional oral care product. The brand's tag line is: "You are 50% bacteria. Care for them." And to help consumers do just that, Gallinée formulates with prebiotics, probiotics, and post-biotic ingredients.

AYUNA· Less Is Beauty is a clean, well-aging skincare brand based in Barcelona, Spain. AYUNA launched in 2017; and the luxury brand takes a quorum-quenching approach to the human skin microbiome, formulating with ingredients that adjust the way bacteria communicate with one another, thus preventing the formation of harmful biofilms and preventing unwanted changes in genomic expression.

**Holiko**, a newer brand to enter the biome beauty market, takes a related but slightly different approach to microbiome skincare. Based in both the Netherlands and Germany, Holiko launched in 2020; and according to **Founder Dr. Beatrix Förster** formulates product to "create unfavourable conditions for unwanted bacteria within the skin microbiome, helping wanted bacteria to create a stable and resilient cohabitation."

"Our key ingredient," she tells me, "is whey concentrate and especially the contained antibodies with detox properties. We attach great importance to the fact that the milk used as a raw material meets the highest cosmetic requirements, but at the same time is surplus milk and not suitable for the food chain."

"The microbiome," believes **Dr. Förster**, "can no longer be ignored when developing skin-friendly products ... The microbiome forms a symbiosis with the skin and needs to be cared for ... This is the only way the skin can be healthy and therefore beautiful in the long term."

## Modify it for the moment: adding live bacteria to better the human skin microbiome

This third approach to microbiome care might be called the MotherDirt approach. You may know MotherDirt as a bold and early innovator in microbiome skincare. The brand got its start in July of 2015, bringing three personal care products to market, including the AO+ Mist, which is sold to this day and includes live *Nitrosomonas eutropha* D23, a patented strain of ammonia-oxidizing bacteria (AOB), manufactured by the brand's parent company AOBiome, a biotech and skin health research company in the United States.

According to the brand's inaugural press release, ammonia-oxidizing bacteria are "a microorganism found in soil and critically important in nature ... [that were also] once a crucial part of the skin's ecosystem, but they've been lost due to modern chemistry in today's products and our lifestyles." (If you're curious about soil bacteria and the benefits they can lend to human skin, you may want to look into a company called Uute Scientific in Finland and that company's RE-CONNECTING NATURE® ingredient.)

The MotherDirt approach to microbiome skincare is a true topical probiotic approach, adding live bacteria to the skin. Though the ingredient makers I spoke with aren't focused on AOB. Lactobio and BASF, for instance, are both working with the lactobacillus genus.

BASF, a legacy beauty ingredient maker with its headquarters in Germany, is on track to launch 2 biome beauty ingredients this year, as **Allison Garlet, Technical Service Specialist – Bioactives**, tells me: "Probiolift™ [which the company believes] is the first cosmetic ingredient with a true living probiotic that helps make the skin appear fuller and improves the appearance of forehead wrinkles; and Postbiolift™, a postbiotic solution that helps make the



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Genemarkers – microbiome clinical testing



© Lactobio-microbiome-skincare-ingredients

skin appear more elastic, smooths the appearance of crow's feet wrinkles, and creates an appearance of an even complexion. Both of these cosmetic ingredients harness the beneficial bacteria, *Lactobacillus crispatus*, that is considerably decreased in older skin." "We've focused a lot of time developing knowledge and capability in understanding how to formulate live bacteria into personal care products," says **Garlet**. "We wanted to understand the impact of different formulation ingredients, including in the impact of preservatives on living probiotics. This testing involves developing formulations and assaying for the live bacteria over time in different temperature conditions. This information," she says, "is essential for formulators."

"**Lactobio** was founded 5 years ago with the aim to identify (by screening) new probiotic lactic acid bacteria with targeted functionalities, and from these new identified strains, develop a microbial solution to a microbial problem" says **Charlotte Vedel, Founder and COO of Lactobio**, a microbial solutions company based in Denmark.

"The [company's] focus," she tells me, "has been on dysbiosis of the human microbiome, especially the skin. The skin is our largest body organ and first defender ... About 20% of the human microbiome is in the skin, these microorganisms help keep us healthy, performing countless functions. They protect us from disease, environmental toxins, and other dangers, digest dead skin cells, produce vitamins and other nutrients, and regulate our immune system. They help ward off harmful microbes."

"When in balance," says **Vedel**, "the pathogens don't cause issues, and the healthy microbiome can protect from their effects. But due to competition for nutrients and things we expose our skin to,

which the good bacteria cannot survive, the pathogens could come to dominate the microbiome and cause skin issues." So here's where lactobacillus comes in. Lactobio offers private label skincare, has its own proof-of-concept brand BAK Skincare on the market, and has commercialized 4 strains of lactobacillus as cosmetic ingredients: "*Lactiplantibacillus plantarum* LB244R® is a bacteria found in fermented cabbage, it inhibits a specific clonal type of *Staphylococcus aureus* associated to severity of eczema; *Lactiplantibacillus plantarum* LB356R® is a bacteria found in fermented beet, it binds to pathogenic ribotypes of *Cutibacterium acnes* and inhibits biofilm formation of the *C. acnes* bacteria; *Pediococcus pentosaceus* LB606R® is a bacteria isolated from a healthy infant microbiome, selected for its ability to inhibit the growth of *Candida*; and *Lactobacillus crispatus* LB714R® is a bacteria isolated from vagina of a healthy late pregnant woman, selected for its ability to bind to *Gardnerella vaginalis* and inhibit vaginosis by establishment of a healthy pH and microbiome in the intimate area," according to notes **Vedel** shared with me.

When asked to distinguish between conventional skincare and the Lactobio style of biome care, **Vella**, notes that, "The skin and the skin microbiome are not separated, there is symbiosis with individual differences, multiple interactions and pathways involved and a lot of the mechanisms and interactions are not yet understood ... Ingredients are typically chemicals or biochemicals and have a physical functionality in a cosmetic product or it can be ingredients with an effect as a bioactive on skin. The mechanism of action can be both directly on the human skin cells or on the microorganisms in the skin or on both."

"Whether a compound is added as an ingredient with a beneficial effect on the skin cells or if a prebiotic or intermediate is added for a microorganism in the skin to produce the same beneficial effect on the skin cells is just different mechanisms of action with the same result on the skin cells. However," she emphasizes, "the live microorganisms contribute with not just an ingredient but a metabolism – a cell factory – and will produce much more than one compound."

**S-Biomedic**, a Belgium-based biotechnology research company founded in 2014, also appreciates the metabolic contribution of probiotics. The company "has developed an expertise and extensive scientific foundations on true probiotics as a living bacteria ... a smart active ingredient factory right on your skin, which can constantly produce fresh beneficial ingredients," according to **Pascal Yvon, SVP of Commercial Strategy and Sales**. The "core principle" at S-Biomedic, he tells me "is to work with the skin microbiome as nature intended it (the power of nature, as the result of millions of years of coevolution). That is: to develop expertise in true skin microbiome commensals and particularly those with high influence potential for health benefits."

S-Biomedic specializes in *Cutibacterium* and what **Yvon** calls a blended approach to ingredient innovation, partnering with key industry innovators to develop proprietary probiotic ingredients and, "developing a portfolio of ingredients available to all beauty brands."

He explains further saying, “S-Biomedic has developed the understanding of thousands of *C. acnes* strains (the advances in sequencing technologies has pushed the boundaries and discovery capabilities), by fully sequencing many of them and identifying their specific beneficial effects on key skin functions. Using its large *C. acnes* strain bank, S-Biomedic has developed a high-performing technology platform to select the *C. acnes* strain of interest for a specific skincare benefit and application (e.g. healthy aging), either directly with true probiotics or indirectly with post-biotics (*C. acnes* metabolites).”

**LAC2Biome** is also at work innovating what’s possible with probiotic skincare. Founded in 2019, Italy – based “LAC2Biome has launched a white label probiotic serum (InfiniteSkin™ Microbiome Serum) with a strong technical package that includes both *vivo* and *vitro* data,” says **Luc Monbourquette, Director of Global Business Development**.

“I can honestly say,” **Monbourquette** tells me, “being involved in probiotics now for nearly 20 years, I’ve never been so excited about a new category such as true probiotic skincare!”

“The reason for [the LAC2Biome] white label solution,” he explains, “was to address the technical challenge of delivering live bacteria in a topical product with 24-month, room-temperature shelf stability. The product meets all the criteria of a probiotic as per the WHO [World Health Organization] definition including the needed strain specific data. What we have seen and validated through our soon to be published clinical study is that our serum has shown to reduce redness, pimples, and increase hydration within as little as 14 days. This once-a-day serum looks to have tremendous potential for consumer benefit and one we are incredibly excited about.”

## Back to the big picture: testing formulations, gathering data, and improving technology

“For the first time ever, we’re able to...ask, What is happening at the level of the invisible?” **Oliver Worsley is Co-Founder and CEO of Sequential Bio**, the biotechnology research company (focused on large-scale genomic testing and AI functionality) that **Dr. Rishabh Kala, Director of Research Service at Genemarkers**, mentioned earlier in this article.

Sequential Bio’s newly announced partnership with Genemarkers will not only mean that the company’s collection strips are available to more beauty industry innovators, developing ingredients and products with the human skin microbiome in mind, but also that Sequential Bio will be able to meet its own database-building objectives more swiftly. Good news for Sequential Bio, which **Worsley** describes as “an end-to-end microbiome testing solutions company for the skincare industry.”

While building the “AI-driven microbiome platform,” he tells me, “we have worked with over 30 companies, and over 10,000 skin microbiome samples, to comprehensively evaluate their products

on the microbiome *in vivo*, and advise them on formulation design.” And he emphasizes that, “the microbiome is complex, and therefore there is a lot of need to test products on the microbiome in a controlled, longitudinal study, directly on the skin!”

“We are planning to grow our database 10x from 10,000 skin microbiome samples and corresponding cosmetic formulations, to 100,000 by the end of 2023,” says **Worsley**. “This dataset will allow us to train more accurate AI-driven insights, leading to improved understanding of global skin types, healthy versus diseased skin, and optimal formulation design with the microbiome at the center.” In short, more data means more possibility.

When asked about how the science has been advancing at Sequential Bio, **Worsley** highlights 3 aspects of the company’s work: “Firstly,” he says, “an exciting area that we work on is functional analysis. From our Skin Patch (or swab), not only do we collect DNA but we collect RNA, from both the human and microbial cells. This allows us to understand inflammatory markers present in the host, and compare these to what the microbiome is doing. Secondly, we can get down to strain level and absolute quantification in our testing, which gives a resolution that can’t be seen using traditional sequencing techniques, for example, the alpha diversity of the skin microbiome on the face may not have changed – but a specific strain of *C. acnes* has been altered leading to a specific inflammatory state. Thirdly, sequencing costs are falling precipitously, this has allowed us to do more exploratory work where we are finding new fungi and new viruses, in addition to bacteria, that we can understand further in the context of product formulation and skin health.”

Telling me why he got into this line of work, **Sequential Bio CEO Oliver Worsley** says, “I saw the human microbiome as endlessly exciting as studying something like astronomy.”

Others have likened it to a planet, a rainforest, a city, or a symphony. Whatever analogy you prefer, the human skin microbiome is an immensely complex ecosystem. And even with our finest sequencing efforts and highest-level learning technologies, we have only just begun to glimpse the sophisticated world that is the human microbiome.

It is clear to me, from the interviews I conducted to write this article and from my own learnings and observations of biome beauty over the years, that we don’t yet know how best to engage with the microbiome for skin health or cosmetic outcomes. But this is, I suppose, the very reason that beauty science exists: so that those among us with the curiosity, the patience, and the tenacity can systematically explore this ecosystem, gather information, and move biome beauty into the future. ■

*CORRECTION: The previous Global Perspectives column (July/August 2022) ‘Microalgae Beauty Ingredient Innovation’, indicated that the INCI for DSM’s PEPHA®-TIGHT CB ingredient was Dunaliella salina. In fact, the INCI for PEPHA®-TIGHT CB is Algae Extract (Nannochloropsis Oculata), Pullulan. Dunaliella Salina Extract is the INCI for DSM’s PEPHA®-CTIVE CB ingredient, which the company says, “protects and stimulates mitochondria ... and can be used in skin energizing formulations to visibly improve skin luminosity.”*