

Let's educate!

Prebiotics  
Probiotics

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# Pro-, Pre-, Post-, Para-biotics: Different technological approaches to interact with body microbiomes

Nutraceutical market is influencing the consumer awareness to select safe and efficient products that could prevent human diseases, improve health and make people feel younger. ROELMI HPC is an Italian company dealing with innovation into the Life science market. Dr Piangiolino is the Market manager for the nutraceutical area and is responsible for medium-long term strategies and investment in this field.

ROELMI HPC nutraceuticals portfolio is quite extended: the production is based on two main technologies, Biofermentation and Nature. Biotechnology is at the basis for probiotics and sodium hyaluronate manufacturing, while Nature leads to obtain natural phyto-complexes via sustainable methods.

Global attention indeed is given to sustainability and environmental preservation; social media campaigns are diffusing and allowing to educate people about climate changes and "being green": sustainability is ROELMI HPC *fil rouge* for proactive efforts in the daily life and from industries perspectives. Low impact technologies (like

bio-fermentation), circular economy, products from non-edible sources, alternative energies, non-animal studies, all aim to concur towards a more sustainable business for us.

All proprietary product lines and technologies are aligned with our sustainability program "NO IMPACT IN PROGRESS® (NIP)" based on Quality and Efficacy, focusing on People safety and Environmental preservation.

By focusing on both innovation and green manufacturing processes, ROELMI HPC has developed the Full Spectrum technology, applied to hyaluronans, derived from the modulation of the fermentation conditions, to obtain multiple peak spectrum, mimicking natural body composition, instead of a single standardized polymerization grade. Full Spectrum technology reported astonishing clinical results with respect to standard

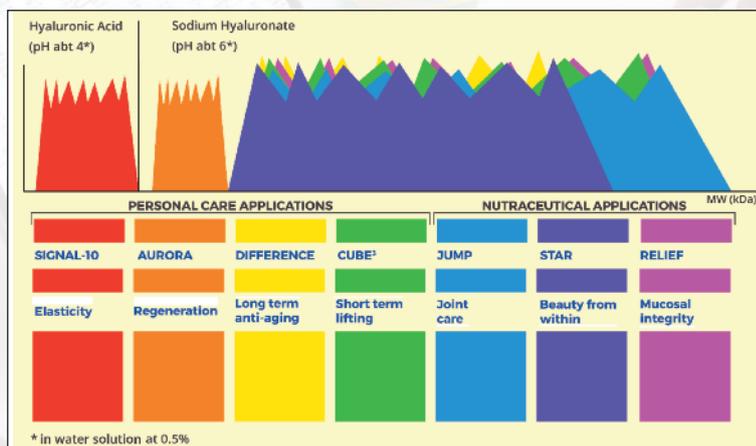


Figure 1 - Hyaluronan 2.0 - Full spectrum technology.

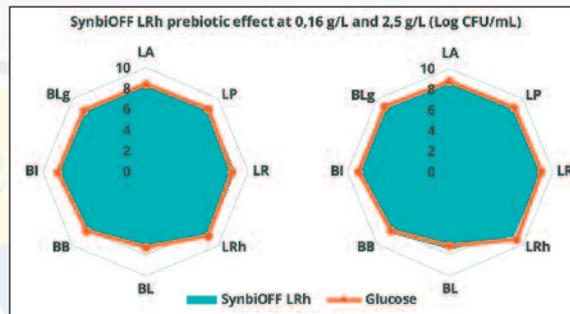
sodium hyaluronate, because it naturally activates physiological processes with a wider range of mechanism. ROELMI HPC has extended the Full Spectrum technology to both Nutraceutical market with ExceptionHYAL® line and to Cosmetics with PrincipHyal® brand, where different spectra have been created for each target (Figure 1).

Although we focus our attention on different nutraceutical ingredients, our most thrilling product category are probiotics: with an expected worldwide growth from \$ 27.9 billion to nearly \$ 45 billion between 2011 and 2018, the probiotic market still has a big part of the dietary supplement and food actor's attention. Such a fast growth is linked to the correlation between probiotic activity on gut balance and healthy effect on other body areas.

Recent studies have highlighted the link between localized microbiome dysbiosis on skin for instance – prevalence of pathogens compared to the healthy microbiota composition – and inflammatory or allergic diseases – for example atopic dermatitis or acne. Further studies pinpoint a correlation between skin and intestine – the so-called gut–skin axis – considering gut dysbiosis as well can affect skin conditions by inducing systemic inflammation which triggers dermatological diseases.

Not all microorganisms may have the same effect on the host due to the heterogeneity of bacteria species and strain specificity in terms of functional performance. Thus the correct use of probiotics as therapeutic or preventive agents necessarily goes through the precise knowledge of their activity. With this purpose in mind, industries are investing into the post-biotic approach by isolating active metabolites from fermentation or promoting complex biomasses characterized by the concomitant presence of deactivated cells and their active compounds.

Considering the influence of gut microbiota into several physiologic pathways and the strong knowledge on bio-fermentation, ROELMI HPC has developed a corporate "Microbiome" focus through the collaboration between Nutra and Cosmetic departments, with the aim to interact with local microbiomes, leading



**Figure 2: Prebiotic effect.**  
SynbioOFF LRh showed to exert a prebiotic effect on SynBalance® strains, promoting probiotic growth as efficiently as glucose at different concentration, suitable for capsule and stick (0.16 g/L and 2.5 g/L respectively).

to a multi-disciplinary approach to restore homeostasis, by involving pre-, pro- and post-biotics via both oral and topical administration.

ROELMI HPC objectives vary from the investigation of probiotics not only within the intestine, but also by looking at their effect on skin inflammation, cognitive function, metabolic pathways, urogenital system, to the exploration of alternative cutting-edge technologies to develop ingredients interacting with microbiomes.

With the aim of providing a wide range of beneficial bacteria for the health concerns, ROELMI HPC developed SynBalance® line of proprietary strains belonging to *Lactobacillus* and *Bifidobacterium* species, characterized by the highest quality and stability features as well as proven performances, both *in vitro* and clinically tested.

At ROELMI HPC we invest a lot in R&D, always seeking the latest need of consumers, by providing scientific dossier for our proprietary strains and high quality standard. Consequently, this lead to investigate how probiotics could make a difference in different body district: up to now, our research is targeting gut-brain-skin axis, metabolic syndrome, gut-liver axis and improvement of nutrients absorption, with extremely positive results.

Studies showed the versatility of probiotics: beyond their intrinsic activity in re-balanced gut microbiota, they can produce vitamins and bacteriocins with antimicrobial, enzymatic or immune-modulating activity according to strain-specific performances.

Recently, attention is dedicated to "synbiotic solutions" which focus on the combination of pre- and probiotic, in order

to booster probiotic functions thanks to prebiotic support.

Internal studies have shown a certain grade of selectivity in the prebiotic capacity as well, showing that some specific prebiotic-strain combinations would give comparable result to the growth performance obtained with glucose only. Even our heat-inactivated strain SynbioOFF LRh exerted a prebiotic effect towards the tested strains (Figure 2), providing new insight about the potential of pre- and parabiotic applications. We define parabiotic as everything which could be an alternative to living probiotics like in this case tyndallized bacteria.

In order to align with the latest market trend and with an eye to the far-east markets, ROELMI HPC introduced a new technology to protect probiotics and make them suitable for food application by encapsulation technology, with the aim to preserve them. A new era of probiotic functional foods potentially opens, by associating the health benefits with leisure: just think about chocolate, juices, bars, meal replacers. Stability, compatibility and feasibility trials have been carried out on our ProbiShell strains, to develop innovative probiotic concepts.

Another challenging subject is personalized nutrition aiming to identify specific needs and address targeted solutions: the genomic analysis is now affordable for the end-user, driven by a strong awareness and willingness to actively preserve his health. Such approach is allowing to determine specific solutions for 21st century diseases in the Western and developed countries: in particular obesity and cardio metabolic diseases, stress and sleep discomforts, cognitive neurodegeneration and comorbidities in elderly.

Within the corporate challenge of technology transfer from one department to the other, ROELMI HPC has designed a post-biotic molecule aiming to rebalance the skin microbiome affected by external stresses like air pollution or salty/chlorinated water and is currently working on heat-inactivated probiotics with prebiotic and immune-mimetic effect directly on the skin.