Innovation Inspired by Nature

There is Possibly Nothing More Natural than Biomimetic Skin Care

By Alison O'Neil, B.S. *

Author's Note:

Perhaps you don't realize your most likely first brush with the concept of biomimicry but, you may recall the show, The Six Million Dollar Man. In 1974-78 these words were emblazoned on everyone's mind and commonly parroted by watchers at the opening of each show, "Steve Austin, astronaut. Barely alive." "We can rebuild him. We have the technology. We can make him better than he was. Better, stronger, faster." But that idea to most of our limited knowledge at the time, was just science fiction, it could never be the truth.

Biomimetics Definition & Meaning

If art imitates life than this was a perfect example of biomimetics. Only we knew it as bionics which is another term that is considered interchangeable. ***Bionics*** or biologically inspired engineering, as it was defined by Jack E. Steele in 1960 through his work in Aeronautical Engineering, is the application of biological methods and systems found in nature. Bionic implants differ from mere prostheses by mimicking the original function very closely, or even surpassing it.

Considered a blend of science and art, biomimicry then is innovation inspired by nature. The simplest way to describe biomimetic design is *that which imitates life.* It seems that the intersection of technology and biology is one place we have found inspiration for today's innovative design in sciences and technology across life.

Otto H. Schmitt, an American biophysicist and one of the key founders of the biomedical engineering field coined and regularly used the term in the early 1960's but, officially published an article on ***"biomimetics"*** in 1969[1]. Following that introduction, Webster's Dictionary added it in 1974. The terms biomimicry and biomimetics come from the Greek word's bios, meaning life, and mimesis, meaning to imitate. Other terms often used are bionics, bio-inspiration, and biognosis. In the literature, Biomimicry appeared in 1982 but it was not until 1997 in her book, *Biomimicry: Innovation Inspired by Nature,* that Janine Benvus[2] is credited for popularizing the idea of a "new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems". Throughout her works, Benvus emphasized sustainability as an objective of biomimicry.

Biomimicry Definition & Examples

There are generally three types of biomimicry modeled after three biological levels in the fauna or flora – one is imitating mechanisms of action; Velcro is the most famous example of biomimetics.

In 1948, the Swiss engineer George de Mestral was cleaning his dog of burrs picked up on a walk when he realized how the hooks of the burrs clung to the fur.

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Another is mimicking natural methods of manufacture, like photosynthesis in a leaf, and the third is mimicking at an ecosystem level – studying organizational principles from the social behaviors, such as ant foraging and bee foraging and leading to the building of a nature-inspired city. Some examples of Biomimicry inspired designs that have changed the way products we use every day are made are Fireflies which are the model for LED bulbs, the adhesive that allows mussels to stick to rocks inspired bio adhesive gel for blood vessels, and Humpback Whale Fins have led scientists and engineers to create the methodology of Wind Power.

The term "biomimetic" is preferred for references to chemical reactions, such as reactions that, in nature, involve biological macromolecules (e.g., enzymes or nucleic acids) whose chemistry can be replicated in vitro using much smaller molecules.

Biomimicry in Skincare – what is it?

Biomimetic skin care is an advanced approach to formulation utilizing innovative plant-based and synthetic biomimetic ingredients that integrate nature and science. These ingredients mimic skin structures and biochemicals which enable optimal delivery and results; this is the next frontier in natural skin care.

Several years ago, I was introduced to **Dr. Cesar Mauricio Rojas,** a scientist in Bogota, Colombia who had an intriguing technology in the cosmetics arena. Utilizing a proprietary physiocell technology to utilize the most active parts of flora from the Amazon, enzymes from those plants were biologically altered and BioZymes were borne. Physiocell technology includes natural enzymes purification from plant sources, that are used to obtain and facilitate the bioavailability of existing phytocomponents mainly from Crassulaceae, Lamiaceae, Orchidiaceae, Asteraceae, Arecaceae, Euphorbiaceae plant families, which include about 300 different plant species.

The observation of nature and the understanding of the processes at different levels, both ecological and chemical, have allowed identification of the intrinsic values of plants such as Copoazu *(Theobroma grandiflorum),* whose fruit is used as a skin moisturizer and to strengthen the hair fiber or the Annatto *(Bixa orellana)* used as a healing agent and as an antibacterial agent.

Theobroma grandiflorum

Bixa orellana

Exotic fruits such as Yaca or Jack fruit *(Artocarpus heterophyllus),* considered the largest fruit on the planet, are used in formulations for hair care. Moringa's antioxidant capacity is used in anti-aging formulations and as anti-pollution for skin and hair.

Artocarpus heterophyllus

Moringa oleífera

Acerola cherry *(Malphigia emarginata)* Okra or Ladies' fingers *(Abelmoscus esculentus),* Papaya *(Carica papaya)* and Karkade *(Hibiscus sabdariffa),* recognized for their wide use in the food industry, are incorporated into the formulations as powerful antioxidants.

Malphigia emarginata

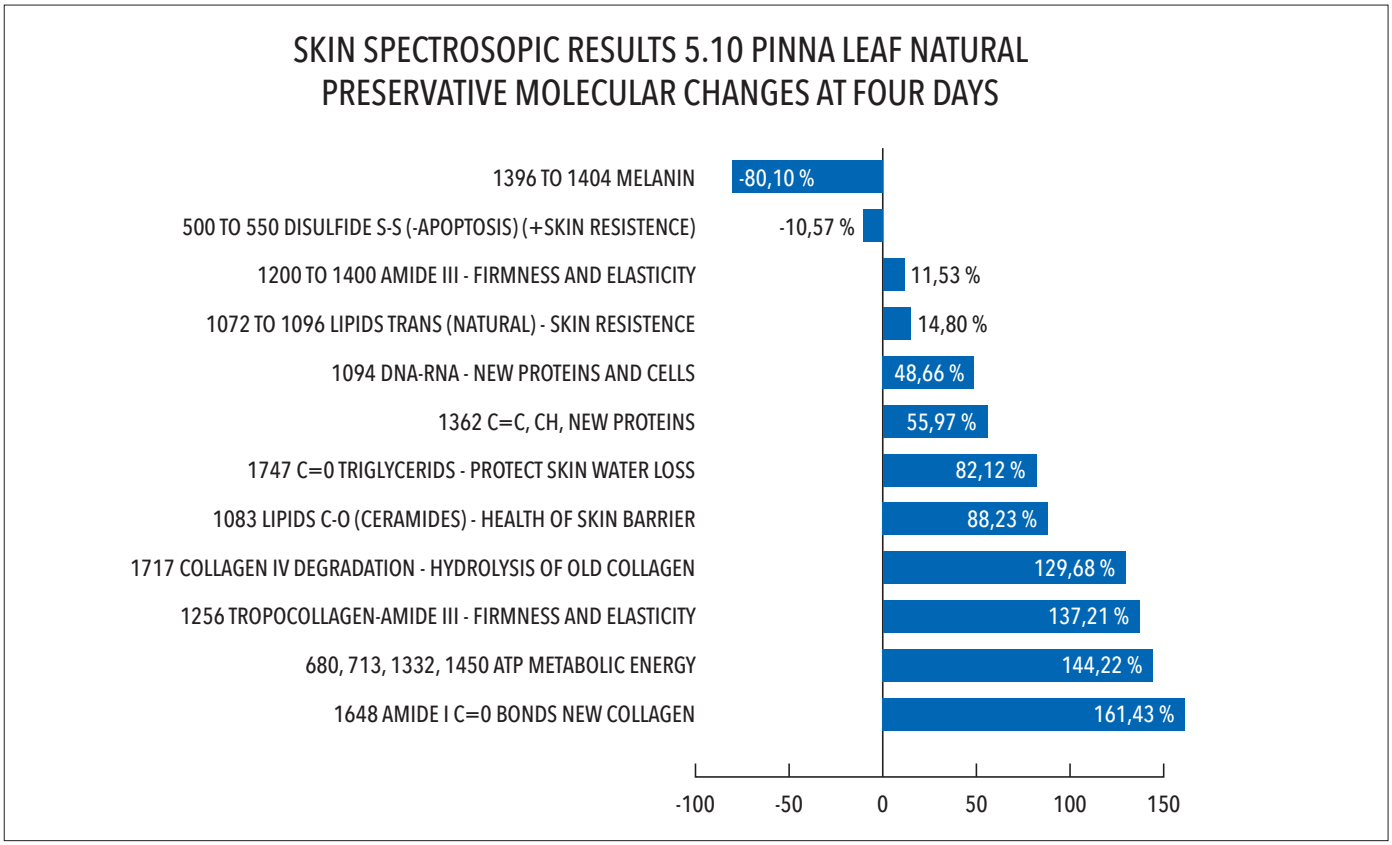
Abelmoscus esculentus

Carica papaya

Hibiscus sabdariffa

As these examples exist many in the great biodiversity of the tropics; Biozymes biotechnology has made it possible to safely utilize the efficacy of its phytocomponents, taking care of the health of the skin microbiome and taking advantage of the synergistic effect that these plants offer at the service of all.

Today, they are used as preservatives like, **Pinna Leaf NP™** and integral compounds of formulas that affect the life of products and the health of the skin directly due to their traits that mimic the natural behaviors of the chemistry of the skin. Spectroscopic studies show decreased melanin production, reduction in old cells, greater skin resistance, heightened skin nucleic acids (specifically DNA & RNA), significant improvement in water loss protection (Natural Moisturizing Barrier), increased ceramides, skin firmness and elasticity, ATP (skin energy), and impressive influences on new collagen production. As it turns out, BioZymes a true example of biomimetic skin care.



Conclusion

The increased interest in natural, sustainable product development has been the rage due to their seemingly friendly ingredients. Drawn from effective marketing campaigns in their favor of sustainability and against the suspected evils of traditional chemistry in personal care products and the environment, they are imagined by consumers to be safe, and effective. As chemists know they may be neither which is why the importance of a new term that has been hiding in plain sight for years is welcomed. Now we can explain how traditional chemistry, utilizing the ideal forms of the ingredients can and will mimic the natural abilities of healing and healthy skin lifelong.

Now, that which imitates life, is effectively impacting life itself.

My introduction to the term and interest in biomimetics was also inspired by recently meeting noted pharmacist and nutritionist, Benjamin Knight Fuchs, R. Ph.
In our conversation he helped me to appreciate the true value of studying the formation, structure, or function of biologically produced substances and materials (such as enzymes) and biological mechanisms and processes (such as protein synthesis or photosynthesis) especially for the purpose of synthesizing similar products by artificial mechanisms which mimic nature.

References

1 *Schmitt O. Third Int. Biophysics Congress. 1969. Some interesting and useful biomimetic transforms. p. 297.*

2 *Benyus, Janine (1997). Biomimicry: Innovation Inspired by Nature. New York, USA: William Morrow & Company. ISBN 978-0-688-16099-9.*

Meeting with Benjamin Knight Fuchs, R. Ph, Pharmacist and Nutritionist with passion and focus on developing skin health products based on the concept of biomimetics

Alison O'Neil: *Can you introduce yourself, your professional and personal path?*
Benjamin Knight Fuchs: I'm a registered pharmacist, specializing in dermatology and I've been compounding skin care formulas both prescription and nonprescription for nearly 40 years.

Alison O'Neil: *Dr. Fuchs, how do YOU define Biomimetic?*
Benjamin Knight Fuchs: Mimicking biology, the same as or analogous to molecules that are already in the body and skin.

Alison O'Neil: *When did you learn about these ingredients?*
Benjamin Knight Fuchs: Biochemistry 101 as biomimetic ingredients are simply molecules (and ultimately ingredients) that are already in the body and skin.

Alison O'Neil: *What inspired you to learn more about them?*
Benjamin Knight Fuchs: In my first year of pharmacy school, I took a course called Medicinal Biochemistry and fell in love with the therapeutic potential of molecules native and inherent to the body in skin.

Alison O'Neil:*What makes working in the field of Biomimetics so exciting?*
Benjamin Knight Fuchs: As a student of biology, particularly to biology of the skin, it's an honor for me to be able to introduce the remarkable biochemicals that make the skin such a resilient and dynamic organ, to the nonscientific public.

Alison O'Neil: *When did you first start using biomimetic ingredients in products?*
Benjamin Knight Fuchs: As soon as started formulating prescription dermatological products in the late 1980s. I focused on the use of HIGH CONCENTRATION, biomimetic ingredients.

Alison O'Neil: *Have products always been Biomimetic? If so, why is this term JUST now becoming more used?*
Benjamin Knight Fuchs: Our understanding of the skin, specifically its components and its healthcare are advancing rapidly, and patients are becoming more sophisticated.

Alison O'Neil: *What changes in the skin/ skin con-ditions have you been most impressed by?*
Benjamin Knight Fuchs: Tissue regeneration, healing, anti-inflammation, dramatic visual appearance of health and a glow of vitality without activating allergic or toxic reactions.

Alison O'Neil: *Do Biomimetic ingredients require specific carrier systems?*
Benjamin Knight Fuchs: Transdermal penetrants are helpful for carrying lipophilic Biomimetic ingredients and necessary for water soluble ones.

Alison O'Neil: *How do they target specific cell functions in the skin?*
Benjamin Knight Fuchs: They do not "target specific cell functions", they target the cell which has had 3.5 billion years of evolution to determine how to target functions.

Alison O'Neil: *Are there any cautions that chemists should be aware of when developing BMM products?*
Benjamin Knight Fuchs: Some biomimetic ingredients can be unstable so utilizing forms of biomimetic molecules that have more stability is advisable.

Alison O'Neil: *How is it best stated when referring to these actives? Biomimetic ingredients? Complete BMM products?*
Benjamin Knight Fuchs: I just call them biomimetic ingredients as they are not all active (e.g., biomimetic esters which support transdermal penetration).

Alison O'Neil: *Any outstanding factors that you think professionals should know?*
Benjamin Knight Fuchs: The most important biomimetic actives are essential nutrients which many patients are deficient in.

Alison O'Neil: *What could be done to make Biomimetics a more acknowledged tool in technology*
Benjamin Knight Fuchs: Education.

Alison O'Neil: *Why is nature's approach necessarily the best?*
Benjamin Knight Fuchs: Nature's approach implies familiarity and functionality and leverages the inherent wisdom of billions of years of cellular evolution.

Alison O'Neil: *What is most challenging about Biomimetics?*
Benjamin Knight Fuchs: Cost.

Alison O'Neil: *And what is your favorite biomimetic product and why?*
Benjamin Knight Fuchs: Truth Biomimetic Mineral Mist, it's effective, gentle, inexpensive, and very functional.

Alison O'Neil: *Thank you, Benjamin. Nice speaking with you*