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The Ingredients *Column*

Stem Cells: Rising to the Top



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In everyday life our skin has to cope with a lot of wear and tear; it is in the process of constant self-renewal to replace the old with the new. It is the adult skin stem cells that are constantly at work for maintenance, renewal, and repair of the skin. As knowledge of skin stem cell function and biotechnology expands, the skin care industry has experienced new discoveries of many types of stem cell technologies; hence, various stem cell culture methods have emerged.

Ingredients include plant stem cell products that can stimulate aging adult skin stem cells, plant stem cell products with unique culture methods that can exploit their botanical bioactive powers and offer other specific skin benefits, and non-plant stem cell materials that can protect skin stem cells and their environment to increase skin stem cell longevity.

Down to the Basics

Stem Cells – All stem cells, regardless of their source, have three general properties: they are capable of dividing and renewing themselves for long periods; they are unspecialized; and they can give rise to specialized cell types.¹

Adult Skin Stem Cells – Adult stem cells are relatively undifferentiated, but they have committed to a specific pathway and can produce only a limited number of cell types within their own family of cell types. The stem cells that reside in our skin govern keratinocyte turnover, melanin function, collagen production, elastin, hair follicle renewal, and much more to maintain skin homeostasis. Skin stem cells are also pivotal for repairing the epidermis after injury, as it is stem cells which produce the various family types of skin cells.

Plant Meristem and Callus Cells – Plant meristems are stem cells that function similar to human stem cells by differentiating into cells specific to the development of certain areas of the plant. Meristemic culture areas are typically from plant buds and root tips. Plant callus cell cultures are also used as stem cell ingredients for their similar bioactivity. Plant callus cell cultures are obtained from the plant during the wound healing process or upon stress. As part of the repair mechanism, these cells proliferate and form a callus that basically heals the wound with stem cells similarities. With both technologies, plant meristem cell and callus cell cultures contain key bioactives with a concentrated and specific bioactive potential. This potential is one of the reasons why plant stem cells make intriguing additions to anti-aging skin care products.

Plant Stem Cells Helping Human Skin Stem Cells

This is not a matter of a simple swap, as we are not replacing our stem cells with those from a plant, but isolating and benefiting from the bioactive potential of a particular plant meristem or callus cell culture. Plant stem cells that have been scientifically evaluated and proven to work can be incorporated into skin care products that hold the promise of not only stimulating the proliferation of human skin stem cells, but additionally benefiting skin physiology.

With the advent of high performance skin care, Mibelle Biochemistry established a novel portfolio based upon plant stem cells that benefit our own skin stem cells. Their technology also includes encapsulating the resulting stem cell culture extract into a liposome to stabilize the oil-soluble and water-soluble components of the bioactives and to increase skin penetration. A recent addition is *Symphytum Officinale* Callus Culture Extract. Utilizing Comfrey, the resulting culture extract was shown to speed up skin renewal by activating our epidermal stem cells. By boosting the epidermal stem cell activation, cell turnover increases to rejuvenate the skin from the inside out and maintain the regenerative capacity of skin stem cells.

Always on the cutting edge, Sederma launched *Globularia Cordifolia* Callus Culture Extract. It is obtained and cultured under caloric restriction conditions which illicit a hormesis mechanism and creates large quantities of substances called phenylethanoid glycosides. These substances mimic defensive and protective mechanisms of the plant and when integrated into a cosmetic formula, it is proven that they transfer this action to human cells as well. In-vitro testing indicates the ingredient protects and preserves skin stem cells by boosting of the ability of the skin to fight against pro-aging agents, reducing micro-inflammations, promoting cell detoxification, and stimulation of sirtuin-1 for cell longevity.

Plant Stem Cells with Other Beneficial Skin Functions

Bioactive composition differs from each plant species and transverses a large magnitude of botanical functionality; we have now crossed the chasm to harness those particular bioactive and metabolite components from botanicals with high tech culture processes that can benefit the skin in various ways and mechanisms.

Innovacos has developed a plant stem cell culture system that has a differentiation point of selectively extracting contents from specific intracellular pocket called the vacuolar of the meristem cell. The culturing process is performed at a low temperature to maintain maximal biological potential. *Vigna Radiatus* (Mung Bean) Meristem Cell Culture Extract targets a myriad of biological mechanisms beneficial to skin. *Vigna Radiata*/Mung Bean repairs ultraviolet-induced damage and maintains maximum cellular viability upon ultraviolet exposure with a decrease of pro-inflammatory mediator (IL-8), inhibition of matrix metalloproteinases, and reduction in extra cellular matrix degradation enzymes. It stabilizes the collagen matrix and improves communication between cells and the extracellular matrix so that the survival of the individual cells is improved.

Add the Perspective of Ethical and Green

Without having to use raw materials that might challenge ethical standards, plant stem cell cultures provide benefits and various functionalities when used in skin care products. Plant stem cells offer a complete green approach to preserve the natural balance of the ecosystem. They are cultured away from pollution, pesticides, toxins, and other external factors.

Developed by the researchers at Sederma's Institute of Biotechnological Research, their cultivation method yields high and reproducible levels of desired molecules from specific botanicals known for their bioactivity. Sederma's technology shows the highest reduction in terms of water consumption and negligible soil occupation with the total absence of pesticides and other contaminants. The recent launch includes *Centella Asiatica* Meristem Cell Culture and has been substantiated with multiple in-vitro studies shown to provide effective relief against the signs of rosacea. This relief occurs by protecting the capillary wall and environment from degradatory attack of nitric oxide and inhibiting pro-inflammatory cytokines (TNF- α) that trigger excessive vasodilation.

Protecting Skin Stem Cells and Their Environments

Skin stem cells, unlike other cells, are able to produce copies of themselves over long periods of time and they need to guarantee lifelong integrity by replenishing the layers of skin cells. The self-renewing capacity of skin stem cells is enormous but declines with age and stress. We must preserve our stem cells from depletion and protect the skin's ability to self-renew, repair, and help preserve cells. An intuitive approach is to preserve skin stem cells and their environment with non-stem cell ingredients.

“The self-renewing capacity of skin stem cells is enormous but declines with age and stress.”

A pentapeptide, introduced by Vincience Biofunctionals/Ashland helps preserve the niche environment of stem cells and optimize epidermal self-rejuvenation. Our skin stem cell populations are established and stored in microenvironment niches that regulate how stem cells participate in tissue generation, maintenance, and repair and are essential to stem cell longevity. Pentapeptide-31 targets five key markers (survivin, p63, β -1 integrin, α -6 integrin and keratin 15) that are involved in the regulation of epidermal stem cells and are essential to maintain the population of the epidermal stem cells. Epidermal stem cells serve as the reservoir for keratinocytes involved in normal differentiation and tissue turnover or damaged cells due to stress.

Activating the skin stem cells and preserving stem cell niches provides the skin with the power of protecting and regenerating itself. Skin stem cells help to facilitate the turnover of all skin cells and their capacity is reduced with age and stress. Replenishing and maintaining a continuous equilibrium of skin cells in all stages of their life cycles is critical to maintaining healthy, youthful-looking skin. Unique and patentable stem cell culture methods may potentially yield the next generation of botanical extracts with sustainable and reproducible composition levels of desired molecules for amplified beauty benefits. By combining technologies in cosmetic formulations, we can yield an ideal combination that can work synergistically to treat and protect the skin physiology.

References:

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Diahne Patnode, expert cosmetic chemist, has over 25 years of progressive experience in formulating and developing trendsetting cosmetic products for some of the most recognized names in the industry, including Redken Laboratories, philosophy/BioMedic, and Arbonne International. After studying biochemistry at the University of Arizona, she discovered the beauty industry and an insatiable curiosity for discovering the latest technological advances to create cutting-edge prestige products. As a leader in Research and Product Development, she continues to provide insight that delivers market leading products. Patnode holds multiple patents and is an active member of the Society of Cosmetic Chemists and Beauty Industry West.