Cell Culture Derived Human Bio-signals in Skincare: Is there an Optimal Cell Type to Culture?

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Definition of terms:

1. ***Bio-signals*** *refers to cytokines & growth factors produced through laboratory culture of human cells.*
2. ***Conditioned media*** *is the name given to the nutrient culture broth after all cells have been filtered out and discarded. It contains the bio-signals produced by the cells during culture.*
3. ***Lysed cells*** *are cells that have been ruptured or burst using repeated freeze-thaw cycles.*

History of Topically Applied Bio-signals to Skin

Over the past decade, the safety and esthetic benefits of topical application of human bio-signals to the skin has become well established. A 2003 pilot study used punch biopsies and profilometry to examine the facial skin of 14 patients who applied a gel containing eight different growth factors twice daily for 60 days. The clinical appearance of smoother, less wrinkled skin was confirmed by microscopic examination showing epidermal thickening and new collagen formation. Additional studies have since confirmed esthetic improvements in the appearance of skin through daily application of bio-signals obtained from culture of human cells.

Skincare products are currently available with active ingredients produced from cultured fibroblasts, stem cells from fat, stem cells from bone marrow, and parthenogenic stem cells i.e. unfertilized human eggs chemically induced to proliferate.

Aging Skin is Injured Skin

The structural and esthetic changes seen in aging skin are the result of accumulated micro-injuries over time. Sun exposure, environmental toxins (particularly smoking), gravity and repetitive facial expressions, extract their toll in large measure as a result of chronic sub-clinical inflammation. As described below, the ability of the body to counteract inflammation declines with age, in effect accelerating the rate of tissue aging in later life.

Indeed, inflammation is considered a major factor contributing to most diseases and debilitating conditions of the elderly. Ideally, bio-signals applied to the skin should be pro-healing and anti-inflammatory.

Is there an Optimal Cell Type?

This document examines: 1) the physiologic suitability of each cell type for producing topically effective anti-aging bio-signals; 2) penetration issues relating to the use of lysed cell products on the skin; 3) evidence that products containing bio-signals from bone marrow stem cells provide significant pro-healing and anti-inflammatory benefit when used following esthetic medical procedures.

Cell Types Cultured for Use in Current Products

FIBROBLASTS

TNS by SkinMedica – cultured neonatal (foreskin) fibroblasts. TNS serum contains a high percentage (>90%) of fibroblast culture conditioned media. Fibroblasts produce small quantities of bio-signals compared to other cell types, particularly bone marrow derived stem cells which, depending on the cytokine being assayed, produce up to 50 times more bio-signals than fibroblasts.

Bio-Essentials by NeoCutis – fetal (aborted) fibroblast cells. NeoCutis products contain PSP (Processed Skin Cell Proteins) created from lysed cultured fibroblasts. The resultant ingredient contains all cell contents and remnants. Large particle and molecular sizes severely limits the ability of such an ingredient to penetrate the stratum corneum. Component bio-signals within the lysed cell contents are in even lower concentration than the TNS product above.

PARTHENOGENIC STEM CELLS

Lifeline by ISCO – unfertilized human ova chemically stimulated to proliferate, and then lysed. Like the NeoCutis product above, Lifeline contains lysed cell products with severely limited ability to penetrate the stratum corneum. Partheno-genic human stem cells are an invention that does not exist in nature. (cont.)

ADIPOSE (FAT) DERIVED STEM CELLS

ReLuma by Vestiage

Stem Factor Serum by Osmosis

Luminesce by Jeunesse

These products contain conditioned media produced during culture of adipose stem cells. The cells are isolated from fat obtained during liposuction. The patients are typically females in their early 50's. Fat cells (adipocytes) and adipose stem cells are both known to produce pro-inflammatory bio-signals.

U Autologous by PCS

This product contains conditioned media produced through culture of one's own adipose stem cells, which are obtained through mini-liposuction. There is no scientific basis to support that this very expensive product is any more potent or better than products made using liposuction by-products of other individuals. Despite culturing one's own cells, the bio-signals produced have a pro-inflammatory pattern.

BONE MARROW DERIVED STEM CELLS

AnteAGE by Cellese

Recent research revealed the important role bone marrow stem cells play in tissue repair and healing throughout the body, particularly in the skin. Like red cells, white cells, and platelets, which also originate in the bone marrow, these stem cells enter the blood stream where they are carried to all tissues. Upon arrival at injuries, some may differentiate into cell types needed for repair (e.g. muscle, cartilage, nerve, etc.). Their major role, however, is to act as command and control of other nearby cells involved in healing. The pattern of bio-signals in conditioned media derived from culture of bone marrow stem cells is strongly anti-inflammatory. On the basis of healing physiology, and the known deleterious effects of inflammation on the skin, bone marrow derived mesenchymal stem cells appear to be the preferred cell to culture to obtain bio-signals for use in products to be applied to the skin. Clinical evidence supports this conclusion. Bone marrow stem cells are typically obtained from young adults in their early 20's.

Clinical Evidence of Anti-inflammatory Efficacy

Products containing conditioned media from bone marrow stem cell cultures demonstrate potent anti-inflammatory effect. This has been especially evident in persons with rosacea, several of whom reported complete elimination of rosacea flare-ups, in spite of continued exposure to the usual triggers.

Other anecdotal reports include enhanced healing of abrasions and burns, and reduced incidence of post-inflammatory hyperpigmentation in persons with higher Fitzpatrick skin types. Several split face trials have shown improved healing with reduced downtime following ablative aesthetic procedures such as factional CO_2 laser resurfacing. Studies are ongoing to determine the possible benefits following medical microneedling, dermabrasion, and radio-frequency factional surface ablation.

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Note: Plant stem cells are not discussed. Cells in the plant kingdom communicate with completely different biochemical molecules than cells in the animal kingdom. We consider the use of the term "stem cell" for such products to be marketing buzz words without physiologic significance or impact upon the behavior of human cells. Like other plant derived products, they may have antioxidant value.