Stem Cell Skin Regeneration: From Vanity to Vitality

By Samiha Chohan

You may have heard of stem cells being mentioned in the beauty industry as a promising avenue for skin care to prevent aging or eliminate fine lines, including exciting new facial treatments, stem cell serums, and even injections, all being sold at a high price as cure-all, magical fountains of youth.

But what is a *stem cell*? Our body has so many different cells—from blood cells to bone cells to muscle cells—which all play different roles and contribute to the organ they are essentially assigned to. Stem cells are cells that have not yet been "assigned" a role and thus have this fascinating potential to be able to become many different types of cells; some stem cells, referred to as pluripotent stem cells, can give rise to any cell type in the entire body. Both plants and animals have stem cells. There are three types of mammalian stem cells: embryonic stem cells, adult stem cells, and induced pluripotent stem cells (Figure 1). Embryonic stem cells are a type of pluripotent stem cell derived from a very early embryonic stage called the blastocyst stage. Adult stem cells are found in many different tissues throughout the adult body; these cells are not pluripotent, but can give rise to many different cell types within the tissue that they are located. Induced pluripotent stem cells (iPSCs) are created using somatic cells (cells of our body other than sperm and egg) in our by introducing genes that "induce" the cells to behave like an embryonic stem cell.

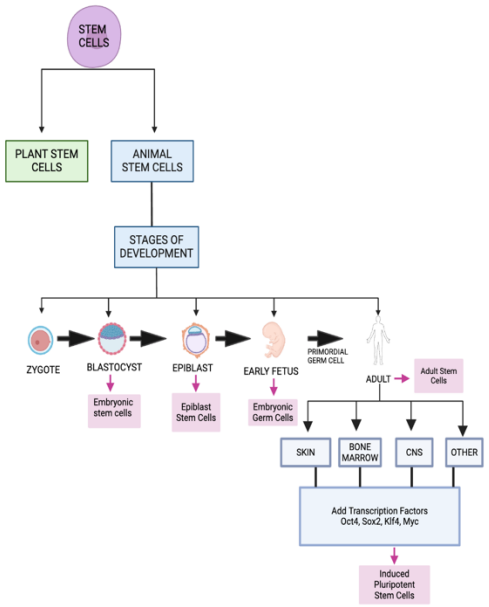

Figure 1: Diversity of Stem Cells.
Stem cells can be plant or animal derived. The diagram highlights human stem cells: embryonic stem cells, adult stem cells, and induced pluripotent stem cells, over the course of human development. https://pubmed.ncbi.nlm.nih.gov/30808416/#&gid=article-figures&pid=fig-2-uid-1

The ability of stem cells to give rise to so many different cell types underpins their regenerative potential—stem cells replace damaged/dead cells throughout the body as a normal part of daily life. Regenerative medicine is a field in which the power of

stem cells is harnessed to replace damaged/dead cells for those suffering from disorders/diseases. Not only has the regenerative potential of stem cells led to an entire field of medicine, it has also caused the term *stem cell* to be hyped by the beauty industry to motivate a sort of stem cell craze in consumers. Despite the consumer hype, there is no evidence to indicating a clinical benefit of stem cell-based skin treatments. The efficacy of certain treatments and accessibility of research is an important issue to help prevent consumers from being misinformed, as well as for driving stem cell research forward, so that these incredible cells can be utilized for skin issues ranging from acne scars to chronic wounds and trauma care.

Currently, there is a lot of misinformation on stem cells. Cosmetic industries are putting out plant-based skincare products, medical spas are performing platelet-rich plasma (PRP) therapies and “stem cell-derived growth factor” injections, but despite the high cost and lofty claims of anti-aging outcomes, there is little evidence to support the claims that these treatments reverse the signs of again. Further, many cosmetics products also utilize plant stem cell extracts which they often fail to mention to consumers. Currently, there is no legitimate data that supports the claims of plant stem cell extracts being anti-aging or regenerative. [1]

After plant stem cells, mammalian stem cells have also been utilized by the beauty industry, from autologous stem cells to allogeneic stem cells. Autologous stem cell refers to a stem cell being derived from the individual themself whereas allogeneic stem cells are derived from a donor. A common procedure marketed as an autologous stem-cell based regenerative treatment is platelet rich plasma therapy (PRP) which theoretically can induce cell proliferation (formation of new cells), but there have not been controlled clinical trials. Allogeneic stem cells are being used in the beauty industry to make specific creams, serums, and intradermal injections. These cells are reported to release paracrine factors such as cytokines, growth factors and neurotransmitters which are advertised to regenerate skin and promote anti-aging. While limited research does show that cosmetics containing human derived stem cells can improve the appearance of wrinkles and hyperpigmentation, there is major concern with the use of procedures as there can be an increased risk of serious side effects, particularly immune reactions which pose a risk to patient safety.[2]

Although the beauty industry has been capitalizing off of the term “stem cell” in a deceitful manner there is much to be admired about these cells and their potential in regenerative medicine. With effective clinical trials and further research, stem cells can be utilized for skin care as well as wound care, which are both applications that can significantly enhance a person’s quality of life.

Let's transition into another realm of skin regeneration where stem cells hold colossal promise: wound care. Diabetes is a prevalent chronic metabolic disease where approximately 25% of all patients have to get lower limb amputations due to the impaired healing of diabetic wounds. This not only has a high economic cost, but also psychosocial cost for patients. [3] Diabetic foot ulcers are a devastating chronic wound where skin ulcerates, becomes infected and the foot tissue becomes destructed. The skin of the foot becomes disrupted and opened with lesions which can lead to gangrene and traumatic amputations. These wounds are hard to heal due to the impairment of blood circulation, nerve damage, poor wound care and more. [3]

Autologous and allogeneic stem cell therapy has become a novel promising therapy to help heal diabetic foot ulcers with stem cells, such as iPSCs, bone-marrow derived stem cells, peripheral-blood derived stem cells, and adipose-derived stem cells being used to help repair tissues. The use of different stem cells for wound healing holds promise in promoting wound healing as they help with the creation of new blood vessels and collagen deposition, but significant challenges remain, such as the risk of stem cells promoting tumor formation due to uncontrolled growth of cells and immune system reactions given that introduction of allogeneic stem cells can cause rejection of these cells triggering mild to severe immune responses [4]. Clinical research with stem cells is ongoing and these issues are being critically worked on so that safe and effective regenerative therapies will one day help those suffering from chronic wounds.

From skincare to wound care, there is great potential for stem cells (Figure 2). However, it is crucial to educate consumers about the different types of stem cells and to require cosmetic companies to be more transparent about clinical evidence regarding claims they make about their stem cell-related products. While current stem cell products do not seem to reverse aging, some have anti-inflammatory benefit that can aid patients dealing with dermatological issues such as acne. Regenerative therapies using stem cells can be used for more severe skin conditions like wound care, potentially even saving limbs in cases of diabetic foot ulcers. It’s important to highlight to the public that as magical as stem cells can seem, there is still much research to be done. In the case of wound care, clinical trials are still ongoing to ensure the efficacy and safety of stem cell therapy. There is a pressing need for more research and clinical trials for stem cell therapies in aesthetics.

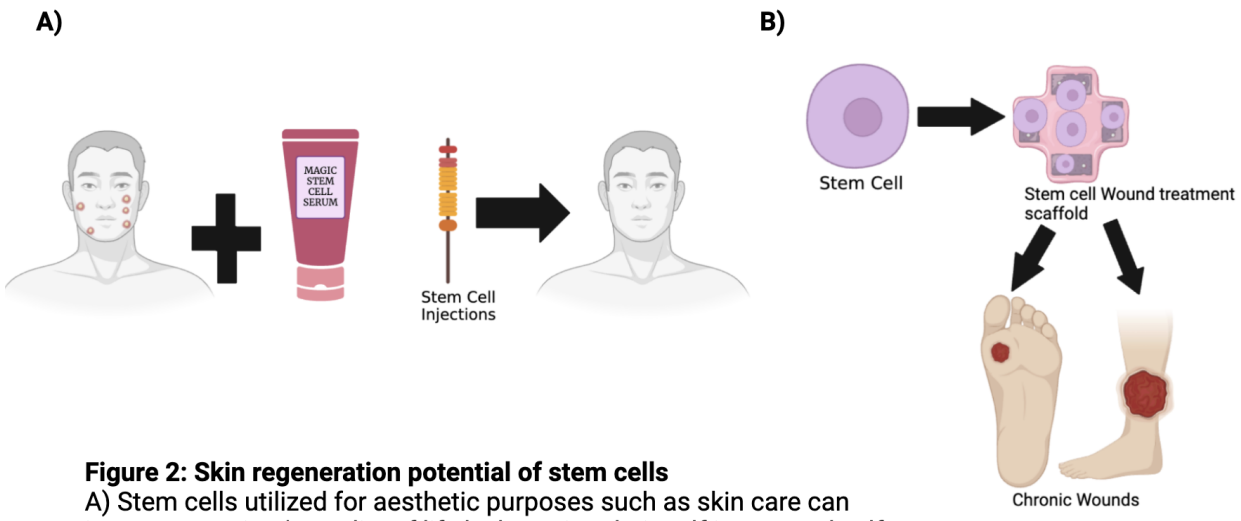

Figure 2: Skin regeneration potential of stem cells
A) Stem cells utilized for aesthetic purposes such as skin care can improve a patient's quality of life by boosting their self image and self concept. B) Stem cells applied in biotechnology for wound healing can greatly contribute to providing significant relief to patients with chronic wounds.

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