1.1. Cosmetics - From Tradition to Modernity:

Cosmetics are products created for skin & hair care for the purpose of cleansing, beautifying and enhancing the attractive features. Skin care is not a modern trend. In fact, people in every civilization used cosmetics to protect and embellish their skin - which naturally leads us to conclude that this is a primordial need. Although cosmetic products have undergone many changes in modern times, the basic concept of using cosmetics to enhance the features of good health has not changed. Resurrecting and preserving a youthful complexion has been the holy grail of beauty since Cleopatra stepped into her legendary bath of milk more than 2,000 years ago. When Hitler tried to ban make-up in Germany, German women refused to work. Roman women used to dye their hair darker with a mixture of boiled walnuts and leeks. The first cold cream was developed by Galen, a Greek physician. People from all these cultures used herbal concoctions with components like henna, sage and chamomile to darken their hair. Up to the late nineteenth century, women in Western countries secretly wore make-up made from mixtures of household products, as make-up was then deemed the domain of celebrities. Cosmetics were for the first time openly put up for sale in the early part of the twentieth century. At the end of the Second World War when people celebrated the return of their loved ones, there occurred a true surge in cosmetic sale and it still continues.

1.2. Science behind Cosmetics:

While cosmetics can be fun to use, the work that goes behind-the-scenes for creating them involves highly advanced science. Cosmetics represent a highly diversified field involving many sub-sections of science and art, because even in an era of high technology, intuition continues to play an important role. Therefore innovative raw materials and formulation techniques are the key factors to create products that can
accomplish multiple tasks. To put just one new product on the shelves can take up to many years, with immense research on synthesizing the active molecule, claim substantiation (efficacy, safety and toxicology) and formulation of the products. Improved knowledge of the biology of the skin and the development of innovative raw materials, and technologies help cosmetic chemists understand how to develop and evaluate the multifunctional personal care formulations desired by the consumer.

1.3. Advancements in Cosmetics:

Cosmetics have advanced into Natural Cosmetics, Cosmeceuticals, Nutricosmetics & Probiotics.

1.3.1. Natural Cosmetics: History repeats itself - but for better benefits! For thousands of years, we have been using natural cosmetic products for skin care. Many of the chemical additives used in cosmetic products, that emerged out of modern science may do the job but at the price of our health. It has become apparent that many of these chemicals are detrimental to health and in the long run, can do more harm than good. Over the years, many inventions and discoveries were made that “improved” on nature’s power and today, the vast majority of cosmetic products contain additives including enzymes, hormones and herbal actives that, supposedly, can be more effective. In the 21st century natural cosmetic is about developing “New skin care concept based on the perfect synergy between nature and technology, between the purest bioactive ingredients and premium performance innovation.” Natural cosmetic Philosophy is “Believe in the synergy of nature, in its simplest form, along with the most complex technology.” Modern natural cosmetic products are free from potentially harmful substances and help promote our looks without damaging our skin. With the technology that exists today to produce natural cosmetic products, we no longer have to find a compromise between health and beauty.
1.3.2. Cosmeceuticals: Cosmeceuticals are cosmetic products that have therapeutic benefits against degenerative skin conditions. The unique combination of cosmetic and pharmaceutical functionality makes them significant in enhancing skin health. “Cosmetics” hide the age and enhance the attractive features. “Cosmeceuticals” do not just hide the age, they slowdown ageing. “Cosmeceuticals” do not just enhance the attractive features, they keep them long lasting. In other words, “Cosmeceuticals” do not just benefit the skin condition, they impart therapeutic usefulness too.

1.3.3. Nutricosmetics: “Nutricosmetics” is all about eating & drinking to attain health & beauty from within. The term nutricosmetics refers to nutritional supplements which can support the function and the structure of the skin. Many micronutrients have this effect. For example, Vitamin C has a well established anti-oxidant effect that reduces the impact of free radicals in the skin and also has a vital function in the production of collagen in the dermis. Other micronutrients like omega-3 fatty acids, carotenes and flavonoids protect the skin from the damaging effects of UV light exposure, which may lead to accelerated skin ageing and wrinkle formation. Nutricosmetics set to be the next big niche and have hit the world market with 100% food-based, organically certified products like “antioxidant-infused chocolate bar, tea, soups, health drinks and tablet-sized dietary supplements.”
1.3.4. Probiotics: Probiotics are ‘Live microorganisms which when administered in adequate amounts confer a health benefit on the host’. Probiotics are beneficial bacteria in the intestinal flora that help aid digestive health, improve immunity and may prevent some allergies. Following the success of Probiotics in health care and extensive knowledge on the beneficial effects of Probiotics for human health, the latest research has been extended in “Probiotics for skin care to promote skin health and beauty”. Bacteria for the skin: By keeping pathological bacteria at bay and preventing overproduction of toxins, Probiotics actually eliminate the root cause of skin damage. Probiotics can prevent ageing and UV damage. Probiotics work from the inside out when consumed orally as a nutritional supplement.

In the body, Probiotics can create health-promoting substances that can circulate in the bloodstream, activating skin’s natural immune defenses, which consequently help inhibit inflammatory responses and free radical generation eventually preventing skin ageing and sun damage. It has been clinically-proven that Probiotics have a positive effect on UV-exposed skin. Studies have shown that skin cell regeneration after UV exposure is accelerated by using Probiotics as a complement to sun protection cream (1). Many studies have underlined the importance and efficacy of the probiotic complex in cosmetic formulations as well. Regular use of cosmetics containing Tyndallized probiotics (heat inactivated probiotic bacteria) undeniably re-established balance – and most particularly, it maintains this balance over time – of normal physiological conditions of the skin, such as pH and ceramide levels. Application of a cream containing

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<tr>
<th>Ingredients</th>
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<tr>
<td>L. Acidophilus</td>
<td>Probiotic</td>
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<td>S. Thermophilus</td>
<td>Probiotic</td>
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<td>Inulin</td>
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<td>Acacia</td>
<td>Probiotic</td>
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<tr>
<td>Niacin</td>
<td>Rebalancing Vitamin C factor</td>
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Tyndallized probiotic lactobacilli has shown a significant increase in ceramides, which translates into a better functioning of normal lipid barriers of the skin.

1.4. Evaluation for deriving clinically correct cosmetics:

The *in vitro* and *in vivo* studies conducted by Cosmetic Chemists & Dermatologists aim at deriving the new wave of ‘Clinically Correct Cosmetics’. The evaluation methodologies must always be standardized in order to obtain consistent results in terms of product efficacy and safety. ‘Clinically Correct Cosmetics’ seem to represent the era of multifunctional health products that combine the aesthetically appealing benefits of traditional cosmetic products with therapeutic benefits. In the future, with the increasing use of functionally active raw materials, with the new *in vitro* technologies able to quantify each molecular event occurring at the surface of the skin, we should finally address the true mechanism of action of different cosmetic products to meet the needs of the market and customers.

1.5. Non Animal Testing for Safety & Efficacy:

The European Union banned cosmetic testing on animals, after more than a decade of debate in Jan 2003. Hence, *in vitro* studies become significant for cosmetic evaluation. Alternative methods have been emphasized for cosmetic testing. However, for some categories of cosmetic product testing for which no alternatives have yet been established, testing will be allowed to continue until 2013.

Non animal studies involve cell lines, enzymes and microbiological bio assays (*in vitro*) rather than animals (*in vivo*). The data obtained can be extrapolated to animals, because of the simple concept of using animal cell lines instead of the complete animal. It can be correlated to certain extent that the cellular activity under *in vitro* conditions would be similar under *in vivo* conditions. However, there can be some deviations as the complete metabolism under *in vivo* conditions can be affected by various conditions which may not be completely mimicked under *in vitro* conditions. But, such deviations are minimal and under ethical grounds, *in vitro* evaluation may still have an edge over
animal studies. *In vitro* studies include various models for screening and positioning of various actives for specific cosmetic applications.

1.5.1. **Safety studies:**

- CAMVA – Chorioallantoic Membrane Vascular Assay - Alternative ocular irritation assay
- Kit based dermal and ocular irritation test systems
- Cytotoxicity studies for determining the effect on cell survival
- Mutagenicity studies for determining the mutagenic potential like AMES assay, chromosomal aberration and micronucleus assay

1.5.2. **Efficacy studies:**

**Skin lightening/tanning:** Melanogenesis inhibition/enhancement, UV protection, Antioxidant & Anti Inflammatory targets.

**Anti Ageing:** Anti Elastase Assay, Anti Collagenase Assay, Anti Hyaluronidase Assay, Collagen enhancement, Antioxidant studies and Anti inflammatory studies.

**Sebum Regulation/ Anti Acne:** *Propionibacterium acnes* inhibitory assay, 5 α reductase inhibition and Anti inflammatory studies (TNF α, LTB4, IL1, IL8).

**Wound healing/Skin damage protection:** Scratch wound closure assay, Agarose droplet migration assay etc.

**Stretch marks prevention:** Inhibition of glucocorticoid hormone that prevents fibroblast proliferation, elastin & collagen formation, Wound healing by growth factors like FGF (fibroblast growth factor), VEGF (vasculo endothelial growth factor) etc., Wound healing by cell proliferation, Collagen enhancement at the wounded site, Elastase & collagenase inhibition to prevent further degradation of tissue.

**Hair growth:** Dermal papilla cell proliferation, 5 alpha reductase inhibition etc.

**Anti Cellulite:** Adipogenesis inhibition etc.

**Anti itch:** Inhibition of Histamine release from activated mast cells, Anti microbial assay etc.
1.6. Cosmetic Delivery System:

Skin acts as a selective barrier to the penetration of compounds. Hence cosmetic products should be compatible to the skin barrier which is attainable by using compatible carriers – emulsions, fluorocarbon gels, liposomes, cyclodextrins, microcapsules etc, which are stable and allow controlled & sustained release of actives and bio availability enhancers. The penetration of active compounds through the skin is of fundamental importance in cosmetic science. To this end, the formulation of appropriate carriers is a must both for cosmetic and dietary supplements.

1.7. Expectations from a Cosmetic product:

While many age-related changes are inevitable, some can be reduced with healthy lifestyle and good skin care. Free radical damage, inflammatory responses due to UV exposure, pollution etc., are the main factors responsible for skin damage. Cosmetics should help skin retain and enhance its natural form for a longer time by Target specific mechanism of action and Perfect delivery system.

![Figure 1.1: Ideal Cosmetic Product](image)

*Figure 1.1: Ideal Cosmetic Product*
1.8. Focus of Sami Labs in Cosmetic Research:

Sami Labs promotes functionally active raw materials after thorough investigation into each possible biological mechanism through various \textit{in vitro} cosmetic evaluation techniques. Skin problems are interlinked with the overall health of an individual and the corrective approach varies from person to person as no two persons are alike. Cosmetic industries should address target specific mechanisms of action of various cosmetic products to meet the needs of the customers and their varying cosmetic concerns.

Innovation is a major drive for Cosmetic Technology. Mechanism of action, safety and appropriate delivery system becomes the key to success of cosmetic technology. Sami Labs Limited, where innovation is a tradition, firmly believes that integration of modern scientific techniques and traditional knowledge can produce new cosmetic molecules with target specific approach. Towards this belief, the present work is targeted at promoting clinically correct cosmetics by appropriate evaluation techniques.

1.9. Aim of the present cosmetic research work carried out at Sami Labs:

\begin{itemize}
  \item \textbf{PART I} - DEVELOPMENT OF A NOVEL \textit{IN VITRO} METHODOLOGY FOR SUN PROTECTION FACTOR DETERMINATION & STUDY OF ACTIVES FOR PHOTOPROTECTION EFFICACY
  \item \textbf{PART II} - SCREENING OF ACTIVES THROUGH VARIOUS MECHANISMS OF MELANOGENESIS AND POSITIONING THEM IN ACCORDANCE TO THEIR SPECIFIC MODE OF ACTION IN RECTIFYING PIGMENTATION DISORDERS
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