



# Skin Pigmentation





# What we perceive as colour is mainly a play of light.

Light refracts off chromophores and our eyes send a message to the brain categorising it into colour. Skin concerns associated with pigmentation rank among the most common concerns encountered by dermatologists, somatologists and skin therapists.

# Pigmentation can be hormonal, inflammatory, genetic and acquired.

The main structures or elements involved in pigmentation include chromophores, melanocytes, melanosomes, tyrosine, tyrosinase, keratinocytes, and corneocytes.

We will also look at the role skin barrier function, inflammation and microbial involvement could play in pigmentation irregularities.

Skin pigmentation is therefore closely linked to melanocyte functionality, surrounding keratinocyte efficacy and extracellular matrix protein and fibroblast function in the underlying dermal compartment. When these are dysregulated, pigmentary disorders occur.

## The process of melanogenesis:

Melanin synthesis is stimulated by sunlight and is controlled by the pituitary gland via melanocyte-stimulating hormone (MSH).

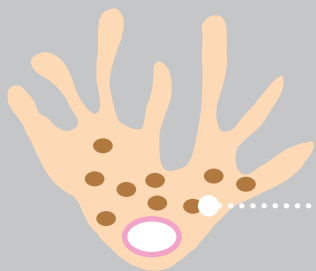
In the presence of UV-rays, the enzyme tyrosinase activates the amino acid tyrosine within the melanosome to produce melanin. When melanogenesis is complete, melanosomes move bi-directionally towards the melanocyte dendrites, to be transferred to the cytoplasm of the surrounding keratinocytes. The pigment darkens and becomes melanin once it reaches the cytoplasm of the keratinocyte.

Two types of melanin can be synthesised during melanogenesis, namely eumelanin and pheomelanin.

UV Rays



Melanocyte



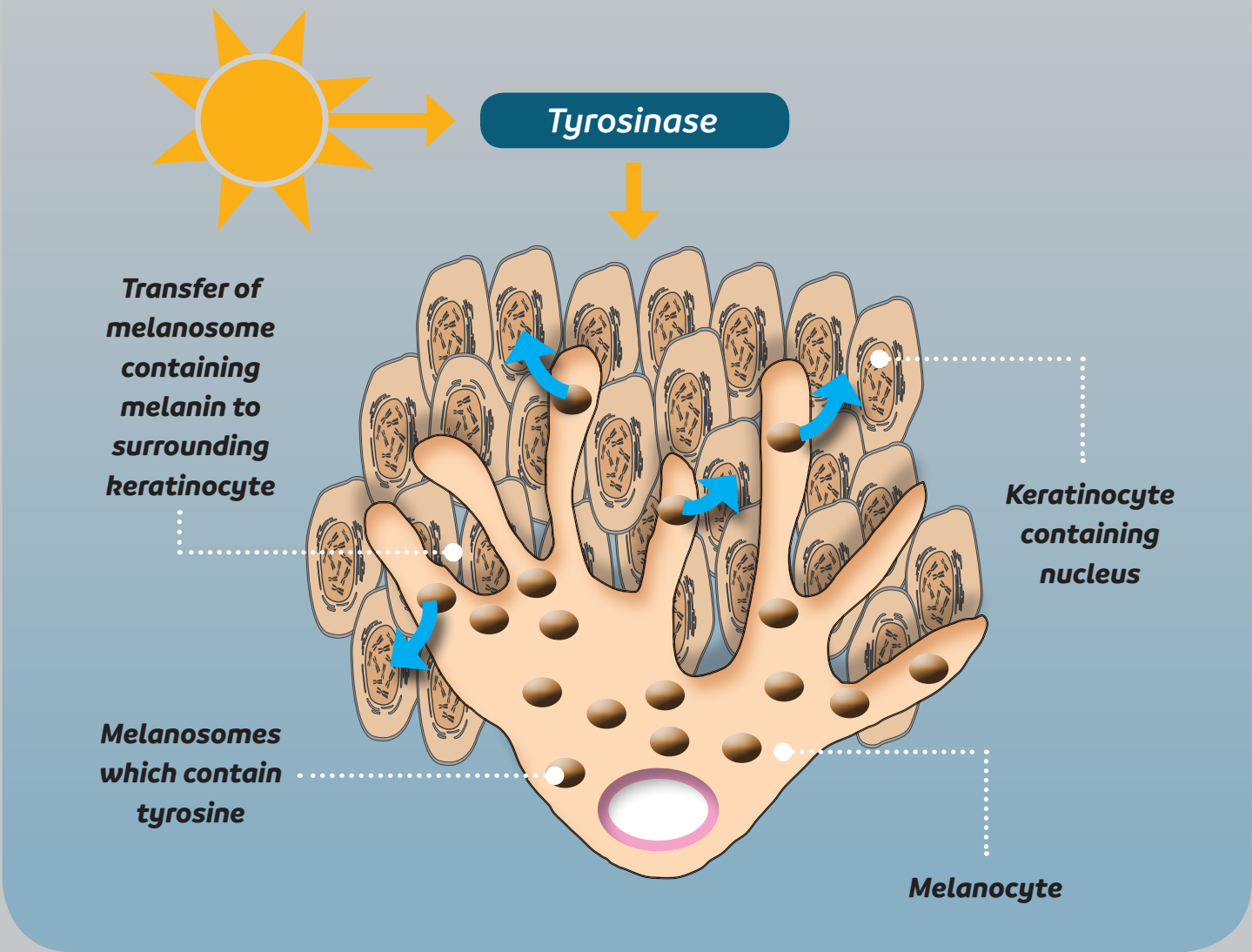
Melanosomes & Tyrosine

Keratinocyte



Nucleus

## The process of melanogenesis:



## Epidermal vs Dermal Pigmentation

Because keratinocytes, melanocytes, and fibroblasts are spread across both dermal and epidermal layers, the deposition of pigment can be observed in both epidermal and/or dermal layers. Depth of pigmentation can be determined by a simple skin stretch, or with the assistance of a Wood's lamp or skin scanning device.

By establishing whether pigmentation is epidermal or dermal, a more accurate treatment approach can be determined, and realistic expectations can be conveyed to the client or patient.

## Hyperpigmentation vs Hypopigmentation

Dyschromia refers to any non-specific pigmentation problems that appear either alone or in combination with other forms of photo-damage in sun-exposed areas.

Hyperpigmentation is the overproduction and over-accumulation of melanin and the more common form of skin pigmentation.

Hypopigmentation is the loss of skin pigment due to a decrease or total absence of melanin in the skin.



## Involvement of skin barrier function, inflammation and the microbiome in pigment irregularities

Melanocytes are known to be extremely sensitive to temperature, allergens, pathogens, chemicals, medication, and mechanical or endogenous stimuli. These triggers can either stimulate melanocyte activity or kill melanocytes. Various acute or chronic inflammatory skin reactions could potentially result in a change of skin colour.

Considering epidermal and dermal pigmentation again, epidermal pigmentation is typically brought on by the epidermal inflammatory response whereas dermal pigmentation is brought on by an inflammatory response and UV-exposure.

Excessive exposure to UV has the potential to stimulate low-grade inflammation and the production of ROS. ROS leads to local inflammation and the activation of the immune processes, further contributing to the stimulation of the melanocytes and the production of excess melanin.

Tinea versicolour is an example of where microbial activity can result in hypo- and hyperpigmented lesions. The condition is caused by a *Malassezia* yeast overpopulating the skin and disrupting the normal pigmentation process. This is an example of how a balanced microbiome is essential to the optimal functioning of yet another process.

A healthy microbiome contributes to the barrier function of the skin, maintenance of pH, prevention of water loss, the regulation of the immune responses and reducing inflammation. By disrupting the microbiome, protective mechanisms no longer function optimally, resulting in skin being more vulnerable to inflammation and melanocyte stimulation.



Any disruption in either the microbiome or the barrier function ultimately leads to inflammation which could contribute to pigment irregularities.



# Common conditions associated with pigment irregularities



## Post-inflammatory hyperpigmentation

Post-inflammatory hyperpigmentation (PIH) is a pigmentary response to any injury.

Figure 1: Post-inflammatory hyperpigmentation due to acne (obtained from <http://s0www.utdlab.com/contents/image.do?imageKey=DERM%2F58817>)



## Melasma or chloasma

A condition commonly associated with pregnancy, the use of oral contraceptives and hormonal imbalances. It presents as areas of ill-defined dark patches, usually in a symmetrical pattern, on the cheeks, forehead, upper lip, nose and chin.

Figure 2: Clinical melasma presentation (sourced from <http://www.dermnetnz.org/topics/melasma-images>)



## Ochronosis

Ochronosis typically presents as blue-black or blue-grey macules of varying intensity on sun-exposed areas such as the cheeks, temples and neck and can be caused by exogenous and endogenous factors.

Figure 3: Variations in the clinical appearance of ochronosis on different photo-types (A, B, C, D) and the histology ochronosis (E, F). (Sourced from Khunger & Kandhari, 2013).



## Solar lentigines

Solar lentigo is a common condition found in areas of sun-exposed skin such as the face and hands. These are commonly referred to as sun-spots, age-spots or liver-spots.

Figure 4: Figure 14: Solar lentigines on the hand (obtained from <http://www.scientificpsychic.com/health/antiaging.html>)





### Actinic Keratosis

Actinic keratosis presents mainly on areas of sun-exposed skin as rough, scaly, reddish macules measuring 2 to 15 mm in size.

Figure 5: Actinic keratosis on the hands (sourced from <http://www.skincancer.org/skin-cancer-information/actinic-keratosis/actinic-keratosis-warning-signs-and-images>)



### Seborrheic keratosis

Seborrheic keratosis is localised, benign, hyperpigmented lesions with a warty appearance often mistaken for warts or melanoma lesions.

Figure 6: Clinical appearance of seborrheic keratosis (sourced from <http://emedicine.medscape.com/article/1059477-clinical?pa=BitqHjEJ3P2bqjvWi%2FI99OnTop6eRrQYpcDu7stC877Q1CkjjIDNG187Kv203A1fBcE%2B7j%2Fuouqh2QIWRJoRB6bXa1aj0VoWN5%2BW19QIDeU%3D>)



### Dermatosis papulose nigra

Dermatosis papulose nigra mainly affects Fitzpatrick skin type IV-VI. DPN is characterised by multiple small, asymmetrical, black or dark brown hyper-pigmented, round, dome-shaped or flat papules or macules, commonly found on the face, neck and upper trunk.

Figure 7: Clinical appearance of dermatosis papulosa nigra (sourced from [http://www.regionalderm.com/Regional\\_Derm/files/dermatosis\\_papulosa\\_nigra.html](http://www.regionalderm.com/Regional_Derm/files/dermatosis_papulosa_nigra.html))



### Tinea Versicolour

Tinea versicolour is a condition that generally results in hypo- or hyperpigmented finely scaled macules. Lesions typically affect the trunk and shoulders but can occur anywhere on the body including the abdomen, neck, and face. It is caused by the yeast *Malassezia globosa*. This is a classic example of a microbial imbalance, as this microbe naturally forms part of the healthy skin microbiome

Figure 8: Figure 14: Solar lentigines on the hand (obtained from <http://www.scientificpsychic.com/health/antiaging.html>)



### Poikiloderma of Civatte

Poikiloderma of Civatte is a common benign condition which involves the neck, lateral cheeks, and upper chest, usually with an undamaged area under the chin. It is often associated with itching, burning, and flushing.

Figure 9: Poikiloderma of Civatte (Sourced from <http://www.atlasdermatologico.com.br/disease.jsf?diseaseId=376>)



### Vitiligo

Vitiligo is a condition where the skin spontaneously loses its pigment in well-defined patches due to the selective destruction of melanocytes.

Figure 10: Clinical appearance of vitiligo (sourced from <http://micropigmentimplantation.com/vitiligo-micropigment-implantation/>)

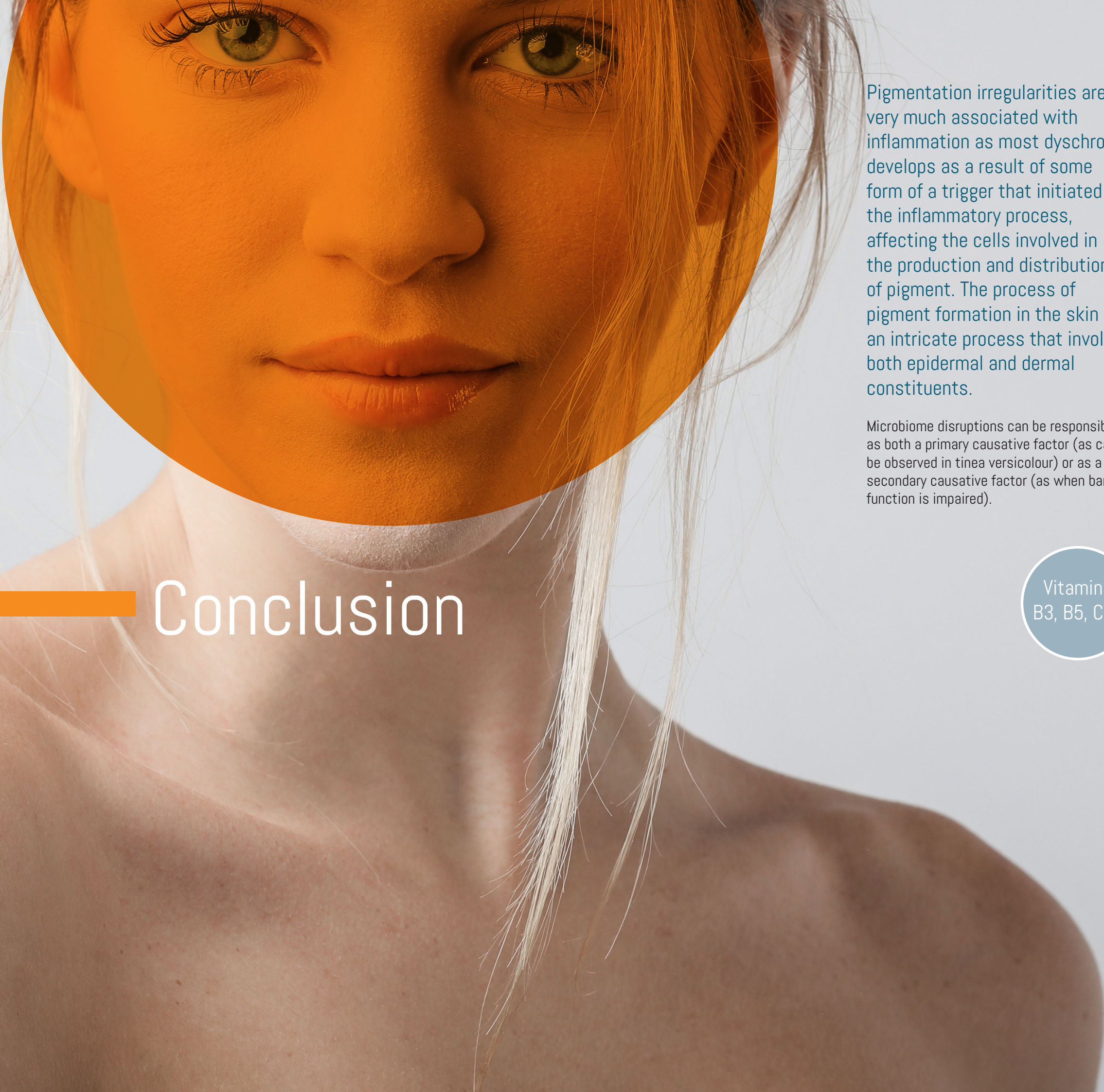


### Pityriasis alba

Pityriasis alba is a benign condition of hypopigmentation occurring predominantly in children and adolescents. The characteristics include round or oval, ill-defined macules and patches, often with scales and flakiness. It can also exhibit as thin plaques.

Figure 11: Variations in the clinical appearance of ochronosis on different photo-types (A, B, C, D) and the histology ochronosis (E, F). (Sourced from Khunger & Kandhari, 2013).





# Conclusion

Pigmentation irregularities are very much associated with inflammation as most dyschromia develops as a result of some form of a trigger that initiated the inflammatory process, affecting the cells involved in the production and distribution of pigment. The process of pigment formation in the skin is an intricate process that involves both epidermal and dermal constituents.

Microbiome disruptions can be responsible as both a primary causative factor (as can be observed in tinea versicolour) or as a secondary causative factor (as when barrier function is impaired).

Vitamins  
B3, B5, C, E



Rooibos



Kigelia



Albizzia



Darutoside



Lily



Daisy

At Esse, we use highly active ingredients to even out skin tone in both a corrective and preventative manner while supporting a healthy and balanced microbiome. These include examples of vitamin B3, B5, C, E, Rooibos, Kigelia, Albizzia, Darutoside, Lily and Daisy flower extracts and the use of probiotics just to name a few.

These are focused to interrupt the process of melanogenesis on both ends, by inhibiting tyrosinase activity as well as preventing the excessive transfer of melanosomes containing melanin to the surrounding keratinocytes.

Conditions associated with pigmentation often affect the quality of life of an individual but are very difficult to treat.

When we look at different treatment approaches and recommendations, we will consider all the factors involved in pigmentation, and how we can go about ultimately improving the condition by taking a holistic approach.



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