Spot On: Understanding Melanin

Most, if not all of your skin care clients, will tell you that skin discolouration is one of their top concerns. Uneven skin tone is usually not a client's only skin issue as it goes hand in hand with many skin diseases and disorders. Skin discolouration is the result of melanin production (melanogenesis) or the lack of it, and it can complicate skin treatments. Knowing this, it is therefore important to understand melanin and its basic function in skin.

What is Melanin?
Melanin is pigment and it gives our skin, eyes and hair color. Its primary function is to protect the skin from damage including photo-damage and/or trauma and it does this as a direct reaction to inflammation. With sun exposure, microinflammatory processes in skin stimulate the production of melanin. Melanin absorbs and converts sunlight to heat as it helps skin cells scavenge free radicals and prevent malignancies from occurring. Melanogenesis also helps protect skin that is healing. We can see this process clearly with acne scars or macules.

Darker skin means there is more melanin in the skin cells, but it does not mean the skin has more melanocytes. No matter what skin color we have, we are all born with a similar concentration of melanocytes, which are located in the basal layer of skin. Melanocytes are dendritic cells, cells that have branch-like projections known as dendrites, and make up about 3% of the cells in the epidermis. Each melanocyte produces the melanin for about 36 skin cells.

Melanin is often misunderstood, for example, a decrease in melanin is actually what leads to hyperpigmentation disorders, freckles, age spots and melasma. In fair-skinned individuals, basal cells contain only a few small melanin granules that are barely visible. Whereas the basal cells of tanned skin or individuals with darker skin contain a distinct amount of melanin granules. The number of active melanocytes decreases by an estimated 10% to 20% per decade of adult life. The melanocytes that remain attempt to compensate for the missing ones, so you have an overproduction of pigment in one area and a decline or complete absence of melanin in another. This is why age spots form and skin becomes splotched with darker and lighter shades of color. Melanin becomes disproportionately concentrated in moles, freckles, etc. During a skin evaluation, the presence of uneven skin tone or freckles indicates that there is a lower amount of melanin in the skin, thus a reduced capacity for DNA repair. In sum, the client is at increased risk for photocarcinogenesis and great care must be taken to prevent further skin damage with sun protection.

The relationship between melanocytes and keratinocytes (skin cells) is referred to as the epidermal-melanin unit. The melanin produced in the melanocyte is transported by melanosomes through the dendrites, which transfer the melanosomes to the keratinocytes. Melanocytes produce two types of melanin: eumelanin and pheomelanin. Eumelanin is brown to black, while pheomelanin is yellow to red.

In tanned skin, eumelanin is the pigment that has been stimulated. Interestingly, women have more pheomelanin than men, so women's skin is generally redder than men's. Those with red hair have high levels of pheomelanin, which imparts a pink to red hue. Pheomelanin is particularly concentrated in the lips and nipples.

How Melanin is Produced
Melanin production and its resultant hyperpigmentation or tanning actually begins in the brain. The pituitary gland is attached to the base of the brain and secretes hormones that govern many body functions. In the
case of melanin, the gland is responsible for creating and releasing a class of peptide hormones called intermediins or melanocyte-stimulating hormones (MSH). When skin is exposed to sun or experiences trauma, inflammation occurs, putting inflammatory mediators into motion, telling the brain’s pituitary to send assistance with MSH. Once in the bloodstream, MSH stimulates the adrenal gland, which triggers tyrosine, an amino acid found in the body. Tyrosinase breaks down by tyrosine. Tyrosinase is broken down further to dopamine, and through a process of many more interactions, and broken-down elements, the melanocytes pump out melanin to protect skin cells from damage. This explanation is overly simplified as the actual process of melanogenesis involves many factors and several hormones and interactions that are not completely understood. In general, however, scientists believe that melanogenesis occurs because of a combination of factors including DNA damage, and these factors may vary from client to client. Having said that, you can see why treating hyperpigmentation can be difficult—as much as we know, we still don’t know everything.

**Prevention and Treatment**

Because the release of melanin begins in the basal layer, the deepest layer of the epidermis, and the layer where new cells are “born” each day, it can be difficult to treat existing hyperpigmentation with esthetic treatments. Additionally, treatments will take at least a month to work as basal cells move up through the layers of skin to the outermost stratum corneum and become sloughed off with exfoliation.

The best treatment for sun-induced hyperpigmentation is sunscreen, which will help prevent further photo-induced inflammatory processes from occurring. This allows skin to normalize more quickly.

The most common treatment for too much pigment or uneven distribution of melanin, is hydroquinone. It’s not exactly bleach, though some people refer to products that contain hydroquinone as skin-bleaching creams. Hydroquinone lightens the skin by inhibiting the chemical reactions that create melanin. It attacks melanocytes as it occupies their receptor sites, blocking tyrosinase. It can be combined with AHAs, which increase cell turnover, hastening skin normalization. Over-the-counter skin lighteners that contain a 2% concentration of hydroquinone or less are adequate for most people. Higher concentrations are available by prescription only. There are also drug formulas that combine hydroquinone with Retin-A and other ingredients. Care must be taken with these prescription products because they can be too irritating and may actually contribute to pigment problems. I often suggest that people alternate hydroquinone-containing products with those that contain other types of brightening agents, or use one type of lightener in the morning, the other at night. Pregnant or nursing women should not use hydroquinone because the appropriate safety studies have never been done.

There are many ways to treat already-existing hyperpigmentation with other hydroquinone-free products and treatments such as chemical peels; tyrosinase inhibitors, such as arbutin, which acts like hydroquinone on the melanocyte receptor sites, bearberry, licorice, kojic acid; in addition to peptides; soothing ingredients; LED; microdermabrasion; retinoids; alpha hydroxy acids; vitamin C; and topical corticosteroids. Vitamin C infusions and in-spa facials will help lighten pigmentation. And with any treatment, sun protection is necessary as a final step to protect the skin.

**Inhibit Inflammation with Food**

Because an inflammatory process stimulates melanogenesis, certain inflammation-abating foods may also be helpful in preventing skin discoloration including foods stocked with antioxidants or brightly colored fruits and vegetables, and healthful, EFA-rich protein. During inflammation, intracellular water loss is encouraged, and this can further damage melanocytes and cause them to function erratically or not at all. Therefore, a diet or regimen that encourages the retention of cell water inside the cell and in the cell membrane, will fortify melanocyte integrity, ultimately, making skin less prone to discoloration.

While not a complete list, some nutrients to consider adding to the diet include alpha-linoleic acid (ALA), which is found in vegetables, beans, fruits, flaxseed oil; gamma linolenic acid, which can be found in seed oils such as borage, evening primrose, black currant and hemp; durian and sulfur-containing foods like garlic, onions, meat, and cruciferous vegetables; zinc, which assists with inflammation from acne; grape
seed extract; vitamin C; coenzyme Q 10; and pomegranate, which boosts skin’s natural SPF.

We are fortunate to live during an age where we have learned so much about the skin and how it connects to all systems in the body. As scientists research melanogenesis and the body’s microprocesses, we may, someday, have a near-cure to a problem that complicates our treatments and so many of our client’s lives.