DYSCHROMIAS

Understanding Them Through Biology and Creating a Protocol with an Integrated Approach

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Understanding How Dyschromias Develop

Melanocytes

Melanocytes are specialized cells primarily responsible for the production of melanin, the pigment that gives color to the skin, hair, and eyes. They are located in the basal layer of the epidermis, where they form a functional unit with keratinocytes (the main cells of the epidermis) known as the melanocyte-keratinocyte unit.
Typically, there is one melanocyte for every 36 to 40 keratinocytes in this unit

Molecular Characteristics of Melanocytes

At the molecular level, melanocytes produce and contain special proteins that help us identify them. These proteins are all involved in producing or storing melanin, like tyrosinase, which kickstarts the whole process

Tirosinase

Starts melanin synthesis

TYRP1 & TYRP2

Help regulate the type and amount of melanin

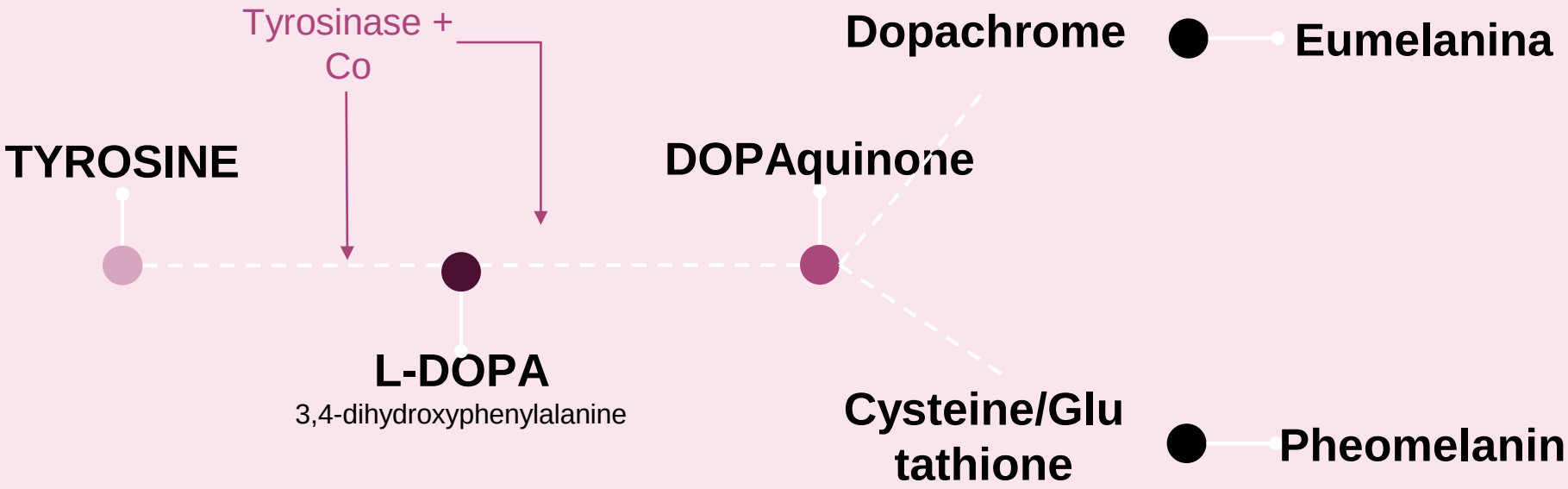
Pmel17 & MART-1

Shape and structure of melanin storage (melanosomes).

Melanin

Melanin is a biological pigment, or chromophore, it acts like a natural sunscreen, absorbing UV radiation and protecting skin cells from damage. The production of melanin starts with an amino acid called tyrosine. Through a process known as melanogenesis, tyrosinase—an essential enzyme—converts tyrosine into intermediate molecules like DOPA and DOPAquinone. From there, the pathway can lead to different types of melanin

Melanogenesis



Melanosome

Melanosomes are specialized organelles found inside melanocytes. Their main role is to synthesize, store, and transport melanin.
Melanosomes are crucial for pigmentation and act as a biological sunscreen, absorbing and dispersing harmful ultraviolet rays.

Development of melanosomes

Stage I: Premelanosome

Small vesicles with no internal structure or pigment. No melanin yet.

Stage II: Fibrillar Matrix Formation

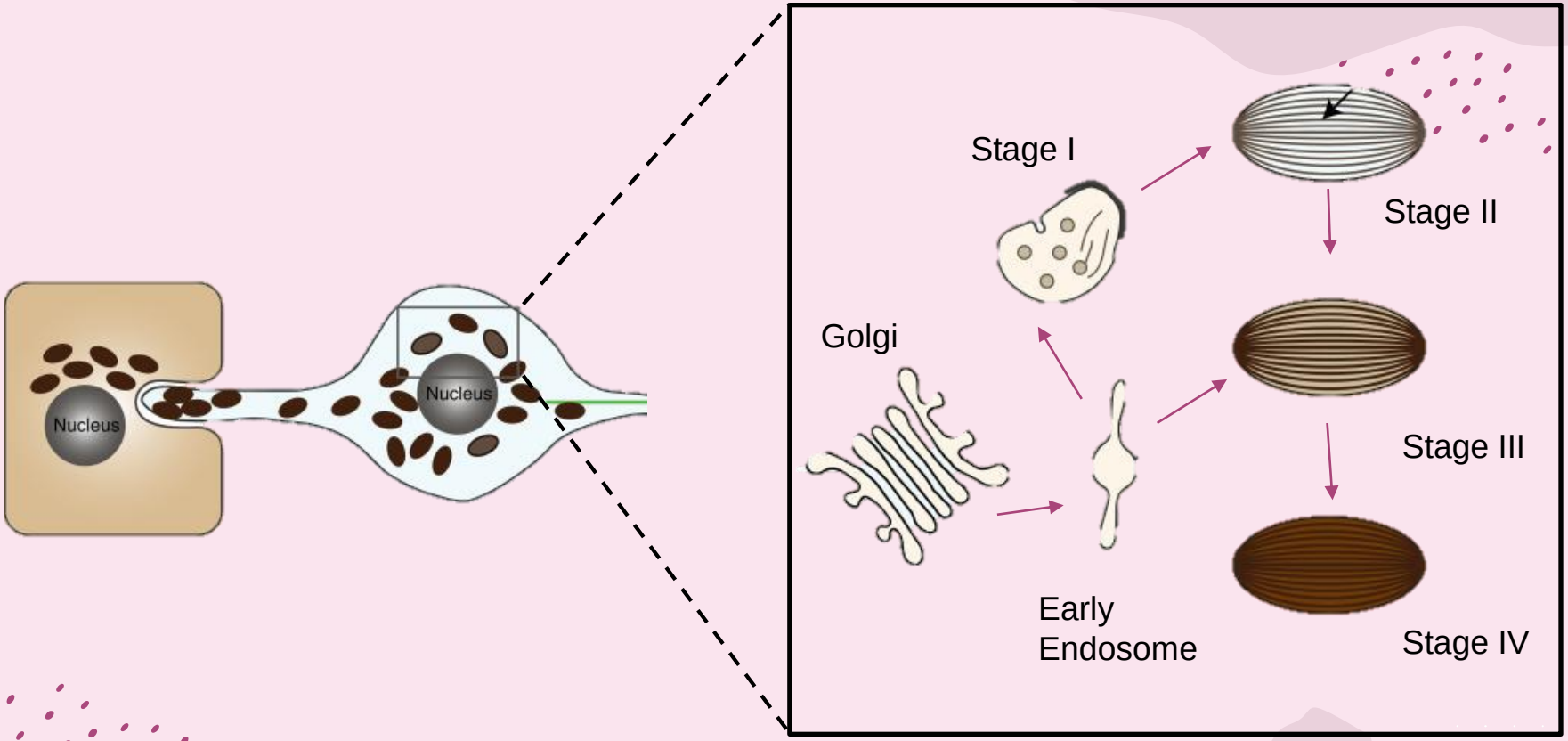
The internal fibrillar matrix is formed, creating a scaffold for melanin deposition. Tyrosinase appears but is not yet active.

Starge III: Melanin Synthessis Begings

Melanin starts to be deposited on the fibrillar matrix. Enzymes like tyrosinase, TYRP1, and TYRP2 become active.

Stage IV: Mature Melanosome

Fully pigmented and melanin-rich. These melanosomes are then transferred from melanocytes to neighboring **keratinocytes**


Nucleus
Nucleus
Stage I
Stage II
Golgi
Stage III
Early
Endosome
Stage IV

Pigmentation Differences

The density of melanocytes is relatively constant across all skin types—around 1200 melanocytes per mm^2. However, skin color is not determined by the number of melanocytes, but by the characteristics of the melanosomes they produce. These include the size, number, and shape of melanosomes, the type of melanin synthesized (eumelanin or pheomelanin), and how effectively melanin is distributed to keratinocytes. These factors not only define skin pigmentation, but also influence its natural protection against UV radiation

Hyperpigmentation & Inflamation

What are melanotropins?

Melanotropins are hormones that stimulate melanin production, the pigment that gives color to the skin. The most well-known of these is melanocyte-stimulating hormone (MSH). These hormones are produced in the brain, in a region called the pituitary gland, and act on melanocytes, the skin cells that produce melanin.

Protectionand repair:

When the skin suffers a injury, such as a burn, cut, or excessive sun exposure, melanotropins may be released. These hormones increase melanin production in the affected area. Melanin has protective properties, as it absorbs and neutralizes harmful UV rays, shielding skin cells from further damage.

Wound Healing and Skin Remodeling:

In addition to boosting melanin production, melanotropins influence other skin healing and repair processes. By regulating melanocyte and other skin cell activity, they contribute to recovery and regeneration after injury.

Post-Inflammatory Pigmentation:

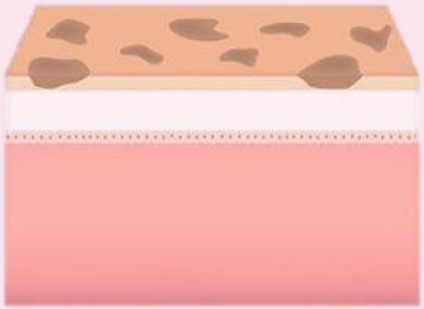
After skin inflammation or injury (e.g., acne, eczema, burns), dark spots often develop. This occurs because melanotropins stimulate melanocytes to produce more melanin in response to damage. This post-inflammatory hyperpigmentation is a natural protective response.

Melasma

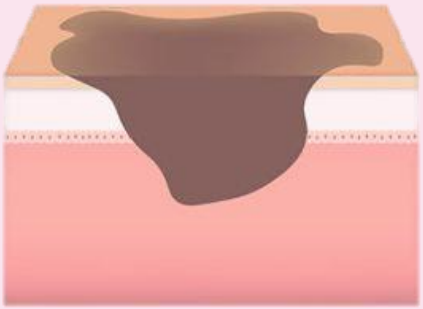
Melasma is a chronic acquired hyperpigmentation with a multifactorial origin.
It appears as brown or grayish patches with irregular borders, most commonly on sun-exposed areas of the face.
It primarily affects women of reproductive age and is associated with:

- Chronic sun exposure
- Hormonal changes (pregnancy, contraceptives)
- Genetic predisposition
- Photosensitizing cosmetics or medications
- Emotional stress

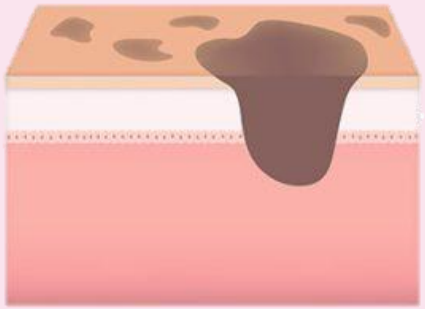
Types of Melasma



Epidermal



Dermal



Mix

Melasma & Emotions

The hypothalamus, in response to emotional stress, stimulates the pituitary gland, increasing secretion of melanocyte-stimulating hormone (MSH).
MSH activates melanocytes, enhancing melanogenesis, which can trigger or intensify melasma, even during proper treatment.
Stress also raises cortisol levels, disturbing the skin's barrier, immune balance, and pigment regulation — deepening dyschromias and slowing healing.
This connection highlights the neuroendocrine influence on pigmentation and underscores the importance of a holistic treatment approach.

Melasma reminds us that the skin reflects more than what is seen — treating it requires harmony between science, care, and emotional balance

02

Designing the Perfect Treatment Plan

Patient medical history

Age	35 years old
Gender	female
Location	Madrid, Spain

2019

Saturn is the ringed one. It’s composed of hydrogen

2020

Despite being red, Mars is a very cold place, not hot

2021

It’s a gas giant and the biggest in our System

What is depigmentation?

To depigment hyperchromia is to reduce or eliminate excess melanin in the skin. Effective depigmentation goes beyond removing pigment — it requires targeting its origin and transfer

Why is depigmentation complex?

Melanin is synthesized by melanocytes, and there are multiple pathways can stimulate or inhibit its production. A successful approach must act on **several mechanisms**, not just one.

WOOD LIGHT

A Wood's lamp emits ultraviolet (UV-A) light (wavelength ~365 nm) that helps visualize skin alterations not visible to the naked eye.

By analyzing the **fluorescence pattern**, we can determine the **depth of pigmentation**:

Mechanisms of Depigmenting Action

Tyrosinase Inhibitors

Block melanin synthesis

Copper Chetlator agents

Inhibit tyrosinase by removing copper

Melanin Transfer Inhibitors

Prevent pigment reaching keratinocytes

Plasmogen-Like Effect

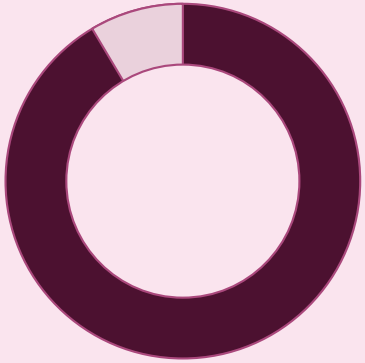
Promotes ECM degradation, reducing pigment

Melanosome Maduration Inhiibitors

Block melanin packaging and transport

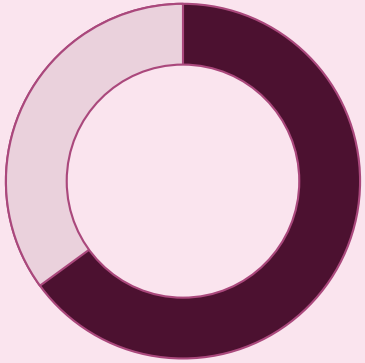
Renewing skin cells helps eliminate pigmented keratinocytes and reveals even-toned skin. This is why exfoliating acids are often used together with depigmenting agents.

Types of Exfoliating Acis



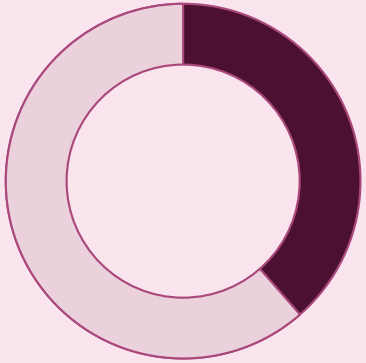
AHAs

Act on the surface



BHAs

Penetrate de pores



PHAs

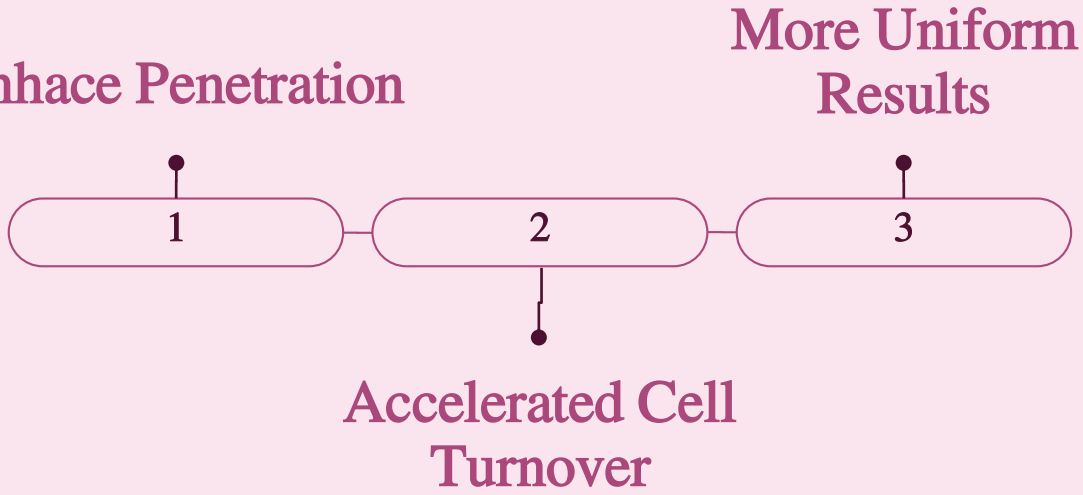
Gentle for sensitive skin

COMBINED TREATMENT

Depigmenting treatments are significantly more effective when formulated as synergistic blends. AHA or BHA exfoliants (such as glycolic or salicylic acid) serve to loosen corneocyte cohesion, promoting cell turnover and enhancing epidermal permeability.

Once the skin is prepped, depigmenting agents—like kojic acid, vitamin C, or arbutin—can penetrate more effectively, targeting melanocytes or interfering with melanin synthesis deeper in the epidermis.

Benefitts of the therapy



Contraindications & Indications

Inducing or maintaining inflammation (deepth peelings, fiction, etc)	Use of tyrosinase inhibitors and daily antioxidants
UV exposure without protection	Daily photoprotection (broad-spectrum SPF, ideally with iron oxide)
Use of tyrosinase activators (e.g., copper peptides, certain essential oils)	Use of tyrosinase inhibitors (e.g., kojic acid, arbutin, azelaic acid)
Initiating treatment without identifying the pigment depth (epidermal vs dermal)	Professional evaluation before combining treatments (e.g., laser + acids)
Stress management and hormonal balance support	Stress management and hormonal balance support

Active Agents examples

- **Retinoids** – Melanosome dispersers.
- **Kojic Acid / Vitamin C** – Copper chelators.
- **Hydroquinone / Arbutin / Azelaic Acid** – Tyrosinase inhibitors.
- **Corticosteroids** – Reduce inflammatory triggers of pigmentation.

In conclusión:

The most successful treatment of hyperpigmentation begins with a holistic approach that targets both internal and external factors.

Key Takeaways:

- **Depigmenting treatments must be strategic and multi-targeted.**
  They work best when combining **exfoliants** (to prepare the skin) with **active agents** that regulate melanin production and distribution.
- **Synergy = Better Results.**
  The right pairing of acids and depigmenting ingredients boosts penetration, accelerates cellular renewal, and enhances visible improvement.
- **Consistency is Essential.**
  Skin needs time to regenerate. Regular sessions and a holistic care routine—including sun protection and emotional balance—make all the difference.

Achieving healthy, even-toned skin is a journey, and combining science, consistency, and patience yields the best results

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