

Part 1: The Modern Age of Photoprotection

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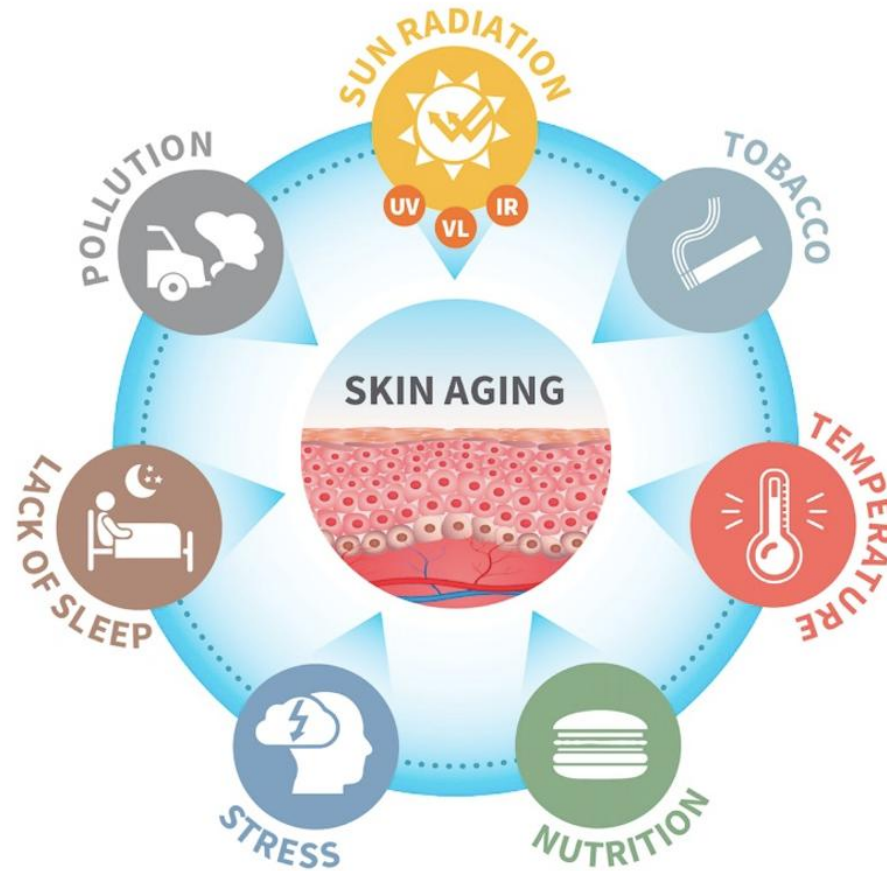


Conflicts of Interest

I have no conflicts of interest as it pertains to this presentation.



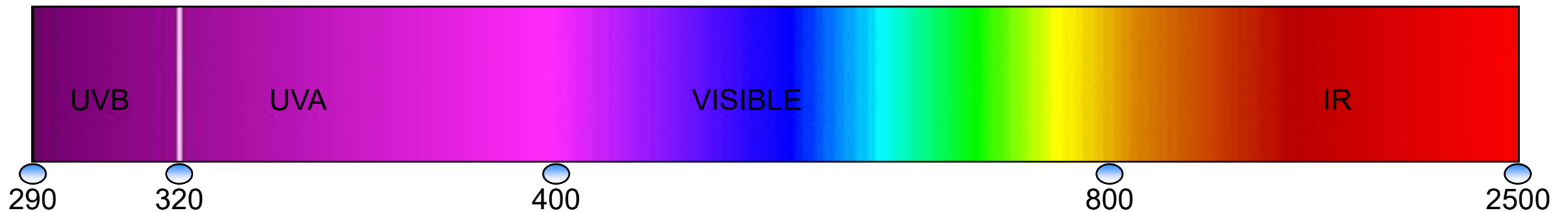
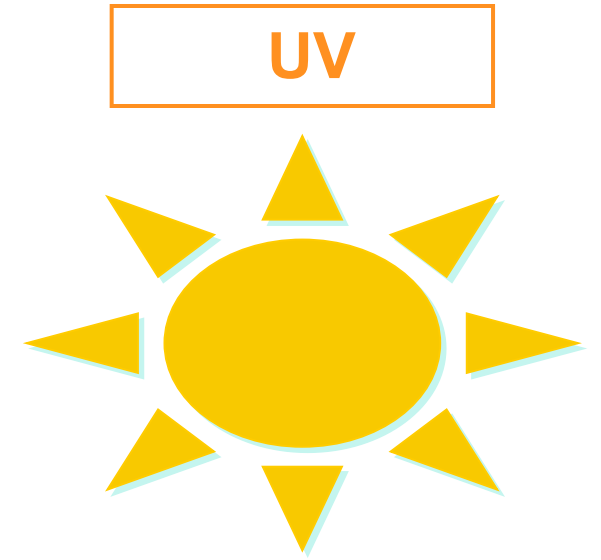
What are the targets of photoprotection?



Sunlight induced photodamage includes visible light, infrared, and ultraviolet radiation effects.

Components of Solar Radiation

- ★ **UVA rays:** Are lower in energy than UVB rays, but they are at least 20 times more abundant. Unlike UVB rays, they are present year-round in all parts of the world.



Sun Radiation Summary

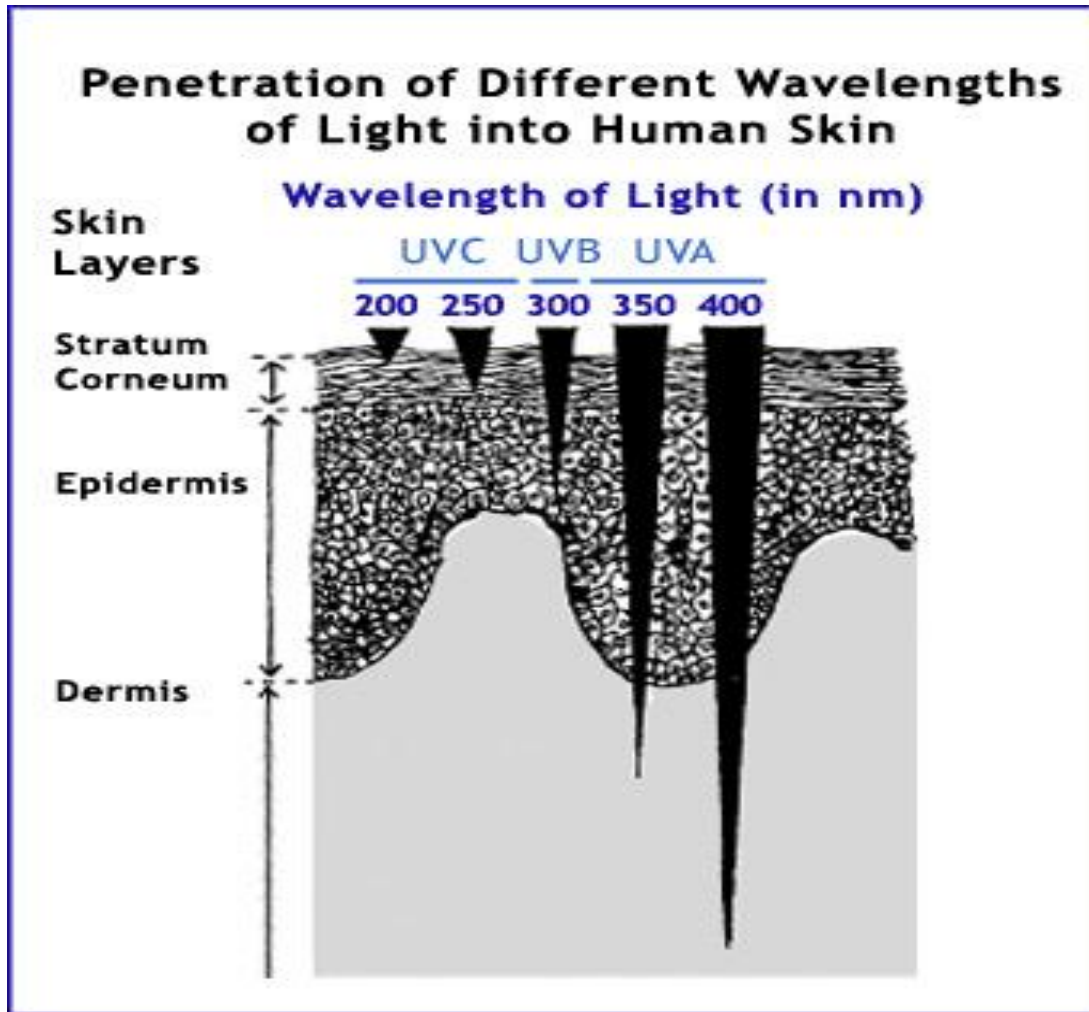
Radiation Type	Energy per Photon	% of Total Radiation Reaching Earth	Effects on Human Skin
UVC ~200-290 nm Short-wave UV	High Energy	~0% (<1% of all UV)	DNA Damage
UVB ~290-320 nm Mid-range UV	Medium Energy	~0.5% (5% of all UV)	Sunburn DNA Damage Immunosuppression Skin Cancer
UVA 320-340 nm (Short-wavelength UVA) 340-400 nm (Long-wavelength UVA) Long-range UV	Low Energy	~5.0% Approximately 20x more abundant than UVB	Sunburn Tanning Skin Aging Significant Immunosuppression DNA Damage Skin Cancer
Visible ~400-800 nm	Lower Energy	~43 %	None Currently Known
Infrared ~800-120,000 nm	Lowest Energy	~49%	Heat Sensation Photocarcinogenesis? Photoaging?

Lim HW, et al. *J Am Acad Dermatol*. 2001;44:505-508.

Lim HW, et al. *Cosmet Dermatol*. 2006;19:3-8.

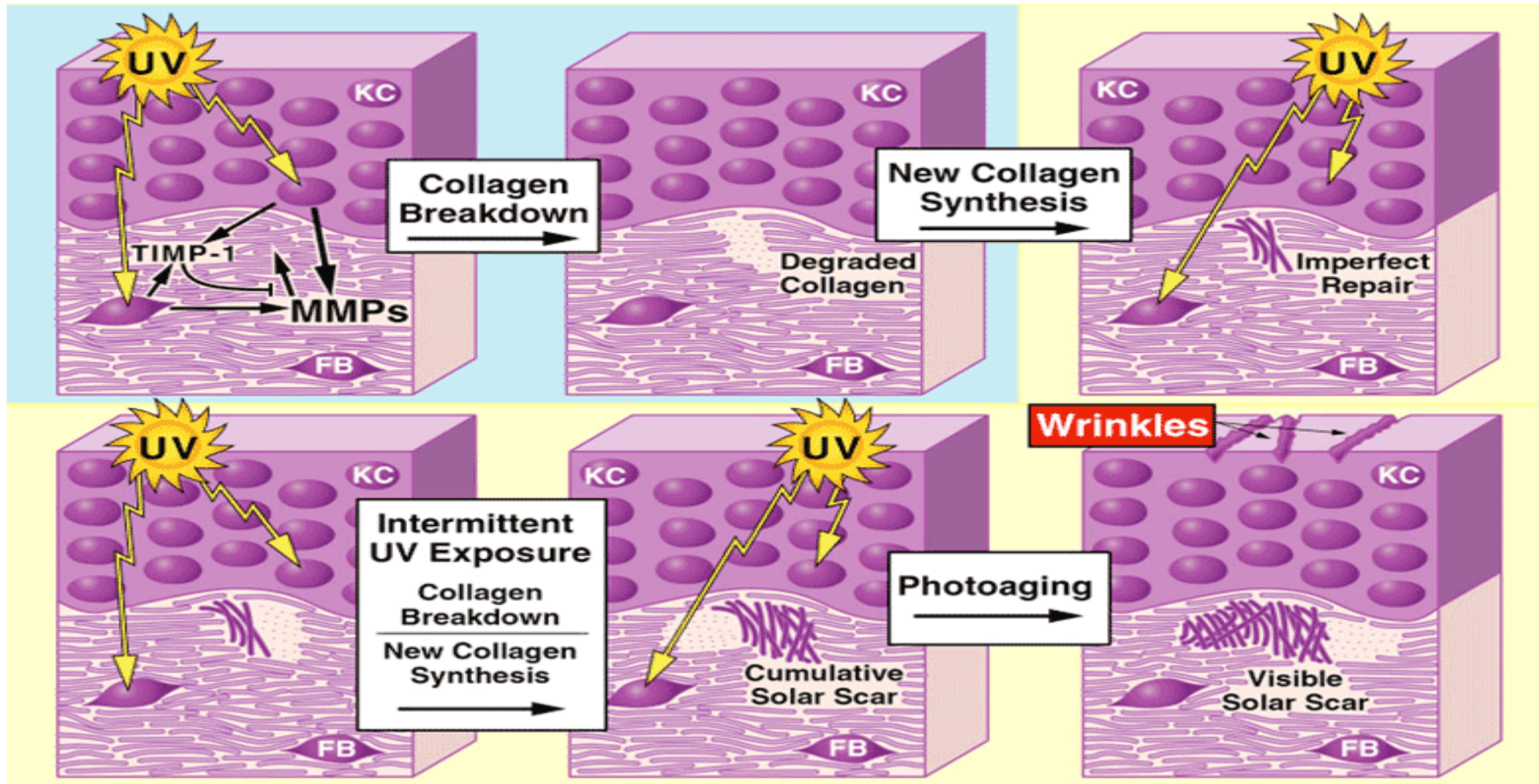
Schieke SM, et al. *Photodermatol Photoimmunol Photomed*. 2003;19:228-234.

Wavelength Skin Penetration



- Very high energy radiation (UVC) is currently blocked by the ozone layer
- High energy UVB radiation does the most immediate visible damage (sunburn)
- Lower energy UVA radiation can penetrate deeper into the skin, leading to long-term damage

Mechanisms of Photoaging



The Modern Age of Photoprotection

- Adaptogens (antioxidants) and their role in topical sunscreens to prevent cutaneous damage from reactive oxygen species
- Endogenous methods of photoprotection based on Fitzpatrick skin type and ethnicity
- Organic sunscreens and their safety profile
- Inorganic sunscreen developments to improve aesthetic properties
- Tinted sunscreens to address effects of visible light and improve skin color matching capabilities
- Customization of sunscreen formulations for various skin needs

Photoprotective Adaptogens:

Adaptogens are antioxidants usually of botanical derivation. Adaptogens are now added to sunscreen formulations.

Adaptogens to Explore



Astragalus



Codonopsis Root



Licorice



Schisandra



Asian Ginseng



Reishi Mushroom



American Ginseng



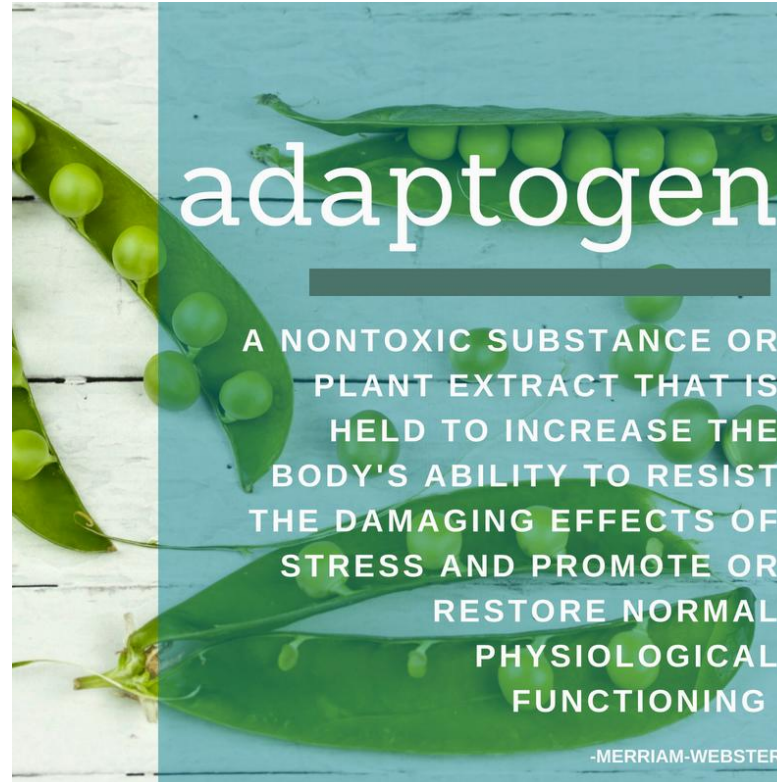
Rhodiola Rosea



Ashwagandha



Eleuthero/
Siberian Ginseng

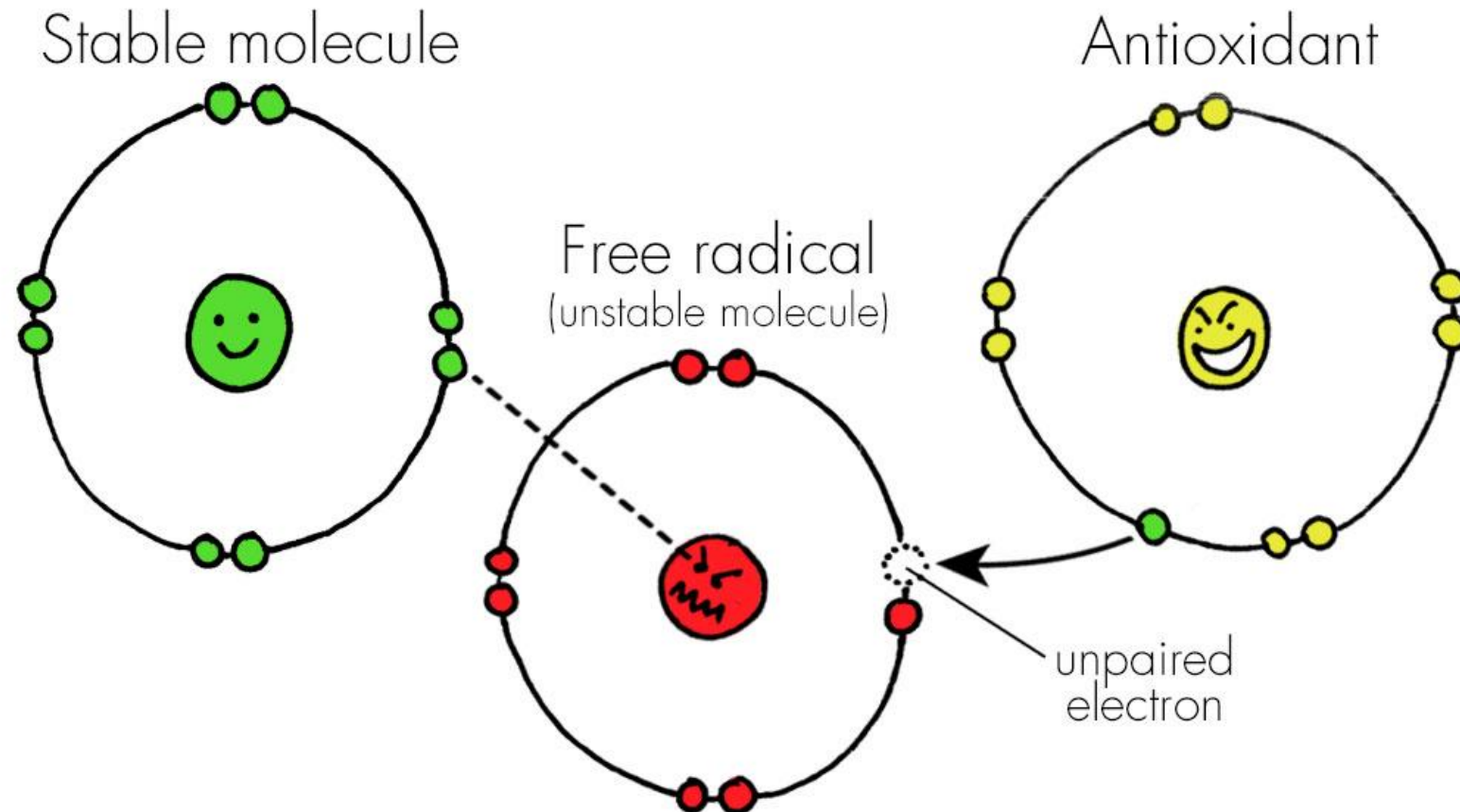


WHAT ARE ADAPTOGENS? Everything You Need to Know

TOP 12 ADAPTOGENS



How do adaptogens function in photoprotection?



Botanical Adaptogen: Candlewood Plant



Plant Adaptogens

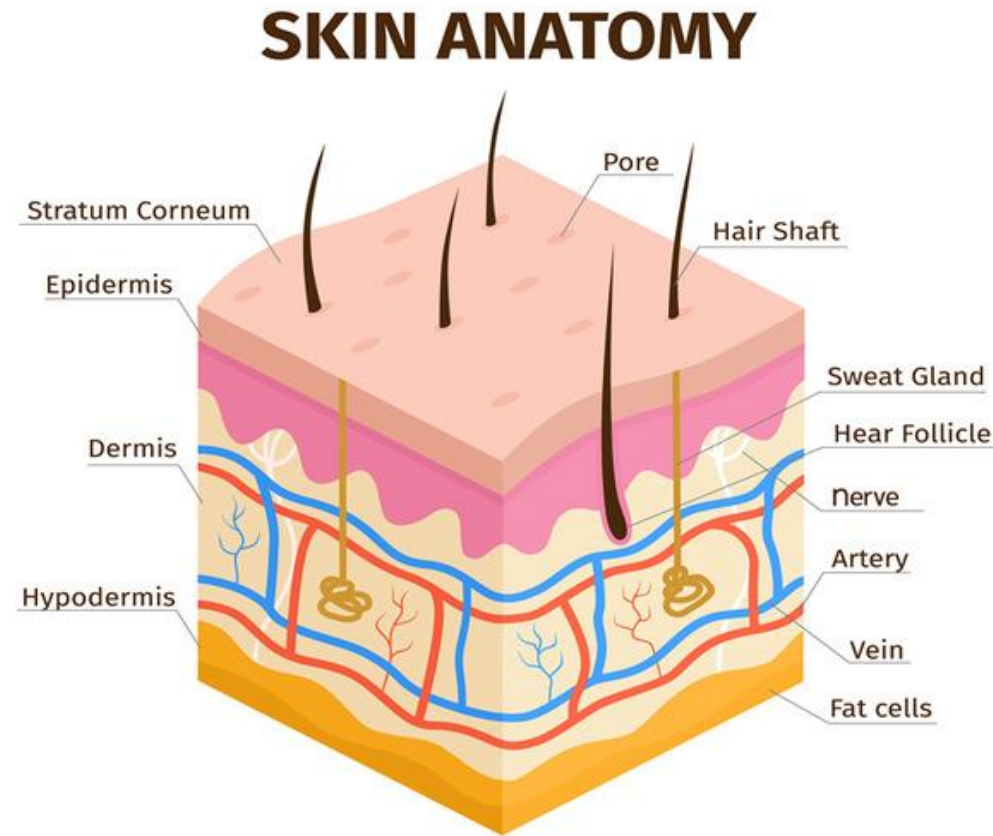
- Antioxidants topically may protect UV wavelengths that “get away”
- Most plants possess antioxidant activity to live in UV rich outdoors
- Candlewood contains kaempferol-3-O-sophoroside
- Antioxidant protects skin DNA



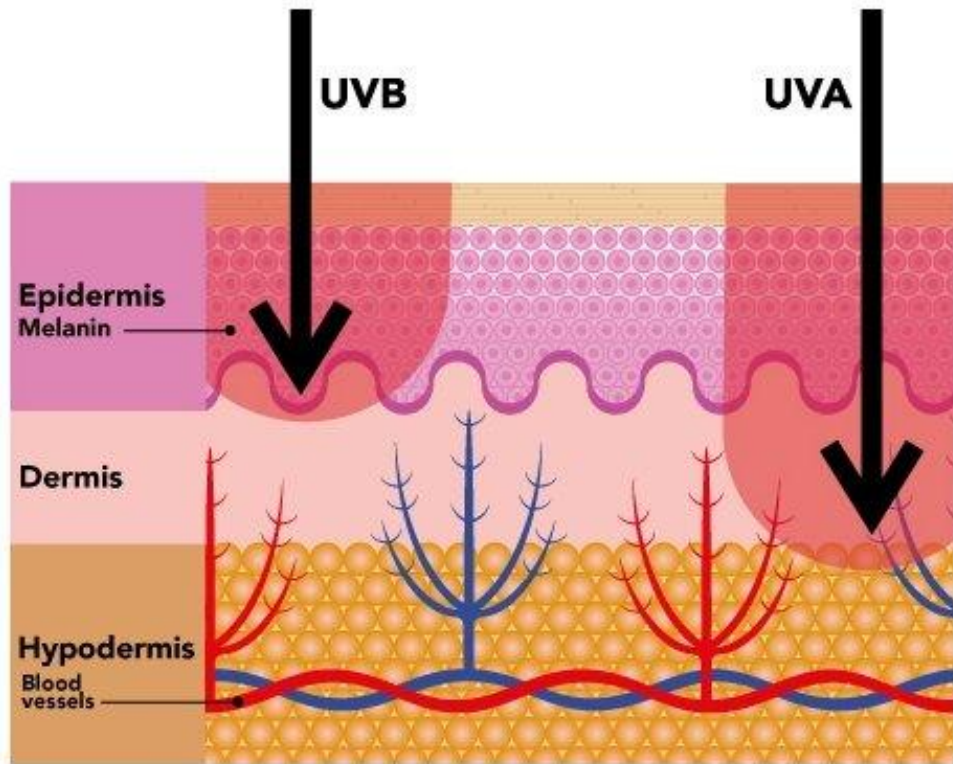
Endogenous Photoprotection



How does the skin provide endogenous photoprotection?



Endogenous Photoprotection: Dermis



- Caucasian dermis is thinner, AA dermis is thicker, less UV penetration in AA skin with decreased photoaging
- AA dermis has closely stacked smaller collagen fiber bundles with surrounding ground substance
- AA DEJ more convoluted, DEJ is stronger
- More fibroblasts and lymphatics in AA dermis
- Thus, AA dermis more resistant to effects of photodamage and aging

Endogenous Photoprotection: Eumelanin vs. Pheomelanin

- More eumelanin in AA skin, eumelanin can function as an antioxidant
- More pheomelanin in Caucasian skin, pheomelanin is a pro-oxidant increasing the release of ROS with photo exposure
- UV filter in basal/spinous layer in AA skin, deeper location provides better photoprotection
- UV filter in stratum corneum in Caucasian skin, less photoprotection especially with exfoliation



Endogenous Photoprotection: Melanosome Distribution

- Melanosomes have more eumelanin in AA skin, more pheomelanin in Caucasian skin
- Melanosomes mainly in basal layer in AA, in SC in Caucasian
- AA melanocytes contain 200 melanosomes, Caucasian melanocytes contain less than 20
- AA melanosome pH neutral, Caucasian pH acidic, tyrosinase more active at neutral pH
- Higher melanosome transfer to keratinocytes in AA skin



Endogenous Photoprotection: Fitzpatrick Skin Type

- AA skin protection
UVB=13.4, Caucasian skin UVB=3.4
- AA skin protection
UVA=5.7, Caucasian skin UVA=1.8
- 3-4 times more UVA reaches upper dermis of Caucasian skin than AA

Fitzpatrick phototype	Description	ITA	Skin color (ITA classification)	UVB protection (SPF)	UVA protection (UVA-PF)	High energy visible light protection (VL-PF)
I	Always burns, never tans	$ITA^\circ > 55^\circ$	Very light	SPF50+	UVA-PF+++ ($>1/3$ labelled SPF)	
II	Burns easily, sometimes tans	$41^\circ < ITA^\circ < 55^\circ$	Light			
III	Sometimes burns, always tans	$28^\circ < ITA^\circ < 41^\circ$	Intermediate			
IV	Rarely burns, tans easily	$10^\circ < ITA^\circ < 28^\circ$	Tan			
V	Rarely burns, tans easily	$-30^\circ < ITA^\circ < 10^\circ$	Brown			
VI	Rarely burns, tans promptly and intensely; highly pigmented	$ITA^\circ < -30^\circ$	Dark	SPF30+	UVA-PF+++ ($>2/3$ labelled SPF)	VL-PF+++

Organic Sunscreens: Safety Profile

THERE ARE TWO TYPES OF SUNSCREENS:



PHYSICAL SUNSCREEN

This sunscreen **WORKS LIKE A SHIELD** ;
it sits on the surface of your skin,
deflecting the sun's rays.

Look for the active
ingredients **ZINC OXIDE** and/or
TITANIUM DIOXIDE .

Opt for this sunscreen if you have
SENSITIVE SKIN .



CHEMICAL SUNSCREEN

This sunscreen **WORKS AS A SPONGE** ,
absorbing the sun's rays.

Look for one or more of the following
active ingredients: **OXYBENZONE** ,
AVOBENZONE , **OCTISALATE** ,
OCTOCRYLENE , **HOMOSALATE** and
OCTINOXATE .

This formulation tends to be **EASIER**
TO RUB INTO the skin without
leaving a white residue.



Organic Sunscreens: Safety Profile

- The safety of organic sunscreens has come under question
- Organic sunscreens may be toxic to the environment
- Benzophenone is absorbed into body and an endocrine disruptor
- Source of allergenicity
- Reason for increased popularity of inorganic sunscreens, especially for children

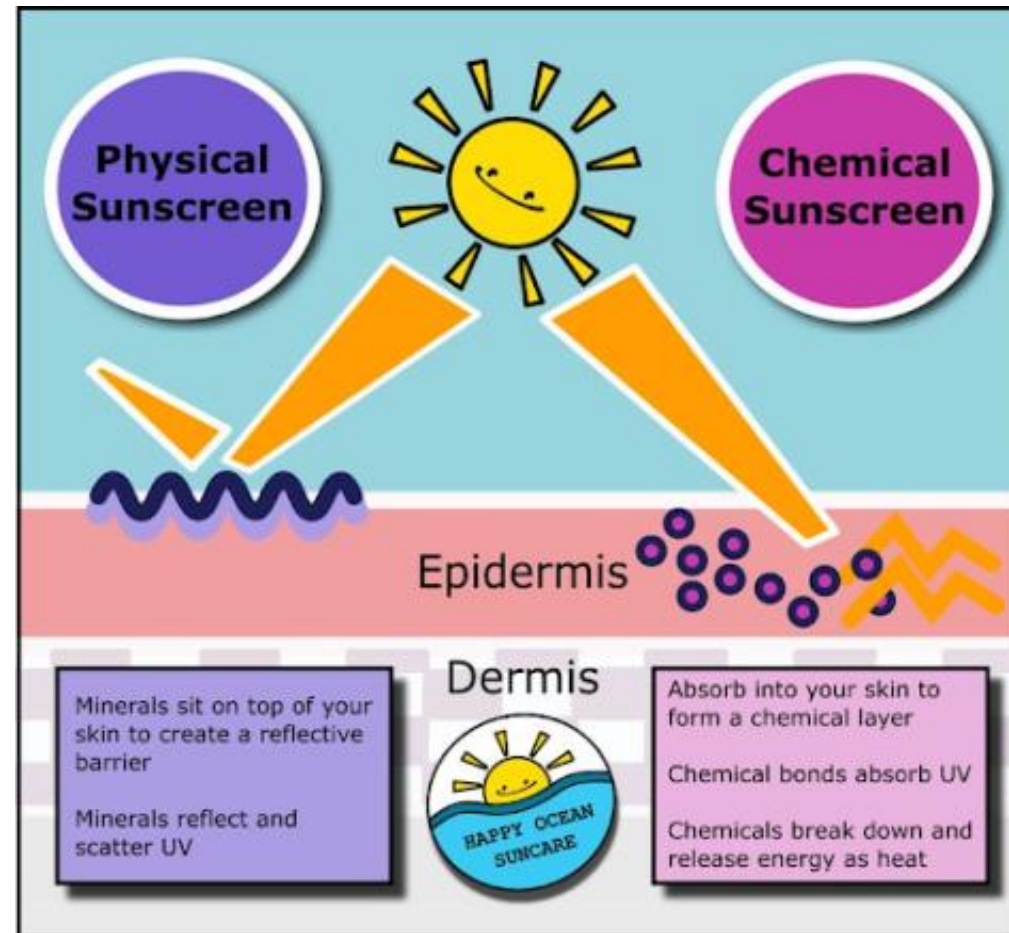


Benzophenone

New Organic Sunscreen Active: Bemotrizinol (BEMT)

- BEMT approved by FDA on June 9, 2026
- First new filter in 25 years
- Widely used outside the US and known as Tinosorb S, or Parsol Shield (US tradename)
- Broad spectrum UVB and UVA photoprotection
- More stable with sun exposure than avobenzone
- BEMT has limited systemic absorption
- Does not leave white film

Inorganic Sunscreens: Improved Aesthetics and Efficacy



Inorganic Sunscreens: Improved Aesthetics and Efficacy

- Inorganic sunscreens include zinc oxide and titanium dioxide
- Inorganic sunscreens do not degrade over time
- Zinc oxide suspended in dimethicone, small particle titanium dioxide
- Titanium dioxide harmful if inhaled, zinc oxide used in pediatric sunscreens

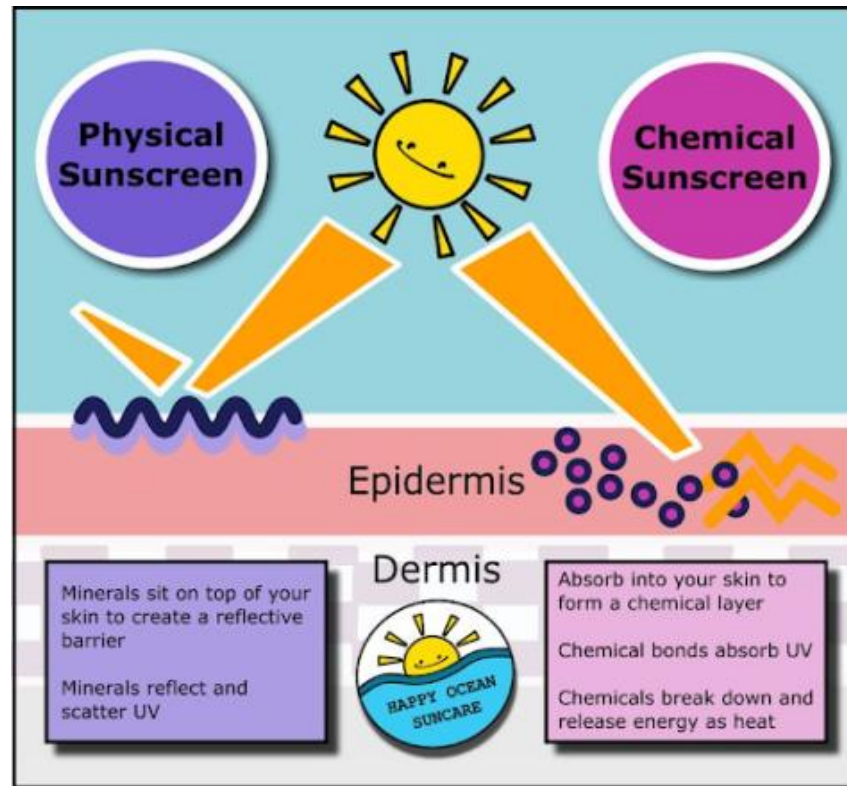


Titanium Dioxide



Zinc Oxide

What are specialty sunscreens?



Specialty sunscreens offer benefits beyond simply sun protection to include:

- Aesthetic tint
- Oil control/Oil free
- Moisturization
- Barrier protection
- Sensitive skin
- Pigment control
- Anti-aging

Specialty Sunscreens: Tinted



Specialty Sunscreens: Tinted



Tinted Sunscreen

- Mineral refers to the use of inorganic filters (zinc oxide), no organic filters
- Can be blended into a variety of skin tones
- Dispensed from a can leading to better stability

Visible Light Protection: Tinted Sunscreens

- Inorganic sunscreens by reflecting and minimally absorbing UV energy
- Inorganic sunscreens, such as zinc oxide and titanium dioxide, can be ground into colorless powders of very small particle size, but SPF goes down as particle size decreases
- Visible light important in dyspigmentation in skin of color
- Iron oxide (inactive ingredient: black, red, yellow) and tinted titanium dioxide (active ingredient) can be included to color sunscreen and block UV and visible light
- Synthetic mica used to increase radiance and brighten skin and enhance color matching capabilities

Visible Light Protection: Tinted Sunscreens

5-IN-1 TINTED SUNSCREEN MOISTURIZER



**4-5 shades
will match
most
Fitzpatrick
Skin Types**



Specialty Sunscreens: Oil Control



- Oil control sunscreens are designed to absorb sebum and minimize facial shine
- Zinc oxide and titanium dioxide, both inorganic filters, can absorb oil until saturated
- Kaolin is also added as an oil absorber
- This technology takes advantage of the multifunctional role of inorganic filters

Specialty Sunscreens: Oil-free



- Oil-free sunscreens are devoid of mineral and vegetable oils. Most are based on silicone oils.
- Oil-free products are sometimes called “clear face” or “breakout free” because they use noncomedogenic oils
- These products are good for facial use in acne patients
- Products are usually tested to be noncomedogenic on the human back and facial tested for safety-in-use on acne prone individuals

Specialty Sunscreens: Moisturizing

- Moisturizers that contain sunscreen are still sunscreens and OTC drugs
- Moisturizing claim has no regulatory meaning
- Moisturizer ingredients are the sunscreen vehicle
- May contain dimethicone, glycerin, hyaluronic acid
- Most lotion and cream sunscreens are moisturizing to a greater or lesser degree



Specialty Sunscreens: Barrier Repair



- Contains ceramides found in intercellular lipids
- Ceramides are produced first after barrier damage has occurred
- Ceramides in a sunscreen may improve barrier repair
- Synthetic ceramides can penetrate into the stratum corneum, but are not incorporated into the intercellular lipids

Specialty Sunscreens: Sensitive Skin



- What does sensitive skin mean on a sunscreen label? Nothing
- There is no regulatory or scientific definition of sensitive skin
- Sensitive skin claim may mean that the product was tested in subjects with sensitive skin

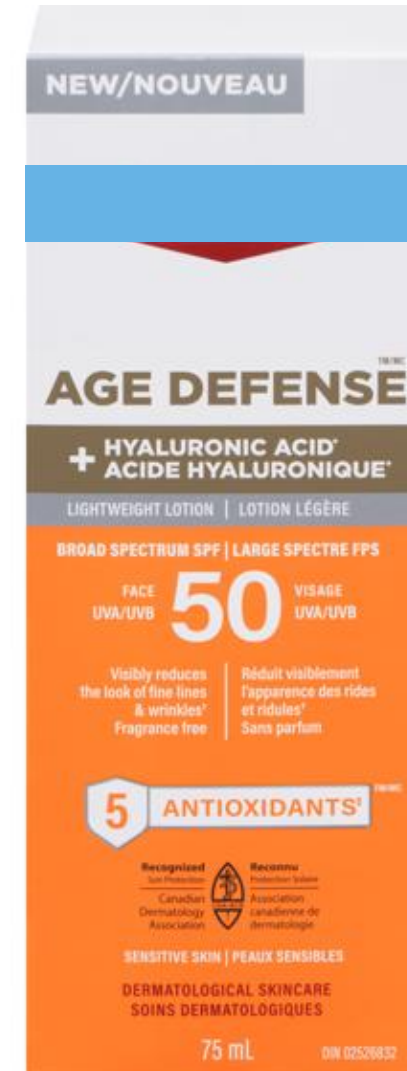
Specialty Sunscreens: Pigment Control



- Pigment control sunscreens contain ingredients to decrease skin pigment production
- Licorice skin lightening ingredient glycyrrhetic acid inhibits rate limiting tyrosinase step in pigment production
- Isobutylamido thiazoyl resorcinol acts as an exfoliant to lighten skin

Specialty Sunscreens: Anti-Aging

- Product contains sodium hyaluronate, a humecant
- Antioxidants: glyrrhetic acid, licochalone A, tocopherol, sodium ascorbyl phosphate, diethylhexylsyringylidenemalonate (antioxidant for sunscreen actives)
- Age defense claim is best supported by the sunscreen actives in the formulation



Specialty Sunscreens: Antioxidant



- Antioxidants can also prevent damage from UVA and UVB radiation by quenching reactive oxygen species (ROS)
- In some ways, antioxidants can protect against damage from UVA/UVB radiation that is not stopped by sunscreens, however antioxidants are not considered sunscreen actives
- Antioxidants do not contribute to the SPF
- Antioxidant cocktails may be put in sunscreens, such as Vitamin C, Vitamin E, niacinamide, licorice root, glycyrrhetic acid, beta-carotene, caffeic acid, gallic acid
- Different patented complexes can confer marketing interest
- Antioxidants may be effective topically, but are more effective when consumed orally

Specialty Sunscreens: Water Resistant



- Water resistant sunscreens must undergo special testing to make claim
- Subjects wear sunscreen and then get in a whirlpool followed by SPF testing:
 - Allow 15 to 30 minutes drying time after product application
 - First 20 minute immersion in water
 - Allow 15 minutes drying time (no towelling)
 - Second 20 minute immersion in water
 - Allow to dry for 15 minutes or until completely dry (no towelling)
- SPF testing is done with a solar simulator shown at an area where the sunscreen has been applied before and after exposure to water
- Water resistant 80 minutes is the maximum claim allowed

Specialty Sunscreens: Dry Touch



- Dry touch does not refer to any scientific or regulatory information or requirements
- Dry touch is a marketing term to relate to the consumer the lack of greasiness in a sunscreen formulation
- Dry touch may also mean that the product does not leave a white pasty tacky film on the face
- The claim is of aesthetic value and does not imply the inclusion of any specific ingredients

Specialty Sunscreens: Baby



- No specific requirements or regulations pertain to baby products
- Baby sunscreens follow the same sunscreen monograph that has not been approved, but the monograph designation is under review
- Baby sunscreens may be the same as adult sunscreens, but they are sold in the baby isle of product display
- Adult and baby sunscreens can be used on anyone



Next Generation Approach to Photoprotection

1. Skin aging is the cumulative effect of all exposome factors over a lifetime, the most important of which is sun exposure
2. All forms of light, including visible, UV, and IR cause skin aging
3. Adaptogens protect the exposome largely through the prevention of oxidative insults and are being added to sunscreen formulations as inactives
4. Sunscreens build on the body's natural mechanisms for photoprotection, which differ among the various Fitzpatrick skin types.
5. Sunscreens are now customized for a variety of skin colors and needs

