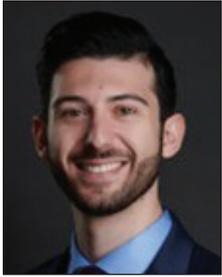


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UV radiation and sunscreen

By Benjamin Cooper, DO, Taha Rasul, MD, and Anthony Concilla, DO



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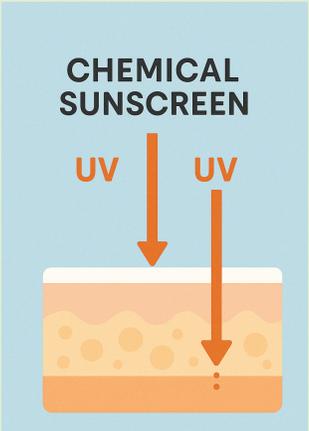
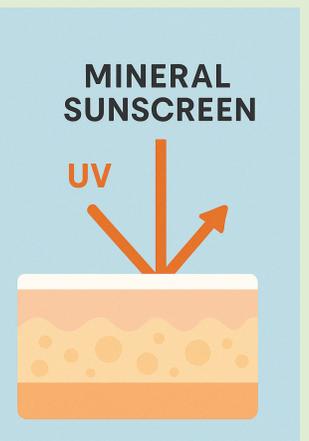


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Ultraviolet (UV) radiation	
<p>Solar radiation composition</p> <p>Figure 1: Penetration of UV radiation into the layers of skin Copyright © Medscape</p>	<ul style="list-style-type: none"> Solar radiation is composed of approximately 50% visible light, 40% infrared radiation, and 9% UV radiation UV radiation consists of UVA, UVB, and UVC
<p>UVA (320-400 nm)</p>	<ul style="list-style-type: none"> Divided into UVBII (320–340 nm) and UVBI (340–400 nm) Penetrates deeper into the dermis than UVB Present from sunrise until sunset Penetrates glass windows Causes photoaging, immediate pigment darkening due to redistribution of melanin, and contributes to DNA mutations via ROS production
<p>UVB (280-320 nm)</p>	<ul style="list-style-type: none"> UVB is 1,000 times more erythemogenic than UVA UVB signature mutation = C → T at pyrimidine dimer sites Main cause of sunburn, erythema, and skin cancer formation Peaks at midday Does not penetrate glass windows
<p>UVC (200-280 nm)</p>	<ul style="list-style-type: none"> Absorbed by the ozone layer, does not reach Earth's surface
<p>Vitamin D production</p>	<ul style="list-style-type: none"> UVB converts 7-dehydrocholesterol to previtamin D3, which is then converted into vitamin D3 in the body
<p>UV light properties</p>	<ul style="list-style-type: none"> Light has properties of both waves and photons To have an effect, light must be absorbed by a chromophore of the epidermis (nucleic acid, protein, urocanic acid, and melanin) or dermis (hemoglobin and porphyrins)
<p>Absorption spectrum</p>	<ul style="list-style-type: none"> The portion of the electromagnetic (EM) spectrum that is absorbed by a particular molecule or chromophore
<p>Action spectrum</p>	<ul style="list-style-type: none"> The portion of the EM spectrum that produces a particular effect
<p>Minimal erythema dose (MED)</p>	<ul style="list-style-type: none"> The minimal amount of a particular UVR that leads to erythema of the exposed skin 16-24 hours after exposure MEDs are important to determine the appropriate starting dose of phototherapy

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Sunscreen	
Sunscreen overview	<ul style="list-style-type: none"> Sunscreens protect the skin from UV radiation through chemical or physical mechanisms
Types of sunscreens	<ul style="list-style-type: none"> Chemical sunscreens, also known as organic sunscreens, are absorbed into the skin and work by absorbing UV radiation and converting it into heat Physical sunscreens, also known as mineral sunscreens, are not absorbed by the skin. Instead, they work by reflecting or scattering UV radiation
Sun protection factor (SPF)	<ul style="list-style-type: none"> Measures the degree of protection an agent confers against UVB-induced erythema Calculated by the MED of protected skin divided by MED of unprotected skin SPF 15 blocks 93% of UV radiation; SPF 30 blocks 97% of UV radiation; SPF 50 blocks 98% of UV radiation Higher SPF values provide greater protection
Chemical sunscreens 	<ul style="list-style-type: none"> UVA sunscreens include avobenzone, oxybenzone, dioxybenzone, sulisobenzene, meradimate, and ecamsule Oxybenzone is associated with contact dermatitis and photoallergy Avobenzone, offering one of the highest UVA-1 blocking abilities, is photolabile and combined with octocrylene to prevent degradation UVB sunscreens include para-aminobenzoic acid, padimate O, octinoxate, cinoxate, octisalate, homosalate, trolamine salicylate, octocrylene, and ensulizole PABA is the most potent UVB agent; associated with contact dermatitis and skin staining. It has largely been replaced by other agents Chemical sunscreens are typically more cosmetically acceptable than physical sunscreens because they blend easily and do not leave a visible white cast, although newer micronized mineral formulations offer comparable cosmetic appeal
Mineral sunscreens 	<ul style="list-style-type: none"> Mineral sunscreens contain either zinc oxide or titanium dioxide, providing broad-spectrum protection against UVA and UVB without irritation Iron oxides offer protection into the visible light spectrum and near-infrared spectrum to help prevent visible light-induced dyspigmentation

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Sunscreen	
Broad spectrum protection	<ul style="list-style-type: none"> Broad spectrum protection means the sunscreen provides coverage against both UVA and UVB rays
Water resistance	<ul style="list-style-type: none"> Water resistance indicates that the sunscreen maintains its SPF after 40-80 minutes of immersion in water. This is important for swimmers or those who sweat heavily. No sunscreen is completely waterproof or sweatproof.
Vehicle and formulation types	<ul style="list-style-type: none"> Lotions and creams: Most common, offering a variety of formulations. Contain oil and water phases which facilitates even coverage. Higher SPF may feel greasy due to oils. Gels: Water-based, useful for oily skin or acne-prone individuals. Easily removed by sweat or water. Sprays: Convenient but may apply unevenly. Useful for areas like the scalp and face. Sticks: Useful for small areas like lips, nose, and eyes Cosmetic sunscreens: Foundation makeup with sunscreen provides some protection (SPF 4-5) from pigments alone.
Choosing sunscreen for sensitive or special skin types	<ul style="list-style-type: none"> For photosensitive patients (e.g., with polymorphous light eruption, porphyrias, solar urticarias, or melasma), sunscreens with higher SPF and UVA-1 protection are preferred Physical sunscreens may be better for sensitive skin types, including those with acne or rosacea, because they are less likely to cause irritation or allergic reactions than chemical filters.
Sunscreen application guidelines	<ul style="list-style-type: none"> Broad-spectrum, SPF 30 or higher Apply generously (2 mg/cm²) Reapply every two hours, and more frequently if swimming or sweating. Ensure even coverage for full protection

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