



Sunscreen Safety

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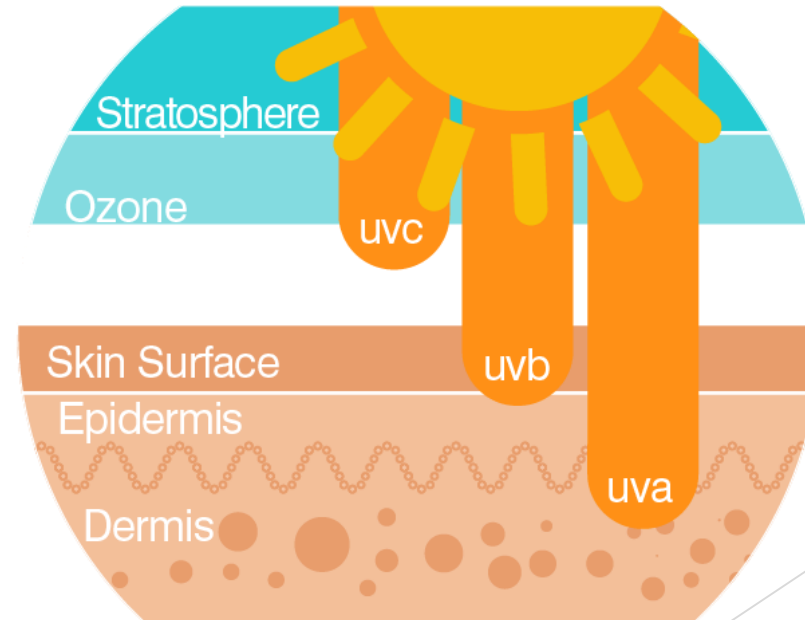
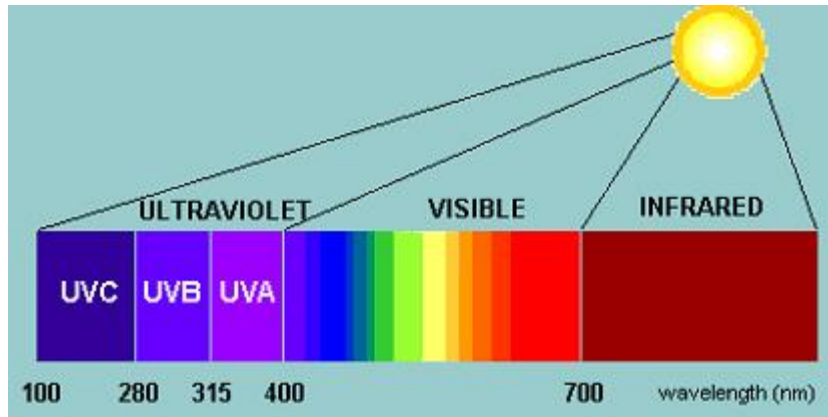
Outline

Sunscreen safety:

- ▶ Application
- ▶ Reactions
- ▶ Publicity
- ▶ Nanoparticles
- ▶ ?Oestrogen absorption
- ▶ ?Free radicals and cancer
- ▶ ?Environmental impact on corals
- ▶ Education and awareness

What is sunburn?

- ▶ Inflammatory response of the skin.
- ▶ Predominantly UVB (290 to 320 nm wavelength range) absorbed by the epidermis (UVA penetrates the dermis and contributes to premature ageing).
- ▶ Both UVA and UVB increase risk of skin cancer.



Sunscreen

- ▶ Sunscreens have different characteristics:
 - ▶ Spectrum of UV protection
 - ▶ Sun protection factor (SPF) and
 - ▶ Type (chemical or physical)
- ▶ Spectrum: Recommend broad spectrum that offers both UVA and UVB protection.
- ▶ SPF: Only refers to UVB radiation.

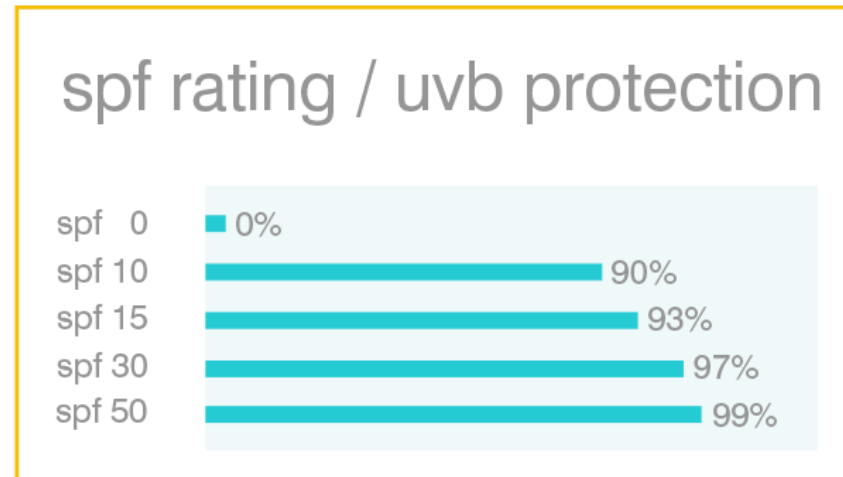


Image: COOLA suncare <http://www.coolasuncare.com/sun-science/>

Sunscreen

▶ Type:

▶ Chemical sunscreens (classic):

- ▶ Absorb UV radiation, resistant to sweat and water.
- ▶ (for a certain period of time).
- ▶ Need to be applied before sun exposure.

▶ Physical sunscreens (mineral):

- ▶ Contain minerals (zinc oxide or titanium dioxide).
- ▶ Reflect and scatter UV radiation.
- ▶ Work immediately and last longer.



FutureDerm

PHYSICAL SUNSCREENS

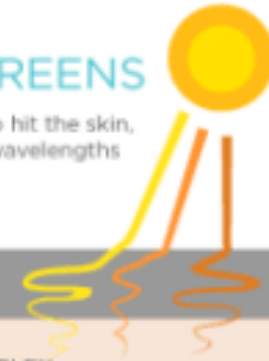
Physical sunscreens prevent UV rays from hitting the skin at all.



- ZINC OXIDE
- TITANIUM OXIDE

CHEMICAL SUNSCREENS

Chemical sunscreens allow UV rays to hit the skin, but transform it into non-damaging wavelengths of light or heat.



- OCTYLCRYLENE
- AVOBENZONE
- OCTINOXATE
- OCTISALATE
- OXYBENZONE
- HOMOSALATE
- HELIOPLEX
- PARSOL 1789
- 4-MBC
- MEXORYL SX AND XL
- TINOSORB S AND M
- UVINUL T 150
- UVINUL A PLUS

Image: COOLA suncare <http://www.coolasuncare.com/sun-science/>

Application

- ▶ Need to ensure correct use to achieve the benefits of sunscreen

Not just slip, slop, slap!

- ▶ Apply enough: should have thickness $2\text{mg}/\text{cm}^2$
 - ▶ Spray on sunscreens: need to ensure spraying liberally to achieve this thickness
?lack of education in the community
- ▶ Hard to reach areas
- ▶ Apply before sun exposure
- ▶ Frequency: re-apply every 2 hours



Reactions

- ▶ Reactions to sunscreen are rare.
- ▶ May be a result of many factors including ingredients, sunlight, other allergens, concomitant medications or creams.
- ▶ Most common reaction is **contact dermatitis**, either due to **irritant contact** or **allergic contact dermatitis**, in addition to another rare type of **photo-contact dermatitis**.

- ▶ Contact dermatitis:
 - ▶ Irritant contact: irritation of the skin when sunscreen applied, usually in those with a history of sensitive skin or eczema.
 - ▶ Allergic contact: less common reaction in those with hypersensitivity to an ingredient in sunscreen, such as fragrances or preservatives.

- ▶ Photo-allergic contact reactions:
 - ▶ Interaction between a sunscreen ingredient and ultraviolet light which leads to a skin reaction. This is usually a result of an allergy to the active ingredient, but can also be due to a reaction to fragrances or preservatives.

Sunscreen

UV Action Spectrum
Maximum Concentration

ACTIVE INGREDIENTS		
Chemical Filters		
UVA Filters		
Oxybenzone	6%	UVB, UVA II
Sulisobenzone	10%	UVB, UVA II
Dioxybenzone	3%	UVB, UVA II
Avobenzone (Parsol 1789)	3%	UVA I
Meradimate	5%	UVA II
Ecamsule ² (Mexoryl SX)	10%	UVB, UVA
UVB Filters		
PABA	15%	UVB
Padimate-O	8%	UVB
Cinoxate	3%	UVB
Octinoxate	7.5%	UVB
Octisalate	5%	UVB
Homosalate	15%	UVB
Trolamine salicylate	12%	UVB
Octocrylene	10%	UVB, UVA II
Ensilizole	4%	UVB
Physical Filters		
Titanium dioxide	25%	UVB, UVA ³
Zinc oxide	25%	UVB, UVA ³

¹Only as a component of certain approved sunscreen formulations approved under the new drug application.
²Absorption varies depending on the particle size.

Image: Skin Cancer Foundation

<https://www.skincancer.org/prevention/sun-protection/sunscreen/sunscreens-safe-and-effective>

Publicity

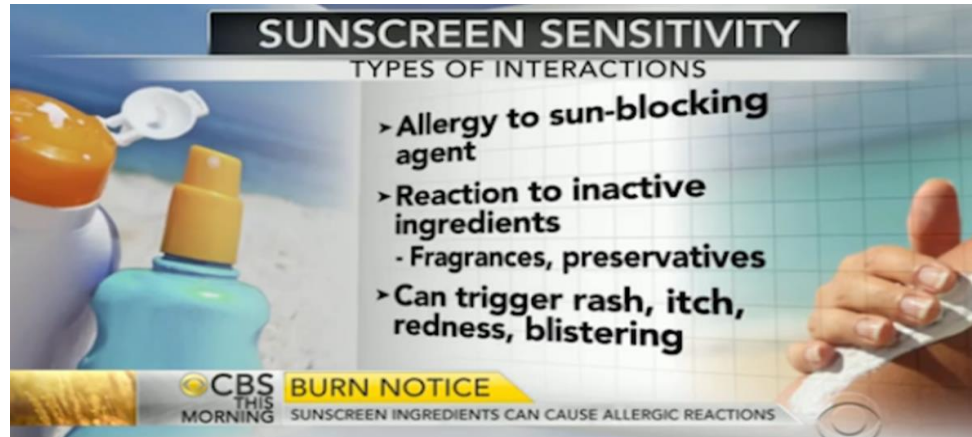


Image: CBS News <https://cbsnews3.cbsstatic.com/hub/i/r/2015/07/01/f3389442-9914-4e13-b20b-500055b1df38/thumbnaill/1200x630/49bc61977b1fb975b2cbb0f6e537dcfa/screen-shot-2015-07-01-at-11-53-40-am.png>

- ▶ It is not clear whether the claims of sunscreen allergy/burns are in fact sunburns - it is possible that people are simply not applying enough sunscreen or not applying it regularly enough.
- ▶ Reminiscent of controversial ?allergy/burns in the media:
 - ▶ TGA tested Banana Boat early 2016: TGA laboratories conducted chemical testing on a selection of Banana Boat sunscreens and found no evidence of a problem with the quality of any of the sunscreens.



Nanoparticles

- ▶ Newer sunscreens have been developed in the last couple of years that contain nanoparticles: nano-sized zinc oxide or titanium dioxide particles that do not form a visible physical “shield” on the skin.
- ▶ Some concern in the community with speculation that nanoparticles penetrate the skin and possibly have toxic effects.
- ▶ The TGA updated their literature review in 2017 (initially dating back to 2006) that concluded studies (both in-vivo and in-vitro) showed nanoparticles of zinc oxide and titanium dioxide do not penetrate the underlying skin, suggesting systemic absorption is unlikely, and neither are likely to cause harm when used as ingredients in sunscreens.



Image: <https://www.tga.gov.au/>

- ▶ The Cancer Council Australia in 2014 agreed that nanoparticles do not pose a risk.

Oxybenzone and oestrogen

- ▶ Concern with oxybenzone, a chemical filter in sunscreen and a synthetic oestrogen ?skin penetration and absorption affecting hormone levels.
- ▶ However, a 2004 study found that oxybenzone did not cause significant hormone disruption in humans.



The screenshot shows the Australian Government Department of Health Therapeutic Goods Administration website. The header includes the Australian Government logo and a search bar labeled "Search TGA". The navigation menu includes "Home", "Safety information", "Consumers", "Health professionals", "Industry", "About the TGA", and "News room". The "Safety information" section is expanded, showing "Reporting problems" and "Alerts". The "Alerts" section is further expanded to show "Current year alerts". The main content area displays a breadcrumb trail: "Home > Safety information > Alerts > All alerts". The title of the alert is "Sunscreens: Potential oestrogenicity of sunscreens". Below the title, it identifies the "OTC Medicines Evaluation Section, Therapeutic Goods Administration".

Image: <https://www.tga.gov.au/>

Retinyl palmitate and cancer

- ▶ Some studies suggest retinyl palmitate generates free radicals when exposed to UV radiation ?interactions with DNA may cause mutations leading to cancer.
- ▶ However, in practice, antioxidants like vitamins C and E present in the body can neutralise free radicals.
- ▶ Lack of scientific support that retinyl palmitate causes cancer in humans (research that generated the controversy was studied in mice not humans).
- ▶ In fact, retinoids (topical vitamin A products similar to retinyl palmitate) are commonly prescribed:
 - ▶ Data does not suggest that topical retinoids increase skin cancer risk.
 - ▶ Oral retinoids are often prescribed to help prevent skin cancers in people at high risk.

Environmental impact on coral



A diver swims above bleaching damage on the corals of the Great Barrier Reef in Australia.

Photograph: Greg Torda/Arc Centre Coral Reef Studies Handout/EPA

- ▶ Emerging concerns of sunscreen chemicals and ?toxic effects on coral reef and coral reef bleaching.
- ▶ Sunscreen chemicals absorb UV and act as photostabilisers to help preserve the integrity of other cosmetic ingredients, preventing their deterioration under the sun.
- ▶ Examples: oxybenzone, butylparaben, octinoxate and 4-methylbenzylidene camphor.
- ▶ Concern that at low concentrations these chemicals damage coral reef DNA, disrupts reproduction and growth, and contributes to bleaching
 - fears that this will erode the resiliency of coral reefs.
 - ▶ A study in 2015 (Downs et al) determined that oxybenzone at low concentrations caused coral deformity, however limitations in the study were noted by biologists (in particular that it was performed in a laboratory with an undetermined application in the wild).
 - ▶ Researchers behind large companies (eg. L'Oreal) dispute these beliefs on the basis of lack of enough study.
 - ▶ There are also alternative beliefs whereby it is felt the primary driver behind coral death is climate change.

Safety education and awareness

- ▶ Likely that most community members lack awareness surrounding correct application technique of sunscreen in order to constitute safe use
 - apply enough, especially if spray on!
- ▶ Choice of broad-spectrum and high SPF.
- ▶ Prevention: recommend that sunscreen is only one part of a sun smart routine (encourage protective clothing/eyewear, avoid hottest parts of the day)

Key points

- ▶ Safety benefits of sunscreen use and sunburn protection in Australia to prevent immediate and long-term consequences of sun over-exposure:
 - ▶ Choice of sunscreen to maximise protection - spectrum and SPF
 - ▶ Correct application
 - Thickness - be liberal (2mg/cm²)!
 - Frequency of re-application
 - ▶ Allergy to sunscreen is rare
 - ▶ No evidence of nanoparticle risks
 - ▶ Oestrogen concerns not validated
 - ▶ Retinoids and cancer concerns unsupported
 - ▶ Environmental impact on coral possible/controversial

Thank you!

Questions?



References

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