

The Burning Facts: Sun, Nanoparticles and Sun Protection



Dr Sarah Lantz

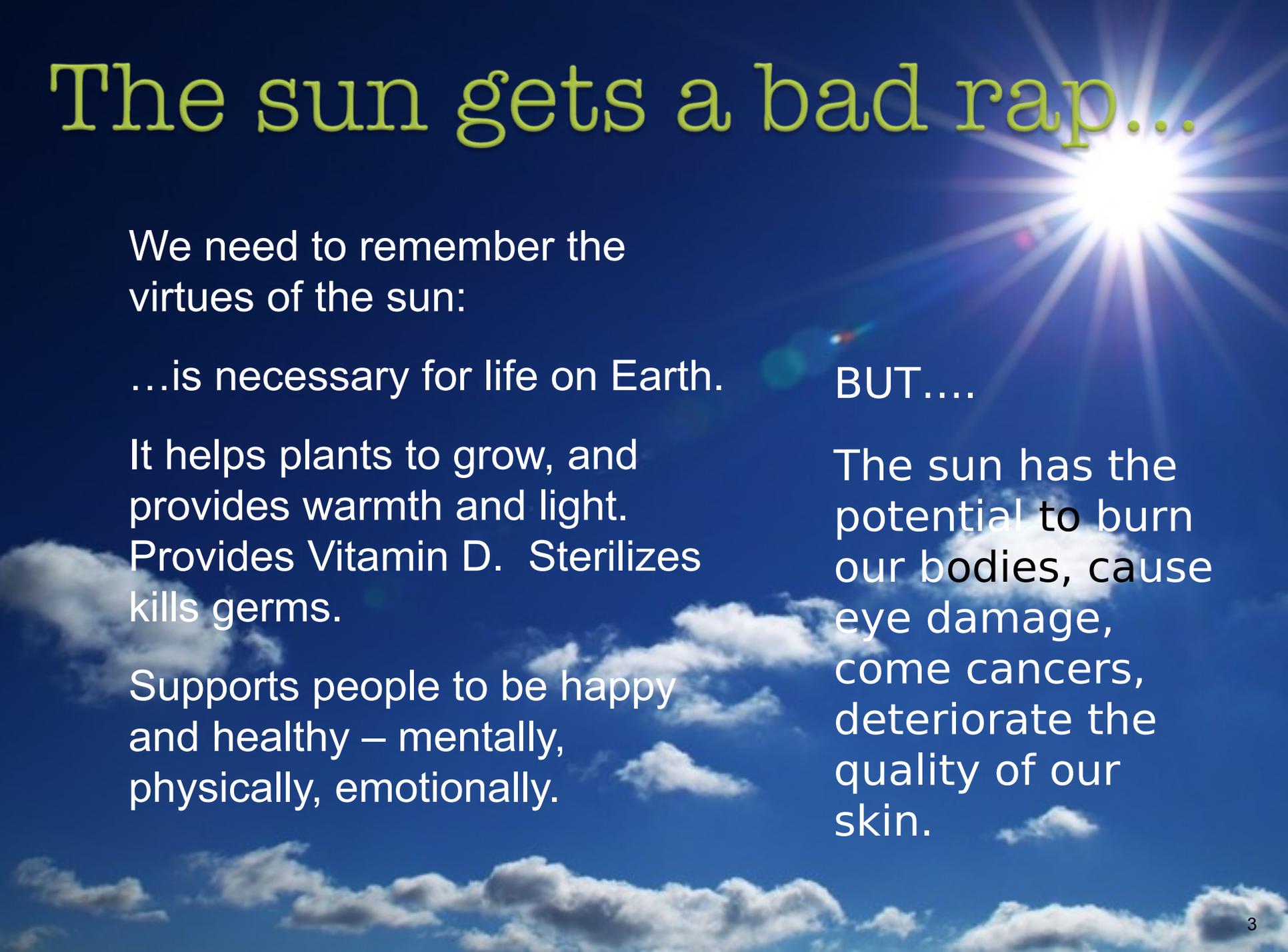
(BA Pub Health, GDip. Nutrition, GDip Women's, PhD)



What are we talking about...

- ▶ The virtues of the sun
- ▶ Vitamin D deficiency
- ▶ How sunscreens work
- ▶ Some of the worst chemical offenders
- ▶ Nanoparticles used in sunscreens
- ▶ What sunscreen I should use
- ▶ 'Internal sunscreen'

The sun gets a bad rap...



We need to remember the virtues of the sun:

...is necessary for life on Earth.

It helps plants to grow, and provides warmth and light.
Provides Vitamin D. Sterilizes kills germs.

Supports people to be happy and healthy – mentally, physically, emotionally.

BUT....

The sun has the potential to burn our bodies, cause eye damage, come cancers, deteriorate the quality of our skin.

Don't use sun protection all the time!

Getting some sun, *without sunscreen*, is good for us. In fact, it's better than good. It's necessary. And this is my rationale:

nearly one third of Australian adults are suffering vitamin D deficiency.

Health practitioners are seeing the resurgence of rickets that had been largely eradicated. Rickets are a softening of bones due to a deficiency or impaired metabolism of primarily vitamin D (phosphorus or calcium) often leading to fractures and deformation.

Daly RM, Gagnon C, Lu ZX, Magliano DJ et al. Prevalence of vitamin D deficiency and its determinants in Australian adults aged 25 years and older: a national, population-based study Clin Endocrinol (Oxf). 2012 Jul;77(1):26-35.

Robinson PD, Hogler W, Craig ME, et al. The re-emerging burden of rickets: a decade of experience from Sydney.

Arch Dis Child. 2006; 91:564-8.

A woman with long dark hair, wearing a purple hoodie and sunglasses, stands in a field of tall grass at sunset. She is holding a large bundle of hay. The sun is low on the horizon, creating a warm, golden glow. The text "And get this..." is written in a green, sans-serif font in the upper right corner.

And get this...

We stay out of the sun to avoid skin cancer, but we have a far greater chance of dying from a Vitamin D deficiency-related cancer than of a sunburn-related skin cancer.

We don't hear about that in the SunSafe campaigns do we?

A few things about Vitamin D

- ▶ Sunlight that generates vitamin D cannot penetrate glass. So you don't generate vitamin D when sitting in your car or in your home.
- ▶ You can't get all the Vitamin D you need from your diet.
- ▶ It takes many months of vitamin D supplementation and sunlight exposure to rebuild the body's bones and nervous system.
- ▶ It is impossible to generate too much vitamin D in your body from sunlight : your body will self-regulate and generate what it needs.
- ▶ Once vitamin D makes it into your body, cholesterol is essential to synthesize it and make it useful to your system. Cholesterol is transported in the blood plasma of all animals, which is why we should be eating some animal fats to get it. These are the *good* fats that our body needs to function effectively. They are essential for calcium to be incorporated into our bones, as well as to boost immune function, and to build a healthy nervous system and digestive tract.
- ▶ Mushrooms are the only vegan source of vitamin D (besides sunlight exposure)

A person with blonde hair, seen from behind, wearing a white tank top. Their arms are raised in the air. They are standing in a field of golden flowers, possibly a field of wildflowers or a similar field. The background is a bright, hazy sun, creating a warm, golden glow over the entire scene. The overall mood is bright and cheerful.

► Our family motto: get sun, not too much, don't get red!

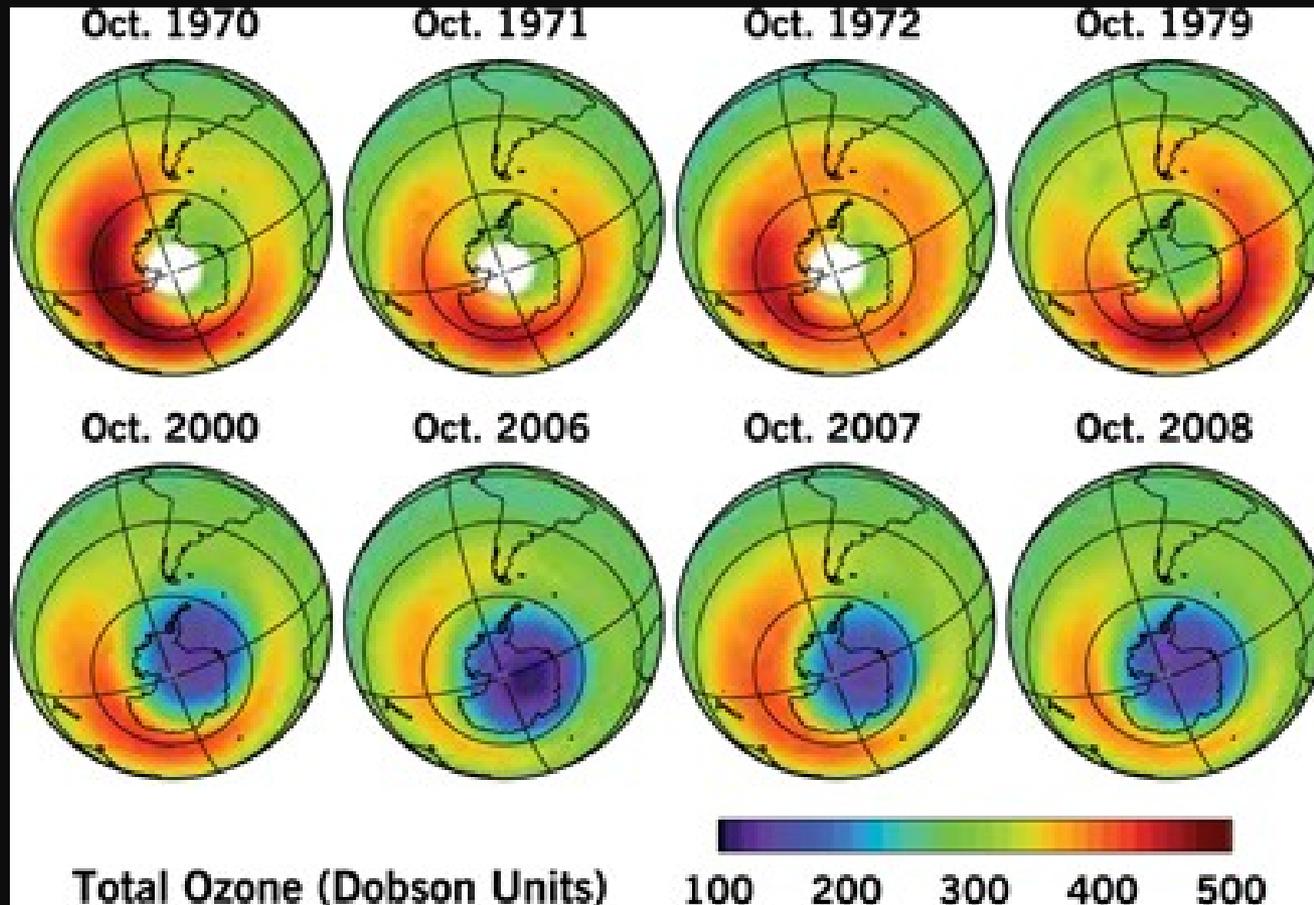


- ▶ its important to wear sunscreen if you are outside for long periods of time (and in the middle of the day), in high altitudes, or in snow/ice covered areas

A bright sun with a starburst effect is positioned at the top center of the frame. Below it, a snowy mountain range stretches across the background. In the foreground, a ski pole is visible, pointing towards the snow. The overall scene is a high-altitude, snowy environment under a clear blue sky.

Harmful UV rays can be up to 80 percent stronger when reflected from the surface of snow.

The more damage there is to the ozone layer, the more UVB rays that reach our bodies.

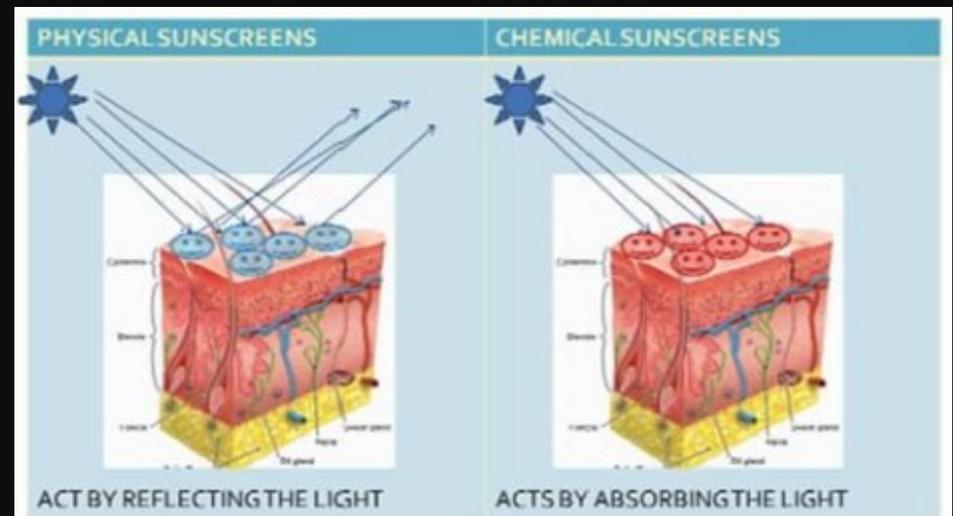


Images of the Antarctic ozone hole using colors to represent varying ozone layer thickness patterns. Total ozone is measured in Dobson units (named after G. M. B. Dobson, an early leader of ozone observations). The natural Antarctic ozone level in October is 300 Dobson units (green on our color scale). In the mid-latitudes, ozone typically exceeded 450 Dobson units in the 1970's (red on our color scale). Ozone levels over Antarctica now decrease to about 100 Dobson units (purple on our color scale).

The thing about sunscreens

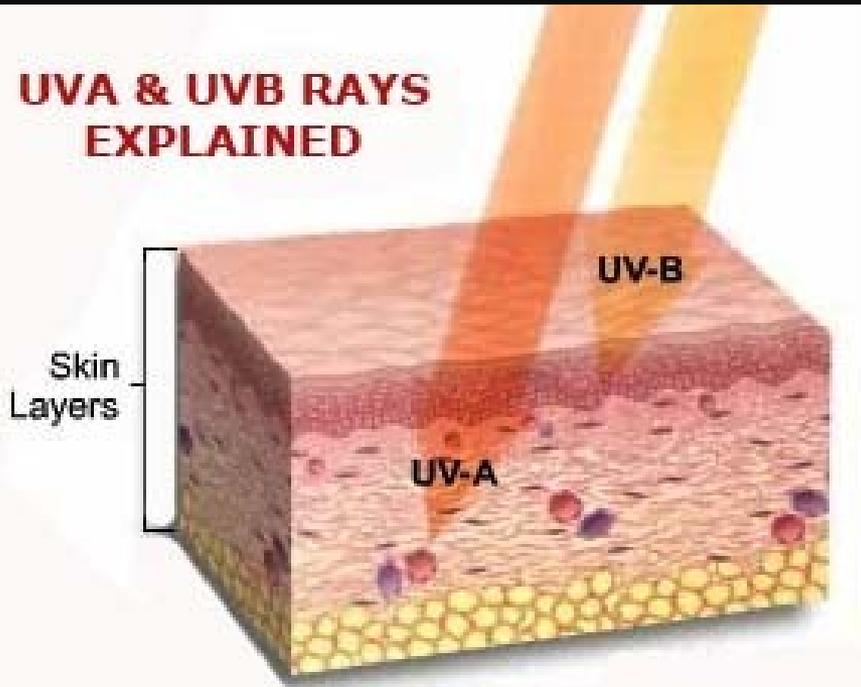
Sunscreens come in two forms:

- ▶ i) physical sunscreens (titanium dioxide or zinc oxide) which form a barrier (or film) on top of the skin that reflects the UV light, and
- ▶ ii) chemical sunscreens, which absorb UV rays before they can do damage.



SPF (Sun Protection Factor)

UVA & UVB RAYS EXPLAINED



- ▶ SPF is the universal measurement of protection against ultra-violet (UV) rays.
- ▶ SPF is determined by measuring the amount of UV rays (in time) it takes to turn skin red without sunscreen. Then this is repeated with sunscreen. Mins to burn without X SPF factor = max sun exposure time.
- ▶ More than 95% of UV rays that hit the earth's surface are in the form of UVA (long wave) rays. These rays are able to penetrate deep into the skin, but are less likely to cause sunburn than UVB (short wave) rays.

Zinc Oxide is best

- ▶ The US Environmental Protection Agency's (EPA) graph (next page) features chemical and physical sunscreen ingredients, as well as the type and amount of ray protection that they provide and their class. Note how zinc oxide fares....

Environmental Protection Agency (EPA)

<http://www.epa.gov/sunwise/doc/sunscreen.pdf>

| FDA Monograph Sunscreen Ingredients | Amount of Ray Protection | | Chemical (C) or Physical (P) |
|--|-----------------------------|-----|---------------------------------|
| | UVA | UVB | |
| Aminobenzoic acid (PABA) | ○ | ● | C |
| Avobenzene | ● | ◐ | C |
| Cinoxate | ◐ | ● | C |
| Dioxybenzone | ◑ | ● | C |
| Ecamsule | ● | ◐ | C |
| Homosalate | ○ | ● | C |
| Menthyl anthranilate | ◑ | ● | C |
| Octocrylene | ◐ | ● | C |
| Octyl methoxycinnamate | ◐ | ● | C |
| Octyl salicylate | ○ | ● | C |
| Oxybenzone | ◑ | ● | C |
| Padimate O | ○ | ● | C |
| Phenylbenzimidazole | ○ | ● | C |
| Sulisobenzene | ◑ | ● | C |
| Titanium dioxide | ◑ | ● | P |
| Trolamine salicylate | ○ | ● | C |
| Zinc Oxide | ● | ● | P |

Protection Level: ● = extensive ◑ = considerable ◐ = limited ○ = minimal

Chemical Sunscreens



While chemical sunscreens can protect against damage from UV rays, most also contain a range of nasty chemicals which can be absorbed through the skin and into our bloodstream.

A study in the *Journal of Chromatography* found that there was significant penetration into the skin of all sunscreen agents they studied.

Sarveiya V, Risk S, Benson HA., Liquid chromatographic assay for common sunscreen agents: application to in vivo assessment of skin penetration and systemic absorption in human volunteers. *J Chromatogr B Analyt Technol Biomed Life Sci.* 2004 Apr 25;803(2):225-31.

Worst Offenders

- ▶ **Benzophenone-3 / Oxybenzone** – is rapidly oxidised in the presence of light and **inactivates important antioxidant systems** in the skin (the skin's natural protection system) (J Invest Dermatol, 1996 Mar 106(3):583-)
- ▶ can be measured in urine after topical application in sunscreen (recommended not to be applied to large surface areas for extended and repeated periods of time...) (The Lancet, Vol 350, 9081, 20 Sept 1997)
- ▶ “One of the most powerful free radical generators known to man... The free radicals initiate chain reactions which can increase skin damage and an increase in skin cancers” (Article “Do chemical sunscreens increase cancer and DNA damage?” - Dr. Loren Pickart)
- ▶ **76-80mg per hour absorbed of chemical through skin surface** (Pharmaceutical Research, Vol. 12, No. 9, 1995)
- ▶ **found 96.8% of people contaminated with this chemical** (US Center for Disease Control and Prevention)

Worst Offenders

- ▶ **Octyl-methoxycinnamate** (used in 80-90% of sunscreens) – produces free radicals (single molecular oxygen) known to be toxic to cells (Chem Res Toxicol 1996 Apr-May; 9(3):605-9)
- ▶ detectable in blood and urine after application to skin (J Eur Acad Dermatol Venereol, 2008 Apr; 22(4):456-61)
- ▶ when tested on mice cells, approx. half died, using a lower concentration than in most sunscreens (New Scientist, vol 168 issue 2259, 2000, October 7; 5,13; Radiation Protection Dosimetry (vol 9; 283)
- ▶ showed estrogenic effects in lab tests making cancer cells grow more rapidly and triggered developmental abnormalities (New Scientist, vol 170 issue 2287, 2001 Apr 21; 5)

Worst Offenders

What about Para-aminobenzoic acid (PABA)?

This naturally occurring chemical is common in many sunscreens, and acts as a dye that absorbs ultraviolet B (UVB) light in much the same way as oxybenzone. PABA contains a benzene ring in which electrons can shuffle between different locations within the six-sided structure. This electron dance matches that of the lightwaves of UVB rays, absorbing and blocking UV-B energy by converting the light to heat. PABA releases free radicals, damages DNA, has estrogenic activity, and causes allergic reactions in some people.

<http://www.ewg.org/analysis/toxicsunscreen>



Worst Offenders

- ▶ **Titanium dioxide: causes DNA damage** (the cells genetic material) due to superoxide radicals, active oxygen radicals and hydroxyl radicals produced when **exposed to light** (Mutat Res 2000 Mar 3; 466(1):1-7 ; Free Radic Biol Med 1999 Aug; 27 (3-4);294-300; FEBS Lett 1997 Nov 24; 418(1-2):87-90; J Photochem PhotoBiol B 2005 May 13;79(2):121-45; Redox Rep. 2001;6(5):319-25)
- ▶ **enhances herbicide absorption through the skin after commercial sunscreen applied (Titanium and OMC)** (Food Chem Toxicol 2007 Jan;45(1)93-7)
- ▶ **PABA (p-aminobenzoic acid) – produces free radicals in the presence of light** (Chem Res Toxicol 1996 Apr-May; 9(3):605-9)
- ▶ **Cinoxate – causes DNA damage** (Mutat Res 1989 Jun 21;2(2): 213-21)

NO SUNBLOCK OR LOTION
IN THE WATER
KILLS FISH + REEF

But what about....?

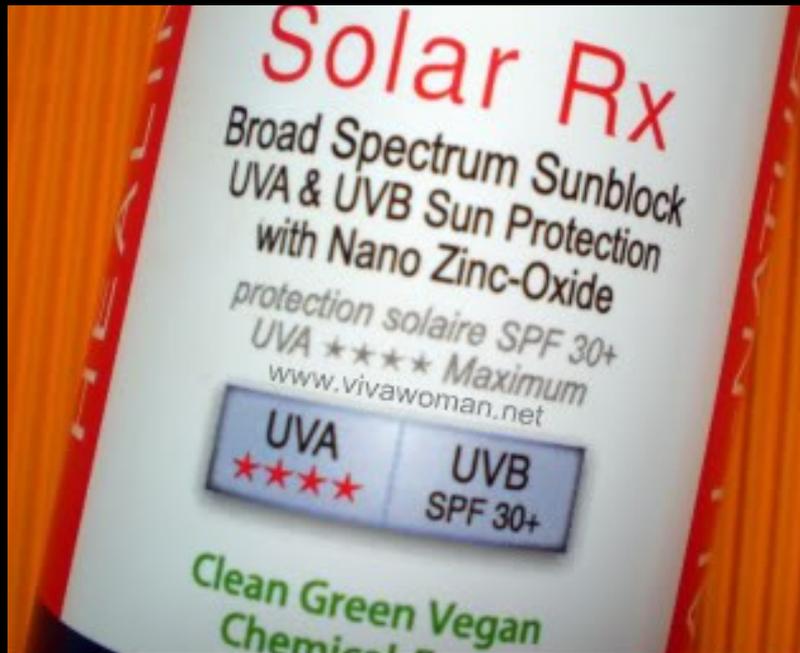
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What about nano-technology?



- ▶ Favoured by manufacturers because the resulting clear, easy-to-absorb creams give a market advantage.

The fear is that they are so small they seep in through our skin cells.

- ▶ In 2009 The Therapeutic Goods Act (TGA) stated:

“To date, the current weight of evidence suggests that nanoparticles do not reach viable skin cells; they remain on the surface of the skin and in the outer layer of the skin that is composed of non-viable cells”.

What about nanotechnology?

▶ Nanotechnology in Colourbond Roofing

- ▶ In 2008, the nano-particles of titanium dioxide, also found in some sunscreens, were leading to serious problems with Bluescope Steel Colorbond roofing.
- ▶ The titanium dioxide was found to be causing the premature weathering of the coating on the pre-painted steel roof sheets after they had been handled by workers with sunscreen on their hands.
- ▶ It has also been shown to cause deterioration of other surface coatings and paints on cars and other consumer products.
- ▶ The finding raised concerns about how safe such an ingredient might be for use on human skin.
- ▶ (www.abc.net.au/news/2013-03-05/fresh-concern-over-nano-particles-in-sunscreen/4552522)

What about nanotechnology?

Exercising the Precautionary Principle

- ▶ There have not been enough studies to conclusively say that nanotechnology in sunscreens are safe in all applications to human beings.
- ▶ We currently have no way of knowing if the brand of sunscreen contains nanoparticles.
- ▶ The TGA does not require manufacturers to disclose whether their products contain them.
- ▶ This is in contrast to the European Union which give effect to the precautionary principle, and require manufacturers to disclose information about the safety of their products
- ▶ You can check your sunscreen's nano technology levels on the Friends of the Earth Australian Sunscreen Guide:
<http://nano.foe.org.au/safesunscreens>

What sunscreen should I use?

Maybe next time
you'll try a little
sunscreen, Bert.



Miessence Reflect Outdoor Balm

Ingredients: certified organic olea europaea (olive) fruit oil, zinc oxide, certified organic butyrospermum parkii (shea) fruit butter, certified organic unrefined cera alba (beeswax) , mixed tocopherols (natural vitamin e) , certified organic copernicia prunifera (carnauba) wax, natural coconut extract, aroma (proprietary blend of essential oils), certified organic simmondsia chinensis (jojoba) seed oil, certified organic rosmarinus officinalis (rosemary) leaf extract, certified organic daucus carota (carrot) CO2 extract



Miessence Reflect Outdoor Balm (SPF 15)

Free from:

- ▶ chemical UV-absorbers
- ▶ chemical preservatives
- ▶ titanium dioxide
- ▶ anything artificial
- ▶ nanoparticles

Microfine zinc oxide offers protection from harmful ultra violet rays whilst organic olive oil keeps the skin supple. Potent antioxidants including natural vitamin E, organic rosemary leaf extract and carrot seed extract protect the skin from premature aging and prevent damage caused by the elements.

Miessence Reflect Outdoor Balm (SPF 15)



The **Miessence Reflect Outdoor Balm (SPF 15)** was chosen as one of the top 39 rated sunscreens by the Environmental Working Group (EWG). The EWG evaluated 500 sunscreens to come up with their recommended list of 39 sunscreens.

***Miessence Reflect Outdoor Balm (SPF 15)** is actually SPF 27, but can't claim it as such because it's not classified via the Therapeutic Goods Act (TGA) as a primary sunscreen.



A bit more on Zinc Oxide

- ▶ Zinc oxide is a natural blocking agent as is the only ingredient (synthetic chemical or natural) to effectively provide comprehensive protection against UVB and both short and long UVA radiation.
- ▶ Zinc oxide is the closest thing to a total sunblock on the market today. It uniformly covers from 290 to 380 nm (wave lengths), thus protecting against UVB and most of the UVA spectrum. No other sunscreen ingredient provides broader protection.
- ▶ It is recognized by the FDA as a Category I skin protectant.
- ▶ Zinc oxide has over a 300-year history of safety, with no known adverse reactions (which is why it is often used to treat babies).
- ▶ **Other Miessence products containing Zinc Oxide include:**
Mineral Powders, Translucent Foundations, Concealers, Lip Creams

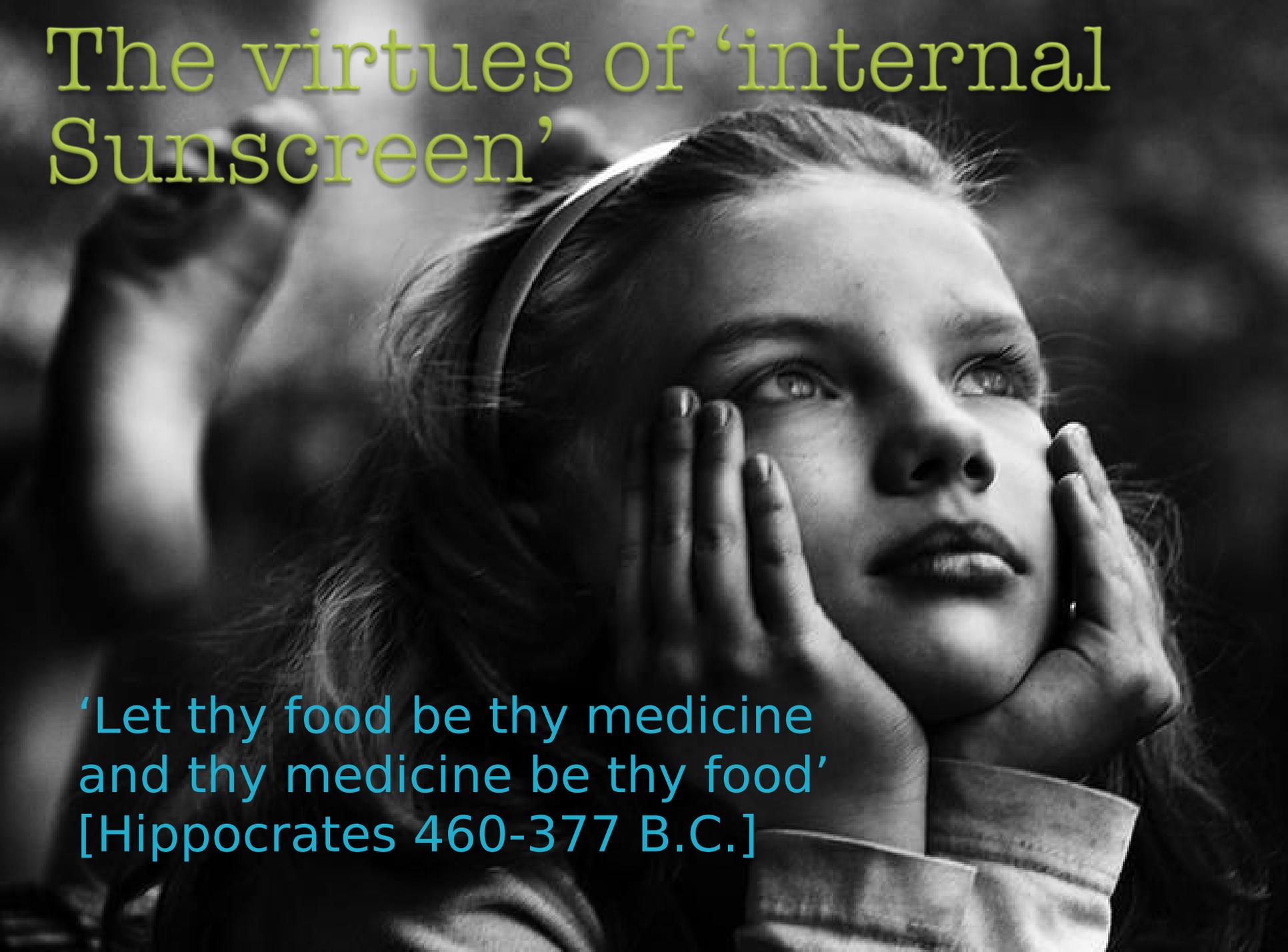
Other Natural Sun Protectors

A close-up photograph of a sliced aloe vera leaf. The thick, clear, gelatinous inner pulp is being poured from the cut end of the leaf into a clear glass container. The background is a blurred, reddish-brown surface.

- ▶ **Aloe vera:** this thick, gelatinous juice of the aloe vera plant can take the sting and redness out of a sunburn. Aloe vera causes blood vessels to constrict. Aloe vera gel also reflects as much as 20 percent of the sun's harmful UV rays.
- ▶ **Miessence products use aloe vera as the base of most of their products:** skin conditioners, moisturizers, hair products, deoderants.

The virtues of 'internal Sunscreen'

'Let thy food be thy medicine
and thy medicine be thy food'
[Hippocrates 460-377 B.C.]

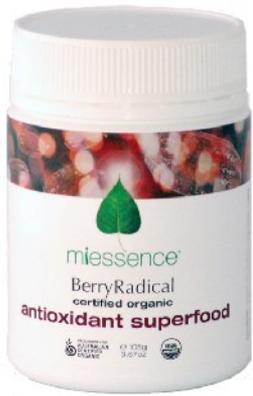


The virtues of 'internal Sunscreen'



Consuming diet full of:

- ▶ antioxidants is another useful strategy to help counter skin damage from exposure to UV Rays.
- ▶ Fresh, raw, unprocessed foods
- ▶ A healthy balance of omega-6 and omega-3
- ▶ Probiotics and Alkalising Greens



Antioxidant Superfood

Combat signs of aging

Boost your energy

Feed your cells



Probiotic Superfood

Certified Organic living wholefoods

Amino acids

Lactobacillus bacteria (full spectrum)



Alkalising Superfood

Potent, raw greens juices

Boost your immunity

Healthy blood pH



The Sun: Natures Original Superfood

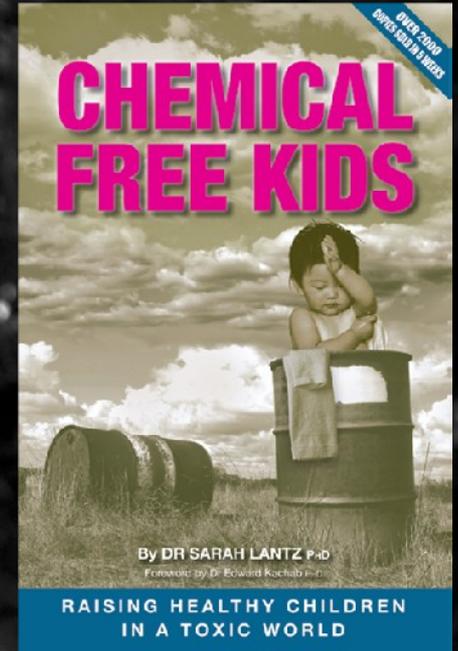


More References

Rob Edwards, Sinister side of sunscreens, *New Scientist*, 07 October 2000

Ma Axelstad, M; Boberg, J; Hougaard, KS; Christiansen, S; Jacobsen, PR; Mandrup, KR; Nellemann, C; Lund, SP et al. (2011). "Effects of pre- and postnatal exposure to the UV-filter octyl methoxycinnamate (OMC) on the reproductive, auditory and neurological development of rat offspring". *Toxicology and applied pharmacology* 250 (3): 278–90. y 2012 which is published in *Environmental Science & Technology*, measured concentrations of five kinds of chemicals called benzophenones in the urine of more than 600 women who were evaluated for endometriosis.

Tatsuya Kunisue, Zhen Chen, Germaine M. Buck Louis, Rajeshwari Sundaram, Mary L. Hediger, Liping Sun, Kurunthachalam Kannan. Urinary Concentrations of Benzophenone-type UV Filters in U.S. Women and Their Association with Endometriosis. *Environmental Science & Technology*, 2012; 46 (8): 4624
Environmental Working Group (EWG) <http://breakingnews.ewg.org/2012sunscreens/>



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