Be On The Safe Side. Only 2 Sunscreen Filters Are Considered Safe, Says The FDA
https://www.clearya.com/blog/safe-sunscreen-filters-according-to-science
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"If I Could Offer You Only One Tip For The Future, Sunscreen Would Be It" - goes the famous song, attributed by an urban legend to a 1997 commencement speech by author Kurt Vonnegut at MIT (which never happened.)

But if *we* could dispense our one advice, "Wear a *Zinc Oxide* Sunscreen and forget about Oxybenzone" would be it.

A few months ago the U.S. FDA dropped a bomb proposing **all FDA-approved sunscreen ingredients are either unsafe, or uncertain** until further analysis - all **except** for the minerals zinc oxide and titanium dioxide, which the FDA finds safe and effective as sunscreen filters.

Before we give you the lowdown on what this means for you, we'd like to reiterate the bottom line. **Don't stop using sunscreen. Just make sure it's got the right ingredients.**
Spoiler: use non-nano, non-spray, zinc oxide.

Why care about sunscreens?
Skin cancer is the most commonly diagnosed cancer in the US, and the rate of melanoma, the deadliest type, has been rising for the last 30 years. The American Cancer Society's estimates that in 2019 over 96,000 new melanoma cases will be diagnosed, and over 7,000 people are expected to die of it [1].

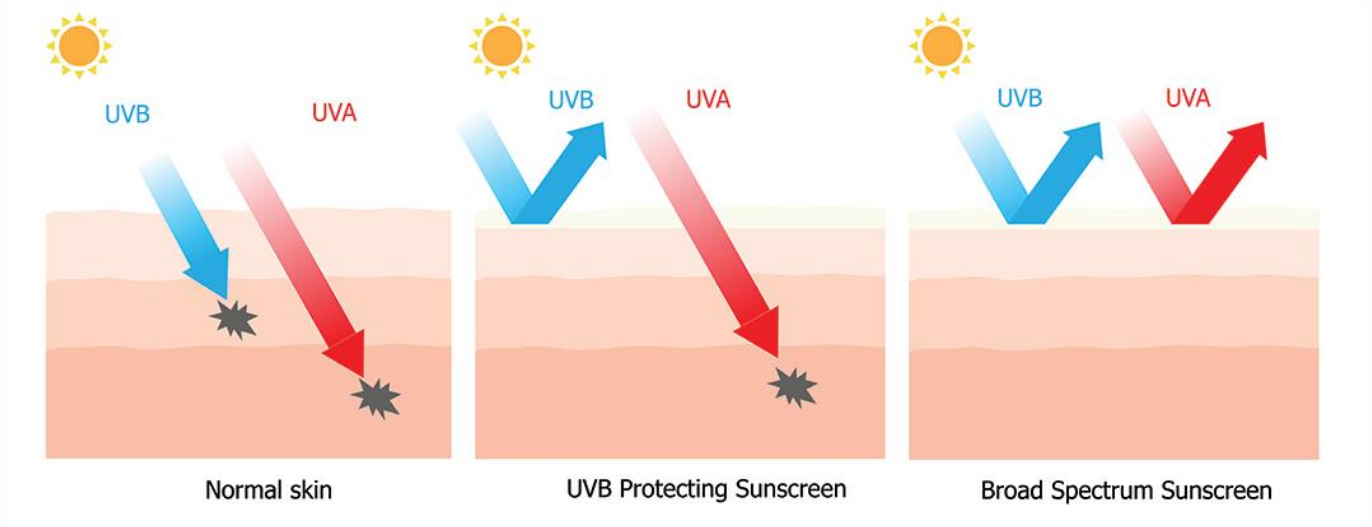
Skin cancer is mostly the result of exposure to ultraviolet (UV) radiation. "Ultraviolet" because its wavelength spans beyond the visible violet sunlight. The UV radiation spectrum can be divided into three components: UVA, UVB, and UVC, and getting to know each of them will help you understand how to protect yourself effectively:

- **UVC** is the most destructive of the three, but luckily it's blocked by the atmosphere's ozone layer, so you're not likely to ever be exposed to it unless you stare into a welding torch or a UV water disinfection lamp.
- **UVB** is blocked only in part by the atmosphere. When it hits the outer layer of our skin it can burn it and directly damage our DNA, which can end up in skin cancer.
- **UVA**, the last UV component, penetrates the atmosphere almost uninterrupted. Although it doesn't cause sunburns, it actually reaches deeper into our skin and damages its dermis layer, which leads to skin aging and wrinkles over time. Today scientists understand that UVA can indirectly cause cancer too, including by damaging the proteins that are responsible for repairing DNA mutations [2,3].

The **SPF** number (Sun protection factor) that you see on sunscreen labels measures how much of the UVB radiation is blocked. For example, SPF 30 means that 1/30 (3.3%) of the UVB radiation will hit your skin, and the remaining 96.7% will be blocked by the sunscreen. Here's another way to think about this: if you your unprotected skin gets burnt within 5 minutes, applying an SPF 30 sunscreen means you'll get the same sunburn within 5 minutes x 30, or within 150 minutes. In comparison, an SPF-50 sunscreen will let 1/50 (2%) of the UVB radiation hit your skin, and block the remaining 98% of UVB radiation. Remember that these protection factors are relevant only as long as the sunscreen is applied liberally and isn't washed away by sweat, water or your towel.

You might be surprised to learn that *SPF measures only UVB protection*, and doesn't mean anything about UVA protection. In other words, some active sunscreen ingredients can block UVB very well, but let harmful UVA radiation pass freely.

Now that we understand that both UVA and UVB can cause cancer, it's clear why it's critical to choose **Broad Spectrum** sunscreens that protect against both UVA and UVB, and not only UVB-blocking sunscreens.
Once more: high SPF is not enough - if your sunscreen is not a *Broad Spectrum* sunscreen, it means even the manufacturer doesn't claim that it blocks UVA from damaging your skin.



We're finally getting to the ingredients...
"Active" sunscreen ingredients can protect our skin from UV rays in two different ways:

1. **Chemical filters**: some active sunscreen ingredients absorb the UV rays instead of your skin - think about it like a sponge. Ingredients that work this way are called *Chemical Filters*, and include avobenzone, oxybenzone, octinoxate, and actually most of the active sunscreen ingredients used today. Most of the chemical filters protect against UVB, and few of them also protect against part of the UVA range.
2. **Mineral filters (Physical filters)**: other active sunscreen ingredients deflect the UV rays - think about it like a mirror. Ingredients that work this way are called *Mineral Filters* or *Physical filters*, and include: zinc oxide (which provides broad spectrum protection from UVA and UVB), and titanium dioxide. In the past mineral filters used to leave a white residue on the skin, but today's mineral filters perform better and some of them don't leave any trace.

Are chemical filters in sunscreens safe and effective? The FDA isn't sure anymore.
In February 2019 the U.S. FDA published a quite dramatic proposed rule to update the regulation of sunscreens. It's a 70 page document [4] with hundreds of scientific references, so let me summarize the bottom lines for you.
The FDA reviewed all the 16 FDA-approved sunscreen active ingredients and divided them into three groups:

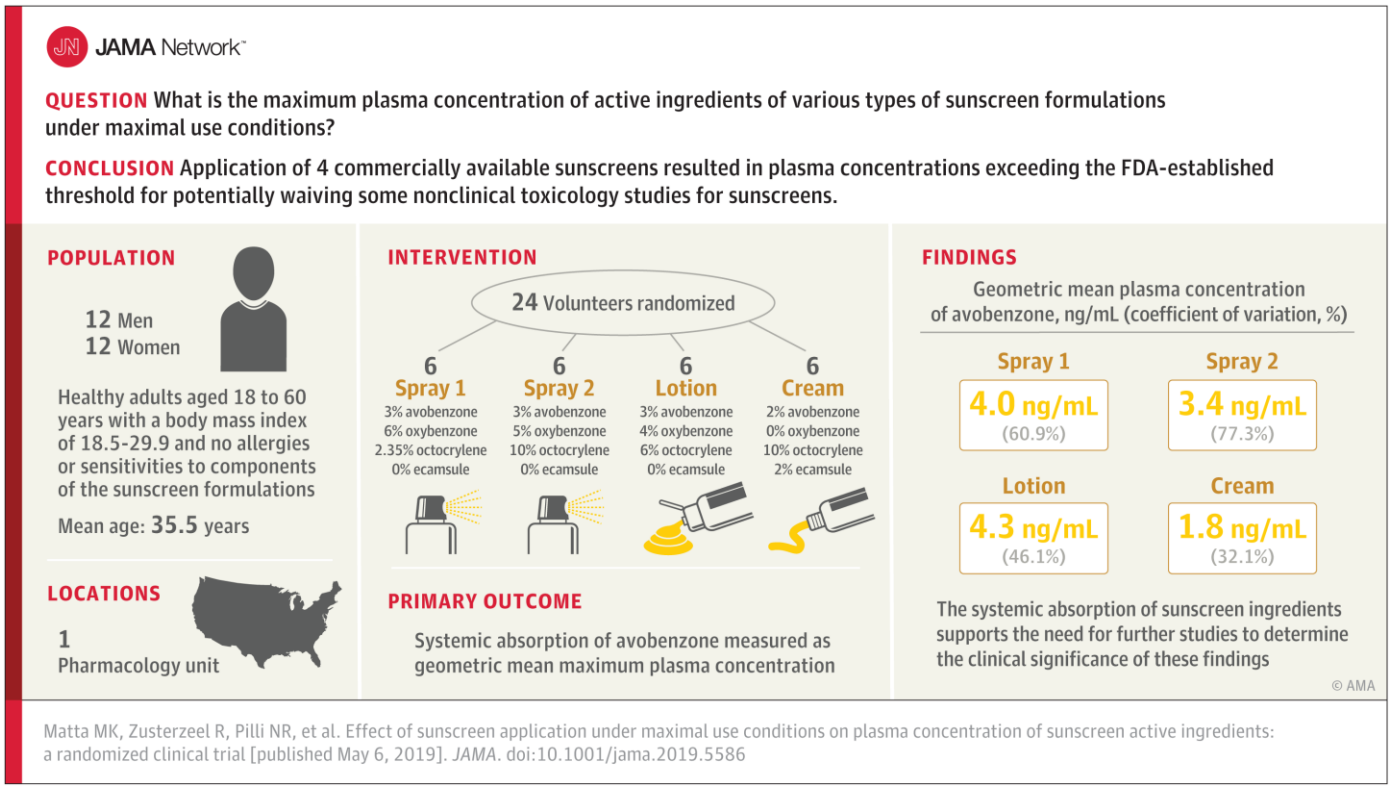
1. **Safe and effective ingredients**: only zinc oxide and titanium oxide (both are mineral filters.)
2. **Not safe and effective**: PABA and trolamine salicylate (these ingredients have actually been abandoned long ago.)

3. **Insufficient data for use in sunscreens**: the rest of the chemical filters. Oxybenzone, avobenzone, cinoxate, homosalate, octinoxate, octisalate, octocrylene, dioxybenzone, ensulizole, meradimate, padimate O, sulisobenzone.

That's right. All the FDA-approved chemical active ingredients used in the US today belong to the FDA's third group, which means that the FDA would need additional data to determine that sunscreens with these ingredients would be safe and effective.
The FDA is now collecting data and will come up with a final ruling later in 2019. Until then the regulation doesn't change, but consumers should of course use their common sense.

Why is the FDA concerned, and why you should be too.
In May 2019, scientists at the FDA's Center for Drug Evaluation and Research (CDER) researched what happens when commercially available sunscreens are used as directed by the product label. They selected sunscreens with common chemical filters (avobenzone, oxybenzone, octocrylene, and ecamsule). 24 volunteers applied sunscreen a couple of times every day, for 4 days, and their blood samples were tested daily for a week to see if any of these 4 active ingredients had penetrated the skin and reached the bloodstream.

The researchers found that all 4 ingredients reached the bloodstream of the participants at high concentrations. How high? By the end of the first day the concentrations already exceeded the FDA's "safety waiver threshold". That's a threshold above which toxicology assessment including systemic carcinogenicity and additional developmental and reproductive studies must be carried out. The concentrations remained above that threshold even on the 7th day, 3 days after the last sunscreen application: in the case of oxybenzone it was then still over 40 times greater than the threshold. The full results were published in the Journal of the American Medical Association [5] and have been covered by the international media.



Honestly, the revelation that chemical filters pass through our skin shouldn't surprise anyone. Back in 2004, scientists of the U.S. Centers of Disease Control and Prevention of the U.S. Department of Health have sampled the urine of 2,517 Americans aged six year and older and discovered Oxybenzone in 97.6% of the samples [6].

Oxybenzone and other chemical filters like octinoxate have been detected in human breast milk too - in Germany (over 20 years ago!) [16], Switzerland [7], and Spain [17], with sunscreens being a possible source.

At this stage the FDA does not say that chemical filters are harmful or should be avoided. It simply points out that these sunscreen ingredients enter our body and that there is a question mark around their systemic impact which must be analyzed before they can regain the FDA's "safe and effective" status.

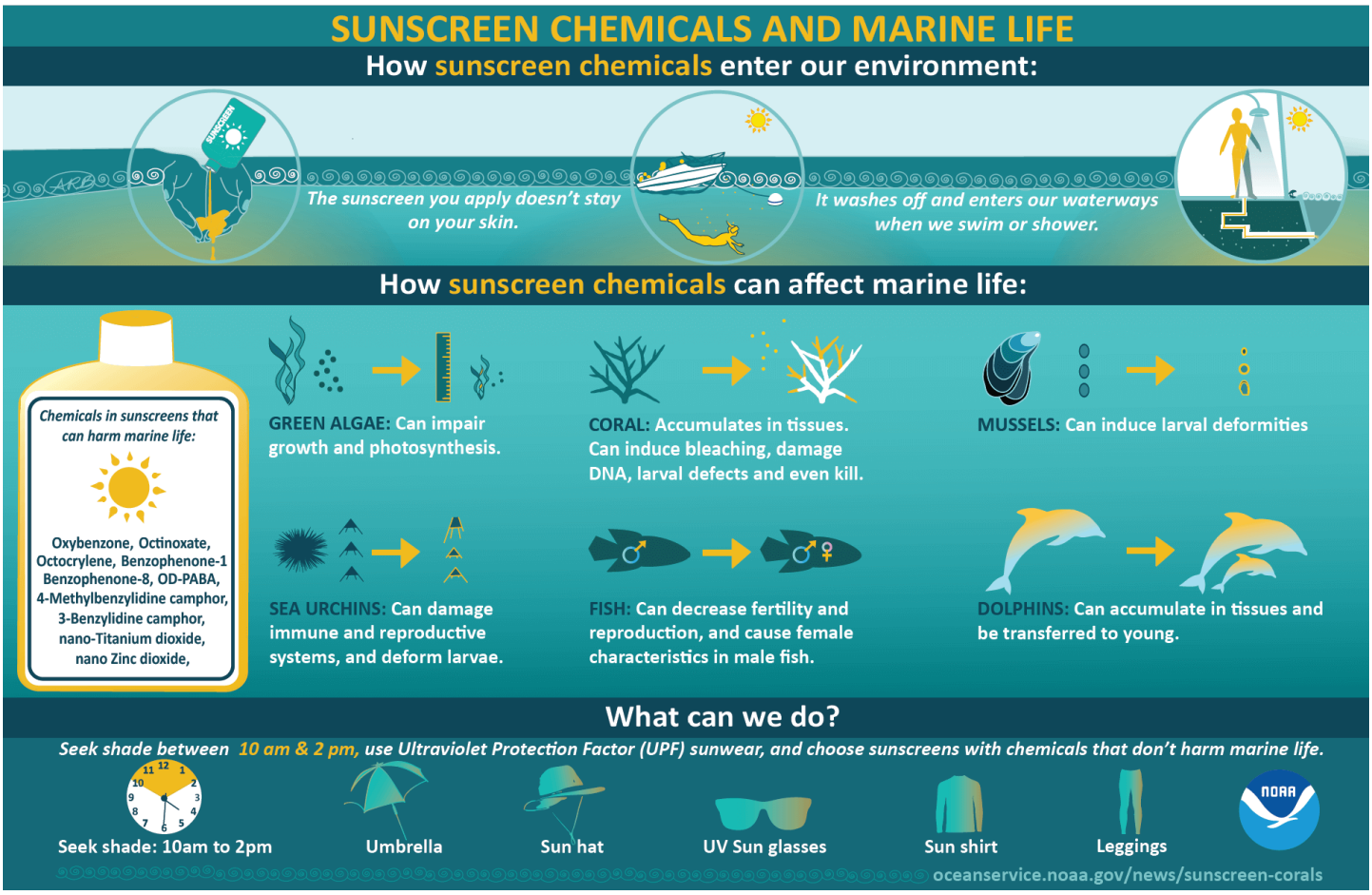
But if you ask scientists focusing on the research of *Endocrine Disruptors* (chemicals that may interfere with the proper function of our hormones) the answer is clear. Oxybenzone, octinoxate, and other UV chemical filters have been linked to hormone disruption, including harming the proper function of the female hormones in animals, their fertility and the neurological development of their offsprings [8, 15]. Exposure to oxybenzone during pregnancy was recently shown to damage neurons and the affect the developing brain of the fetus in mice [19]. Oxybenzoe, homosalate, and other chemical filters were also shown to interfere with functions of human sperm [9], and oxybenzone has been associated with lower testosterone levels in adolescent boys [10].

There's more. Mix oxybenzone with chlorine, which is commonly used as a swimming pool disinfectant, and you get an altered chlorinated-oxybenzone, which according to some studies [11] is dramatically less effective in UV blocking, and at the same time more toxic to our cells. Avobenzone, another very common chemical UV filter, was also reported [12] to produce toxic compounds when transformed by pool disinfectants (sodium hypochlorite), and so does octinoxate, which chlorinated byproducts were shown to create mutations in cells [18].

Another troubling aspect of oxybenzone and other chemical filters that is making waves in recent years, is their destructive impact on coral reefs and marine life. Studies [13] have discovered that oxybenzone can damage coral DNA, cause deformation in growing baby coral, and increase the rate of coral bleaching. The U.S. National Oceanic and Atmospheric Administration (NOAA) warns that sunscreen filters can also harm fish, algae and other sea creatures, which in turn endanger the species that rely on them as a source of food. How does oxybenzone get to the sea in the first place? It is simply washed off swimmers and discharged into the sea by wastewater facilities. It's true that sunscreen is only one contributor to the pollution of the sea and the dying reefs, but these contributions add up.

Do mineral filters pose a risk to the oceans? Apparently it's a question of size. The mineral filters used in sunscreens, zinc oxide and titanium dioxide, can be either made of *nano-sized* particles (particles smaller than 100 billionths of a meter), or made of bigger *non-nano* particles. Multiple scientific researches [14] have concluded that mineral filters, both nano-sized and non-nano sized, remain on the human skin's surface, do not reach viable skin cells and do not reach the bloodstream.

While nano-sized mineral filters in sunscreen lotions seem safe for humans, this may not be the case for marine life. Dr. Craig Downs, executive director of the Haereticus Environmental Laboratory told Clearya: "nano-particles of the mineral oxides can cause toxicity to coral, fish, and marine invertebrates." As for non-nano sized mineral filters, Dr. Downs explains: "Zinc Oxide, if it non-nanotized, is relatively safe for coral and fish."



The bottom line - which sunscreen should you choose?
While the scientific evidence associating common chemical filters with potential hormone disruption and environmental damage continue to accumulate, consumers should choose whether to take part in this experiment or opt for using mineral filters, which at this time are the only two active ingredients determined as safe and effective by the FDA's proposed ruling.

If you go for mineral filters, choosing a sunscreen becomes a relatively simple task:

- **Aim for a sunscreen lotion or cream (but not a spray which can be accidentally inhaled) with up to 25% of *non-nano zinc oxide* as active ingredient, which provides broad spectrum protection against both UVB and UVA.**
- Titanium dioxide is considered safe and effective as well. However, titanium dioxide doesn't protect you against the full range of UVA rays, so only use it if your sunscreen also includes zinc oxide as the main active ingredient.

We prefer the non-nano form of zinc oxide and titanium dioxide, although according to the FDA's review of recent scientific literature [4], the physical properties of zinc oxide and titanium dioxide prevent their absorption through the deeper layers of the skin in any meaningful extent, even when applied at the maximum 25% concentration, and regardless of their particle size.

One last thing
We focused here on *Active* ingredients, but sunscreens, like other skin care products, often contain tens of other *Inactive* ingredients, such as parabens (preservatives), phthalates (common ingredients in synthetic

fragrance) that are also linked to hormone disruption, certain cyclosiloxanes (associated with reproductive harm), and sometimes have chemical filters listed under different names, adding to the confusion.
So if you feel you need an extra pair of eyes to quickly scan the ingredient list for you, simply use the Clearya chrome extension to automatically check your sunscreen's ingredients safety, while you shop online.

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