

Exposing the Hazards of Sunscreen

by Elizabeth Plourde, CLS, NCMP, PhD

While visiting Hawaii in the summer of 2010, I read a local newspaper article indicating that the coral reefs were dying due to global warming. I felt called to research this die-off, because the familiar Hawaiian waters in which I was swimming felt colder than they had in the 40 years I had been enjoying them.

I soon found studies showing that various chemicals used in sunscreens directly kill the coral and that they are hazardous to all species of life, including humans. I learned that these chemicals especially impact the rapidly developing bodies and brains of young children and fetuses. As I uncovered the vast amount of documentation showing the dire consequences that arise from the entrance of these chemicals into our environment, I became impelled to compile this evidence and sound a clarion call for us to change our behavior today, before more damage is done.

This large body of research exposes what happens when we slather ourselves and our children with the many chemicals that are incorporated into today's sunscreens. Sunscreens have been promoted with the promise that they protect us from both skin cancers and photoaging of the skin. In actuality, their use increases the risk of skin cancers, including melanomas, and results in greater photoaging because, when wearing them, we tend to expose our skin for longer periods to the solar rays that break down collagen and elastin.

Prior to the advent of sunscreens, the threat of sunburn would get us out of the sun before we depleted the antioxidant supplies in our skin—antioxidants designed to protect skin from the solar rays that can cause damage at the cellular level. Over the years,

as the incidence of skin cancers kept rising with the ever-increasing use of sunscreen,^{1,2} manufacturers came to realize that the first highly promoted sunscreens, which only blocked the ultraviolet B (UVB) rays that cause sunburn, allowed the ultraviolet A (UVA) portion of the solar spectrum through. The UVA rays are capable of penetrating much deeper, and thus can cause cancerous changes in the skin, as well as changes that lead to skin aging.³

Recognition of these facts resulted in U.S. Food and Drug Administration (FDA) guidelines, published in 2011, mandating that a sunscreen must filter both UVA and UVB radiation in order to claim "Broad Spectrum SPF" protection on the label.⁴ Since each of the chemicals only blocks a certain portion of the UV spectrum, sunscreens now include multiple chemicals to provide shielding from a broader range of the spectrum. There are several inherent problems with this strategy. One is that some of the chemicals and metals used to filter the UV rays actually break down when exposed to sunlight, with the result that they are no longer capable of shielding skin from the radiation. Moreover, combining them to cover a broader portion of the UV spectrum causes some of them to break down even more rapidly than when they are used individually.⁵ Another problem is that even when individual chemicals do not show measurable toxic effects, they may exhibit much greater toxicity when they are combined.⁶ Researchers recommend that future studies examine combinations of these chemicals to more accurately assess whether they are safe or harmful to life.

Another major reason skin cancers have been increasing is that the UV spectrum makes up only a small percentage of the total solar radiation that reaches us through the earth's atmosphere. Near

infrared (NIR) radiation constitutes a much larger proportion of the solar radiation that reaches our skin, and these rays penetrate even deeper than UVA rays.⁷ Research has not yet come up with satisfactory ways to prevent the damage caused by NIR rays, which studies show leads to skin cancers, as well as photoaging of the skin due to the ability of this type of radiation to destroy both collagen and elastin.⁸

After learning that sunscreens did not provide the promised results, I kept uncovering studies that revealed their chemicals create damaging effects in the many forms of life that have been tested. Unfortunately, it has taken years for proof of harm from sunscreen chemicals to be exposed because generational studies require sufficient time to determine whether offspring are harmed. One study that clearly revealed sunscreen chemicals result in both general and reproductive toxicity in the offspring of mice took 12 years from the beginning of the study for the results to be published.⁹

HAZARDS OF METAL OXIDE NANOPARTICLES

Another problem with potentially far-reaching consequences is the increasing use of nanosized materials in sunscreens. These materials have been engineered so that their particles measure less than 100 nanometers (one nanometer is one-billionth of a meter). Because these extremely size-reduced materials are relatively new to mankind and very different from any natural, "bulk" materials, researchers have not developed testing techniques capable of determining if they are harmful.

Titanium dioxide and zinc oxide are the metals that are being incorporated into sunscreens, as they filter both UVA and UVB rays, with zinc oxide covering a broader portion of the UVA spectrum than titanium dioxide. These metal oxides in their natural form are thick, white, opaque pastes, so manufacturers reduce them down to nanosized particles to make them more transparent to the eye and therefore more aesthetically appealing to the public. These metals in their natural form are considered relatively safe. In 1998, the FDA approved the use of titanium oxide nanoparticles in sunscreen—even though testing had

not been performed to determine if the tiny particles were as safe as the parent bulk compound.¹⁰ Many research papers have stated that the nanosized oxide particles exhibit very different behaviors from their bulk counterparts, and that available research techniques are not adequate to determine if their unique reactivities could result in toxicity.

However, in the last few years, scientists have been concluding that these tiny particles are capable of inflicting great harm. Researchers have discovered that titanium dioxide nanoparticles can actually kill skin cells. They also have determined that, due to their small size, these particles can cross cell membranes as well as pass into the nuclei of cells, where they cause damage to the DNA and disrupt normal cell division.¹¹ These particles can also cross the blood-brain barrier, which is designed to keep toxins out of our delicate, susceptible brain cells.¹² In addition, the offspring of mice exposed to titanium dioxide nanoparticles undergo large DNA deletions, which indicates crucial damage could arise in human babies who are exposed in utero to this nanosized metal.¹³

Metal oxide nanoparticles may also be causing broader environmental effects. Although sunscreen use has been widely recommended before any outdoor activity—including swimming in oceans, lakes, and rivers—comprehensive studies to determine whether aquatic and marine life would be harmed have not been performed. A study published in 2011, 12 years after FDA approval of metal oxide nanoparticle use in sunscreen, concluded that the "long-term risks of titanium dioxide nanoparticles are currently unknown."¹⁴ This study of zebrafish identified obvious harm to the fish and found titanium dioxide nanoparticles distributed throughout their bodies, including in the gills, livers, hearts, and brains. A 2011 review of studies that identified adverse effects on zebrafish also concluded there were no satisfactory testing methods available to measure the effects of nanoparticles.¹⁵ A study published in 2010 showed that zinc oxide nanoparticles are lethal to phytoplankton.¹⁶ Still another study rated zinc oxide as "extremely toxic" and titanium dioxide nanoparticles as "harmful" to marine life.¹⁷

HARM FROM HORMONALLY ACTIVE CHEMICALS

Yet another source of harm is the hormonally active chemicals found in sunscreen, which are ubiquitous in the waterways of the world. In the oceans, these chemicals, even at a very low concentration, kill coral in 96 hours by promoting viral infections. A study published in 2008 identified benzophenone-3 (BP3), octyl methoxycinnamate (OMC), 4-methylbenzylidene camphor (4-MBC), and butyl paraben (BP) (used as a preservative) as the cause of the die-off.¹⁸ Tragically, some sunscreens whose labels state they are safe to use around coral reefs can contain the above chemicals, as well as titanium dioxide.

The offspring of fish exposed to sunscreen chemicals exhibit combinations of male and female sexual development to such a degree that researchers term them "intersex" fish, and some of these fish even stop spawning.¹⁹ Additionally, ecosystem toxicity is seen from use of these chemicals, as they accumulate in both marine and aquatic food chains.^{20,21} Furthermore, studies have shown that the offspring of mice and rats exposed to sunscreen chemicals exhibit general toxicity in their thyroid and reproductive systems, suggesting these chemicals are capable of causing the same damage to human offspring.^{22,23}

In addition to their use in sunscreen, these chemicals are widely used in a variety of other personal care products. In fact, one of the most common sunscreen chemicals, BP3, is now found in the bloodstreams of 97 percent of Americans who were tested. It is even found in 90 percent of Americans who state they have never used sunscreens.²⁴ BP3 belongs to a chemical family known as phenols. Phenols can cross the placenta and enter fetuses.^{25,26} They have been identified as so toxic that in 2011 California outlawed bisphenol A (BPA) in baby bottles and sippy cups, joining 10 other states that have done so.

Sunscreen chemicals have also been found in household dust, and this provides them easy access to enter our bloodstreams through our lungs.²⁷ Additionally, they are found in 85 percent of nursing mother's milk samples, which means our babies are drinking them.²⁸

THE IMPORTANCE OF VITAMIN D

Another, equally dangerous result of sunscreen use is that it can inhibit the manufacture of vitamin D in our skin. The vitamin D produced in the skin in response to solar radiation is crucial to our overall health. The worldwide use of sunscreen, along with the promotion of sun-avoidance behavior, has led to what researchers are calling a vitamin D deficiency pandemic. This, in turn, has led to the reemergence of rickets (a condition characterized by soft bones in newborns and toddlers, potentially resulting in bow-legged or knock-kneed children) in some parts of the world, including the U.S.²⁹ Rickets has been dubbed the "seventeenth century disease," as it was rampant during that time period, when increasing numbers of people were congregating in cities and having limited exposure to sunlight. It was common in industrialized areas of the U.S. and Europe during the late nineteenth and early twentieth centuries. That pandemic was wiped out through encouraging people to spend more time in the sun, advising them to take their babies and toddlers outdoors more often, and fortifying foods with vitamin D.

Today, fear of sunlight has led not only to a new rise in rickets, but also to an increase in the many other disease states that develop from low vitamin D, including osteoporosis. Since vitamin D is involved in glucose metabolism, low levels can lead to type 2 diabetes in adults, and low vitamin D during pregnancy can result in children being born with type 1 diabetes, as well as newborns going into seizures.^{30,31} Low vitamin D can also trigger autoimmune diseases, such as Hashimoto's thyroiditis,³² and bowel disorders, such as Crohn's disease.³³ Because the vitamin is involved in muscle metabolism,^{34,35} deficient levels can lead to fibromyalgia, and weak muscles can result in bladder incontinence and weak pelvic floors in women,³⁶ which may increase the number of cesarean deliveries that are necessary.³⁷

There has been growing interest as to whether vitamin D deficiency may also contribute to the explosion in the incidence rates of autism over the last 20 to 30 years.³⁸ A researcher at MIT, Stephanie Seneff, PhD, points out that normal brain development is heav-

ily dependent upon both cholesterol and vitamin D being present in sufficient quantities. She suggests that, by inhibiting the synthesis of vitamin D3 sulfate and cholesterol sulfate in the skin, sunscreen use may be a contributing factor in autism.^{39,40}

Evidence points to several additional reasons why the prolific use of sunscreen chemicals should be examined in relation to rising autism rates. Many of the sunscreen chemicals are likely to impact the fetal development of boys more than girls, as they act as potent anti-testosterones, and autism statistics show the ratio is four boys for every girl diagnosed.⁴¹ Also, sunscreen chemicals can cause thyroid disruption in utero, and a higher percentage of thyroid development disorders is being identified in autistic children.^{42,43}


Another factor that suggests sunscreens could contribute to autism is that aluminum may be used to coat the titanium dioxide nanoparticles; aluminum has been found in various sunscreens even though it is not listed as an ingredient on some of the labels at present.⁴⁴ This potential introduction of aluminum to the body is significant, as there is some evidence the aluminum in vaccines may be contributing to the increase in autism seen today.⁴⁵

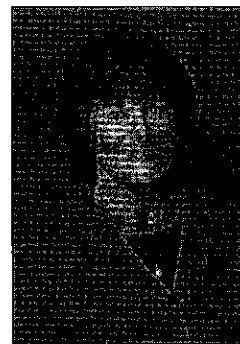
SENSIBLE PROTECTION FROM SOLAR RADIATION

One simple way to help protect the skin from solar radiation is through the use of antioxidants—those powerful molecules that prevent cellular damage throughout the body. In fact, antioxidant foods and supplements are touted continually in the media and by doctors for their contribution to total body health.

It is also important to read the entire label of all the personal care products you buy, as many cosmetics, body lotions, and shampoos contain sunscreen chemicals. Even processed foods may contain titanium dioxide, which is approved by the FDA as a food additive. Look at all labels, from perfumes to soaps to puddings, as sunscreen chemicals and metals are being utilized both for coloring as well as to protect the color of the products.

Sun-protective clothing also requires careful consideration. Some manufacturers make such clothing by impregnating cloth with titanium or zinc oxide nanoparticles to block UV radiation. The nanoparticles wash out with repeated washings and get into the water supply, endangering our ecosystems. We can protect our skin without continuing to pollute our planet, as thickly woven cloth can provide the same protection against UV rays.

This knowledge empowers everyone to adopt environmentally safe sun behaviors—from avoiding harmful products to making use of healthy antioxidants—a choice we can all make. Together we can restore our aquatic and marine environments, as well as protect our health and that of our children. 



ABOUT THE AUTHOR

Elizabeth Plourde, PhD, is a licensed clinical laboratory scientist and a North American Menopause Society Certified Menopause Practitioner who has devoted the last 25 years to researching, writing, and educating women about achieving health through attaining hormonal balance. As a professor, she has taught at San Diego University for Integrative Studies and Concordia University. Her most recent book is *Sunscreens—Biohazard: Treat as Hazardous Waste*, which is available from PPNF (ordering information on page 36).

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