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REPORT

Protecting Your Skin From The Sun

With ongoing depletion of the ozone layer, using sunscreen and taking other steps to protect against harmful ultravoilet radiation are more important than ever.

By Dave Tuttle

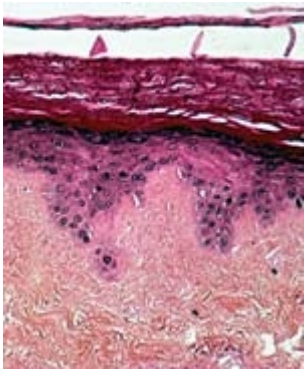
In recent decades, the incidence of skin cancer has increased dramatically. The annual incidence of malignant melanoma per 100,000 individuals nearly tripled among American men, rising from 6.7 in 1973 to 19.3 in 1997.[1] *During the same period, the incidence of malignant melanoma among American women more than doubled, from 5.9 in 1973 to 13.8 in 1997. Today, one American dies of melanoma every hour of every day.*[2] *Skin cancer rates are expected to soar in the future due to the slow but steady depletion of the Earth's protective ozone layer.*

Increases in pollutant levels inexorably lead to a reduction in the atmospheric filters that have protected humans from harmful radiation for eons. The sad reality is that the ozone layer will continue to decline in the near future as a result of previous environmental affronts, even if corrective steps are taken immediately. In the meantime, each of us can take steps to guard against individual exposure to these heightened radiation levels.

How the Sun Accelerates Skin Aging

Age takes its toll on the skin, even if one avoids the sun entirely. Sun exposure, however, dramatically hastens and worsens these inevitable changes. Chronically sun-exposed skin loses its thickness as its collagen concentrations decline.[3] The skin's elastin fiber network is disrupted and glycosaminoglycans, a component of the skin's structure, are diminished. This produces skin that breaks easily, bruises, sags, and itches—all of which are visible signs of aging.

Other, more benign changes to the skin's surface include liver spots and moles. Liver spots are dark, flat patches of pigment with rounded edges. These spots, which are more accurately called age spots because they have nothing to do with the liver, resemble freckles. They are not cancerous or precancerous, so you need not be concerned about them. Moles, also called nevi, are very common. They come in various shapes and sizes, and are usually found on the face, arms, and legs. The average person has between 10 and 40 moles, and they rarely become cancerous. Should a liver spot or mole change its shape or color, however, you should consult a dermatologist.



Photomicrograph of skin tissue from skin culture, magnified 125 times. The epidermis, in darker pink, contains four types of distinct cells:

Ultraviolet radiation first enters the epidermis, which is the skin layer that comes in contact with the environment. Over time, this can result in actinic or solar keratosis, producing dry, scaly lesions that can be yellow-brown, reddish-brown, or the same color as the skin. These lesions may produce a small bump on the skin or they may be flat. A quarter of the population is estimated to have at least one of these lesions. Fortunately, they are usually harmless. If they are not removed, however, approximately one in 10 can develop into a malignant form of skin cancer called squamous cell carcinoma. Actinic keratoses can sometimes be treated with topical medications (e.g., fluorouracil) so that they peel off. If this treatment is not successful, they can be removed surgically, burned off (electrical cautery), or frozen off (cryotherapy).

Ultraviolet radiation also produces various changes to the skin's layers that are not visible to the eye.[4] These include a thickening and wrinkling of the dermis, the tough but highly flexible protective barrier beneath the epidermis. Within this layer are blood vessels and nerves that help the skin to perform its functions. The damage to blood vessels produced by ultraviolet radiation is known as telangiactasia. Still further from the surface is the hypodermis, which contains the sweat glands, sebaceous glands, and hair follicles, along with additional nerves and blood vessels. Damage to the sebaceous glands is known as solar comedones.

keratinocytes, melanocytes, Merkel cells, and Langerhans cells.

Melanocytes are the skin's primary defense against ultraviolet radiation. The melanocytes make up 8-10% of all epidermal cells and release small amounts of a pigment called melanin into the skin. This pigment produces the tan desired by sun worshippers. The two types of melanin are eumelanin and pheomelanin.[5] While both are beneficial, the main protective effect against radiation comes from eumelanin, which limits the amount of ultraviolet penetration through the epidermal layer and scavenges for the DNA-damaging free radicals produced by radiation. The pigmentation produced by melanin also helps to protect the skin from further damage by making it harder for the skin to burn.

Photomicrograph of melanocyte, magnified 2,800 times. Melanocytes make the dark skin pigment melanin, which accumulates on the epidermis forming a shield against the sun's UV rays.

Regrettably, melanocytes decline in number and efficiency as we age.[6] The density of active melanocytes declines by 10-20% every decade after we reach age 40. Because there are fewer melanocytes to react to incoming radiation, the probability of burning increases. This has been linked statistically to the likelihood of skin cancer. The greatest numbers of melanocytes are found on the shoulders and upper back, followed by the arms and lower back—precisely the areas that receive the most sun exposure. This is nature's way of protecting us from the effects of solar radiation. With age, however, even the melanocytes that remain become less efficient in performing their role, making it vitally important to take measures to prevent or limit sun exposure.

Ultraviolet Radiation and Skin Cancer

Two main types of ultraviolet radiation penetrate the earth's surface: ultraviolet A (UVA) and ultraviolet B (UVB). UVA, which accounts for 90% of the total radiation, has the longer wavelength (320-400 nm) of the two and is able to penetrate the lower layers of the skin. UVB has a shorter wavelength (290-320 nm) and affects only the skin's top layers, but is responsible for sunburn and most of the initial damage done to the body's DNA. Recent research has shown that both types of ultraviolet radiation contribute to long-term alterations in DNA structure that lead to skin cancer.[7] Both types also partially suppress the immune system, rendering it less able to perform its vital roles.

UVB radiation is directly absorbed by DNA, which leads to the formation of compounds known as pyrimidine dimers. About 75% of these dimers are thymine dimers, the type considered to be the most carcinogenic. Increased quantities of thymine dimers or a decreased rate of their removal have been statistically linked to greater DNA mutation rates and subsequent development of skin cancer.[8] While UVA radiation does not produce dimers, it leads to the formation of free radicals, which also can damage DNA.

A study in the Journal of the National Cancer Institute found a dose-dependent relationship between people's DNA repair capacity and their risk of de-veloping malignant melanoma.[9] Unfortunately, as we age, our ability to repair this DNA damage diminishes, in part because of a decline in the proteins that participate in DNA repair. The rate of dimer removal also slows, leading to more potential mutations.

While the body has an amazing ability to heal itself, extended periods of exposure to ultraviolet radiation can overwhelm the body's defenses and lead to cancer. The three main types of skin cancer are basal cell carcinoma, squamous cell carcinoma, and melanoma.

The basal cells are found on the bottom of the epidermis, the skin's outermost layer. Above them are the squamous cells, which make up most of the remaining epidermis. Basal cell carcinoma and squamous cell carcinoma are both cancers of the keratinocytes, the skin cells that distribute the melanin produced by the melanocytes. Although rarely fatal, basal cell carcinoma and squamous cell carcinoma can spread to other parts of the body.

More than 800,000 people in the US are diagnosed with basal cell carcinoma each year, the most common skin cancer. Basal cell carcinoma usually appears as a small bump on the neck or head, though it can develop on any sun-exposed area. Because these tumors develop slowly and sometimes resemble psoriasis and eczema, consulting a dermatologist to ensure a correct diagnosis is highly recommended. If treated in time, more than 95% of all basal cell carcinoma can be cured.

Squamous cell carcinoma is the second most common skin cancer in the US, with more than 200,000 cases diagnosed each year. It usually appears as a red patch of skin or a nodule, though it can sometimes resemble a wart. These growths often develop on sun-exposed parts of the body, but can also appear on skin areas that have been damaged by burns or other injuries. People with compromised immune systems or chronic skin inflammation often are at increased risk for squamous cell carcinoma. Unlike basal cell carcinoma, squamous cell carcinoma can metastasize, so prompt medical attention is recommended for those who think they may have squamous cell carcinoma.

Melanoma, the most serious skin cancer, occurs when melanocytes damaged by ultraviolet radiation begin to divide out of control.10 Unlike basal cell carcinoma and squamous cell carcinoma, which are caused by prolonged sun exposure, melanoma is produced by occasional episodes of severe sunburn. For this reason, melanoma is the most common skin cancer in young adults. It is also the most deadly form of skin cancer in people of all ages.

Melanoma lesions usually resemble moles of about 6 millimeters in diameter, but they often have an irregular shape or varying colors. Rarely found on the hands, arms, or face, they occur most commonly on areas of the body that are infrequently exposed to the sun, such as the lower back and upper legs. The risk of melanoma is doubled in people who have had five or more sunburns so severe that blistering occurred. While fair-skinned people are at highest risk, those with darker skin can also be affected. Although survival rates for those with melanoma are high if the cancer is detected early, survival rates decline dramatically once the cancer has spread.

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Modest Precautions Make a Difference

Until World War II, the middle and upper socioeconomic classes considered suntans to be vulgar.[4] Bodies were covered and hats were worn to preserve pale skin tone. The only people with tans were those who worked outdoors. For the past 50 years, however, the “golden” tan has been venerated as a sign of good health. This has led to a huge escalation in sun exposure and skin cancer.

Recently, growing income levels and leisure time have led to more people engaged in outdoor recreation and vacationing in sunny climes. Rising global temperatures have also had an effect, as noted in an article in Physics in Medicine and Biology.[11] In northern Europe and Russia, for example, rising temperatures have made winter less oppressive and extended the period of the year suitable for outdoor activities, thus encouraging people to spend more time in the sun. In fact, the study’s author believes that climate change will be the largest determinant of sun exposure—and the consequent incidence of skin cancer—for people in these regions.

What can we do to minimize our exposure to damaging radiation? The first and easiest thing is to rearrange our schedules. Avoid outdoor activities between 10 a.m. and 3 p.m., when radiation is strongest. The relatively minor radiation during the rest of the day will stimulate all the vitamin D we need for good health without causing burns. If you must go out during peak-radiation hours, wear protective clothing and apply a quality sunscreen to all exposed areas.

One of the best ways to protect against the sun is to wear appropriate clothing. While people are often advised to wear hats and long-sleeved garments to minimize the amount of skin exposed to ultraviolet radiation, the assumption that all clothing provides an acceptable level of protection is incorrect. Several studies have shown that, contrary to popular opinion, some textiles provide only limited ultraviolet protection.[12] In fact, one-third of commercial summer clothing was found to have a sun protection factor (SPF)-equivalent of less than 15.

A number of textile parameters influence the protection offered by a finished garment, including fabric porosity, type, color, weight, and thickness. Ultraviolet absorbers are sometimes added to yarns to enhance a garment’s protective value, but their availability is limited. Moreover, even if a piece of clothing offers an acceptable level of protection when new, laundering and stretching can reduce its ability to protect. Wetness also keeps clothing from doing its job, so wearing a T-shirt while romping in the surf is no substitute for sunscreen.

Unfortunately, no rating system or approved testing protocols exist to establish the protective value of clothing. Until such a system is developed, try to wear tightly knit garments that are as thick as comfort allows. Even better, apply sunscreen to areas you intend to cover with clothing. There is no such thing as too much protection.

Not All Sunscreens Are Alike

Most everyone is familiar with the SPF system, which accords higher numbers to sunscreens that offer greater levels of protection. Yet most people do not realize that the SPF system is based on the sunscreen’s ability to prevent erythema, technically defined as an inflammatory redness of the skin. An SPF of 15 is usually considered to be a sunblock because, if properly applied, it will prevent redness. This does not mean, however, that ultraviolet damage does not occur. Significant injury, DNA damage, mutations, and carcinogenesis can and do occur with cumulative suberythemal ultraviolet exposure.[13] This clearly calls for an SPF higher than 15.

Bear in mind that sweating, water immersion, rubbing off, and photodegradation reduce a sunscreen’s effectiveness. In addition, sunscreen users usually apply only one-quarter to one-half of the thickness (2 mg/cm2) used to measure SPF in the laboratory, which means a sunscreen with an SPF as high as 30 could effectively be rendered one with an SPF as low as 7.5. Frequent and liberal applications of sunscreen therefore are essential to provide the level of protection indicated on the product label.

Even sunscreens with the same SPF are not created equal. A study published in the Journal of Investigative Dermatology found a significant difference in immune-system suppression between two products with an SPF of 15.[14] As noted earlier, one of the deleterious long-term effects of ultraviolet radiation is reduced efficiency of the immune system. While the immunosuppressive and carcinogenic potential of the more erythemogenic spectrum is well established, only recently has the contribution of UVA radiation to immune-system suppression been recognized, even though UVA accounts for approximately 90% of total ultraviolet radiation and, unlike UVB, can penetrate glass windows.

The Journal of Investigative Dermatology study compared two sunscreens with an SPF of 15. The first, which contained avobenzone, octocrylene, and octyl salicylate, had a UVA protection factor of 10 based on an in-vivo pigment-darkening method. The second product, made from zinc oxide and octyl methoxycinnamate, had a UVA factor of 2. Nonlinear regression analysis based on changes in skin-fold thickness revealed that the first sunscreen had an immune protection factor of 50, while the zinc-oxide formulation had an immune protection factor of 15 (equal to its SPF). In other words, the product with avobenzone was more than three times more protective. Given the immune system's importance in preventing the initiation and growth of skin cancer, it is advisable to use a sunscreen that contains avobenzone and other ingredients that maximize UVA protection as well as offer UVB protection.

Protecting the Body's Largest Organ

Now more than ever, we need to take preventive action to protect our skin. The ongoing radiation assault from the ozone layer's depletion makes this a vital health concern. While everyone looks better without leathery skin, there is more than vanity at stake—your skin is your body's largest organ, and it deserves the highest level of respect.

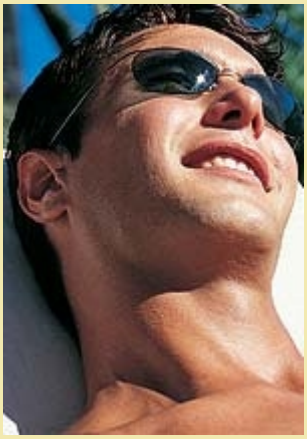
An extensive study in Archives of Dermatology reveals just how important this is.[15] On four consecutive days, a sunscreen with an SPF of 15 was applied to four sites on the buttocks of 18 women ranging in age from 20 to 55. The sunscreen was applied 30 minutes before exposure to two doses of ultraviolet radiation sufficient to provoke a minimum level of erythema. Of the four sites of application, one was treated with sunscreen daily, while the remaining three were treated on three of the four days they received radiation, skipping either days two, three, or four. A fifth site served as a control and was not irradiated.

The researchers found there was no significant difference in thymine dimer formation between the irradiated and nonirradiated sites when an application of sunscreen preceded each irradiation. When the sunscreen was not applied for even a single day at this minimal radiation level, however, a statistically significant increase in thymine dimer formation was noted. While the women's bodies removed some of the dimers from the irradiated areas, 25% of them were still there 72 hours later.

Considering how much time we spend in the sun, it quickly becomes apparent that regular use of sunscreen is essential to protect our skin. If ultraviolet radiation is absorbed regularly, these ongoing concentrations of dimers could accumulate and produce conditions conducive to melanoma and other skin cancers.

The best way to protect against harmful ultraviolet radiation is to minimize sun exposure, wear protective clothing, and liberally apply sunscreen. Your eyes may be the mirrors to your soul, but your skin is what people notice first. And vibrant, healthy skin says a lot about who you are.

New Study: UVA Light More Harmful than Previously Thought



Type A ultraviolet (UVA) light, previously considered less dangerous than type B ultraviolet (UVB) light, "could contribute more significantly to skin cancer than previously assumed," according to a study recently published in the Proceedings of the National Academy of Sciences.

UVA, which causes skin to age, produces less direct damage to DNA than UVB "and therefore has been considered far less carcinogenic," wrote the study authors, who were led by Gary Halliday of the Melanoma and Skin Cancer Research Institute in Sydney, Australia.

The researchers studied two types of skin cancer cells to examine the effects of UVA. Most mutations caused by UVA were found in cells deep in the skin, while those caused by UVB were found in superficial layers of the skin.

"Because of the mutagenic effects that UVA waves have on dividing stem cells in the skin, the researchers propose that this type of ultraviolet light could contribute more significantly to skin cancer than previously assumed," the Australian study team concluded. "Given the traditional emphasis on UVB, these results may have profound implications for future public health initiatives for skin cancer prevention."

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