

# Sunlight

*The best protection against skin cancer is a good tan.*

George Hamilton

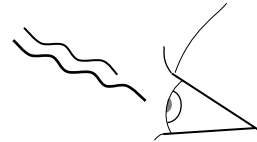
*Keep your face to the sunshine and you'll never see the shadows.*

Helen Keller

The sun not only makes life possible, but it is the central organizing force in the living world exerting both daily and seasonal influences. In animals, the sun governs reproductive, activity-rest, and feeding patterns. Even the animals imprisoned in our homes for our amusement and protection will establish a resting spot near a window and will bask in the sun when let out. In the human world, the development of artificial light has reduced dependence on sunlight. Biologically, however, we are still creatures of the sun.

Until the late twentieth century, scientists believed that activity, sleep, and social interactions controlled circadian rhythms. In the last twenty years, new research has come to light. We now know that in organisms as diverse as single-celled algae and humans, light is the primary stimulus regulating the circadian biological clock.<sup>158</sup> The mammalian circadian pacemaker, located in the suprachiasmatic nucleus (SCN) of the hypothalamus, generates 24-hour rhythms for many physiologic functions including body temperature and hormonal secretion.<sup>159-161</sup>

Light enters the body via the retino-hypothalamic pathway: through the eyes, converted to nerve impulses, and transmitted to the SCN.<sup>162</sup> The SCN conveys this information to the pineal gland, a key interface between environmental lighting and hormonal output. The pineal produces melatonin which, in turn, signals activities throughout the endocrine system via its influence on the pituitary gland and hypothalamus.<sup>163,164</sup> Pineal melatonin, in effect, “feeds back” on the SCN, thereby influencing the SCN’s activities.<sup>165,166</sup> Based on the interdependent cooperation between the pineal and the SCN, they can be aptly described as coequal regulators of our biological clock, sharing a position atop the hormonal chain of command.

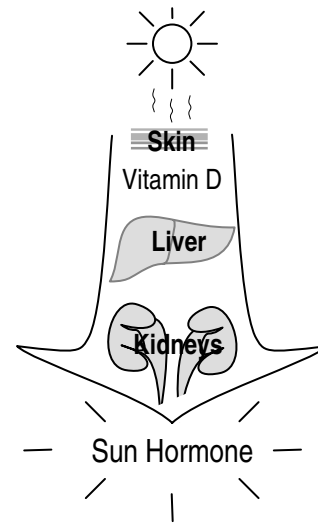


Both the light-sensitive SCN and the light-sensitive pineal are centrally involved in sex drive and reproductive function,<sup>167-171</sup> and marked differences in the size and morphology of the SCN exist among women, heterosexual men, and homosexual men.<sup>172-174</sup> In male rodents, experimental light deprivation causes profound testicular shrinkage and a reduction in testosterone levels to near-castrate levels.<sup>175-178</sup> In a wide range of other animals, summer to winter light changes induce decrements in reproductive hormones, copulatory performance, and gonadal mass.<sup>179-189</sup> Furthermore, breeding season in animals can be delayed or advanced by altering light availability;<sup>190,191</sup> and in humans, circadian (daily) hormonal rhythms can be delayed or advanced by the same means.<sup>192,193</sup> Without wishing to crassly disillusion anyone, hot summer nights of love and romance may not be entirely unrelated to animalistic seasonal breeding influences.

Humans are not seasonal breeders in the sense of some animals that mate only during a particular time of the year. Even so, a light-related seasonal influence on human libido cannot be discounted in view of studies showing that in both males<sup>194-196</sup> and females<sup>197,198</sup> sex hormone levels are highest during the time of the year when the sun shines the longest. The fact that light is testosterone-enhancing is illuminating news for men. And it suggests that men who report an increased sex drive after spending a day at the beach seeing women in swimsuits basking in the sun may be as much aroused by the sunlight as by the women. To enhance testosterone levels in men, and to increase sex drive in both sexes, maximize daylight hours by retiring early and rising early; and get outside as much as possible.

In addition to synchronizing biorhythms, sensational new research demonstrates that the sun acts as a hormonal catalyst-precursor. When solar ultraviolet radiation in the wavelength range of 290-320 nanometers (UVB) strikes exposed areas of the body, it chemically reacts with a type of cholesterol present in the skin called *epidermal 7-dehydrocholesterol*, converting it to vitamin D.<sup>199</sup> This much we knew since the early 1920's. But here's where it gets exciting.

Vitamin D then undergoes an assembly-line chemical makeover first in the liver then in the kidneys.<sup>200</sup> Through this process, mild-mannered vitamin D turns into a "super hormone" inelegantly named *1,25-dihydroxyvitamin D3* (I prefer to call it "sun hormone"). Early reports on sun hormone showed that it regulated intestinal, bone, and kidney function. These findings shed light on the mechanisms by which vitamin D exerts its classical effects on skeletal health, given that all three of these organs are involved in calcium metabolism (via absorption, mobilization, and reabsorption, respectively).<sup>201</sup> Recent research has revealed that the biologic effect of sun hormone is more comprehensive than originally believed, with positive implications for many disease states including osteoporosis, cancer, psoriasis, multiple sclerosis, and arthritis.<sup>202-206</sup>



The sun hormone/cancer connection is particularly provocative when considered in the context of the prevailing twin messages from health authorities that we should 1) avoid the sun, and 2) wear sunscreen, to protect ourselves from skin cancer. I dissent from this consensus; and I further maintain that the combined effect of these two recommendations is an increase in cancer and other forms of pathology and woe, including osteoporosis and depression. Before we discuss the role of sun hormone in cancer prevention, let's address the role of sunlight in cancer causation. As you will see, the relationship between sunlight and skin cancer is at variance with popularly accepted notions.

The incidence of all types of skin cancer has risen dramatically in the U.S. and around the world since the 1970's.<sup>207-209</sup> However, because this has occurred concurrently with an increase in many types of cancer (see Chapter 6), it is more

accurate to say that we have a cancer problem including skin, rather than a skin cancer problem per se. This is an important clarification because it is likely that all types of cancer are caused by the same or related factors. (For example, ultraviolet radiation depletes epidermal and dermal antioxidants;<sup>210-212</sup> and antioxidant supplementation has been shown to protect against skin cancer and many other types of cancer, as well.<sup>213-215</sup>) DNA resides in every cell of our body, and every cell is intimately interconnected with every other cell (this dynamic integration of parts distinguishes a living organism from a machine). DNA is constantly damaged by oxidative stress, and repaired (see Chapter 4). Unrepaired damage to DNA can cause abnormal cell growth leading to cancer. Therefore, cancer reflects a critical interruption in the biologic harmony of life resulting in aberrant cellular behavior. This is the larger picture.

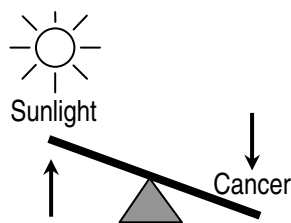
The causative role of ultraviolet radiation in skin cancer varies with the type of skin cancer. The deeper in the skin cancer occurs, the more complex is the inducing influence of the sun. Highly common, easily treatable, non-aggressive, and rarely life-threatening, squamous and basal cell carcinoma occur superficially on the skin and directly correlate with cumulative sunlight exposure. Melanoma, by contrast, occurs deeper in the skin and although treatable early, spreads quickly and kills many. Unlike squamous and basal cell carcinoma, melanoma is not related to total sunlight exposure.<sup>216-218</sup>

In a nutshell, here's what the research tells us about melanoma risk: a suntan is protective whereas intermittent intense sunlight exposure increases risk. Therefore, not only is melanoma incidence not directly correlated with sunlight exposure, but in the case of construction workers and others who work outdoors, chronic sunlight exposure inversely corresponds with melanoma. On the other hand, individuals who spend most of their time indoors and incur sunburn occasionally while vacationing or during recreational activity, suffer more melanoma.<sup>219-225</sup> Frequency of episodes of painful sunburn during childhood is particularly associated with occurrence of melanoma years later, so protect your children.<sup>226-228</sup> Fluorescent lighting has not been ruled-out as a possible cause of melanoma, with at least two studies finding a connection<sup>229,230</sup> (if confirmed, this would help explain why melanoma is much more prevalent among white-collar workers than among blue-collar workers<sup>231,232</sup>). Finally, the following two constitutional factors are associated with heightened risk of melanoma: 1) size, number, and irregularly shaped moles, and 2) low "tannability" (a propensity to burn rather than tan).<sup>233-235</sup>

The only reason why a "healthy tan" has become an oxymoron is because of moronic pronouncements by health authorities portraying our eons-old ally as a dastardly foe. There is no evidence to support the proposition that a suntan is unhealthy - quite the contrary. For example, a study published in the *American Journal of Epidemiology* found that among tan women, those who wore a bikini more frequently experienced a lower incidence of melanoma.<sup>236</sup> The most likely reason why chronic sunlight exposure protects against melanoma is because it enhances sun hormone levels,<sup>237,238</sup> and sun hormone has been shown to inhibit cancer<sup>239-241</sup> including melanoma.<sup>242,243</sup> (Chemical

analogues of sun hormone are being developed to treat breast cancer<sup>244,245</sup> and leukemia.<sup>246,247</sup>) Sporadic overexposure to sunlight offers no such benefits; rather it reduces immunity,<sup>248-251</sup> which increases risk of all types of disease including cancer.

Consistent with the anti-carcinogenic properties of sun hormone, sunlight exposure is correlated with lower overall cancer death rates.<sup>252-255</sup> For example, the geographic epidemiology of prostate cancer parallels the historical distribution of rickets (a vitamin D deficiency disease). The highest death rates from prostate cancer occur in areas that had high prevalence of rickets - regions with winter ultraviolet radiation deficiency due to a combination of high latitude and persistently thick winter cloud cover.<sup>256-258</sup> Incidence of pancreatic cancer, one of the most lethal tumors, also rises with distance from the equator.<sup>259,260</sup>



Not only are prostate and pancreatic cancer directly correlated with darkness, but both are also directly correlated with dark skin.<sup>261-264</sup> Many researchers theorize that African-Americans are genetically predisposed to these forms of cancer. I subscribe to a different theory, which takes account of the fact that blacks in Africa have much lower rates of pancreatic and prostate cancer than North American blacks.<sup>265</sup> In my view, African-Americans are genetically predisposed to dark skin (there's an astute observation), and dark skin is more resistant to ultraviolet radiation. Therefore, blacks require more sunlight than whites to produce a given amount of sun hormone.<sup>266-268</sup> For this reason, the instruction to avoid the sun (which fails to discriminate appropriately based on skin color) has a disproportionate adverse impact on members of races with heavily pigmented skin.

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### Rickets: An Osteoblast from the Past

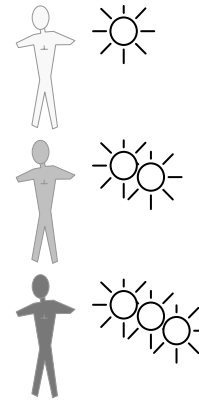
Rickets is a vitamin D deficiency disease. It was once a worldwide medical problem, but it has been largely eliminated – largely but not entirely. There are some who will question why I am spending time discussing a relatively rare disease. My answer is that its victims are children.

No child in the 21<sup>st</sup> century should suffer skeletal deformity from a nutritional deficiency disease that is completely, easily, preventable. Yet it happens every day. Deficiency must be severe and prolonged to cause overt rickets, but milder deficiency can cause subtle skeletal abnormalities. White babies residing at low latitudes are at low risk of vitamin D deficiency, but black babies born during wintertime at high latitudes are at high risk.<sup>269-273</sup> Muslims who don't consume dairy products and who adhere to the custom of covering-up their body are at high risk – which is why rickets is prevalent in Kuwait despite year-round sunshine.<sup>274</sup>



Breast-fed infants nursing from a woman with low sunlight exposure are at higher risk of vitamin D deficiency than formula-fed infants.<sup>275</sup> Therefore, in addition to taking her baby outdoors, nursing mothers should take themselves outdoors. Poor maternal vitamin D status during lactation results in low breast-milk vitamin D.<sup>276,277</sup> Even before the baby is born, poor maternal vitamin D status during pregnancy can adversely affect fetal bone development.<sup>278</sup> If your baby is in a high-risk group, you should consider supplemental vitamin D. But because of the potential toxicity of vitamin D supplements, you should consult your doctor for dosage instructions. If your doctor tells you that rickets no longer exists, find a new doctor.

Natural selection produced a skin color gradient running north and south from the equator, which was subsequently undone by the intercontinental migrations and slave trading of the latter half of the last millennium. Before European expansion rearranged global demographics, darker-skinned people were concentrated closer to the equator and lighter-skinned people were concentrated closer to the poles. When dark-skinned people migrate northward and fair-skinned people southward, from their respective evolutionary homelands, both groups are departing the area of the world for which they are genetically best-suited to thrive. This does not mean that people should not live wherever they please. It simply means that dark-skinned people should make a special effort to expose themselves regularly to sunlight; and fair-skinned people should take special precautions to avoid sunlight overexposure.



Mention of avoiding sunlight overexposure invokes sunscreen, the widespread availability and use of which began in the 1970's. Since then, steadily rising sales of sunscreen products has coincided with a steadily rising incidence of all types of skin cancer. Now that skin cancer has become the most prevalent tumor in the United States,<sup>279,280</sup> the American public is left wondering what – besides a full-blown skin cancer epidemic – it received in exchange for millions of dollars spent on sunscreen products.

Most sunscreens block “short-wave” UVB radiation, but are virtually transparent to “long-wave” UVA<sup>281</sup> (others advertise UVA protection, but block only a small percentage of UVA solar radiation). From the beginning, the claim that sunscreen protects against skin cancer was dubious because UVB comprises only about 10% of the solar radiation spectrum. The assertion that UVB radiation was solely responsible for skin cancer was based on hopeful speculation supported by unwarranted inferences drawn from limited data. With the recent emergence of evidence implicating UVA radiation in the development of melanoma,<sup>282-284</sup> sunscreen has been exposed – just as its users have been all along.

Not only are they not protected, but sunscreen-users may incur a heightened risk of skin cancer. For one, sunscreen fosters a hazardous false sense of security. The skin's alarm system, literally the red flag, is short-circuited by sunscreen.<sup>285</sup> Without skin reddening as a cue to desist sunlight exposure, the sunscreen-user is like a pilot flying without a visible horizon – unable to gauge where optimal ends and excessive begins, and facing potentially catastrophic consequences of misjudgment.

Studies confirm what reason suggests: sunscreen-users spend more time in the sun and have higher rates of melanoma.<sup>286</sup> The higher incidence of lethal skin cancer among sunscreen-users may not be attributable only to greater duration of sunlight exposure. Rather, new research suggests that certain constituents of the chemical cream (sunscreen) with which health authorities advise us to coat our bodies, may turn carcinogenic when struck by ultraviolet radiation.<sup>287-290</sup> Moreover, since UVB is the portion of the ultraviolet spectrum that initiates vitamin D production, sunscreen, by blocking UVB, inhibits formation of sun hormone.<sup>291-293</sup> Increased risk of melanoma, but no sun hormone enhancement and no suntan, is a fool's bargain if ever I've heard one.

Not only does sunlight affect your physical health, but your mental health as well. The rhythm of blues is seasonal, and the relationship between darkness and despair is more than metaphoric. Moods tend to descend with temperature (to the extent that low temperature keeps people indoors) and daylight duration. Approximately 95% of the population experiences some degree of seasonal variation in behavior and mood.<sup>294,295</sup> At its upper extreme, seasonality manifests itself as clinical winter depression, called seasonal affective disorder (SAD). SAD strikes approximately 10% of the population;<sup>296</sup> and in the Northern Hemisphere, it begins in October/November and remits in February/March. The incidence of SAD is three times higher among women,<sup>297-300</sup> and it is most prevalent in high-latitude areas meteorologically prone to cloudy winter days.<sup>301-303</sup> The seasonal blues hit particularly hard in Alaska, Antarctica, and other circumpolar regions where winter days are extremely short.<sup>304-306</sup>

Phototherapy is highly effective at treating SAD,<sup>307-311</sup> and has produced positive, but less consistent, results at treating other disorders, such as premenstrual syndrome,<sup>312,313</sup> bulimia,<sup>314,315</sup> and nonseasonal depression.<sup>316-319</sup> An effective phototherapy regimen involves regular exposure to 1) bright light 2) containing all visible wavelengths. Sunlight contains all visible wavelengths; whereas the incandescent and fluorescent lights that illuminate the indoor environs in which modern-day humans spend most of their time lack significant components of the color spectrum. Moreover, not only is a sunny day many times brighter than the most well-lit room, but sunlight also radiates ultraviolet and infrared waves. Light bulbs do not provide these invisible wavelengths, both of which buoy mood and contribute to our general well-being.<sup>320,321</sup> Incidentally, the sun also radiates cosmic rays, gamma rays, x-rays, radio waves, and electric waves – but all of these are intercepted by the atmospheric layers surrounding the Earth, and thus do not reach its surface.

From the standpoint of health, light emitted by the bulbs in our homes and offices is inferior to sunlight. In fact, photobiologists suspect that overexposure to "cool-white" indoor light conspires with sunlight deprivation to subtly upset human biochemistry. Research in this area has important implications in view of the trend toward an increasingly indoor society. For inhabitants of higher latitudes, where colder temperatures and shorter daylight hours prevail, the artificial light issue carries added significance.

Besides making you feel better, combating osteoporosis and cancer, and firing sex drive, sunlight can advance fat loss by curbing appetite (and in men by bolstering testosterone, see above). The influence of sunlight on appetite is attributable to the same mechanism that makes sunlight a mood elevator: the neurotransmitter serotonin. Sunlight exposure spurs serotonin production (this is why excessive sunlight exposure makes you sleepy); and sunlight deficiency can lower serotonin levels sufficiently to instigate depressive symptoms and/or carbohydrate craving in susceptible individuals.<sup>322-324</sup> This explains why carbohydrate craving is a hallmark symptom of SAD and other serotonin-related forms of depression,<sup>325,326</sup> and it explains why carbohydrate craving responds to phototherapy.<sup>327</sup>

As discussed in Chapter 11, carbohydrate-rich meals boost serotonin levels. But unlike sunlight exposure, medicating the blues with carbs has downside implications for body and mind. So before you reach for a sweet snack or pay for expensive drugs that unnaturally alter brain chemistry, try taking a vigorous walk on a sunny day. You'll be healthier, wealthier, and maybe even wiser given the ability of natural wonders to inspire a transcendent perception of our place and purpose in the universe.

**To enhance physical and mental health, regularly expose yourself to moderate doses of sunlight and *don't burn*.**

In summary, our biology is wedded to the sun and our physical and mental health depends on it. Since the dawn of human history, we have existed under the sun, relying on it for vision, warmth – even worshipping it. And our world, both figuratively and literally, revolves around the sun. In view of these facts, why have health authorities denounced the sun in recent years, portraying it as a menace to health? Yes, overexposure to sunlight, especially in susceptible individuals, can increase the risk of skin cancer. But moderate, regular sunlight exposure helps protect against many of the deadlier forms of cancer, including melanoma, and provides many other health benefits both physical and mental. According to an article published in a 1993 issue of *Preventive Medicine*, if health authorities would hush their anti-sun advisories and instead encourage regular, moderate sunning, approximately 30,000 U.S. cancer deaths per year could be averted.<sup>328</sup> This is yet another example of the “experts” misrepresenting information to the detriment of public health. What's their excuse this time for their inability to see the larger picture? I suppose the sun got in their eyes.

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