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# THE UV ADVANTAGE



**Michael F. Holick, Ph.D., M.D.**  
and Mark Jenkins

**The Medical Breakthrough That Shows How to  
Harness the Power of The Sun for Your Health**

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*Dedicated to the memory of my good friend Don Christal, who  
championed heliotherapy and had a true appreciation of the  
benefits of sunlight.*

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# PREFACE

**I**T HAPPENED AGAIN the other day. I was in a hotel elevator and overheard a woman telling her companion how much she loved to be in the sun but she couldn't anymore because "it would kill her." It's the kind of thing I hear all the time, and it is what inspired me to write this book.

My goal is to help put society's attitude toward sunlight into proper perspective. I've been researching this subject for many years, and institutions from NASA to the National Zoo have come to me for advice. I've successfully treated a variety of serious diseases with exposure to the kind of radiation that's in sunlight (UVB), including osteoporosis, osteomalacia, high blood pressure, and psoriasis. Results of my studies have been published in major scientific and medical journals.

Most people have taken my support of moderate sun exposure to mean I advocate *tanning*. Not true. Do I lie out in the sun for hours at a time or frequent tanning salons? *No*. Do I go out in strong sunshine without a sunscreen on, and does my skin get tanned? *Yes*. Why? Because I recognize that my body needs a certain amount of sun exposure to be healthy. Do I put sunscreen on after a certain amount of time? *Yes*. Why? Because I understand that there are risks as well as benefits associated with being in the sun. I recently ran into that poster boy for tanning, George Hamilton. When he found out I was an advocate of sun exposure, he jokingly commented that my skin was so pale he could see his reflection in it!

I am advocating *common sense*, something often in short supply in modern America's approach to health. I also respect your right to do something that may make you look and feel better. I believe I can help you make choices that will pursue this goal in a healthier, more effective way. Our society doesn't seem to believe in a happy medium, only in extremes. Do not be afraid—you are not going to die just because you go out in the sun. Indeed, the UVB radiation in sunlight is essential for good health. The notion that we have to protect ourselves from the sun all the time is misguided and unhealthy. This sun phobia explains why so many people are suffering from conditions related to sun deprivation.

Part of the problem is that our national health leaders have lost faith in the public's ability to make informed decisions about health. Their attitude seems to be: *We can't trust the public to be judicious in its attitude toward sun exposure, so let's tell people they shouldn't spend any time in the sun*. The problem with this presumptuous approach is that eliminating sun exposure is out-and-out *unhealthy*. Lack of sunlight is associated with a host of conditions from colon, breast, prostate, and ovarian cancer to heart disease, high blood pressure, Type 1 diabetes, multiple sclerosis, and depression. Many of these policymakers are out of touch with new research and are unfamiliar with the growing body of evidence that shows how important sunlight is to human health.

Your overall well-being depends in part on developing an appropriate relationship with the sun. However, it can be a challenge to get the kind of information you need to establish such a relationship. The main purpose of this book is to provide you with an unbiased understanding of the issues at hand. Equipped with this information, you will be able to make your own decision about what your relationship to the sun should be. You, too, can learn to use sunlight for health.



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## CHAPTER ONE

# The Facts of Light

## *Why you need sunlight, and how you got conned into thinking it was bad for you*

**I**T WAS THE SUMMER of 1997 and for months my staff and I had been studying the vitamin D status of a random group of people living in the Boston area. As Director of the General Clinical Research Center and Professor of Medicine, Dermatology, Physiology, and Biophysics at Boston University Medical Center, I had designed and was leading this study. I was sitting in my office when the results came in. Although I had a strong suspicion by that time of what the study would reveal, the actual numbers were staggering. Fully 42 percent of the people we studied were vitamin D deficient. My study, which was accepted for publication in *Lancet* (only one in a hundred papers submitted to this renowned journal are published), confirmed what most scientists in the field believe. That is, there is an epidemic of vitamin D deficiency in the United States and much of the Western world. Some have called this a “silent epidemic” because, although the consequences of vitamin D deficiency are profound, there are often no obvious symptoms.

What is the cause of this “silent epidemic”? In part, it is the result of very few people these days eating enough foods rich in vitamin D—mostly “oily” fish such as salmon and mackerel. Also, most Americans do not compensate for a diet poor in vitamin D by following recommendations to drink enough vitamin D-fortified milk or to take nutritional supplements. (Milk usually contains far less vitamin D than the FDA approves of.)

Still, none of these factors is as important in explaining the widespread levels of vitamin D deficiency as is the fact that as a society we are increasingly choosing to deprive ourselves of our most important source of vitamin D—sunlight.

Exaggerated warnings about the perils of sun exposure are driving Americans to hide beneath long sleeves, floppy hats, and wraparound sunglasses and to slather every square inch of skin that isn’t covered with high-SPF sunscreens. (My studies have shown that SPF 8 reduces vitamin D production by 97.5 percent and SPF 15 reduces it by 99.9 percent). The result of all this is to block out the sun that humans need to make vitamin D. The inescapable fact is that humans have evolved in such a way as to be dependant on sunshine for life and health. Sunlight is the fuel that enables your body to manufacture vitamin D. When you block out sunlight with sunscreens and head-to-toe clothing, you stop that supply of fuel and your body can’t make enough vitamin D.

Why does this matter? The short answer is that the benefits of vitamin D on human health are many, varied, and profound. We’ll take a thorough look at these benefits in [chapter 4](#). Suffice it to say that in some respected medical circles, sunlight is being described as a “wonder drug.” It can provide “immunity” against some of the most devastating diseases

around, including heart attack, stroke, osteoporosis, and certain of the most deadly internal cancers. The statistics speak volumes. Some researchers, notably Dr. William Grant, have proven that, in America, increased sun exposure would result in 185,000 fewer cases of internal cancers every year and 30,000 fewer deaths (specifically cancers of the breast, ovaries, colon, prostate, bladder, uterus, esophagus, rectum, and stomach). Sunlight has a similarly dramatic effect on high blood pressure, one of the leading causes of heart attack and stroke—people who spend time in the sun or on a tanning bed experience a blood pressure-lowering effect similar to that of standard medications that have unpleasant side effects. We've found that sunlight has a beneficial effect on heart health equal to exercise. Then there's bone health. Sun exposure helps build and maintain bone density and reduces fractures, one of the main causes of death and disability among senior citizens. Humans also need sunlight to control the biological clocks that regulate mood, and appropriate sun exposure is responsible for keeping down rates of depression associated with seasonal affective disorder (SAD) and premenstrual syndrome (PMS). Let's not forget that sunlight plain old makes you feel better—not something to be dismissed in this high-stress world in which many of us live.

## How Sun Exposure Benefits Human Health

- Improves bone health
- Enhances mental health (SAD, PMS, depression, general mood)
- Prevents certain cancers
- Improves heart health
- Alleviates skin disorders
- Decreases risk of autoimmune disorders, including multiple sclerosis, Type 1 diabetes mellitus, and rheumatoid arthritis
- Alleviates conditions related to obesity that prevent participation in an exercise program

Those who heed warnings to avoid the sun because “sunlight is dangerous” (whom I refer to as “sun-phobes”) are robbed of the life-sustaining benefits of sun exposure—and this idea denies basic evolutionary science.

## In the Beginning ...

From the beginning of recorded time, humans have worshipped the sun for its therapeutic properties. This can be seen in cave paintings that show that exposure to sunlight was necessary for life and good health. Medical practitioners reported the benefits of sun exposure on heart health 6,000 years ago in the time of the ancient Egyptian pharaohs Ramses and Akhenaten. Sun therapy was also praised by the legendary Hippocrates (creator of the Hippocratic Oath) and the doctors of bygone Rome and Arabia. The Egyptians, Mesopotamians, and Greeks all had sun deities, and the influence of the sun in religious belief also appears in Zoroastrianism, Mithraism, Roman religion, Hinduism, Buddhism, and among the Druids of England, the Aztecs of Mexico, the Incas of Peru, and many Native American groups.

That ancient peoples instinctively understood that sunshine was good for them is not surprising. Humans have depended on sunlight to sustain life and health since our ancestors slithered out of the primordial ooze. Without the calcium-rich environment of the bubbling

saline oceans in which life evolved—and from which we could absorb calcium right into our primitive skeletons—our creepy-crawling ancestors got their calcium on land by eating plants. The main job of calcium is to build bones, and these ancient relatives of ours developed a system of absorbing the calcium through diet into the bones. This chemical process required the presence of vitamin D, which was made in the skin when it was exposed to sunlight.

Fast-forward a couple million years, and Homo sapiens were still using sunlight to make the vitamin D needed to regulate the calcium necessary for bone health. Early humans lived near the equator where sunlight is plentiful, and they developed dark, melanin-rich skins that protected them against sunburn but still “let in” enough sunlight to make vitamin D. As humans started to migrate away from the equator to regions where sunlight is less intense, and where for several months of the year the sun isn’t strong enough for the human body to make vitamin D, skin got less pigmented so it would more effectively “let in” the sun when it was available. The farther north humans migrated, the fairer their skin became to make use of available sunlight. Eventually humans couldn’t migrate any farther north because there wasn’t enough sun to make the vitamin D needed to survive. Then something fascinating happened—humans developed the means to harvest the seas for vitamin D-rich fish and mammals of the sort still traditionally eaten by Eskimos and Scandinavians and that enable people to live in climates with very little sunlight.

Even today, people with fair skin don’t require much exposure to sunlight to make enough vitamin D to be healthy, and people with dark skin are naturally well protected against sunburn. Conversely, people with fair skin get sunburned quite easily and may be susceptible to skin cancer, whereas dark-complected people more easily become vitamin D deficient when living in northern climates.

Although this is a very simplistic explanation for why humans need sunlight for health and life, it should put to rest the notion that sunlight is something humans must fear. Sunlight is necessary for human survival!

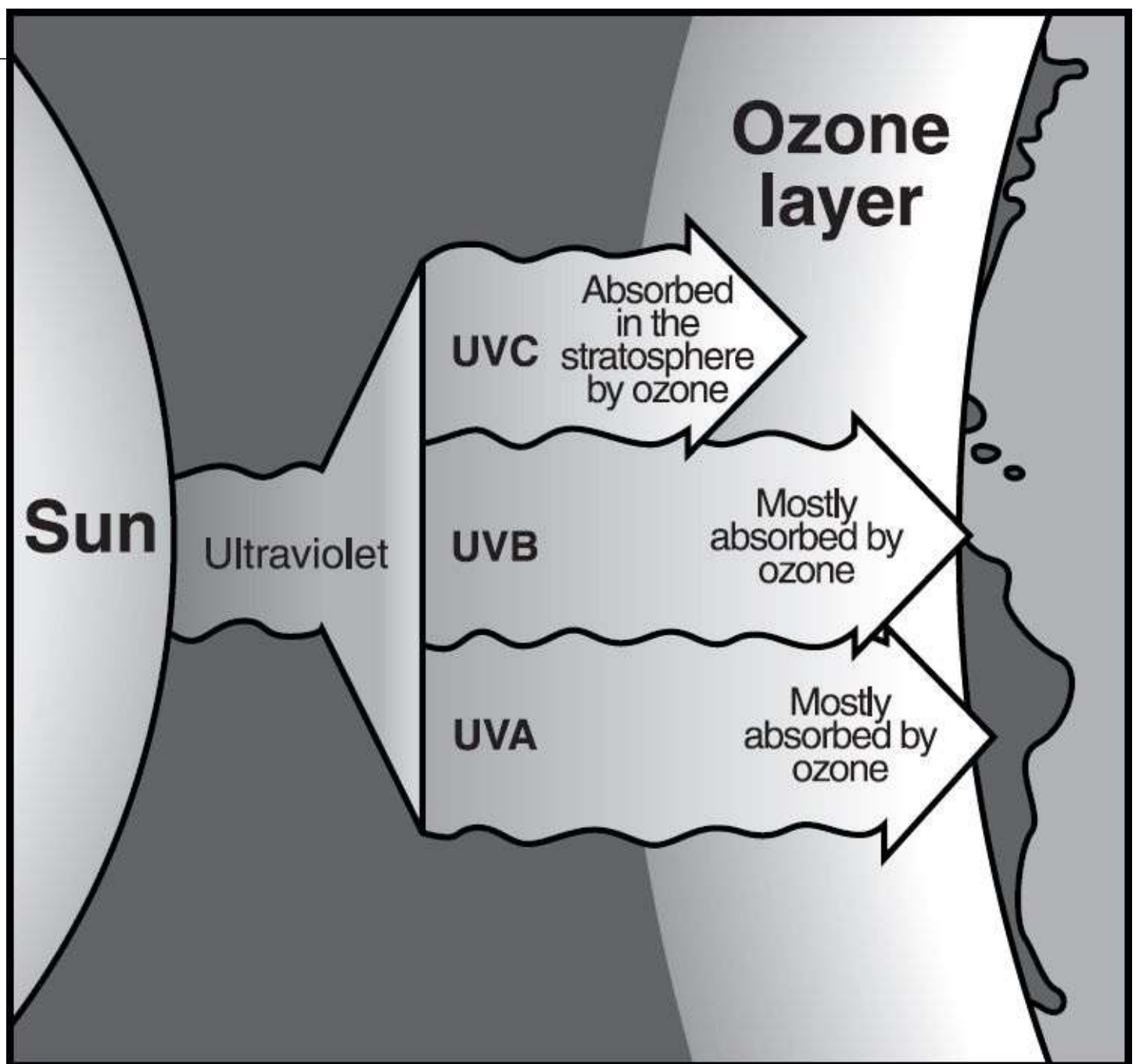
## Sunlight 101

To fully understand the pros and cons of sun exposure, you need to know what’s going on “up there” and how it affects you “down here.”

Sunlight consists of a mixture of electromagnetic radiation of various wavelengths, from the longest, called infrared, through red, orange, yellow, green, blue, indigo and violet, to the shortest in wavelength, called ultraviolet (see [figure 1.1](#)).

Ultraviolet, or UV radiation, consists of UVA, UVB, and UVC. UVC is completely absorbed by the atmosphere. UVA and UVB reach earth’s surface but have different effects on your body. UVA radiation causes wrinkles and in extremely high doses may be responsible for melanomas.

UVB is the form of radiation that reddens skin and that may be responsible, over the long term, for non-melanoma skin cancer. When UVB causes sunburns, it may contribute to melanoma. UVB is also the form of radiation that starts the reaction in skin that stimulates the production of vitamin D.



**Figure 1.1** The sun produces electromagnetic radiation of various wavelengths, including ultraviolet A, B, and C.

Until recently, most sunscreens only blocked UVB radiation, which may have precipitated the rise of melanoma in the United States and other Western cultures. That's because sunscreens that block out only the burning UVB radiation enable people to stay out in the sun for unlimited periods of time during which they are not protected against UVA radiation. Without any sunscreen at all, people would not have been able to stay out in the sun long enough to receive the dosage of UVA necessary to cause melanoma.

Thankfully, researchers have now developed “broad spectrum” sunscreens, which protect against both UVA and UVB radiation.

The level of UV radiation that reaches the earth varies depending on several factors, including the following:

- **Stratospheric ozone.** The ozone layer absorbs most of the sun's radiation, but how much it absorbs depends on what time of year it is and certain other natural phenomena. As a whole, the ozone layer has thinned due to industrial pollution and now-banned substances.

previously emitted by refrigerants and certain consumer products such as hairspray.

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- **Time of day.** UV levels are at their most intense at noontime, when the sun is at its highest point in the sky. When the sun is at its highest point, the UV radiation has the least distance to travel through the atmosphere to earth. Contrarily, the sun's radiation must pass through the atmosphere at a greater angle during the early morning and late afternoon, and therefore UV intensity is greatly diminished at those times.
- **Time of year.** The angle of the sun changes with the seasons. This causes the intensity of the UV radiation to vary as well. UV intensity is greatest during the summer months.
- **Latitude.** The sun's radiation is most intense at the equator where the sun is directly overhead and the radiation from it has to travel the shortest distance through the earth's ozone atmosphere. Therefore, at the equator, more UV radiation reaches the earth's surface from the sun. At higher latitudes, the sun is lower in the sky and UV radiation has to travel a greater distance through thicker ozone to reach the earth's surface. This makes the UV radiation in middle and high latitudes less intense.
- **Altitude.** UV radiation is more intense at higher altitudes because there is less atmosphere to absorb it. When you are at higher altitudes, therefore, you are at greater risk of overexposure.
- **Weather conditions.** The more clouds there are, the less UV radiation can penetrate to the earth's surface. However, UV can still penetrate cloud cover, which explains why you can still get sunburned on a hazy summer's day.
- **Reflection.** Certain surfaces reflect UV radiation and increase its intensity even in shaded areas. Such surfaces include snow, sand, or water.

## Science and Sunlight

When modern science began investigating the connection between sunlight and health, it was initially believed that the health benefits of sunlight were the result of the warmth generated by the sun. It was Sir Everhard Home, in the late 1700s and early 1800s, who deduced that it wasn't the heat of the sun's radiation but rather the occurrence of a chemical effect on the body caused by the sun that produced sunburn. Home also showed that dark-skinned people had a natural resistance to sunburn. In the 1820s, a Polish doctor named Jędrzej Sniadecki first observed that children who lived in the city of Warsaw had a much higher prevalence of rickets than youngsters who lived in the Polish countryside. Dr. Sniadecki thought it was probably the lack of sunshine in the cramped confines of Warsaw that was to blame for this widespread condition. Sniadecki was able to successfully treat the afflicted city kids by taking them into the countryside for sun exposure, which began a long-standing tradition for treating this condition. Floating Hospital in Boston, now a modern multistoried structure, got its name because it was originally a large boat that, in the summertime, took children with rickets into Boston Harbor to be bathed in sunshine. Although the exact relationship between sunlight and bone development was not yet understood, a health movement was pioneered by Arnold Rikli at the end of the 1800s with this motto: "Water works wonders, air can do even more, but light

works best of all.”

By the beginning of the twentieth century, scientists had determined that it was the UV radiation in sunlight that stimulated the production of vitamin D in the human body. They determined that this was important for a variety of health reasons. Based on findings that the vitamin D created by sun exposure improved bone health, the dairy industries of Europe and the United States started fortifying milk with vitamin D. A craze was under way, and vitamin D fortification was being touted by the manufacturers of products as varied as Bond Bread, Rickter’s Hot Dogs, Twang Soda, and even Schlitz Beer.

The first few decades of the twentieth century were the heyday of photobiology and heliotherapy. Photobiology is a branch of science that investigates the effect of natural and artificial radiation on all life forms; heliotherapy focuses on the sun’s abilities to heal the sick. Photobiologists and heliotherapists were credited with developing effective treatments for rickets, tuberculosis, and psoriasis. Hospitals all over Europe and the United States had built solariums and balconies so they could offer their patients a pleasant place to enjoy the sun’s healing rays. In addition, a photobiologist had won the Nobel Prize for Medicine. However, the tide was about to change.

## Frightening People Out of the Daylight

So what happened? How did we reach a point in our history when sun became something to be feared instead of worshipped? Shunned instead of desired? The simple answer lies in the fact that there are many billions of dollars to be made in emphasizing the only major medical downside of sun exposure (non-melanoma skin cancer) and not much money to be made in promoting the sun’s many benefits.

Medicine has long known that, despite all the sun’s benefits, a health downside of sun exposure is non-melanoma skin cancer. In the 1920s, it was recognized that farmers in Europe developed skin cancer on their most sun-exposed areas—their ears, face, nose, and backs of their hands. In 1941, the first issue of the *Journal of Cancer* put the issue in perfect perspective, stating that an increased risk of non-melanoma skin cancer was one of the prices to be paid for a decreased risk of cancer of the prostate, breast, and colon. Unfortunately, in the past quarter century, the relationship between sunlight and skin cancer has been blown out of proportion. The major culprits are the cosmetic wing of the pharmaceutical industry and some dermatologists.

### Pharmacology Takes Over

The decline of sunlight as a popular and successful treatment for a variety of diseases was hastened by major medical breakthroughs. It started with the discovery of penicillin in 1928. The success of this and other wonder drugs heralded the beginning of the era of pharmacology and saved the lives of millions. However, it also precipitated the eclipse of disciplines such as heliotherapy and photobiology, which appeared quaint and outdated by comparison. It wasn’t long before people had been converted en masse to the idea that synthetic drugs were much more effective in preventing and curing most maladies that affect humankind than anything Mother Nature had to offer—a belief that largely prevails today.

In the 1960s and 1970s, as the leisure culture expanded and people were spending more time outdoors, the “cosme-ceutical” industry developed anti-sunburn creams that gave the user a false sense of security and encouraged excessive sun exposure. These products began making extraordinary amounts of money for the companies. Although the products were

initially introduced to prevent sunburn, they soon were being cannily marketed to prevent skin cancer. ~~There is an important role for modern sunscreens in preventing skin cancer, and people should control sun exposure in the same way they watch how much salt, sugar, and fat they eat and how much alcohol they drink.~~ However, the sophisticated and aggressive “educational” campaigns funded by the cosme-ceutical industry have created an anti-sunshine hysteria that is detrimental to our health because it converts people into sun-phobes by convincing them that no amount of sun exposure is safe.

So desperate is the anti-sun lobby to convince you of the dangers of the sun so that you will buy its products year-round, its representatives will tell you with a straight face that if it’s February in Boston and you’re planning to walk to the corner store to buy a quart of milk or sit outside on your lunch break, you should wear sunscreen. This is wrong-headed and alarmist. Even on the sunniest February day, the sun isn’t strong enough in New England or New York to increase your risk of skin cancer significantly. This is but one example of the kinds of inaccurate information the anti-sun lobby puts out to alarm people. In so doing, it convinces people of the need for its products and services.

The scare tactics of the cosme-ceutical industry have been embraced by most of the dermatology profession. These groups have worked in concert and have frightened the daylights out of people—or, to put it more accurately, frightened people out of the daylight. It has turned them into sun-phobes.

To put the dangers of skin cancer in context, it’s worthwhile looking at some statistics. Non-melanoma skin cancer, which may be caused by long-term sun exposure, has an extremely low death rate. Fewer than half of 1 percent of people who develop non-melanoma skin cancer die; non-melanoma skin cancer claims 1,200 lives a year in the United States. Compare that with diseases that can be prevented by regular sun exposure. Colon and breast cancers, which may be prevented by regular sun exposure, have mortality rates of 20 to 65 percent and kill 138,000 Americans annually. Osteoporosis, a bone disease that can be mitigated by regular sun exposure, is endemic, affecting 25 million Americans. Every year, 1.5 million Americans with osteoporosis suffer bone fractures, which can be fatal when the person is elderly. Non-melanoma skin cancer is not something to be taken lightly, and I would never minimize its effects on sufferers, but in public health terms, it is relatively unimportant when compared with a host of killer diseases that can be prevented by regular, moderate sun exposure.

What about melanoma? This is an important question. Though rare, melanomas are by far the most dangerous form of skin cancer, and, if left untreated, they are often fatal. Eighty percent of all skin cancer fatalities are attributed to this type of cancer. However—and this is a critical point—there is no credible scientific evidence that moderate sun exposure causes melanomas. In [chapter 2](#), I will clear up the confusion surrounding the relationship between sun exposure and skin cancer, confusion that the media doesn’t seem able to unravel and the anti-sun lobby has a vested interest in maintaining.

The anti-sun lobby also plays on people’s fear of developing wrinkles—a growing concern in our youth-obsessed culture. It’s true that sun exposure causes the skin to age prematurely, but it is possible to take advantage of the benefits of sun exposure while minimizing wrinkles. Interestingly, the type of sunscreens used in the 1960s probably predisposed people who sunbathed during that era to wrinkles. I’ll take a closer look at this issue in [chapter 3](#).

So why has no one stood up to the anti-sun lobby and said, “Hey, wait a minute, for too long you’ve exaggerated the dangers of sun exposure and ignored the fact that human beings

need sunlight to live”? Well, I have! The problem is, whenever anyone challenges the anti-sun coalition doctrine that sun exposure does nothing but cause skin cancer and wrinkles—usually by publishing a new study that demonstrates a positive link between sunlight and disease prevention—this news is drowned out by another well-funded round of disinformation about the hazards of sun exposure. The bibliography at the end of the book lists many of the published studies that show the beneficial association between the vitamin D you get from sunlight and many areas of health.

It’s difficult to get the facts out because there is no sun lobby. Sunshine is free, after all, so there’s not much money to be made extolling its virtues. The indoor tanning industry has tried to step up to the plate (modern indoor tanning equipment provides many of the same benefits as natural sun exposure). However, the indoor tanning industry consists of numerous small, independent companies that could hardly be considered unified. The industry’s trade organization, the Indoor Tanning Association, is a pauper compared with the wealthy princes representing the cosmetic industry and the dermatology profession, and it has trouble making itself heard over the anti-sun din.

It doesn’t help that media outlets have little appetite for “feel good” health stories—they believe their readers are more engaged by stories about what’s going to kill them rather than what will make them feel better. Of course, it’s also important to understand that newspaper editors and TV producers are busy men and women. When slickly packaged information about the “hazards of sun exposure” lands on their desks and no one contests this information, they are inclined to publish it verbatim to fill column inches and airtime. Often the “educational” material put out by the anti-sun lobby has been endorsed by eminent-sounding professionals and organizations.

Increasing numbers of studies are confirming the link between vitamin D and good health, however, and attitudes are beginning to change. More important, in the past few years there has been a breakthrough in our understanding of why sun exposure benefits health in so many ways, something that was not fully comprehended until recently. This breakthrough has forced people to take a closer look at the benefits of sun exposure. I am proud to say that I have been at the forefront of this research.

## **Sunshine and Cellular Health**

I’ve been interested in the importance of vitamin D to human health for three decades. Way back in 1970, when I was a graduate student at the University of Wisconsin studying under the academic luminary Dr. Hector DeLuca, I isolated and identified the active form of vitamin D (1,25-dihydroxyvitamin D<sub>3</sub> [1,25(OH)<sub>2</sub>D<sub>3</sub>]) that provides the human body with so many health benefits. The immediate significance of this discovery was that doctors were able to prescribe tiny amounts of this substance to people whose bodies could not make their own active vitamin D due to kidney failure and who suffered severe bone problems as a result.

Even after all these years, I still find this area of science fascinating! I continue to perform studies and have published more than 200 research papers in peer-reviewed medical journals, which means the articles have to be approved by a screening board made up of experts in that particular field. Some of the journals that have published my studies include the *New England Journal of Medicine*, *Lancet*, and *Science*.

Medicine has long known that there is a clear and undisputed relationship between sun exposure and bone health. Without the vitamin D that comes almost entirely from the sun,



your bones could not obtain the calcium they need to be strong. The pediatric bone disease rickets is unknown in children who get enough sun exposure, and, indeed, one of the most effective ways of treating kids with rickets is to get them into the sunshine.

The relationship between sun exposure and bone health is so incontrovertible that even the anti-sun lobby hems and haws about this issue. When its spokespeople are put on the spot, they usually mumble something along the lines of, “Kids gotta drink more milk.” In fact, vitamin D-fortified milk was introduced to combat rickets, but much of the milk sold that is supposed to be rich in vitamin D does not actually contain the vitamin D it is supposed to. My own studies, published in the *New England Journal of Medicine*, proved this, and that research has been backed by other studies, including one by the Food and Drug Administration (FDA).

Rickets is again on the rise in our society—a shocking development given the medical advances during the past century. The main reason is that mothers breast-feed their children without taking a vitamin D supplement or providing their infants with any form of vitamin D supplementation. Human milk contains hardly any vitamin D, and without sun exposure or a vitamin D supplement, infants are at a high risk of developing rickets. Another reason rickets is being seen with increasing frequency is that many kids these days spend too much time indoors and out of the sun or are slathered in sunscreen and made to wear protective clothing before they go out to play.

## Obesity: The Vitamin D Connection

Obesity and the vitamin D deficiency–related condition osteomalacia often go hand in hand. Osteomalacia is characterized by extreme bone and muscle pain and weakness. Being overweight predisposes a person to osteomalacia because the excess fat absorbs and holds onto the vitamin D from the sun and diet so that it cannot be used for bone building and cellular health. In addition, obese people are frequently vitamin D deprived because they go outside much less for practical and self-esteem-related reasons. A vicious cycle then begins.

When an obese person has osteomalacia, the bone and muscle pain and weakness make it virtually impossible to participate in any sort of physical activity that might help the individual manage his or her weight. As a result, the individual will become even more obese, which will in turn worsen his or her vitamin D status and exacerbate the osteomalacia.

Treating a person’s vitamin D deficiency will cure osteomalacia and make it possible for the individual to exercise. A study I participated in showed that it was possible to increase obese people’s vitamin D levels by exposing them to UVB radiation, in this case from tanning beds.

Treating obese people who have vitamin D deficiency–related osteomalacia may have benefits other than enabling them to exercise. Recent research has shown that being vitamin D deficient interferes with the secretion of a hormone called *leptin*, which signals the brain when a person has consumed enough fat. Building the vitamin D in that person’s bloodstream to normal levels will restore that process.

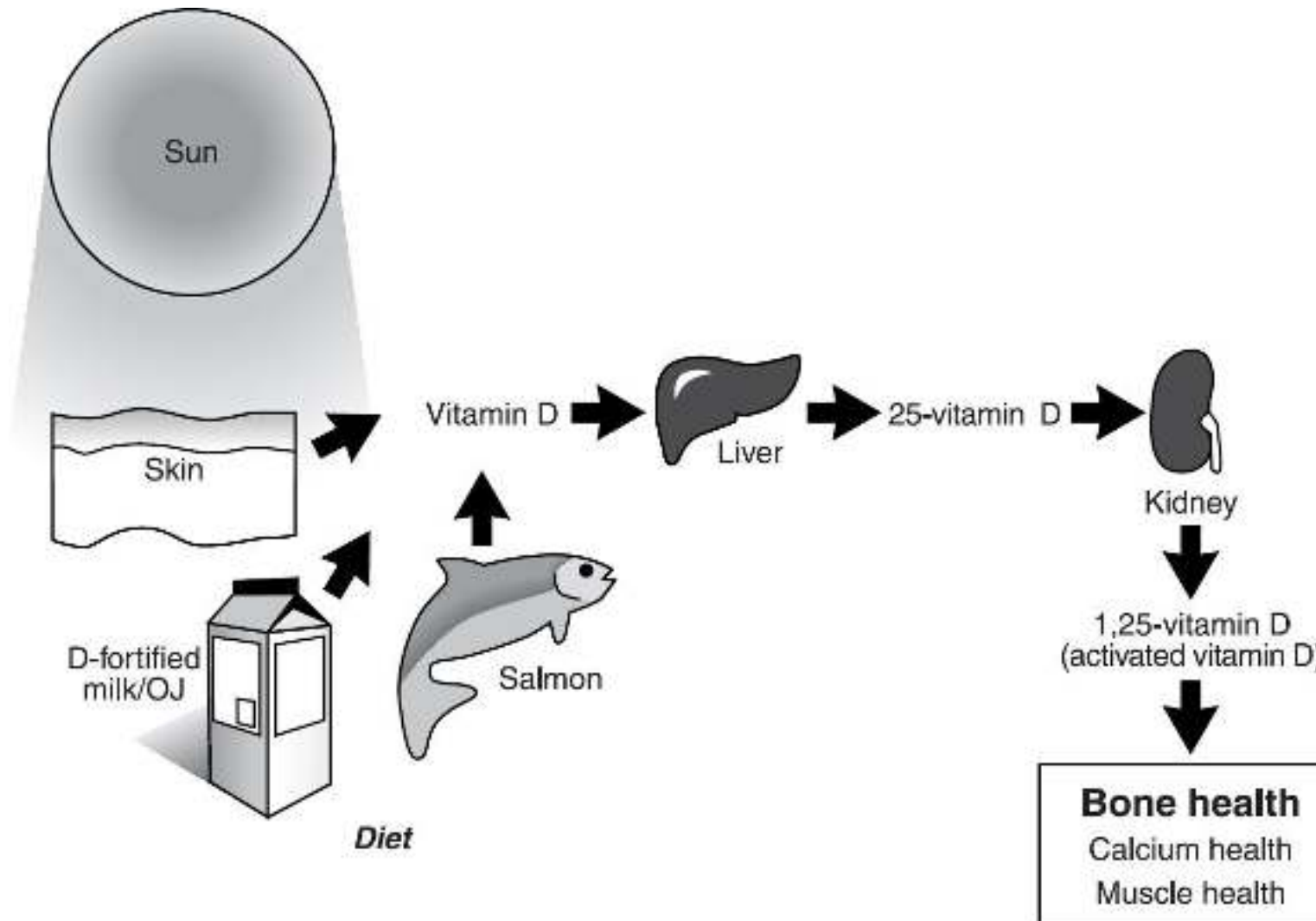
Much more research needs to be done, but I think there is enormous potential for UVB exposure from the sun or artificial sources to be used to treat people with obesity.

Increasing numbers of adults are developing a vitamin D deficiency–related bone condition known as osteomalacia (pronounced os-tee-oh-muh-LAY-shuh), sometimes called “adult rickets.” This condition, characterized by vague bone and muscles aches, is frequently misdiagnosed as fibromyalgia or arthritis. The “fibromyalgia epidemic” that some doctors refer to may actually be a massive increase in vitamin D deficiency–related osteomalacia (see [chapter 4](#) for more on this important subject).

We know that sunlight is essential for bone health, and we have understood this for more than a century. More recently, scientists have become interested in the fact that people living in sunny climates have a lower incidence of organ- and cellular-related conditions, such as

heart disease and cancers of the breast, colon, ovaries, and prostate. Unlike the connection between sun exposure and bone health, the link between sun exposure and cellular and organ health was more difficult to establish. In part this is because much of what we now know is based on putting together research findings from different parts of the world, which was not possible in previous eras. Because it took longer for scientists to make the connection between sun exposure and cellular health, we only recently established what the connection actually is.

It's quite complicated, so before I get into that, let's back up to what was believed just fifteen years ago.



**Figure 1.2** Previous understanding of how vitamin D benefits health. Until recently it was believed that the only place activated vitamin D (1,25[OH]<sub>2</sub>D<sub>3</sub>) could be made was in the kidneys from where it was disbursed in order to promote bone health.

Until the mid-1990s, it was believed that the kidneys make the body's entire supply of activated vitamin D (the only form of vitamin D that provides humans with health benefits). The kidneys make this supply from the 25-vitamin D in the bloodstream (25-hydroxyvitamin D, or 25[OH]D<sub>3</sub>) that is created by the liver out of the vitamin D that is made in the skin after sun exposure and, to a lesser extent, from foods that contain vitamin D (see [figure 1.2](#)). The supply of activated vitamin D that the kidneys actually manufacture is very small, and this supply doesn't change no matter how much 25-vitamin D there is in the bloodstream. In other words, you could dramatically increase the 25-vitamin D content in your bloodstream by lying on the beach all summer long, drinking quarts of milk, and eating mackerel at every meal, but your kidneys would still produce the same tiny trickle of activated vitamin D. The main job of

this precious little amount of activated vitamin D, it was thought, was to contribute to bone health.

As the person who actually discovered the activated form of vitamin D, I was very closely involved with what was happening in the field of vitamin D research, and I have to be honest—there was something that was really bugging me!

Here's what we couldn't figure out. In response to increased exposure to sunlight, cellular and organ health benefits were occurring that appeared to be the work of activated vitamin D. These benefits included lower blood pressure and decreased risk of cancer. However, this couldn't be the work of activated vitamin D if what we believed we knew about the kidneys' production of activated vitamin D was true. There was apparently a connection between sun exposure and cellular and organ health. But our limited understanding of how activated vitamin D is produced prevented us from making the claim that one was responsible for the other.

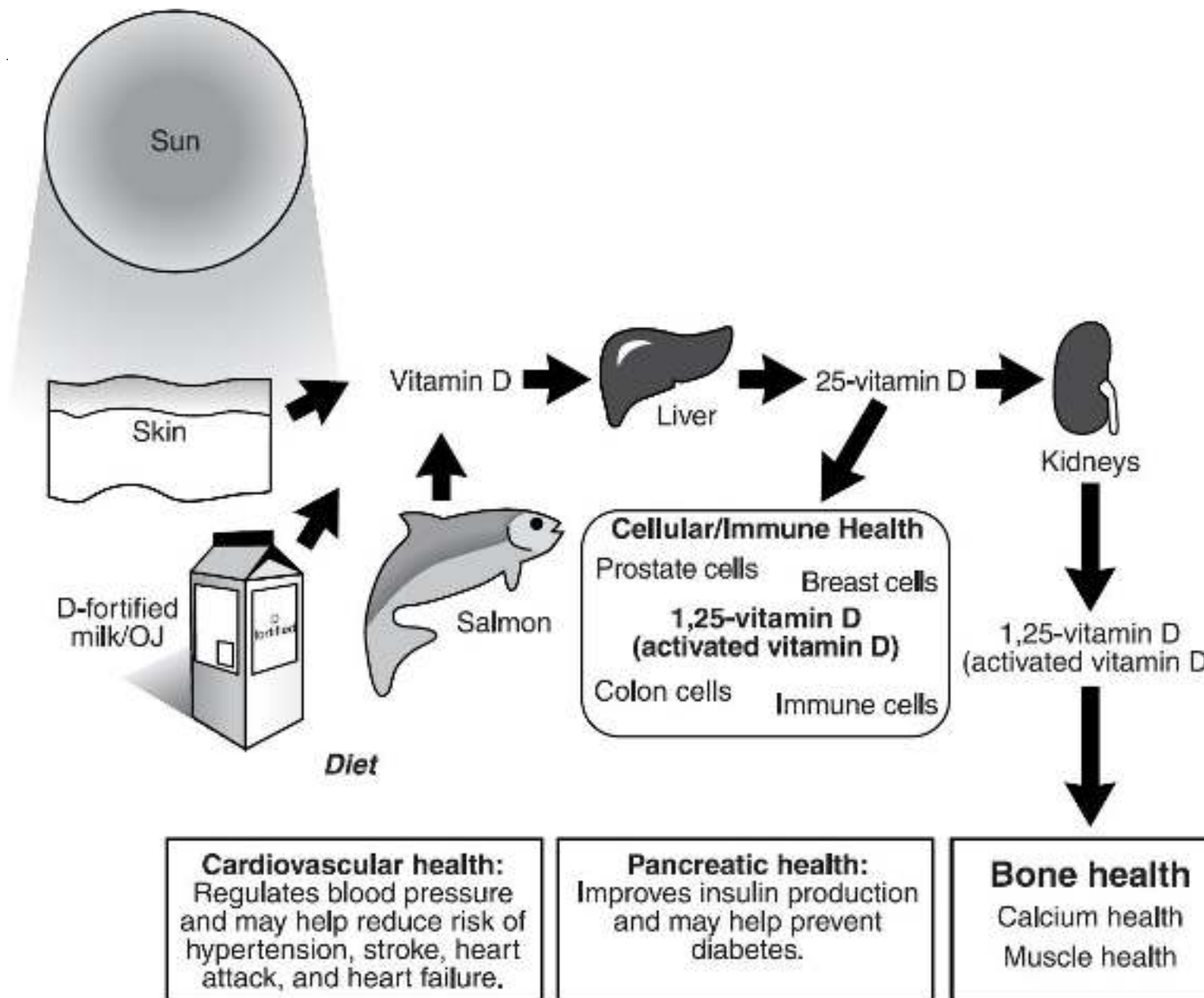
All the while, we were teetering on the verge of a breakthrough in our understanding of the relationship between sunlight and cellular health. Finally, it happened. What my colleagues and I discovered in studies at the Vitamin D, Skin, and Bone Research Laboratory at Boston University Medical Center was that humans have the ability to make activated vitamin D throughout the body.

The process is extraordinary. Whereas once we thought that only the kidneys could activate vitamin D, we now understand that a variety of cells have this ability, including the breast, prostate, colon, brain, skin, and probably most other tissues and cells. When the 25-vitamin D reaches and enters these cells, it is converted into activated vitamin D. Unlike the kidneys, however, which make activated vitamin D from 25-vitamin D and send it out through the bloodstream to the intestine and bones, in these cells 25-vitamin D is converted into activated vitamin D and used on the spot within the cell group (see [figure 1.3](#)). After it performs its important functions in the cell, the activated vitamin D extinguishes itself (that way it cannot leave the cell and enter the bloodstream to create a harmful form of vitamin D toxicity). Because this vitamin D activation process begins and ends within the cell, there is no evidence of increased activated vitamin D in the bloodstream, not even when more activated vitamin D is being made by these cells. It is for this reason that scientists had difficulty making a connection between sun exposure and vitamin D.

## Could You Be Vitamin D Deficient?

You may be deficient in this vital vitamin if you:

- Rarely go out in the sun
- Always wear makeup and/or sunscreen on all exposed areas when outdoors
- Do not take a multivitamin
- Do not take a vitamin D supplement
- Do not eat a vitamin D-rich diet (oily fish, fish, liver, egg yolks, and so forth)
- Have dark skin and do not live near the equator
- Are older than 60 and live in a high latitude or deliberately avoid the sun



**Figure 1.3** *New understanding of how vitamin D benefits health.* Recent breakthrough discoveries have shown that vitamin D can be activated within a variety of cells, including those of the prostate, breast, and colon, where it prevents the unhealthy cell proliferation characteristic of cancer. This process is self-contained within these cells. After the cells use the activated vitamin D, it is extinguished.

This discovery is significant because we now know for sure that increasing vitamin D levels in our bloodstream via sun exposure, and to a lesser extent diet, will help lower the risk of several diseases—especially those caused by abnormal cell growth, such as cancer. We have also since discovered that our immune system has the ability to make activated vitamin D, meaning that sun exposure may have a role in preventing and treating autoimmune diseases such as multiple sclerosis, rheumatoid arthritis, and Type 1 diabetes.

My laboratory studies confirmed that activated vitamin D is an extremely potent substance that is one of the most effective inhibitors of abnormal cell growth. The discovery by my laboratory and other laboratories that cells throughout the body can activate vitamin D is a major breakthrough in vitamin D research. It is what's behind the emergent realization that—contrary to what we hear so often—the advantages of sun exposure far outweigh the potential negative consequences.

Add to this the growing body of research showing that sun exposure helps regulate circadian rhythms, thus preventing mood-related conditions such as seasonal affective

disorder, premenstrual tension, and depression (see [chapter 5](#)). Some of the most exciting work in this area was done by me and my colleagues here in Boston. For example, we recently confirmed something that scientists had discovered in the 1980s that had never been followed up on: It's not just the brain that makes the "feel good" substance beta endorphin. When exposed to ultraviolet radiation, skin also makes beta endorphins. This may explain why people often feel so good after spending time at the beach or even in a tanning bed.

## **Why the Elderly and People of African Descent Need to Be Especially Concerned**

The connections among sun exposure, vitamin D production, and disease prevention are important information for all of us, but they have special implications for two groups: older people and people of African descent. These two groups have a harder time making vitamin D than the rest of us.

**The Elderly** The older you get, the more difficult it is for your body to convert sun exposure into vitamin D. That means to maintain healthy levels of vitamin D in your body, you need more sun or you need to expose more skin area to sunlight. Unfortunately, older people are especially receptive to the alarmist warnings about excessive sun exposure. The elderly often decrease their sun exposure at a time when they need more of it to be healthy. Studies I have participated in have shown that well over half of Americans age 65 and older are vitamin D deficient. If you are a senior citizen, you need to be much more concerned about the risk of fracturing a hip because you are vitamin D deficient than the risk of getting wrinkles or skin cancer. Consider this alarming statistic: Approximately 300,000 hip fractures will occur in elderly men and women this year; 20 percent of those people will die within a year, and 50 percent will never regain mobility and have to move to a nursing home. For this population, the best advice is this: Get out in the sun! It's good for you.

**People of African Descent** People whose ancestors came from Africa and other countries near the equator have skin that evolved to be resistant to the sun's radiation. That this kind of skin is not efficient at converting the sun's radiation into vitamin D isn't an issue in Africa because there are unlimited amounts of sunshine on that continent. However, when people of African descent live in northern latitudes, they often become vitamin D deficient because their superprotective skin might not convert enough of the weaker, more limited amounts of sun into vitamin D. Studies I have participated in show that up to 80 percent of elderly African Americans are vitamin D deficient. What is remarkable is that the Centers for Disease Control has recently reported that 42 percent of African American women of childbearing age (15 to 49 years old) throughout the entire United States are vitamin D deficient by the end of winter. On average, 40 to 60 percent of African American adults are vitamin D deficient. African Americans are at increased risk of a variety of conditions associated with vitamin D deficiency, including cancer of the breast and prostate. Americans of African genetic lineage are also more likely to have forms of high blood pressure/hypertension and heart disease that are more resistant to drug treatment. Again, the best advice is simple—increase your exposure to sunlight.

## **Putting Sun Exposure into Perspective**

Sun is crucial to your overall physical and mental well-being. Depending on what kind of skin you have, where you live, and what time of year it is, you need sun exposure in varying amounts to maintain adequate levels of vitamin D. It is true that there are some drawbacks to excessive sun exposure, and I examine these in depth in later chapters of this book. However, as you will see, the drawbacks of sun exposure pale in comparison with the health benefits.

Let's put the pros and cons of sunlight into perspective with an analogy. Exercise is another example of something that has both benefits and drawbacks but that is, on the whole, good for you. Everyone knows that exercising is good. It prevents a variety of chronic illnesses and makes you look and feel better. But if you exercise too much, or if you have certain predisposing risk factors—flat feet or a faulty backhand—then you may develop overuse conditions such as Achilles tendonitis or lateral epicondylitis (“tennis elbow”). Every year, people die of heart attacks while running or lifting weights. Nevertheless, no self-respecting doctor would take the position that “exercise is unhealthy.” Most doctors will tell you to take certain precautions when exercising, but none would ever advise you not to be active.

The same goes for sun exposure. Sunlight is not “unhealthy.” Precautions do need to be taken, but a regular, moderate amount of unprotected sun exposure is absolutely necessary for good health—as you will come to discover as you turn the pages of this book.

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## CHAPTER TWO

# The Facts About Skin Cancer and Sunshine

## *Why the statement “sunlight causes cancer” is overstated, and how to harness the sun for health*

**F**EW WORDS STRIKE FEAR in our hearts more than “cancer.” Some people can’t even bear to utter the term and instead substitute the phrase “the ‘C’ word.” Fear of skin cancer is one of the main reasons for the hysteria over sun exposure. Thanks to how the cosmetic and pharmaceutical industries and some dermatologists have shaped people’s attitudes through the media, the belief is that “Cancer kills, and sunshine causes cancer, so I’m going to avoid sunshine.”

As is the case with so many supposed health axioms, the relationship between sunshine and cancer isn’t as straightforward as most people think. There are a number of myths associated with what causes skin cancer. Before I set the record straight about the link between sun exposure and skin cancer, let’s talk about the focus of all the attention—your skin.

## Introducing Your Skin

You know that joke children play on each other? One wiseacre says to an unsuspecting friend, “Hey, your epidermis is showing!” You may remember as a kid wondering, “What is he talking about? Can everyone see my underwear or something?” That little prank was many people’s introduction to their skin. As you discovered (to your great relief) when the joke was revealed, your epidermis is your skin, or, more accurately, the outer layer of your skin.

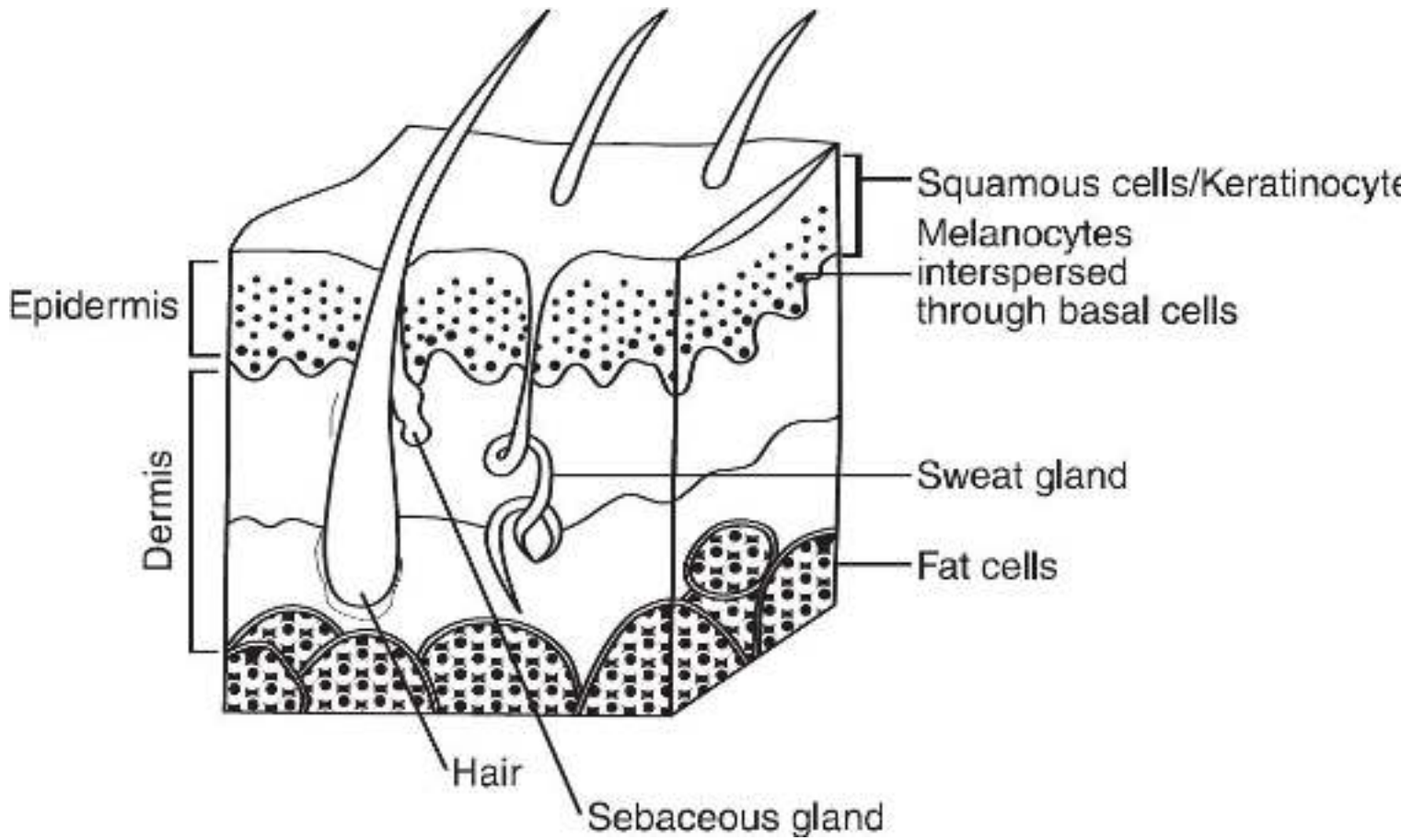
That everyone can see your skin is just one indication of how important it is. It is your body’s largest organ and weighs about six pounds. Skin provides a protective covering for your entire body and protects you from sunlight, heat and cold, infections, toxins, and injury. Other important functions of the skin are that it regulates body temperature and retains water. And, of course, your skin helps you convert sunshine into vitamin D.

Your skin has two layers, the outer *epidermis* and the inner *dermis*. These two layers are quite different (see [figure 2.1](#)).

The inner dermis layer contains blood vessels, lymph ducts, nerve fibers and nerve endings, hair follicles, and glands. The job of these glands is to produce sweat to keep you cool and to create an oily substance called *sebum* that helps prevent the skin from drying out. Sweat and sebum get to the skin’s surface through tiny holes called *pores*.

The outer epidermis is thinner than the dermis and is made up of *squamous* cells (also

known as keratinocytes). Beneath these squamous cells are fuller shaped cells called *basal cells*. Basal cells are constantly dividing and rise to the top of the epidermis where they are programmed to die and become the dead outer layer of our skin, known as the *stratum corneum*. Underneath and interspersed between the basal cells are *melanocytes*.



**Figure 2.1** A cross-section of your skin

Melanocytes produce *melanin*, a pigment that gives skin and hair its color. The more melanin in your skin, the darker it is. For example, people of African descent have more melanin in their skin than people of Norwegian descent. The importance of melanin is that it absorbs the ultraviolet radiation of the sun, thus protecting the skin cells against sunburn. Because dark-skinned people are “designed” to live in sunny regions, those with darker skin produce melanin all the time, whereas light-skinned people mainly produce melanin only in response to sun exposure. As you’re about to find out, however, everyone who produces melanin in their skin—which is everyone except very fair-skinned or freckled, red-haired persons—has a natural defense against the sun’s radiation.

## How Your Skin Tans ... and Burns

One of the most important jobs of the epidermis—especially for light-skinned people—is to adapt quickly to protect skin cells from the sun’s radiation. The defense mechanism the skin uses against sunburn is what we call “tanning,” which is an ingenious process. In response to sun exposure, the melanocytes produce melanin pigment that makes the skin darker. This protects the skin because melanin pigment absorbs UV radiation. Even short bursts of sun exposure will trigger the melanocytes to produce more melanin pigment.

Dark-skinned people do not have more melanocytes, but their melanocytes are more



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