

MARK SISSON

THE PRIMAL BLUEPRINT DEFINITIVE GUIDE TO

SUN

EXPOSURE AND VITAMIN D

HEALTH

How to increase energy, improve immune function,
and reduce cancer risk through optimal Vitamin D exposure

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SUN EXPOSURE & VITAMIN D HEALTH

Our genes are accustomed to an outdoor lifestyle that features plenty of sun exposure to facilitate optimal levels of vitamin D in the bloodstream. Vitamin D plays a critical role in healthy cell division, and deficiencies can increase cancer risk and disturb healthy hormone and immune function. Humans evolved at tropical latitudes, spending most of their days outdoors—hunting, gathering, relaxing, building shelter, and soaking up plenty of intense rays throughout the year. The migration to higher latitudes (with less sunlight and less vitamin D potential), coupled with the nutrient-deficient diets of civilization, presented a sudden and very serious health risk to humans.

Consequently, a remarkable and rapid genetic adaptation occurred: the lightening of skin pigment and hair color to afford enhanced sun absorption at higher latitudes. While most of us realize how the latitude of our ancestral heritage affects our racial characteristics today, it's instructive to consider that this lightening of pigment was truly a matter of life or death. We simply could not have survived our transition to a grain-based diet outside of African latitudes without this rapid genetic adaptation—one that occurred through the classic Darwinian process of mutation (random chance) and natural selection (the mutation favored reproduction process). That is, those with lighter skin were able to survive, thrive, and reproduce at higher latitudes.

I'd like for you to reflect on this human history lesson and realize that you still have high requirements for sun exposure and vitamin D production hardwired into your genes. Vitamin D insufficiency is one of the biggest and most health-compromising disconnects of modern life. Many of us lead indoor-dominant lifestyles, have an irrational fear of the sun due to unfounded concerns

about skin cancer risk, or live at a latitude highly incongruent with that of our ancestors.

While Primal Blueprint Law #7 - Get Adequate Sunlight, might be perceived as lightweight at first glance, it is truly still a matter of life or death for the many modern citizens who are deficient in sun exposure and vitamin D levels. This eBook details a strategy to help you reconnect with your genetic requirements for sun exposure in a safe and strategic manner.

Vitamin D deficiency due to lack of adequate sun exposure represents an extraordinarily serious, but minimally appreciated public health problem. A 2009 study published in the *Archives of Internal Medicine* revealed that 77 percent of Americans had insufficient vitamin D levels. Experts believe a similar deficiency rate exists in urban population centers across the globe, and is a strong contributing factor to the high rates of cancer and many other debilitating health problems that plague advanced society. While indoor-dominant lifestyles and sun-challenged population centers present significant logistical challenges to obtaining optimal amounts of sun exposure and vitamin

D levels, we are further handicapped by conventional wisdom's promotion of narrow, distorted viewpoints regarding sun exposure and skin cancer, and the misguided notion that diet alone can supply adequate vitamin D.



Bundle up in there! It's hot out!

Most of us have a general understanding that sunlight feels great on our skin and is good for our mood; that we shouldn't get too much of it or we'll get wrinkles and skin cancer; and that vitamin D is made mainly from sunlight and is important for

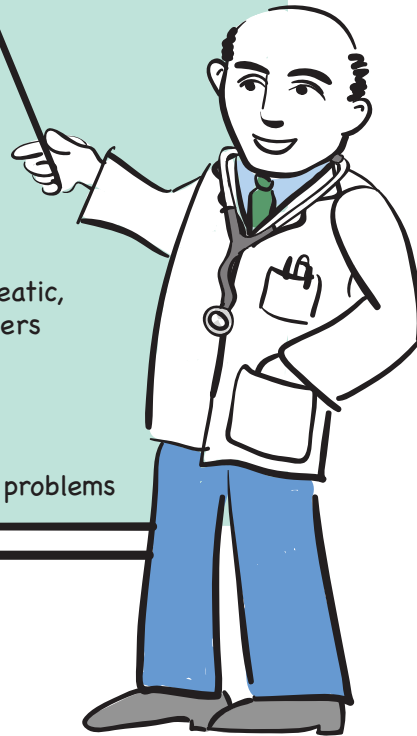
general health. Few are aware of how widespread vitamin D deficiency has become, how critical vitamin D is to general health, and how inconsequential diet is in comparison to sunlight when it comes to attaining adequate vitamin D.

Vitamin D assists with healthy metabolic, cardiac, immune, skeletal, and neurological function. It supports fertility and safe pregnancies, helps control inflammation, boosts immune function, supports mood and circadian rhythm health, improves fat metabolism, and helps prevent hypertension, strokes, heart attacks, dementia, clinical depression, multiple sclerosis, high blood pressure, colorectal, ovarian, pancreatic, prostate and breast cancers, diabetes, multiple sclerosis, autism, arthritis, and other serious health problems. Studies suggest that the common conditions of fibromyalgia and chronic fatigue syndrome (the causes of which are vague to medical experts), as well as a variety of non-specific muscular aches and pains for which emergency room treatment is sought, may be rooted in vitamin D deficiency.

Vitamin D regulates calcium levels in the body, a critical factor for bone density and a variety

Vitamin D Benefits

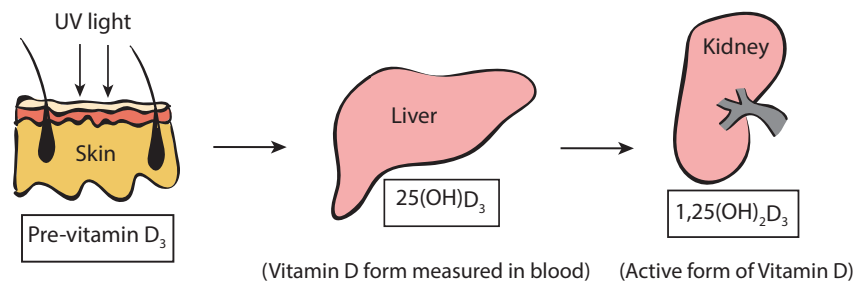
- Supports healthy:
 - Metabolic function
 - Immune function
 - Skeletal function
 - Neurological function
- Supports fertility
- Aids in safe pregnancies
- Helps control inflammation
- Boosts immune function
- Supports mood & circadian rhythm health
- Improves fat metabolism
- Enhances cell division
- Helps prevent:
 - Hypertension
 - Strokes
 - Heart attacks
 - Dementia
 - Clinical depression
 - Multiple sclerosis
 - High blood pressure
 - Colorectal, ovarian, pancreatic, prostate, and breast cancers
 - Diabetes
 - Multiple sclerosis
 - Autism
 - Arthritis
 - And other serious health problems



of other metabolic and neuromuscular activities. Declining bone health (due to depleted calcium) is one of the major elements of aging and demise, and can be easily combated with regular strength training and sun exposure. Recent studies have even suggested that higher levels of vitamin D can benefit athletes by improving fast-twitch muscle strength and power, increasing bone density, reducing inflammation, and boosting immune function.

People living in sunny climates have lower rates of cardiovascular disease and many forms of cancer, as well as lower blood pressure (vitamin D promotes relaxed, flexible blood vessels) commensurate with their proximity to the equator. Epidemiologists observing these trends have isolated sunlight as the key variable and ruled out extenuating lifestyle factors (diet, exercise, etc.) that might otherwise explain improved health and longevity.

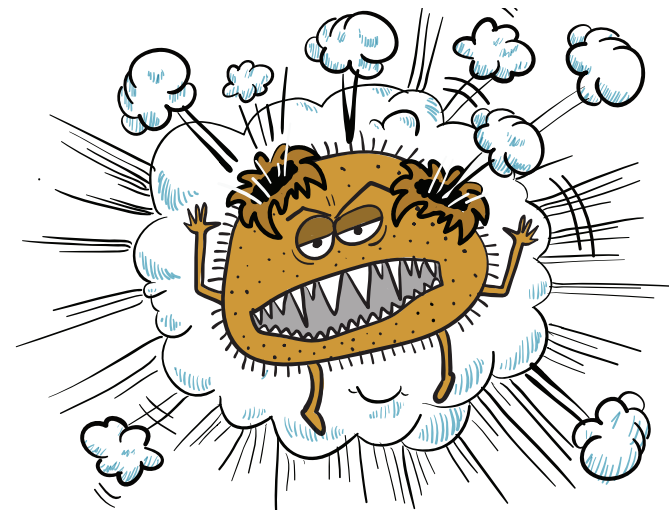
Vitamin D is not actually a vitamin but a hormone. It interacts with every cell and tissue in the body, influences numerous metabolic pathways, and acts upon more than 2,000 genes.



When sunlight hits your skin, vitamin D is manufactured by skin cells and then released into the bloodstream. Then, your liver creates a vitamin D metabolite called 25-vitamin D that enables all the cells in your body to activate vitamin D for their particular needs. It is for this reason that vitamin D offers such wide-ranging health benefits and disease protection. For example, vitamin D triggers genes in your skin to produce mood-elevating beta-endorphins, while vitamin D receptors in your brain help stimulate the production of serotonin, bolstering the influence of sunlight on circadian rhythm (your body's internal clock that monitors the 24-hour cycle of biological processes).

Vitamin D is important for cancer prevention because it helps regulate cell growth, particularly by acting on a gene known as P53 that is respon-

sible for hundreds of millions of daily cell replications. Vitamin D supports the process of *apoptosis*, whereby uncontrolled cell growth is snuffed out before the cells become malignant. Adequate vitamin D exposure throughout life offers tremendous cancer protection, but periods of deficiency can be disastrous because unhealthy cell division goes unchecked.



Vanquish cancer cells with vitamin D

VITAMIN D HISTORY

Vitamin D synthesis emerged as a central component of evolution 350 million years ago, when vertebrates first left the water for land. Out of the calcium-rich sea, early land creatures relied

on vitamin D produced from sunlight to maintain healthy mineralized skeletons. Thanks in significant part to vitamin D, these creatures proliferated and became more complex. Evolutionary biologists report that vitamin D's ability to boost immune function and destroy invading organisms has been conserved in the genome of all primates for over 60 million years.



Early vertebrates needed sun to evolve

The first modern humans to take shape in Africa between 200,000 and 100,000 years ago were representative of a couple million years spent in the equatorial sun, and displayed the skin, hair, and other attributes similar to those of equatorial African descent today. Sixty thousand years ago,

modern humans first left Africa to colonize areas farther and farther away from the equator. Many experts believe that our ancestors' skin remained dark for tens of thousands of years because the hunter-gatherer diet was so rich in vitamin D. This neutralized potential selection pressure for sunlight absorption.

Somewhere in the last 6,000-10,000 years a remarkable genetic adaptation occurred—the lightening of skin pigment and hair to allow for increased vitamin D absorption from sunlight. The timeline suggests that the activation of genes to lighten skin pigment was driven primarily by the transition from a hunter-gatherer diet to an agriculture-based diet, and further compounded by the diminished levels of sunlight at various latitudes. All had been well in Europe and other northern latitudes for tens of thousands of years, even among those with dark skin, until all of a sudden (in the evolutionary timeline) we removed vitamin D from the diet and saw within the human race an explosion of pigment diversity that became well-aligned (for the most part) with latitude.

This extremely rare and rapid adaptation in the model of mutation and natural selection is not a trivial matter. As humans colonized the globe, those who were unable to eat or manufacture sufficient vitamin D perished. *Note:* When humans ventured into extremely high latitudes, such as beyond the 60th parallel (Scandinavia, Alaska, etc.), where vitamin D production from sunlight is impossible, survival was only afforded via the heavy intake of oily, coldwater fish that shored up sun exposure deficiencies in vitamin D.



Skin pigment affects the rate of vitamin D synthesis. Those with darker skin need more time outside—especially if they live at higher latitudes

Today, our widespread vitamin D deficiency occurs mainly because many of us spend far less time outdoors absorbing sunlight than our hunter-gatherer ancestors did, and/or we live at latitude in discord with our skin pigment. The following three tips will help you enjoy all the health-enhancing, cancer-preventing benefits of

vitamin D, while minimizing your risk of cancer and sun damage to your skin.

1. Understand the Big Picture: Get the scoop on widespread vitamin D deficiency, exaggerated cancer risks, sunscreen drawbacks, and daily requirements.

2. Get Adequate Sunlight: Calculate your optimal sun exposure times, prevent burning, and protect sensitive skin.

3. Eat and Supplement Wisely:

Enjoy vitamin-D-rich foods, avoid foods that interfere with vitamin D production, and supplement with vitamin D during the winter months and/or when other lifestyle challenges are present.

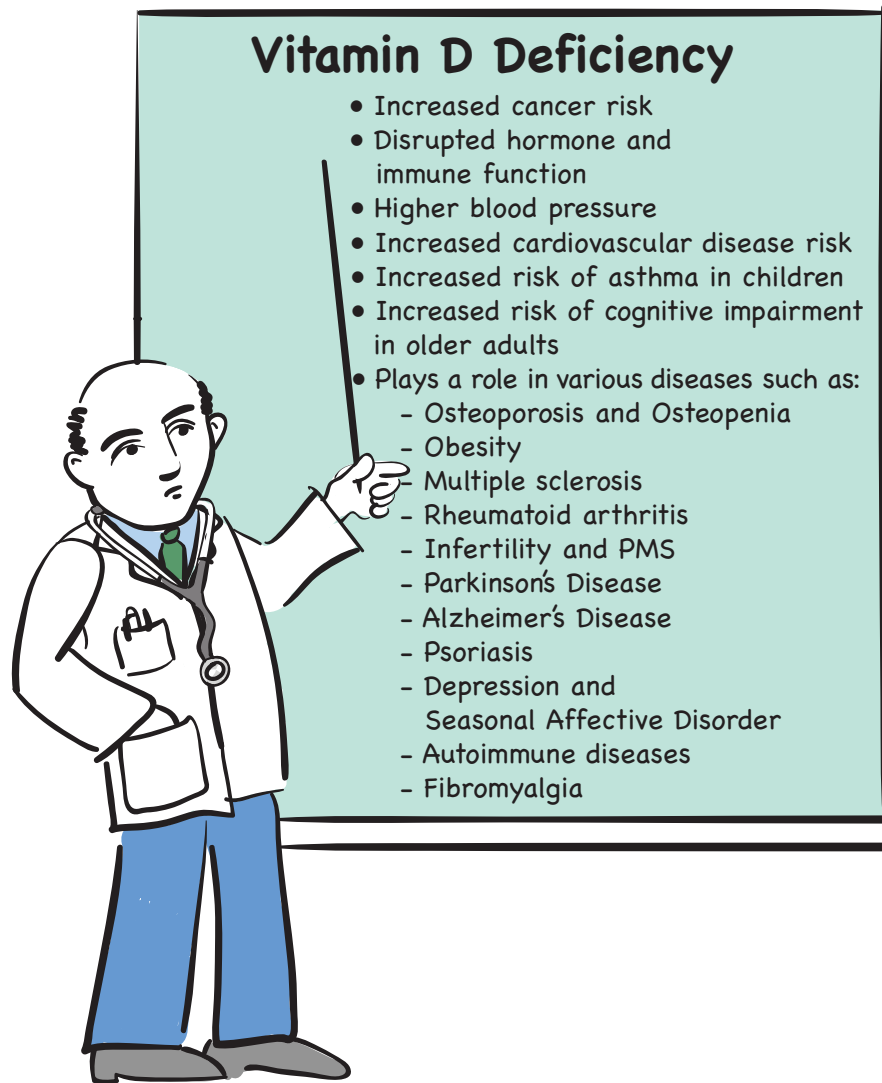
UNDERSTAND THE BIG PICTURE

Before we delve into a detailed strategy to safely and strategically increase your vitamin D levels, I want to present some important information about vitamin D deficiency, cancer risk, sun-screen, and recommended daily intake in hopes that you'll appreciate the true and complete story, and keep conventional wisdom's scare tactics about sun exposure in proper perspective.



Vitamin D Deficiency: Dr. Michael Holick, author of *The Vitamin D Solution*, one of the world's leading vitamin D experts, and the first person to isolate and identify the circulating form of vitamin D in the body, cites estimates that 50,000-70,000 Amer-

icans die prematurely each year from conditions related to insufficient sun exposure. University of California researchers believe that over 600,000 cases of colon and breast cancer worldwide can be prevented annually simply through increased vitamin D intake. Recent studies suggest that vitamin D deficiency may be at the root of many health complaints and misdiagnoses, including persistent and generalized joint and muscle pain that is often labeled as depression, fibromyalgia, chronic fatigue syndrome, or hypochondria.



The highly respected Nurses Health Study (tracking the health habits of 127,000 nurses over two decades—the largest epidemiological study of women in history) revealed that the risk of breast cancer, the most deadly female cancer, drops dramatically when vitamin D levels are adequate, and that raising vitamin D levels into optimal range can prevent up to half of all breast and two-thirds of all colorectal cancers in the United States.

Still more evidence comes from the disturbing statistics among those of African descent, who need to spend up to 10 times longer in the sun to match the vitamin D levels of their fair-skinned

counterparts. This poses a serious complication for those living outside tropical latitudes. Consequently, African American males have an 89 percent greater risk of cancer mortality than do white men, and have particularly high rates of digestive tract cancers (colon, rectum, mouth, esophagus, stomach, and pancreas), all of which are strongly associated with vitamin D deficiency.

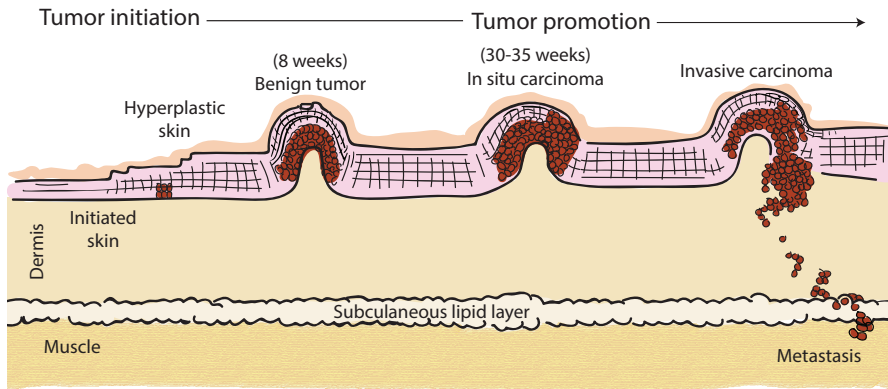
Perhaps most shocking is the very real probability that you and your family could quite possibly be deficient in vitamin D, even though you may lead an active, outdoor lifestyle, enjoy a sunny summertime climate, and eat a vitamin D-rich diet (oily fish, supplements, fortified foods, etc.). If you are subjected to the typical sedentary forces of modern life (commutes, indoor work environment, lots of digital entertainment at home, etc.), and heed conventional wisdom's recommendations for sunscreen use (namely, lather up obsessively every time you venture outdoors), you can easily become deficient in vitamin D, elevating your risk for serious disease, compromising your ability to lose weight or build fitness, and even challenging your maintenance of a sunny disposition—pardon the pun!

Cancer Risks Exaggerated: As Dr. Holick mentions in *The Vitamin D Solution*, there is absolutely no scientific evidence linking regular, moderate sun exposure (getting tan, but not pink or red) to



*Practice safe sun. There's no need for the oil.
Those rays will find you!*

any form of skin cancer. It is only *excessive* sun exposure that presents a skin cancer risk. For example, the accumulation of many years of routine exposure of face, neck, and other sensitive areas can cause carcinomas (the less serious forms of skin cancer), while serious sunburns are a major risk factor for the most dangerous form of skin cancer known as melanoma.



Even a couple serious burns before age 18 (young skin is particularly vulnerable to damage from sunburn) is enough to elevate your risk of melanoma in future years. Isolated sunburn episodes can permanently damage the pigment-producing cells known as melanocytes located between the dermis and the epidermis. If these melanocytes become cancerous and are not treated in a timely manner, they can easily metastasize through the bloodstream and lymph system to other organs.

It should be noted that sunburn is only one of several melanoma risk factors. Others include becoming vitamin D deficient from *insufficient* sun exposure, eating the Standard American

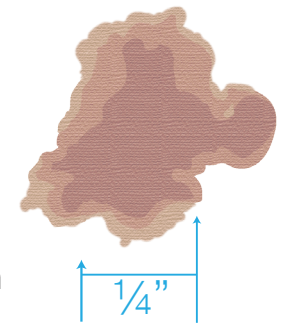
(nutrient-deficient, pro-inflammatory) Diet, and possessing a fair-skinned, heavily-moled complexion. In fact, melanoma rates are much higher in North America and Europe than at equatorial latitudes, in people lacking sun exposure, and on parts of the body that receive little or no sun exposure. You can manage your melanoma risk by examining your skin regularly for growths characterized by the following “ABCD” acronym:

Assymetrical shape

Border irregularity

Color that varies on the growth

Diameter that is larger than a quarter-inch



The least serious and most common form of skin cancer is called *basal cell carcinoma*. This type of cancer typically appears in fair-skinned people on sensitive areas of the skin that are routinely exposed to sun and have a tendency to burn, such as the face, neck, upper back, arms, and hands.



Examples of basal cell carcinoma

Basal cell carcinomas appear as skin bumps that are raised and irregular in shape or color, and can expand in size, crust, or bleed. Nodular basal cell carcinomas are flesh-colored and translucent. Pigmented basal cell carcinomas are dark in color and sometimes confused with melanoma. Superficial basal cell carcinomas are red and often mistaken for psoriasis or eczema. Basal cell carcinomas rarely spread and are easily treated by excision or laser/radiation removal.

Squamous cell carcinomas are the second most common form of skin cancer. They are also found on sensitive, sun-damaged skin, particularly among fair-skinned people. Squamous cell

carcinomas are more varied in appearance and locale on the body. They are of greater concern than basal because the more severe cases can metastasize if they are not treated. Squamous cell carcinomas commonly appear as red, scaly, crusty, and wart-like, and can grow quickly. These cancers are treated by burning, freezing, radiating, or surgical removal.



Example of squamous cell carcinoma

In your efforts to protect against skin cancer, it's certainly advisable to screen sensitive areas commonly exposed to sunlight and at risk of excess exposure, such as your face, neck, and hands. However, you must not fail to obtain the minimum amount of sun exposure on large skin surface areas that will guarantee healthy vitamin D

levels and also help your hormones and sleep cycles align optimally with your circadian rhythm.

Sunscreen Drawbacks: It's important to understand the differences between UVA and UVB—the two classifications of ultraviolet radiation that reach earth—with respect to sunscreen use, cancer risks, and vitamin D health. UVA rays, the far more abundant yet less energized form of radiation, penetrate to the lower layers of the epidermis, where they trigger cells called melanocytes to produce a substance called melanin that causes tanning. UVA rays are considered more dangerous because their deep penetration can damage skin pigment cells and lead to wrinkling, free radical production, compromised immune function, and the formation of melanomas. Furthermore, UVA risks and damage are difficult to monitor because there is no immediate evidence or deterrent in the form of sunburn.

UVB rays comprise only five percent of the radiation that reaches earth and are less penetrating, but are the only form of radiation that triggers vitamin D production in the skin. Excessive exposure to UVB radiation causes your skin to burn

and redden, and thus also increases melanoma risk. Even if burning does not occur, long-term excessive exposure to UVB radiation is a major factor in non-melanoma skin cancers.

Unfortunately, until recently most sunscreens blocked only UVB radiation. These products effectively prevented sunburns according to their SPF ratings, but have also significantly contributed to vitamin D deficiency and increased cancer rates over the past several decades. With the best natural deterrent to excess sun exposure (sunburn) neutralized by sunscreen, people have been spending excessive time unprotected from UVA rays and getting none of the vitamin D benefits from sunshine! Today, high quality “broad spectrum” sunscreens block both UVA and UVB rays, but their widespread use is still a major factor in the vitamin D deficiency epidemic.

Preventing sun damage from excessive long-term sun exposure is the major reason for the sunscreen obsession promoted by conventional wisdom. Sunburn prevention is a sensible goal, and full-spectrum sunscreen can be a valuable tool to keep you safe. However, ignoring the im-

portance of adequate sun exposure in the process is one of the biggest health mistakes you could ever make. It's absolutely shocking how poorly we do at achieving such a simple health requirement, a shortfall I believe is largely due to medical and "skinceutical" industry authorities constantly warning us to stay out of the sun or to use heavy sunscreens. Did you know that the application of an SPF 8 sunscreen compromises vitamin D production by 90 percent, while an SPF 30 blocks 99 percent of vitamin D production?

The good news here is that you can adopt a strategy to protect your sensitive areas from overexposure with good sunscreen, hats, and clothing; at the same time, you can obtain significant sun exposure on the large skin surface areas of your body that make the most vitamin D and are at the least risk of overexposure compared to the relatively small skin surface areas like your face, for example.

The basal and squamous cell carcinoma growths that arise in fair-to-medium-skinned people after decades of sun exposure are certainly no fun, but it's important to realize that these conditions are

easily treated. Furthermore, Dr. Holick asserts in *The Vitamin D Solution* that for every skin cancer attributed to excessive sun exposure, there are 55 cancers attributed to insufficient sunlight. I'm not suggesting you err on the high side and become a golden brown sun god or goddess without sufficient concern for your skin health, but when you see how easy it is to maintain healthy vitamin D levels, there really is no excuse for anyone to fear the sun and risk becoming vitamin D deficient.

How Much Do You Need?: Vitamin D scientists cite the evolutionary model in suggesting that we obtain an average of 4,000 international units (I.U.) of vitamin D each day. This approximates the amount of vitamin D manufactured by our ancestors who led outdoor lifestyles at equatorial latitudes. This level of daily production will ensure that your vitamin D blood values fall within the optimum range. For reference, experts estimate that the Standard American Diet provides only about 300 I.U. of vitamin D each day.

While the US Recommended Daily Allowance for vitamin D stands at a paltry 200 I.U., numerous health authorities have revised their recommen-

dations upward in the face of recent vitamin D research. The US government's Institute of Medicine Food and Nutrition Board nearly quadrupled its recommended intake from 200 I.U. per day (issued in 1997) to 700 I.U. daily for most adults (800 I.U. for elderly); in 2008, the American Academy of Pediatrics doubled its recommended intake from 200 I.U. (issued in 2003) to 400 I.U. daily from the beginning of life through the teenage years. However, experts such as Dr. Holick, Dr. Erin Michos of Johns Hopkins Medical School's Heart and Vascular Institute (who authored a 2010 study suggesting vitamin D deficiency increases stroke risk), and Dr. Ghada El-Haff Fuleihan of American University Medical School in Beirut (who led a study suggesting children and teens can benefit from 2,000 I.U. per day—10 times the US RDA—due to the demands of rapid skeletal growth) believe this recommendation still falls woefully short of ideal intake.

As you can see, there is significant dispute in the medical and scientific communities as to how much vitamin D we need. In 2010, the Institute of Medicine convened an expert panel to assess vitamin D deficiency. The panel was not convinced

that a link between vitamin D and the aforementioned health conditions exists, and determined that a 600 I.U. daily intake was adequate. Consequently, the board didn't even consider sun exposure in their evaluations, since one can easily obtain 600 I.U. from diet. This approach fits nicely with the dermatologist's mantra that even a little direct sun exposure is unnecessary and should be avoided.



"But Doc, I love to hike and enjoy the beach."

"That's fine, but wear long sleeves, pants, a hat, gloves, and a ski mask!"

The panel also cited evidence that excessive dietary intake can lead to assorted health problems, including kidney damage. While this is true, vitamin D toxicity is so rare that it could almost be considered an impossible consequence under normal circumstances. Documented cases are typically caused by ingesting supplements or foods that are grossly over fortified due to botched production. While we know that it's possible to get too much sun and burn to a crisp, it's actually impossible to develop toxic vitamin D levels from sun exposure because your skin destroys excess vitamin D before it can enter your bloodstream.

“My recommendation is very simple,” Dr. Holick says in response to the controversy over vitamin D guidelines. “I don't see any downside to increasing your vitamin D intake.” Since there is no conclusive evidence that increasing vitamin D intake is harmful, and plenty of respected studies suggest that vitamin D deficiency is a serious problem, I believe conventional wisdom has reconciled irrational fears of sun exposure by offering minimal vitamin D recommendations, instead of appreciating the bigger picture of vitamin D

health and the safe, sensible sun exposure that entails. When it comes to reducing health risks, I always like to err on the safe side. In this case, the safe side—for most everyone—involves getting more sunlight!

Consider testing your vitamin D blood levels to determine where you stand today. Be sure to get the most relevant and accurate test, which is for the circulating form of vitamin D known as 25-hydroxyvitamin D. It may also be called “25-vitamin D” or “serum 25(OH)D.” The best time to get this test is early fall, when your vitamin D levels are at their highest after a summer of (hopefully) adequate sun exposure.

Thanks to the burgeoning business of direct-order blood tests, you can utilize an online resource such as [DirectLabs.com](https://www.DirectLabs.com) to order all kinds of blood tests, including vitamin D, at a fraction of the price billed through traditional medical channels. DirectLabs.com is the same lab utilized by clients in the [Primal Advantage Metabolic Coaching Program](#). You simply visit [DirectLabs.com](https://www.DirectLabs.com) and order the test(s) or popular test packages that appeal to you. You can then search the website for the

closest blood draw lab to your home, proceed there with your paperwork, and have your blood drawn. A few days later, the results are posted and available to download at your private login at DirectLabs.com.

Ordering blood tests online eliminates the tedious and often expensive process of needing to visit a physician to obtain orders for blood work. The vitamin D test is available at DirectLabs.com ala carte for only \$44, but it's also a component of some very affordable and more comprehensive test packages, such as the DirectLabs Comprehensive Wellness Panel for \$129 with vitamin D inclusion.

Your vitamin D levels are represented in nanograms per milliliter (ng/ml). Dr. Holick comments on common values as follows: Under 20 ng/ml is deficient. Under 30 ng/ml is insufficient. The ideal range is 40-60 ng/ml, with anything under 100 ng/ml acceptable. A level over 150 ng/ml is considered toxic, and virtually impossible to get through sun exposure and sensible eating, as mentioned previously.



Add some primal play to your sun sessions!

If you have even the slightest sense that you might not be getting the routine and ample sun exposure you need during the months of peak solar intensity at your latitude, get your vitamin D tested to see where you stand, and be prepared to take action accordingly.

GET ADEQUATE SUNLIGHT

A sensible approach to sun exposure involves minimizing your cancer risks while exposing large surface areas of your skin to sunlight as often as possible during the late spring, summer, and early fall months. Maintaining a slight in-season tan is a good general indicator (if you have fair

to medium skin pigment) that you are manufacturing enough vitamin D to keep optimal levels circulating in your blood year-round. On a more technical note than your tan line, vitamin D advocates believe that if you produce or ingest a total of 4,000 I.U. of vitamin D per day you will land in the optimal range. Since numerous variables (which we'll discuss shortly) challenge your ability to manufacture vitamin D from sunlight year-round, it's encouraging to know that vitamin D can be stored in your fat cells for later use. This is a critical evolutionary adaptation to preserve health during the periods of the year when days are shorter and rays not as intense as they are in the summer months.



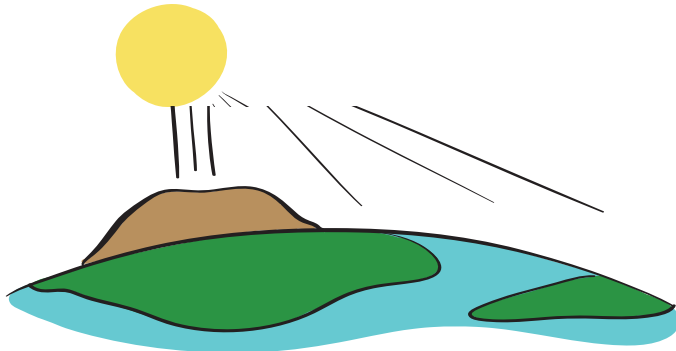
*Remember the ABCs of vitamin D. **Always** protect sensitive areas like your face, **Bare** large surface areas like your legs, **Control** the amount of time your skin is unprotected so you don't burn*

Adequate sun exposure does not mean sunburn. For the rest of your life, do whatever it takes to avoid sunburn: go inside, cover up with clothing and a hat, or use broad spectrum sunscreen to shield all ultraviolet radiation. If you feel your personal risk factors are considerable, protect your face and neck from sun exposure routinely or even obsessively if you are inclined! Your face and neck are far more likely than your belly button to become wrinkled and damaged by overexposure in the course of an active, outdoor lifestyle. Since your face and neck only represent around nine percent of your total skin surface area, they are inconsequential to your vitamin D health. It's also advisable to routinely protect your eyes with high quality UV-protection sunglasses, particularly if you have light-colored eyes.

I don't believe that you need to be obsessive about sun exposure calculations, but it's helpful to have a solid understanding of all the variables that affect solar intensity and vitamin D production, and proceed in a strategic manner to obtain as much sun as possible without increasing your risk of skin cancer. Technically speaking, ultraviolet radiation must be of an intensity greater than

three on the UV index for your skin to make vitamin D. Following are some of the major variables that affect solar intensity.

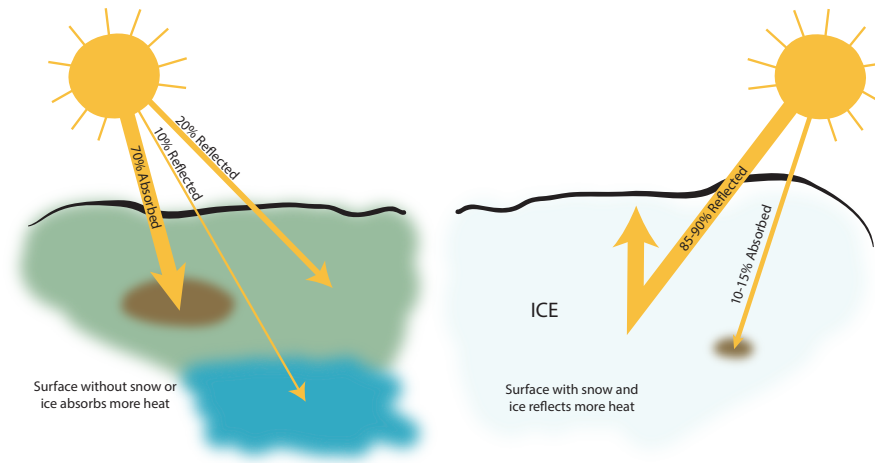
Altitude: The higher the altitude, the more intense the UV rays, and the more accelerated the vitamin D. Sunlight has less atmosphere to penetrate at high altitudes, producing more intense ultraviolet radiation and easier vitamin D production.



The higher the altitude, the stronger the sun

Ground Surface: Radiant surfaces reflect a large percentage of ultraviolet light hitting the earth, thereby increasing the intensity of your exposure. *Albedo* is a value that indicates how strongly something reflects light, measured on a scale of 0-1. While approximately 30 percent of all ultraviolet radiation reaching earth is reflected, a

particularly bright surface such as fresh snow reflects up to 90 percent of UV radiation, giving it an albedo value of .9. Concrete (.55) and sand (.4) also have high albedo values. Grass (.25) and bare soil (.17) have lower values.

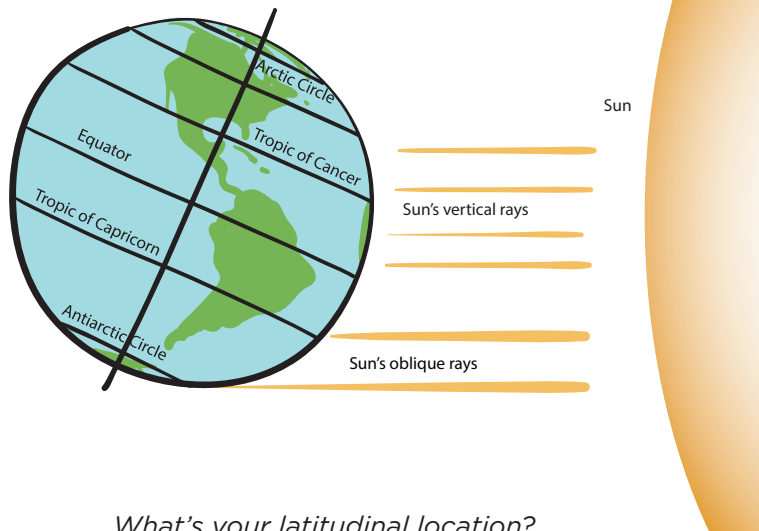


The more reflective the surface, the more vitamin D is absorbed

Latitude/Time of Year: The closer you are to the equator, the easier it is to manufacture vitamin D. In the tropics (0-23.5 degrees latitude), vitamin D synthesis is possible year-round because the sun's rays strike the earth at a consistently high intensity throughout the year. In the polar regions, (above 66.5 degrees latitude), the angle of the UVB rays hitting the earth is too oblique to ever support vitamin D synthesis. Someone

living in New York City (40 degrees latitude) or Portland, Oregon (45 degrees latitude) can make vitamin D for approximately eight months out of the year, while someone living farther north at 53 degrees latitude (e.g., Manchester, England; Hamburg, Germany; or Edmonton, Canada) can only make vitamin D for five months out of the year.

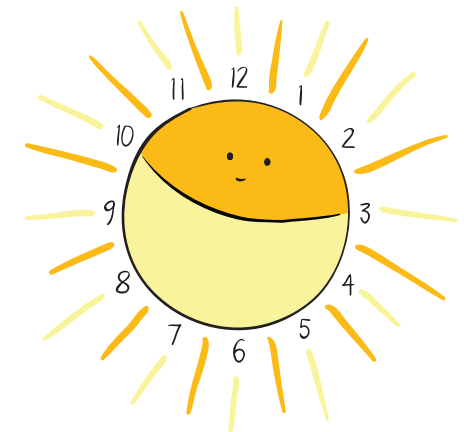
This diagram represents the June condition, when solar radiation strikes the surface perpendicularly on the Tropic of Cancer, creating summer conditions in the Northern Hemisphere. In the Southern Hemisphere, the sun's rays are more oblique and spread over larger areas, thus receiving less energy per unit of area, making it winter in this hemisphere.



Skin Pigment: The lighter your skin, the more sunlight you absorb. Your body produces a substance called *melanin* that darkens skin to protect it from excess solar radiation. Those of African

descent manufacture high levels of melanin at all times due to their genetics. Those of lighter skin tones manufacture melanin with more variation in accordance with daily and accumulated seasonal sun exposure. Those with red hair and extremely fair skin have difficulty manufacturing any melanin. People with lighter skin can manufacture vitamin D more efficiently, but also burn faster.

Time of Day: There's a five-hour window for peak vitamin D production. Even at the equator, the early morning and late afternoon sun is not intense enough to support vitamin D production, so the vitamin D window of opportunity is between 10 a.m. and 3 p.m. on any given day, at the appropriate time of year depending on your latitude.



Set your circadian rhythm to sun time

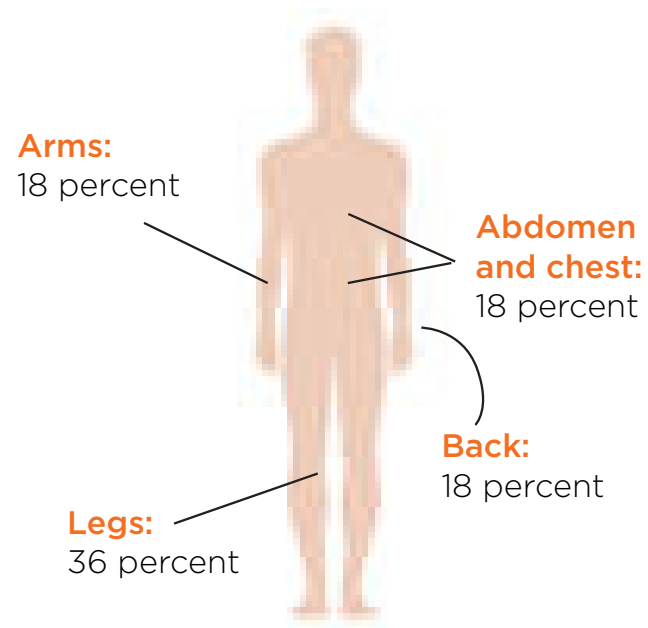
Weather/Atmospheric Pollution: Cloud cover and ozone pollution hamper vitamin D production by diffusing the intensity of UV rays. In the South-

ern Hemisphere, ozone pollution is minimal compared to that of the far more populous Northern Hemisphere. Hence, people in Australia, New Zealand, South America, and South Africa make vitamin D easier than their northern counterparts at an equivalent distance from the equator. It's common on television news programs in Australia and New Zealand for commentators to recite a daily "burn time" based on solar intensity calculations, since sun exposure is so intense Down Under.

So, how to enjoy optimal vitamin D levels without increasing your risk of skin cancer? According to Dr. Holick, the starting point is to estimate how much sun exposure time it would take for you to sustain a very slight "pinkish" sunburn. This pinkish hue typically registers 24 hours after sun exposure. You could also measure this skin state by your ability to make a white stripe mark with your fingers across your darkened skin. While this time calculation is obviously just an estimate, and you certainly don't need to "take one for the team" with a stopwatch in hand to get an absolute value, I think you can do a pretty good job evaluating current solar conditions and estimating your burn time.

Showing pink (i.e., slightly burned) skin a day after sunbathing represents a "minimal erythemal dose" of sun exposure, or 1 MED. Once you estimate your 1 MED time, Dr. Holick recommends spending 25 to 50 percent of that time exposing 25 to 50 percent of your total skin surface to direct sunlight. You can see now how just getting out into the sun for a bit of color whenever you can (being careful to stop well short of burning) is a winning formula—no need to sweat any details!

When it comes to calculating your total skin surface, Dr. Holick provides the following estimates:



Obviously, the aforementioned solar intensity variables significantly affect how much sun exposure is required for 1 MED on any particular day. In *The Vitamin D Solution*, Dr. Holick presents several pages of spreadsheet charts to help you accurately estimate your ideal sun exposure time by cross-referencing all the variables. You can also visit the following web site, which allows you to input many of the main variables to determine your recommended exposure time: http://nadir.nilu.no/~olaeng/fastrt/VitD-ez_quartMED.html

Let's break down some examples. A fair-skinned person frolicking on the beach (.4 albedo) in Brisbane, Australia (latitude 27, intense Southern Hemisphere UV radiation) in the summer (average UV index = 12) may obtain 1 MED in just 10 minutes. A person of medium skin pigment playing on a grass field (.25 albedo) in New York City (latitude 40, more air pollution) in the fall (average UV index = 4) might not burn even after a couple hours of direct sunlight exposure.

According to Dr. Holick and other vitamin D experts, sessions of 25 to 50 percent of 1 MED time with 25-50 percent of skin exposed two to three

times per week during the vitamin D activation months will ensure healthy vitamin D levels year-round. A single session will enable your body to manufacture an estimated 2,000 to 4,000 I.U. of vitamin D. Because skin-manufactured vitamin D lasts twice as long as ingested vitamin D, even a single brief sunbathing episode delivers the equivalent of a massive amount of ingested vitamin D.

MARK'S SUN APPROACH

I believe Dr. Holick's recommendation of 25 to 50 percent of 1 MED time for 25 to 50 percent of skin surface two to three times per week with UV rays at an intensity of three or greater is sensible, but perhaps leaning a little conservative. These exposure periods will steer you well clear of any burning risk while allowing you to make enough vitamin D to maintain an optimal range of 40-60 ng/ml in your blood year-round—perhaps with some supplementation necessary in the winter.

Since avoiding burning is a pretty simple objective to achieve (and calculate for) I personally enjoy sun exposure sessions that are more lengthy and frequent than those suggested by Dr. Holick. In my estimation, these prolonged sessions help me pro-

duce 10,000 I.U. or more of vitamin D during a typical one- to three-hour outdoor outing of hiking in the mountains, relaxing/exercising at the beach, or playing Ultimate Frisbee at a park.

Being fair-skinned (blond hair, blue eyes, Scandinavian descent) and living at 34 degrees latitude in Malibu, CA, I can spend a couple hours exposing up to 90 percent, and at least 50 percent,



of my skin surface (shirt off until I have to cover up to prevent burning) without risking any burn, even during the summer between 10 a.m. and 3 p.m. However, I have lived an active, outdoor lifestyle at this latitude for decades, and my body produces a hefty amount of protective melanin in response to this lifestyle.

There is also some scientific and anecdotal evidence from the Primal Blueprint community that eating antioxidant-rich foods and eliminating pro-inflammatory foods from the diet can improve skin resistance to free radical damage and make you less susceptible to sunburn.

The most important message I'd like to impart is to get yourself out of the danger zone of insufficient sun exposure and inadequate vitamin D levels while at the same time avoiding any skin cancer risk. This requires only the perfunctory effort of exposing your arms and legs to some sun a few times per week during the warm months. All but the most sun-challenged folks should have no problems, and offer no excuses, for achieving the minimum sun exposure recommendations. For those who may struggle,

such as a person of African descent living in the USA (note the aforementioned cancer stats) or anyone living above the 45th parallel (Pacific Northwest, Great Lakes, Canada, most of Europe, all of Scandinavia), can supplement with vitamin D and also expose themselves to artificial ultraviolet light to account for their environmental challenges.

Beyond the vitamin D benefits gained from achieving the minimum sun exposure requirements, there are many positive health benefits that come from spending as much time as you can in the sun (taking appropriate measures to never burn your skin, of course).

The sedentary, high-tech influences of modern life are in conflict with our genetic proclivity to spend time outdoors roaming the earth and acquiring abundant daily physical exercise. I think the vast majority of modern citizens would agree (or at least benefit from, if they didn't agree!) that more sunlight, fresh air, open space, and physical activity would improve their health and well-being.

While a daily 30-minute gym workout produces many health and fitness benefits, an indoor exercise session falls well short of the intangible benefits of

outdoor workouts conducted in fresh air, sunlight, and open space. This is a great time to echo the familiar refrain of moms everywhere to “go outside and play.” Heed this advice for the rest of your life. Break free from all the confinements of the modern world—planes, trains, automobiles, homes, offices, even exercise gyms—and spend some time basking in the sun, breathing fresh air, challenging your body physically, and enjoying the comprehensive benefits of an active, outdoor lifestyle.

I would like you to view this goal of attaining adequate sun exposure in the same manner as you would a fitness goal, such as developing stronger muscles. It's dangerous and destructive to overdo it, and your body requires a strategic approach for best results. Notice and appreciate how your melanin production over the course of the year varies in concert with how much sun you are getting. Do your best to nurture the process by avoiding burning at all costs, achieving gradual transitions into the heavy exposure months, and shying away from long periods of insufficient sun exposure and minimal melanin production.

If you have valid skin cancer concerns or are otherwise experiencing a bit of resistance to the message at this point, let's be clear that avoiding the sun or using sunscreen heavily will greatly reduce your risk of non-melanoma skin cancers (which are generally minor and easily treated), but dramatically increase your risk of the aforementioned cancers and diseases, including melanoma. This projection is supported by data from the world's leading vitamin D scientists and physicians.

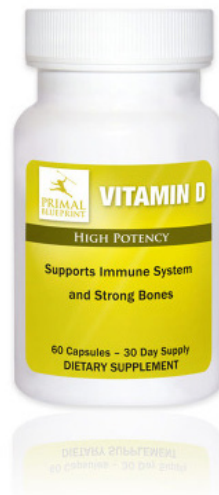
Based upon their narrow viewpoint of protecting your skin from damage caused by excessive ultraviolet radiation, dermatologists and sunscreen makers may be sleeping well at night advocating obsessive use of full-spectrum sunscreens and an avoidance of direct sun exposure. After all, these parties are not obligated to recognize the link between vitamin D deficiency and multiple sclerosis, depression, osteoporosis, and melanoma. That said, I greatly appreciate the development and widespread use of full-spectrum sunscreens, as well as the devoted efforts of dermatologists to prevent and treat skin cancer, rates of which continue to climb. In fact, in recent years I've had a few minor growths removed, as has my wife,

and we will continue to be vigilant about managing risk factors and seeking medical treatment when necessary. I urge you to adopt an open mind about the bigger picture of what the sun can do for you, instead of isolating the risks involved when you go overboard with sun exposure. Like all other health issues, moderation and sensibility are key.

EAT AND SUPPLEMENT WISELY

Compared to adequate sun exposure, dietary intake of vitamin D is not nearly as significant for health, as a quick glance at the forthcoming Vitamin D Doses sidebar will reveal. Experts estimate that we obtain at least 80 percent of our total vitamin D from sun exposure, with the rest coming from food and supplements. If you have trouble getting enough sun, or have any other vitamin D risk factors (those living at latitude in discord with their skin pigment/ancestral latitude, the obese, growing youth, and pregnant/lactating women all have greatly increased vitamin D requirements), eating vitamin D-rich foods, taking vitamin D supplements, and using artificial light can help bump your levels into the healthy range.

It's also imperative to avoid foods that interfere with nutrient absorption, such as grains. The phytates in grains bind with calcium and other important nutrients, compromising bone health and markedly increasing your demand for vitamin D (since vitamin D regulates calcium levels in the bloodstream). A blood test in the fall will give you an indication of how important your food choices and supplementation (from nutrition or artificial light) will be as you head into the winter months.



Even though I enjoy a relatively high level of sun exposure during the peak solar intensity months at 34 degrees latitude where I live, I supplement with a 2,000 I.U. vitamin D capsule each day during my low sun exposure months of November through February (I get another 400 I.U. of vitamin D with my daily multivitamin year-round). Dr. Holick recommends a similar level of supplementation, with some variation based on individual factors, as well as physician-prescribed mega-doses for those deficient or obese. The

fat-soluble nature of vitamin D means that taking a large dose once a week will offer the same benefit as a smaller daily dose, so if you aren't good at remembering to take your pills you can make up for a few skipped days easily. Furthermore, remember that large amounts of vitamin D synthesized from summer sun exposure will be dispersed into your bloodstream as needed over the winter months.

We can also include artificial light in our discussion of supplementation. Tanning beds have achieved a certain level of popularity for the health (and cosmetic) benefits they offer, as well as controversy for their potential dangers. While I strongly assert that nothing beats the actual sun and the great outdoors, tanning beds may help improve the health of those who have limited access to UVB radiation from direct sunlight. In fact, ultraviolet radiation is the same whether it's from solar or artificial sources. A quality modern tanning bed will emit both UVA and UVB radiation in a ratio that replicates natural sunlight, hence requiring the same precautions and burn prevention considerations.

Remember that sun-manufactured vitamin D lasts twice as long in the body as ingested forms, so you can effectively double the following values that are derived from the sun or an artificial light source for comparison against ingested sources. Oily, coldwater fish is the primal-approved food to focus on from the sidebar list, since this type of seafood also provides exceptional nutritional value in the form of omega-3 fatty acids.



If you are going to visit a tanning salon or use a tanning bed, be sure that the unit you are using is made with low or medium pressure lamps, as opposed to older models with high pressure lamps that emit only UVA radiation. Adopt a strategy of moderation; Dr. Holick suggests exposing yourself for only half of the manufacturer's recommendations. Be sure to completely shield your eyes and lips, and be particularly conservative about exposing your face.

Incandescent light bulbs do not stimulate vitamin D production. You must expose yourself to light that emits UVB radiation, such as the light emitted by a tanning bed. There is also a product called a Sperti Sunlamp that has a similar effect to a tanning bed and can trigger vitamin D production in only a few minutes of exposure to your skin.

I've mentioned briefly that obesity presents additional challenges to the goal of vitamin D health. When body fat levels are excessive, vitamin D stored in fat cells is not easy to mobilize and blood levels can become deficient, as can calcium levels, since vitamin D is key to regulating calcium. With vitamin D and calcium out of balance, fatty acid

enzyme levels can skyrocket five times above normal, promoting increased fat storage. Increasing vitamin D levels can accelerate fat loss by normalizing these fatty acid synthase levels.

Furthermore, increased sun exposure can be an effective weight loss tool because it regulates levels of the appetite suppressing hormone leptin (as does exercise), and improves bone density (relieving the joint and muscle pain that commonly hinder exercise efforts of the obese), muscle strength, recovery rate, energy levels, and mood, thereby facilitating a more active lifestyle. While moderating insulin production and getting adequate exercise are the major weight loss catalysts, basking in the sun has an important place in the big picture too. Unfortunately, obese people are typically disinclined to spend time in the sun with large surface areas of their skin exposed, exacerbating vitamin D-related health problems.

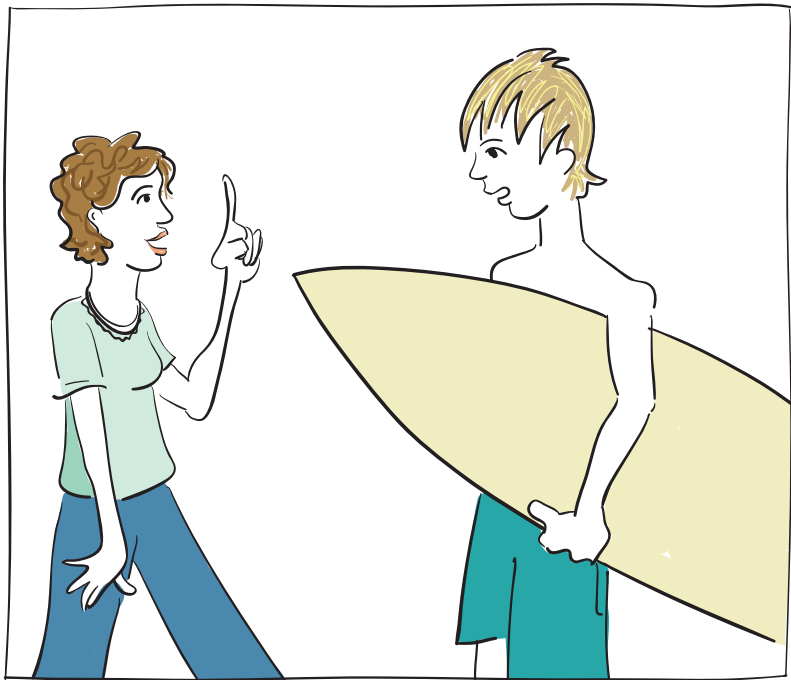
20,000 I.U.	<i>1 MED of sun (or artificial) exposure (UV index 3 or greater) in a bathing suit (60% + skin exposure)</i>
10,000 I.U.	<i>estimate from 20-40 minutes of sun (or artificial) exposure (UV index 5-10) for fair-skinned person with 60% + skin exposure (tanned but not burned)</i>
4,000 I.U.	<i>50% of 1 MED with 37% of skin exposure per Dr. Holick's recommendation</i>
1,360 I.U.	<i>1 tablespoon of cod liver oil</i>
1,000 I.U.	<i>typical size of a vitamin D supplement capsule or pill (can range from 400 I.U. to 2,000 I.U.)</i>
600-1,000 I.U.	<i>3.5 oz of wild-caught salmon</i>
400 I.U.	<i>3 oz sun-dried Shitake mushrooms</i>
200-300 I.U.	<i>3.5 oz of tuna, sardines, or mackerel</i>
300 I.U.	<i>Standard American Diet average daily intake</i>
100 I.U.	<i>8 oz of fortified milk, juice, infant formula, or yogurt. One serving of fortified bread or cereal</i>

(Based on levels providing a 200-calorie serving)

THE PRIMAL BLUEPRINT SUN EXPOSURE AND VITAMIN D HEALTH TIPS SUMMARY

1. Understand the Big Picture

Vitamin D deficiency is a serious but minimally appreciated public health problem. Conventional wisdom promotes avoiding the sun due to distorted fears about skin cancer. Skin cancer risks come from *excessive* exposure: isolated burning episodes (especially during your youth) and



“Wait, honey! Drink a glass of milk for your vitamin D.”

“Chillax, Mom. I get more D from my paddling session than from that glass of milk. Besides, I don’t want to get leaky gut like you and Dad.”

long-term routine exposure to sensitive areas in fair-skinned people. Insufficient sun exposure is a major risk factor for many cancers and health problems, including melanoma.

Suncreens prevent burning as intended, but also hinder vitamin D production. UVA rays penetrate deeply, causing tanning and, if exposure is excessive, wrinkling, free radical damage, compromised immune function, and melanoma. UVB rays produce vitamin D, but also cause burning and cancer risk from overexposure. Use only full-spectrum sunscreens, which block both UVA and UVB rays.

Vitamin D advocates believe 4,000 I.U. of vitamin D per day represents an ideal production level, modeled after our ancestors’ outdoor, equatorial lifestyles. However many government and health agencies recommend far less. Test your blood for 25-vitamin D levels, with the ideal range falling between 40 and 60 ng/ml.

2. Get Adequate Sunlight

Use Dr. Holick’s calculations off of 1 MED (burn) time, evaluating the relevant variables (altitude, ground surface albedo, latitude/time of year, skin

pigment, time of day, weather/atmospheric pollution) to safely expose large skin surface areas as often as possible to achieve healthy vitamin D levels. Strive to maintain a slight in-season tan and always prevent burning. Cover or screen areas most vulnerable to sun damage (face, neck) if fair-skinned.

3. Eat and Supplement Wisely

Sun exposure results in at least 80 percent of your vitamin D production. Oily, coldwater fish and nutritional supplements are the best dietary resources to boost levels. Grains should be avoided because they interfere with nutrient absorption and increase vitamin D and calcium requirements. Tanning beds and UV lamps can help boost vitamin D levels when sun challenged, but the same precautions should be taken against excessive exposure.

