

## 2 THE PHYSIOLOGY OF SKIN AND HAIR

To be effective, skin and hair care must have a sound basis in human physiology. This section is a detailed description of skin and hair, from its structure to specific aspects that relate to cosmetic care. You can study this information at any time, and re-read portions when you want to focus on a particular condition.

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### SKIN

#### *Skin Structure*

It's easy to think of skin as that part of our body that keeps the inside in and the outside out, a barrier. Skin is also a temperature regulator. But from a skin care perspective, it's far more important to understand that skin is an organ of the body whose primary job is elimination.

The skin reacts to external conditions such as heat, sunlight, and cosmetic preparations. But more importantly, it reacts to internal conditions: The skin is an eliminative organ—it is a means by which the body can eliminate that which it does not want. Skin secretes several different kinds of substances. It secretes metabolic waste materials and toxins (the result of poor diet, poor digestion, infection, illness, and pharmaceutical drugs) in order to remove them from the body. It secretes sweat in order to cool the body. And it secretes sebum in order to protect the skin itself. All of these effect the quality and texture of your skin, sometimes positively, sometimes negatively.

The skin is a two-way membrane: Material enters and exits through the skin.

Skin is composed of three general layers: epidermis, dermis, subcutaneous. The *epidermis* is the outer, non-sensitive, layer of skin which consists of four sub-layers\* which are progressively more compressed and horny as they approach the surface, many small nerve endings, and no blood vessels. Epidermal cells begin growing in the lowest layer as a result of cellular division and, as they mature, work their way up to the top layer, where they are sloughed off. The upper layer, called the *stratum corneum* “is composed of squamous plates or scales fused together to make the outer horny layer. These plates are the remains of the cells and contain a fibrous protein *keratin*. The most superficial layer sloughs off or ‘desquamates’.”<sup>29</sup> “It can take three to four months for cells to reach [the outer layer], and if you are treating your skin the results may not show for that length of time...”<sup>13</sup> New cells are produced at a slower rate as we age: the renewal cycle in young women is about two weeks, while for mature women it is about three weeks.

The *dermis* is composed of vascular tissue (containing blood vessels, lymph vessels, sweat glands, sebaceous glands, and hair follicles), muscle, and nerves. Sebaceous glands are especially abundant in the scalp and face, and on the face they are more abundant on the nose, cheeks, forehead, and chin than other areas.

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\* Gray's *Anatomy* states there are five sub-layers, but other sources claim four.

The *subcutaneous* or *hypodermis* layer is fatty tissue, also called adipose tissue, with a network of blood and lymph vessels. Its thickness varies with your age, sex, and general health. It gives smoothness and contour to your body, contains the fat needed for energy, and acts as a protective cushion for the outer skin, hair, and nails.

Sebaceous glands “are small, sacculated, glandular organs, lodged in the substance of the dermis.”<sup>29</sup> Each gland has a single duct which typically opens into a hair follicle, but also along “the free margin of the lips. On the nose and face the glands are of large size . . . and often become much enlarged from the accumulation of pent-up secretion.”<sup>29</sup> The eye area has fewer and smaller sebaceous glands than elsewhere on the face.

Sebum is produced in the sebaceous glands and secreted through the sebaceous ducts into the hair follicles, from which it ascends to the skin surface. The flow of sebum carries with it dead skin cells that flake off from the inside of the duct or follicle. The lipid composition of sebum analyzed by thin-layer chromatography was: ceramides (13%), fatty acid (47%), cholesterol (7%), cholesterol esters (2%), squalene (11%), triglycerides (3%), and wax esters (17%). The quality and the quantity of sebum is determined by the quality of the blood which in turn is determined by both the quality of the diet and the quality of the metabolism—how well the organs are working..

Sebum protects the skin by reducing the evaporation of water from the skin (dehydration) and blocking the penetration of excess water into the skin. Cholesterol in sebum also aids in the healing of the skin tissue and prevents foreign organisms from infecting the skin.<sup>5</sup> Environmental conditions, such as a cold dry wind and topical chemicals, can reduce sebum’s protectiveness. Typically, sebaceous glands are more active when we are young.

The lipid film present on the surface of the skin is composed of both sebum and the lipids of the epidermal cells.

Pores are the openings in the epidermis for the hair follicles. Pore size is related to sebaceous gland size. Pores enlarge to accommodate greater oil flow. Often acne clears up because the pores enlarge enough so that the sebum no longer gets stuck there.

Sweat glands are found throughout most of the skin. The gland consists of a single tube, the lower part of which is coiled into a ball, and the upper part, or duct, which traverses the dermis and cuticle and opens onto the surface of the skin. There are two types of sweat glands: eccrine and apocrine. *Eccrine* sweat glands are widely distributed over the skin. Their primary function is to regulate body temperature, but they also eliminate toxic substances and waste products. The clear perspiration they continually secrete is mostly water with traces of salt, carbohydrates, protein, and oil; it cools the body as it evaporates. Eccrine sweat usually does not have an odor problem. *Apocrine* sweat glands are concentrated in the underarm area, around the nipples, and in the genital area. They are stimulated by the same hormones that cause hair growth in the underarms and genital area. The milky fluid they secrete is rich in organic material which is subject to bacterial decay and is the primary cause of body odor. Hair traps both sweat and bacteria. Cleansing is the best control of odor; underarm shaving is also advantageous.

Connective tissue is chiefly composed of collagen and elastin. Collagen, elastin, and reticulin are dermal proteins—they are composed of protein fibers. These fibers are, at the macromolecular level, composed of fine cross-striated fibrils of mucopolysaccharides linked with protein. Collagen, elastin, and reticulin are composed of the 20 amino acids in differing proportions. Collagen alone comprises 33% of the total body protein and 70% of connective tissue. In the dermis it provides elasticity and strength.

Smooth, elastic skin contains mainly non-crosslinked, flexible, “soluble” collagen. Lined, wrinkled, inelastic skin is caused by crosslinked, insoluble collagen. Collagen is called soluble when it can absorb large quantities of water, which allows it to remain elastic. Crosslinking occurs when the sulfur-containing amino acids in protein oxidize and form a disulfide bond. Crosslinking also affects all the other components of connective tissue.

There is a close association between the skin and the nervous system; nervousness or anxiety can be reflected in the skin, especially as acne, psoriasis, and eczema.

Skin color is “due to the presence of pigment in the cells of the epidermis. This pigment is more especially distinct in the cells of the stratum basale [lowest level] . . . . As cells approach the surface and desiccate, the color becomes partially lost. . . . The pigment (melanin) consists of dark brown or black granules of very small size, closely packed together within the cells, but not involving the nucleus.”<sup>29</sup>

### *Skin Classifications*

We often describe skin as oily, normal, dry, combination, sensitive, acne-prone, and mature, but what it really is is balanced (normal), unbalanced (oily, dry, combination, acne), and damaged (wrinkled, lined, etc.).

Different geographical-racial groups of people can have different skin characteristics. For instance, the Mongols have thick skin with fewer pores, sweat glands, and sebaceous glands, and the nerve endings are farther from the surface than the skin of Caucasians.

#### **Balanced Skin**

**Normal** skin is usually defined as skin that is neither oily nor dry. It produces enough oil to prevent dehydration but not enough to thickly coat the skin. It is the optimal condition for skin.

#### **Unbalanced Skin**

**Oily** skin is skin that produces so much sebum that the surface is, except for a brief time after cleansing, covered by a thick, shiny coating of it; this oil may aggravate a tendency to acne, it may interfere with the appearance of makeup, and its shiny appearance may be undesirable. Generally the pores are larger than in other types of skin.

**Dry** skin is skin that is lacking in moisture in the epidermal layer; this lack of moisture is caused by insufficient sebum and/or inadequate supply of blood. It typically feels tight. The pores are usually fine and barely visible. The skin can have a dull appearance. And it has a tendency to flake and will become drier in cold and windy weather. Dry skin suffers from a paradox: applied water cannot penetrate the skin, and evaporation of applied water may dry the skin even more.

**Combination** skin is oily in those areas where the sebaceous glands are most abundant—forehead, nose, and chin—and normal in the other areas.

**Sensitive** skin is skin that frequently becomes irritated, reddish, and sore. This reaction is undoubtedly an allergic response to substances and extreme environmental conditions.

**Acne-prone** skin is skin that is prone to one or more of the forms of acne. Acne-prone skin usually has at least one “spot”, although it can experience brief intervals of no spots. It is usually also oily skin. Acne often begins when a person enters puberty; it is thought to be a response to the hormones that are activated at that time. It can extend into the late 40s and beyond.

#### **Damaged Skin**

**Mature\*** skin is lined, wrinkled, and sagging. Often it is thinner than it was when it was young. Sometimes the texture is coarse. These conditions can be brought on by more than just age—see section on Aging.

Moisture “is needed to keep skin youthful or at its best. Skin can only be firm and elastic if it contains the right moisture balance. This moisture is brought to the skin by the blood supply.”<sup>15</sup> It can be temporarily reduced by environmental conditions.

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\* Mature is a euphemism for no-longer-young-and-getting-older.

### *Skin's Absorption of Nutrients*

The skin does absorb and use nutrients and other chemicals. (This is the basis of dermal patches used to help smokers quit and to administer pain medication.) Certain substances penetrate the epidermal and dermal layers and are subsequently absorbed into the systemic circulation: their path is through the hair follicles and the sebaceous glands. Other substances seem to penetrate the interstitial spaces (the gaps between the cells of the skin). Some substances are effective carrying agents which, when combined with other ingredients, enable the latter to better penetrate the skin's surface.

### *Aging*

In aging, the skin becomes less firm because of a decrease in the amount of mucopolysaccharides. Collagen becomes less soluble and, therefore, less elastic. Sebaceous glands do not change with age per se, but are less active solely as a result of the lower level of circulating androgens, or male sex hormones. Sweat glands become less active with age, and the number of active eccrine glands is reduced.

What ages the skin? UV radiation (primarily from sunlight); cigarette smoke; some topical chemicals like mineral oil and coal tar dyes (common in makeup); allowing dead skin cells to pile up on the skin; diet (caffeine beverages, alcohol, sweets, excessive red meat); genetics (heredity).

### *Fingernails*

Fingernails are flattened, elastic horny structures that adhere firmly to the dermis. The exposed part is called the *body*. A part called the *root* is implanted into a groove of the skin. The *cuticle* is attached to the surface of the nail a little in front of the root. The part beneath the body and the root is called the *nail matrix*. It is thick under the greater part of the body and its color is seen through the transparent tissue. Near the nail root, the tissue of the nail is not so firmly adherent to the connective tissue below, which causes this portion of the body to be a whiter color. Because of its shape, it is called the *lunula*. The horny part of the nail consists of a greatly thickened stratum lucidum (the next to the top layer of the epidermis) and the cuticle consists of the stratum corneum (the top layer of the epidermis).

The nails grow in length by the proliferation of cells in the lowest layer of the epidermis at the root of the nail, and in thickness from that part of the same layer which underlies the lunula.

### *Skin Ailments*

The most common skin ailments are discussed here in ways that will help you choose the best natural care.

#### **Acne**

Acne is a condition with several forms:

- whiteheads (a small whitish lump on the skin under which is a pore plugged by sebum),
- blackheads (a sebum-plugged pore whose surface is darkly colored),
- papules (a small elevation of the skin),
- pimples (a small inflamed elevation of the skin), and
- cysts (a closed sac having a distinct membrane).

Acne is a result of sebum getting stuck in the sebaceous ducts and/or follicles and clumping with the dead skin cells found there, forming a block or plug. When sebum and dead skin cells form a plug, the bacteria that normally live at the base of the gland begin to feed on the dead, oily cells and they release an enzyme that breaks down the sebum into free fatty acids and toxic byproducts. Ultimately, the bacteria, sebum, and dead cells completely block the opening. If pressure builds within the follicle, pustules and cysts result, visible inflammations of the infections within the skin.\*

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\* Most of this material is excerpted from *Diet for Natural Beauty* and *The New Age Herbalist*.

Sebum gets stuck in this way when it is thicker, more sticky, and more profuse than normal and when the epidermis lining the duct fails to shed properly (this last is called hypercornification). Thick, sticky sebum is usually a result of a diet high in saturated fats (from meat, eggs, butter, cheese) and sticky fats (from pasteurized milk, simple sugars, chocolate, nuts, hydrogenated fats), and also hormones. Acne is usually a result of a person's overall dietary pattern and not a reaction to a specific food; it takes time to develop, and time to improve.

Acne can be caused by or aggravated by improper skin care, cosmetics, metabolism, and diet. Metabolism includes the body's excretion of toxins via the skin, high production of sebum, and tendency of sebum to stick to dead cells in the pores. After all is said and done, some people are just prone to acne. They have to be vigilant in their skin care to stay acne-free.

Mineral oil clogs pores. Many commercial skin care products can aggravate acne. It may be that the best way to counter acne is to discontinue commercial skin care products.

### **Milia**

"Milia are small epithelial cysts that clinically resemble whiteheads. They are hard, painless, and stationary, and generally remain white."<sup>30</sup>

### **Dermatitis**

Dermatitis is an inflammatory skin condition characterized by inflamed, red skin that is often itchy and/or swollen and which may develop blisters and/or lesions. Dermatitis may be caused by allergy to topical substances and/or foods but is more likely to be caused by internal glandular imbalance, especially of the liver or kidneys.

Dermatitis as an allergic response can be enabled by environmental stress in an otherwise not sensitive person, which is to say even people whose skin is not normally sensitive can suffer from dermatitis when their body is stressed in an unusual and/or prolonged manner. The stress that can lead to dermatitis varies from person to person.

### **Eczema**

Eczema is a non-contagious inflammatory disease of the skin. It is thought to be a form of dermatitis. "Eczema can include crusty sores, scabs, thickened skin, pimple-like eruptions and sometimes even lesions. The skin can be either oozing or crusty and easily becomes infected."<sup>34</sup> There are many causes, including contact with an irritant, nutritional deficiencies, food sensitivities, and emotional imbalance and upset.

### **Dryness**

There are three basic causes of dry skin, nails, and hair:

- 1) a diet deficient in essential fatty acids and/or containing trans fats
- 2) harsh chemicals in cosmetics and/or housekeeping products that contact the skin/hair
- 3) a drying environment (low humidity)

The solution is to address each cause. Remedy your diet by eating 1–2 tablespoons of unrefined flax oil daily (see Chapter 6). Stop using cosmetics and housekeeping products with harsh chemicals\*. Increase the humidity of your home. Nourish your skin externally (see Chapters 3 and 4).

### **Skin Fungus**

Dermatophytic fungi can cause a skin infection anywhere on the body. The most common organisms are *Trichophyton*. Their infections are known as *Tinea*. The specific name refers to the location of the infection, e.g.,

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\* How do you know which commercial cosmetics may dry your skin? This is a great question but hard to answer. The safest answer is to avoid all commercial cosmetics. Synthetic ingredients and refined natural ingredients are limited in their ability to nourish your skin. These appear in virtually all commercial cosmetics.

*Tinea corporis* is an infection on the body (commonly called “ringworm”), and *Tinea pedis* is an infection on the feet (commonly called “athlete’s foot”). Dermatophytes can invade keratinized tissue (e.g., hair, nails, any area of the skin) but are restricted to the dead cornified layer of the skin.

*Tinea versicolor*, more accurately called *Pityriasis versicolor*, is a common fungal infection of the body. The infection causes uneven skin color that can look like white freckles. The yeast that causes the infection is normally present on everyone’s skin. Why it causes an actual infection is unknown.

Fungal infections are successfully treated with topical and/or oral prescription drugs; oral use is appropriate for extensive or recalcitrant infections. They can also be treated with natural remedies. Although the yeast is easy to kill, it can take weeks or months for the skin to regain its color.

### Liver Spots

Liver spots are brown, freckle-like spots that appear on the skin, usually appearing as we age. The brown pigment is called *lipofuscin*. The spots are caused by oxidation of polyunsaturated fats and protein by free radical activity; they are toxins and waste materials resulting from the digestion of some cooked foods. *Lipofuscin* also accumulates inside our bodies, especially in the brain and nervous system. You might think of the skin spots as the tip of the iceberg.

The cells cannot dispose of the *lipofuscin* pigment, so it can gradually accumulate. Further oxidation can be arrested and existing spots may be reduced by using certain fatty oils in your diet and on your skin, and by avoiding cooked food and polyunsaturated vegetable oils.

## HAIR

Hairs are found on nearly every part of the skin. They vary much in length, thickness, and color in the different areas of the skin and also in the different races of mankind. In Caucasians, blonds average 120,000 scalp hairs, brunettes have about 100,000, while redheads have about 80,000 hairs. Red hair is thicker than blond hair.

### *Hair Structure*

Hair is a filament which grows out of the skin. It grows from a *bulb* through a *follicle* (skin depression or cavity). The bulb is whiter in color and softer in texture than the rest of the hair. The *hair root* is the part of the hair within the follicle. The *hair shaft* is the segment of the hair that extends or projects beyond the skin. The bulb is surrounded by blood vessels which supply nourishment; the small cone-shaped elevation of the bottom of the follicle is called the *hair papilla*. The hair grows in length by new cells passing upward from the papilla into the root. Sebaceous glands adjoin the follicle and secrete sebum into it; sebum makes hair lustrous and pliable and keeps the skin surface soft and supple.

Hair is composed of cells of differing materials arranged in layers. The shaft consists of three parts: The interior part is the *medulla*. The *cuticle* is the exterior layer; it consists of a single layer of flat scales which overlap one another. The middle part—the chief part—is the *cortex*. Its cells are elongated and united to form fibers which contain pigment granules in dark hair and air in white hair. While the medulla is usually absent in the fine hairs covering the surface of the body, it is generally present in the hairs of the head.

Hair is made of keratin, a protein containing 18 amino acids, including two sulfur-containing amino acids methionine (0.6%) and cystine (18%), the former being the amino acid occurring in the least amount and the latter in the greatest amount. The keratin fibers are thought to exist in a double or compound helix; the structure is based on hydrogen bonds, salt links, and disulfide bonds. Cystine “acts as a bridge in the structure of [the] hair and it is the amino acid destroyed by cold wave solutions and other chemicals.”<sup>11</sup> When the bonds and amino acids are damaged, the hair is damaged.

Naturally straight hair is stronger than curly hair. Straight hair is round or oval in cross-section, while curly hair is flattened.

The density of scalp hair follicles diminishes slightly until about the age of 50, after which there is little further reduction in density.

### *Hair Color*

The two main hair pigments are melanin and pheomelanin. They are formed in specialized cells called melanocytes located in the papilla. Pigments are secreted from the melanocytes by their tentacles (called dendrites) into the cortical cells of newly formed hair in the follicle. Melanin begins as colorless granules which are subsequently colored black-brown by tyrosinase (an enzyme) acting on tyrosine (an amino acid in melanin). It produces brown, black, or blond hair depending on its concentration. Pheomelanin is colored red-yellow by tryptophan, and is responsible for red hair.

The melanocytes' secretion of pigment slows down or stops when they become shriveled or contracted or when their blood supply is reduced by constricted blood capillaries. In any case, the growing hair lacks pigment and is seen as grey. Hair "turns grey" as the pigmentation process is interrupted; sometimes this is caused by mineral deficiencies such as copper or zinc. (Robert Cummings in his seventies had no gray hair, presumably because of vitamin supplements to bolster the pigmentation process.) Bleaching destroys melanin.

### *Dandruff*

Dandruff is a scalp condition where the dead cells in the outer layer of the epidermis form large scales which are easily visible. This can happen to a scalp that is oily or dry. While the cause is unknown, several factors, both internal (hormonal imbalance, impaired metabolic nutrition, diet, and tension) and external (increased bacteria and fungi activity, biochemical changes in the scalp, and topical medications and cosmetics), have been identified.

### *Growth Cycle*

Each hair undergoes a growth cycle. The first stage, called *anagen*, is characterized by active growth and usually lasts 18 months to several years. The rate of growth may vary. How fast and how long hair grows determines its maximum length: some people's hair can grow past their waist while others cannot grow past their shoulders. The second stage, called *catagen*, is one of rest. The third and final stage, called *telogen*, is when the hair dies and eventually falls out. The growth cycles of the individual hairs are out of sync so that the hairs which are shed at the end of their resting phase are somewhat evenly distributed throughout the scalp and represent about 15% of all hairs. Another result of the unsynchronized growth cycles is that, in the absence of frequent hair cuts or trims, the ends become uneven.

Some women experience diffuse thinning of the scalp hair as they age; it may first become evident after menopause. Women, unlike men, rarely become totally bald. Baldness, partially or totally, in men is common and stems from heredity, male hormones, and age. "Male pattern baldness" is found in 90% of all men having permanent hair loss. The earlier it begins, the greater its eventual extent.

### *Damage*

When the cuticle layer is intact and when the scales lie flat, the hair feels smooth, resists tangling and looks shiny because light reflects from its surface. Damaged cuticle has a rough and pitted surface which causes the hair to tangle easily and look dull. The ends may fray and split into layers—what we call split ends.

Hair damage begins in the cuticle and, as it becomes worse, extends into the inner layers of the hair shaft. At its least, the cuticle is roughened. At its worst, the cuticle and some of the underlying layers are gone.

Minor damage can be relieved, even repaired, by certain practices described in the Hair Care Program section. Major damage cannot be repaired.

## SKIN, SUNLIGHT, AND VITAMIN D

Sunlight is critical to all life forms. Aside from the simple pleasure of feeling sunlight on our bodies, sunlight benefits us in several ways: it is a source of vitamin D, energy, and well-being. It can also cause sunburn, wrinkles, and skin cancer.

We know of three different types of ultraviolet radiation based on their wavelength: UV-A, UV-B, and UV-C. They have different effects on humans.

- UV-A rays have wavelengths from 320–400 nanometers (one billionth of a meter). The rays cause tanning. They may also be responsible for long-term skin damage like wrinkles and skin cancer. UV-A is present throughout the day. UV-A penetrates more deeply than UV-B, and can damage collagen and elastin.
- UV-B rays have wavelengths from 280–320 nanometers. UV-B rays cause sunburn and inflammation of the skin, and have also been linked to long-term damage. UV-B also causes special skin cells called melanocytes to produce melanin, which is protective. Humans manufacture vitamin D from cholesterol by the action of UV-B in sunlight on skin. The amount of UV-B present in sunlight has to do with the angle of the sun's rays and the altitude (see below). UV-B does not penetrate clouds, smog, or fog. Only 5% penetrates glass.
- UV-C rays have wavelengths shorter than 280 nanometers. UV-C rays don't yet penetrate the earth's ozone layer (thank goodness), but should they do so in the future they are expected to burn skin rapidly in extremely small doses. UV-C is also present in some lights. For this reason, fluorescent and halogen and other specialty lights may contribute to skin cancer.

### *Producing Vitamin D Naturally*

“Latitude and altitude determine the intensity of UV light. UV-B is stronger at higher altitudes. Latitudes higher than 30° (both north and south) have insufficient UV-B sunlight two to six months of the year, even at midday. Latitudes higher than 40° have insufficient sunlight to achieve optimum levels of vitamin D during six to eight months of the year. In much of the US, which is between 30° and 45° latitude, six months or more during each year have insufficient UV-B sunlight to produce optimal D levels. In far northern or southern locations, latitudes 45° and higher, even summer sun is too weak to provide optimum levels of vitamin D. A simple meter is available to determine UV-B levels where you live.

“Sun exposure at higher latitudes before 10 am or after 2 pm will cause burning from UV-A before it will supply adequate vitamin D from UV-B.... Only sunning between 10 am and 2 pm during summer months (or winter months in southern latitudes) for 20–120 minutes, depending on skin type and color, will form adequate vitamin D before burning occurs.... In order to achieve optimal levels of vitamin D, 85 percent of body surface needs exposure to prime midday sun.

“It takes about 24 hours for UV-B-stimulated vitamin D to show up as maximum levels of vitamin D in the blood. Cholesterol-containing body oils are critical to this absorption process. Because the body needs 30–60 minutes to absorb these vitamin-D-containing oils, it is best to delay showering or bathing for one hour after exposure. The skin oils in which vitamin D is produced can also be removed by chlorine in swimming pools.

“Single, infrequent, intense skin exposure to UV-B light not only causes sunburn but also suppresses the immune system. On the other hand, frequent low-level exposure normalizes immune function, enhancing NK-cell and T-cell production, reducing abnormal inflammatory responses typical of autoimmune disease. Thus it is important to sunbathe frequently for short periods of time, when UV-B is present, rather than spend long hours in the sun at infrequent intervals. Adequate UV-B exposure and vitamin-D production can be achieved in less time than it takes to cause any redness in the skin. It is never necessary to burn or tan to obtain sufficient vitamin D.”<sup>37</sup>



### *Ozone and Sunlight*

Ozone is a gas composed of three atoms of oxygen. The ozone layer is the region of the stratosphere containing the bulk of atmospheric ozone. The ozone layer lies approximately 10–25 miles above the Earth’s surface. The ozone layer absorbs a portion of the radiation from the sun, preventing it from reaching the planet’s surface.

The three types of UV light respond to ozone differently: UV-A is not absorbed by ozone. UV-B is mostly absorbed by ozone, although some reaches the Earth. UV-C is completely absorbed by ozone and normal oxygen.

Stratospheric ozone is constantly being created and destroyed through natural cycles; ozone concentrations vary naturally with sunspots, the seasons, and latitude. The total amount, however, remains relatively stable. Modern chemicals can accelerate the destruction process, resulting in lower than normal ozone levels; this is referred to as ozone depletion. When ozone levels are unnaturally low, the concentration of UV-B at the earth’s surface is higher than normal—and more dangerous to you. Ozone depletion is a known phenomenon these days, particularly in certain areas; it is thought to be a result of human activities, especially those that release chlorofluorocarbons\* (CFCs), halons†, carbon tetrachloride‡, and methyl chloroform (an industrial solvent and degreasing agent) into the atmosphere. Ozone “holes” have been found over Antarctica and areas in the southern latitudes (like Australia).

While an increase in UV-B radiation caused by ozone depletion is suspected to cause health problems, including skin cancer, there is no evidence that this is so.

### *Role of Essential Fatty Acids*

The presence of essential fatty acids in the body enable it to absorb sunlight, including UV rays, “through the skin and store it in the body in the form of chemical bonds.”<sup>5</sup> Our bodies can then draw on that stored sunlight, withdrawing energy with which to improve our overall energy balance and well-being. Sunlight cannot be stored when the essential fatty acids are deficient; it is this sunlight that can cause skin cancer.

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\* CFCs are commonly used as refrigerants, solvents, and foam blowing agents.

† Halon was used for fire and explosion protection throughout the twentieth century.

‡ Carbon tetrachloride was formerly widely used in fire extinguishers and refrigeration, but now largely abandoned due to its toxicity. Used to dry clean laundry prior to World War II.