

*the science inside*

# SKIN

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



## ***Dear Reader:***

Science data and statistics are always changing, and it is important to be informed of current research. To help keep you up-to-date with the latest information on skin health, the American Association for the Advancement of Science would like to share the following updates regarding skin health:

- ◆ Major medical groups, including the CDC, recommend using sunscreen with an SPF of 15 or higher. However, a growing number of health care providers, including the M.D. Anderson Cancer Center, suggest products of SPF 30 or higher, particularly for those whose skin burns easily. *(See references on pages 17, 32, and 45.)*
- ◆ The number of doctor visits Americans make each year to get skin rashes checked out has dropped from 11.8 million to 10 million, according to the National Ambulatory Medical Care Survey: 2006 Summary, National Health Statistics Report No. 3. (See reference on page 23.) <http://www.cdc.gov/nchs/data/nhsr/nhsr003.pdf> is the most recent data. Check the site for regular updates to the statistics.
- ◆ According to the CDC's National Program of Cancer Registries, 53,792 new cases of melanoma were reported in 2005, the most recent year for which statistics were available in Summer 2009. The National Cancer Institute estimates that 68,720 new cases will be diagnosed in 2009. *(See reference on page 36.)*
- ◆ Estimates vary as to the likelihood of developing melanoma during the average American's lifetime. MedlinePlus, developed by the National Institutes of Health, estimates that 1 in 65 people will be diagnosed with melanoma at some point in their life. In 2009, The Skin Cancer Foundation predicted that 1 in 55 people will be diagnosed. *(See reference on page 36.)*

As the science advances it is possible that more recent data will provide you with different numbers. While you can use this book as a starting point, check credible sites, such as those above, for results on the most up-to-date research.

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT  
OF SCIENCE

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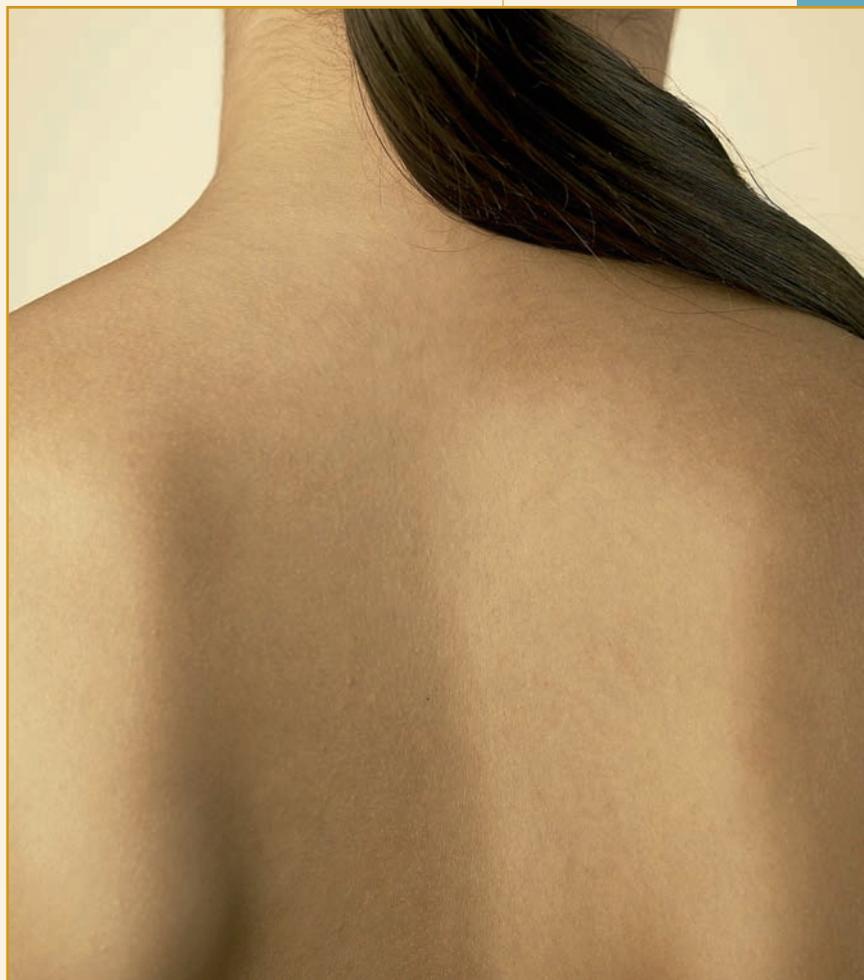
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# INTRODUCTION: HEALTHY SKIN

**S**kin is the body's largest organ. It is also the most visible. A square inch of skin has millions of cells and many nerve endings for sensing temperature, pain, pressure, and touch. It keeps us sheltered from the elements and protects our insides from drying up.

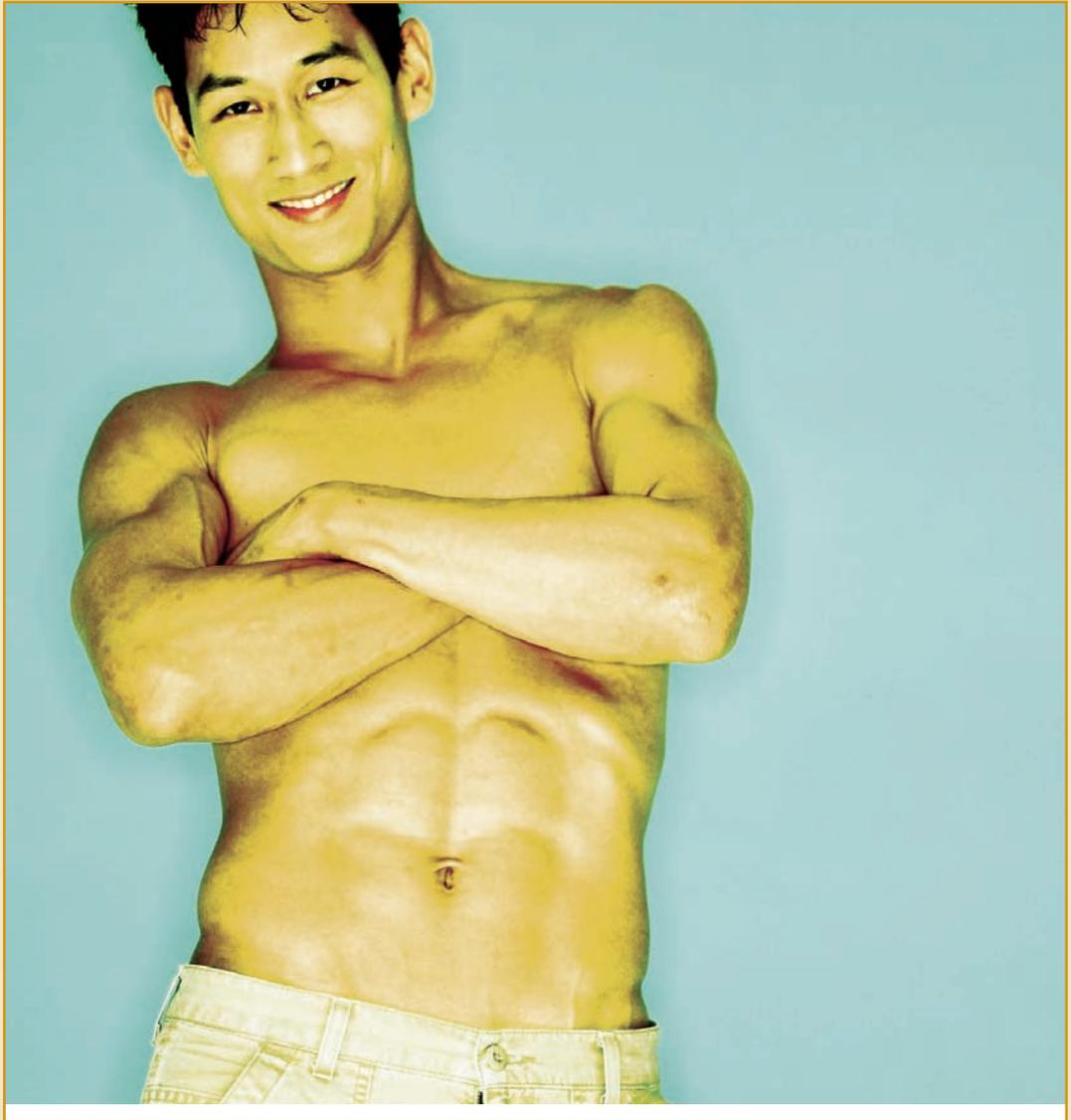
Yet despite its toughness, skin is sensitive and can be damaged if it isn't cared for. It requires our protection from the sun and from irritants. It needs our help in retaining moisture. It demands a little thought now and then.

In this book, you will learn all about your skin and how to take care of it. You will learn about skin ailments, from acne to skin cancer, and how to prevent them. Finally, we will look at the promising research scientists are doing to improve skin care to keep your skin healthy for a lifetime.



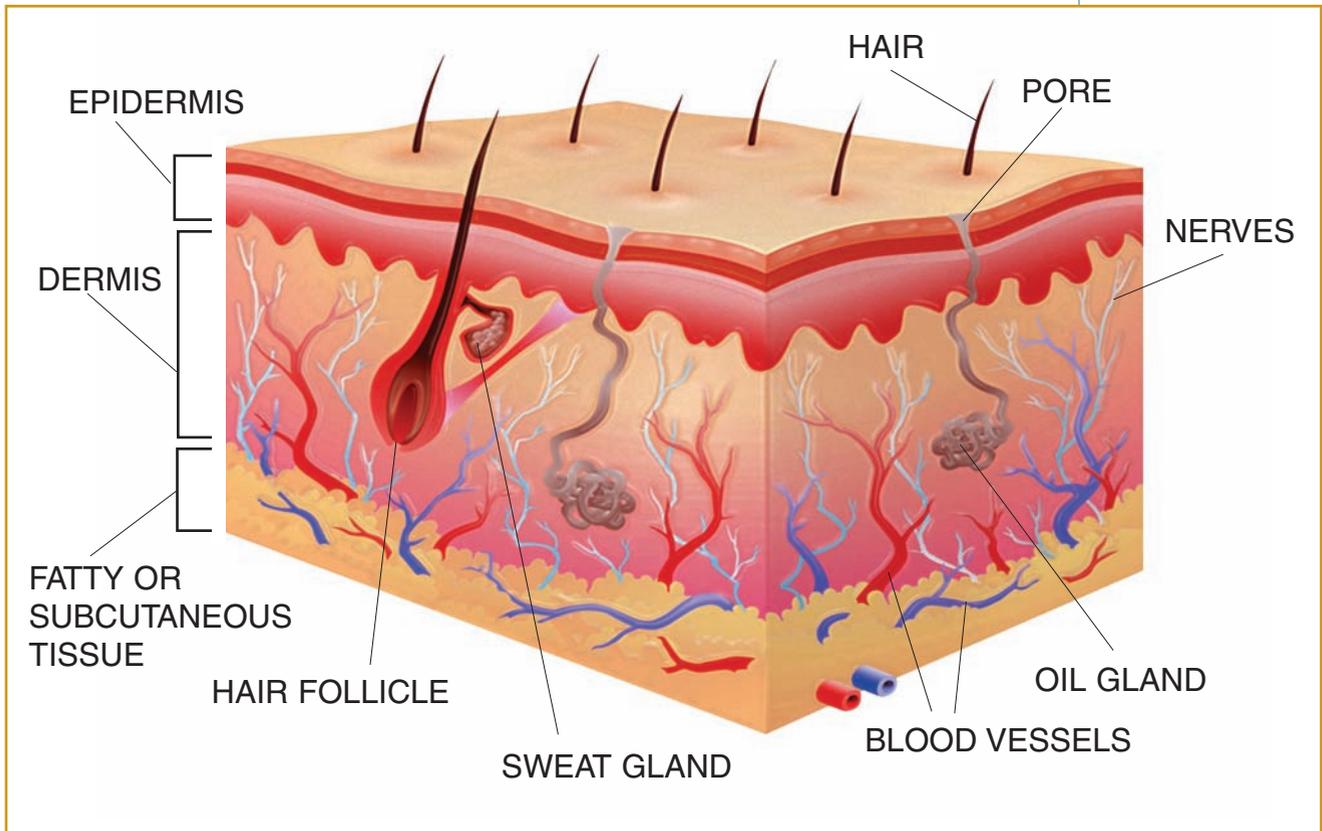
*The body sheds 30,000–40,000 dead skin cells off its surface every minute. This amounts to nine pounds of cells every year.*

## Skin: The Science Inside



*Your skin is about 1/10 of an inch deep. The thinnest skin on your body is on your eyelids and on the inside of your elbows, and the thickest skin is on your palms, the soles of your feet, and your upper back.*

# Part 1: Skin Form and Function



## What is skin?

Skin is actually made up of three different layers:

- The epidermis
- The dermis
- The subcutaneous tissue

The **epidermis** is the top layer of skin, the part you see. Only as thick as a sheet of paper, the epi-

dermis mostly builds new skin cells and makes **melanin**, a **pigment** that gives skin its color. When we go outside, the melanin in our skin helps protect us from being burned by the sun's ultraviolet rays.

**Basal cells** form the bottom of the epidermis. They divide and form **squamous cells**, which

*A cross section of the three layers of skin*

## Skin: The Science Inside

produce **keratin**, a protein that reinforces your skin cells to help protect you from the environment.

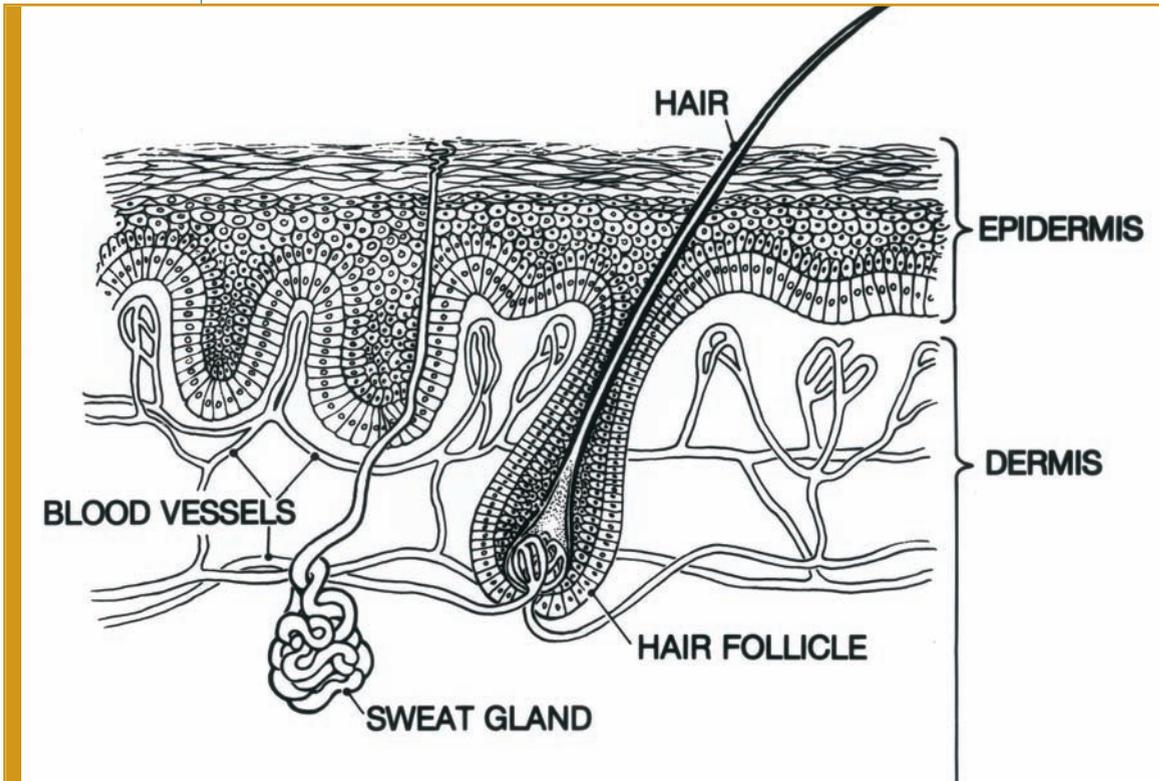
As the basal cells divide, they push the squamous cells up toward the surface of your skin. As they move up, the cells shrink, flatten, and die. When they reach the top layer of the epidermis, they become the **stratum corneum**, the outermost layer of skin that protects the body.

**Melanocytes**, which make the melanin in your skin, and **Langerhans** cells, which are part

of your immune system, are also found in the basal layer of your epidermis.

The **dermis** is the middle layer of our skin and makes up the majority of it. It includes strong fibers called **collagen** and **elastin**, which give our skin strength and elasticity.

The dermis contains sweat **glands**, oil glands, **blood vessels**, **nerve** fibers, lymphatic channels (the tubes that carry the bodily fluid **lymph**), **hair follicles**, and muscle cells.



*A cross section of dermal and epidermal skin layers*

### Why are there different skin/hair colors?

No one can deny the importance of skin color within our society. Socially it can affect many things, but scientifically, skin color is a lot less complex.

Most scientists agree that sunlight levels determine whether a population tends to have light skin or dark skin. Sunlight contains ultraviolet radiation (UV). The darker the skin, the less UV penetrates into it.

Too much UV is bad, because it destroys an important nutrient, called folate. But some UV on our skin is good, because it helps our cells produce vitamin D, another important nutrient.

Where there is a lot of direct sunlight, like in places close to the equator, people get more than enough sunlight to produce vitamin D, but they are very susceptible to folate damage. Having dark skin that protects against the destruction of folate is advantageous in these parts of the world. As a result, people with genes for dark skin are healthier and produce more offspring, who also have darker skin. After many generations, populations in these areas are mostly dark-skinned.

Where sunlight is weak, making it difficult to produce enough vitamin D, the genes that produce light skin are favored, allowing more UV to penetrate. In these parts of the world, people with those genes are healthier and produce more offspring. Over time, populations in these areas evolve to be light-skinned.

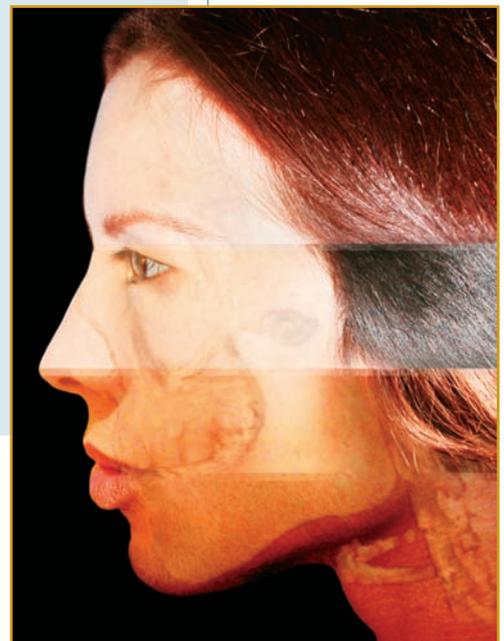
The skin colors themselves are the result of a pigment called melanin. Melanin is produced by melanocytes, cells that reside in the skin's top layer, or epidermis. There are two types of melanin: **eumelanin**, which produces a brown to black color, and **pheomelanin**, which produces a red to yellow color. Although melanin is the

main determining factor in what color a person's skin will be, there is also another pigment located in the dermis, which contributes to the color. This yellow-colored pigment, called **carotene**, is converted to vitamin A. Along with the pigments, there are other factors that contribute to skin color, such as the **subcutaneous**, or fatty, tissue layer of skin. The way that light filters through this layer, as well as the other two layers of skin, has an effect on the way that skin color is perceived.

Sometimes skin color develops unusually. Most people have **moles** (also known as birthmarks or nevi). Generally these are just harmless clusters of darkly pigmented cells, but they should be watched because changes can warn of developing skin cancer. **Vitiligo** is an autoimmune disease that causes the skin to develop milky-white patches. These develop because the body mistakenly makes antibodies to its own melanin.

Hair color is also a result of how much melanin a person has in their body. Individual hair shafts grow from follicles that are rooted in the subcutaneous layer, passing through the dermis and epidermis. Each hair is genetically programmed to produce a certain amount of melanin. The production of melanin occurs in the middle layer of the hair shaft, referred to as the **cortex**. When hair grays, the cortex has slowed the amount of melanin produced by the hair, causing the hair to turn gray and eventually white.

*The color of skin is determined by the amount of a photoprotective pigment called melanin. Melanin comes in two forms: pheomelanin and eumelanin. Individuals with a light complexion produce more pheomelanin and those with a dark complexion produce more eumelanin. The number and size of melanin particles vary among individuals, producing a vast range of skin tones.*



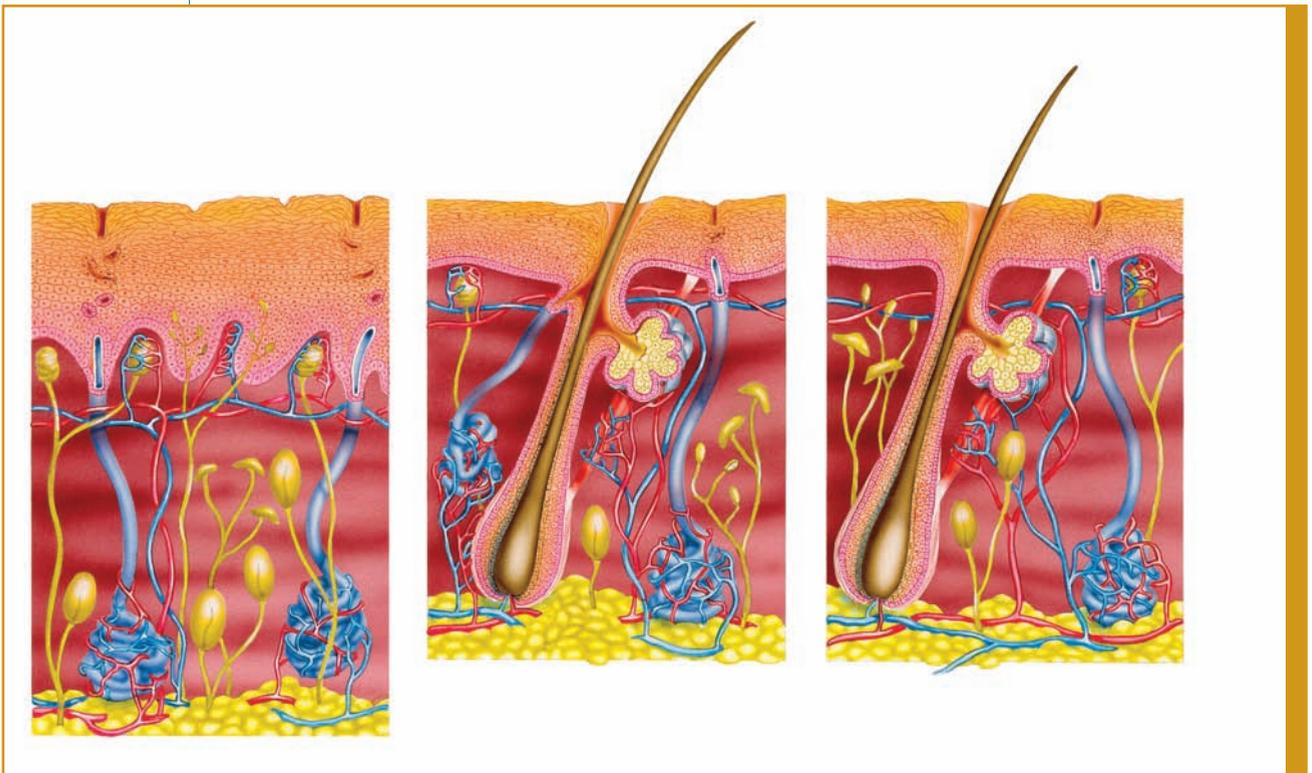
## Skin: The Science Inside

Our sense of touch comes from the nerve endings found in the dermis.

The top surface of the dermis and the bottom surface of the epidermis are covered with bumps that help them fit together like puzzle pieces. The patterns these bumps create are unique to each of us and make up our fingerprints and other lines on our skin.

The **subcutaneous tissue** is the bottom layer of skin and is mostly made up of fat. It also contains our skin's nerves and blood vessels, as well as the roots of our oil and sweat glands and hair.

A hair follicle is the tube-shaped sac that contains a hair. One hair grows out of each follicle and follicles are found throughout the body, except on the palms, soles, and lips.



*These images show skin from different areas of the body. From left to right, they are from the palm or sole, the groin or armpit, and the rest of the body. The palm skin shows a much thicker epidermis (pale pink, top) than the others and is richly supplied with sensory nerves (yellow) in the dermis (dark pink). The skin from the groin shows a large hair arising from a follicle. A sebaceous gland (to the right of the hair) produces sebum, an oily substance which waterproofs the hair. A coiled sweat gland (blue) can also be seen leading to the skin's surface through the hair's shaft. The skin from other parts of the body has fewer sweat glands.*

Oil glands are known as **sebaceous glands**. They secrete an oily substance called **sebum**, which helps skin and hair retain their moisture, protects them from friction, and acts as waterproofing. Oil glands are found all over our bodies, but are concentrated on the scalp, face, chest, and genitals.

Two types of sweat glands help the body cool off. The **eccrine glands** produce sweat when we're hot, stressed, or experiencing strong emotions. They're mostly found on our palms, soles, scalp, and underarms. The **apocrine glands** develop during puberty and produce sweat during times of stress or strong emotion. They're mostly found under our arms and around nipples and genitals. Sweat is released from the lower layers of the skin through **pores**, or tiny holes in the skin.

In addition to containing all these things, the subcutaneous tissue also acts as a pillow to protect our internal organs from injury and holds in our body's heat to keep us warm.

## Why do we have skin?

We all know that skin keeps us from seeing each other's insides. But, really, what is it supposed to do? Skin has four main jobs:

**PROTECTION:** Our skin is our first line of defense against infection. It keeps dirt, germs, and other harmful substances in the environment from getting to our insides.

It also keeps us from drying out. The oil produced in our sebaceous glands rises to the surface of our skin or hair and acts as a barrier so that only a certain amount of moisture can leave our bodies. Often our skin feels dry when too much oil is removed from the skin and moisture is allowed to escape from the body.

**TEMPERATURE REGULATION:** Blood vessels in our skin expand and contract based on how warm or cold we are. When our body is hot, our blood vessels expand and bring warm blood closer to the surface of our skin, so that heat is released. Our sweat glands also make extra sweat so it can evaporate from the skin's surface and cool us off. In this way, our skin acts like a built-in air conditioning unit.

## Skin: The Science Inside



When we're cold, the opposite happens. The skin's blood vessels narrow, trying to keep the warm blood away from the surface of the skin. The skin will become pale and cold, and body heat will move inward toward our organs.

We also may develop goose bumps. When the body gets cold (or excited), it causes the muscles attached to the base of each hair to pull it upright. This reflex, which all mammals and birds have, lets an animal warm up by trapping extra air closer to the skin so it can act as a warming layer. Animals also use this technique to make themselves look bigger to enemies. That's why a cat looks bigger just before it gets into a fight with another animal, and why birds look fluffier when they're sitting at a birdfeeder on a cold day. Goosebumps no longer serve a purpose for humans.

**SENSATION:** Nerves in our skin send signals through the spinal cord to our brain about the things around us. This tells us about our surroundings, like whether we're touching wet mud or hard rock. Nerves also protect us by warning us about what can hurt us, like really hot or sharp things.



Nerve receptors are not evenly spaced throughout the body. Where they are closer together, we are more sensitive. They are furthest apart in the middle of the back. They are closest on our hands, lips, face, neck, tongue, and feet. In fact, each fingertip has about 100 touch receptors.

There are about 20 different kinds of nerve endings; the most common ones are heat, cold,

pain, and pressure (or touch) receptors. There are more pain nerve endings in our bodies than any other kind, which helps the body know where it is injured.

Other nerve endings in our skin lead to sexual excitement. These nerve endings stimulate the nervous and endocrine (hormonal) systems, which send messages to the brain and the sexual organs to “turn them on.” (Of course, all senses play a role in sexuality, as does the mind, and not every touch is arousing.)

**HEALTH WARNINGS:** The skin can act as an early warning system to let us know that there’s something wrong elsewhere in the body. The skin’s texture, temperature, and color all give hints about our general health and when something is wrong elsewhere. For instance, if the skin is hot, then we may have a fever and be sick. A yellowish color to the skin may point to problems with our liver. An irregularly shaped brownish spot that suddenly appears even could point to skin cancer.

# Skin: The Science Inside

## Skin and the Body's Systems

The **integumentary system** consists of the skin, hair, nails, glands, and receptors. Its main function is to act as a barrier to protect the body from the outside world. It also functions to retain body fluids, protect against disease, eliminate waste products, and regulate body temperature. In order to do these things, the integumentary system works with all the other systems of your body, each of which has a role to play in maintaining the internal conditions that a human body needs to function properly.

The integumentary system has many functions, most of which are involved in protecting and regulating your body's internal functions in a variety of ways:

- Protects the body's internal living tissues and organs
- Protects against invasion by infectious organisms
- Protects the body from drying out
- Protects the body against abrupt changes in temperature
- Helps dispose of waste materials
- Acts as a receptor for touch, pressure, pain, heat, and cold
- Stores water and fat
- Helps in the production of vitamin D.

Your body is a complicated system that consists of many subsystems that help to keep it functioning properly. These subsystems serve a variety of purposes and require certain materials to work right, as well as means of communicating information to other parts of the body. Thus, the skin and other parts of the integumentary system work with other systems in your body to maintain and support the conditions that your cells, tissues, and organs need to function properly.

The skin is one of the first defense mechanisms in your **immune system**. Your skin has tiny glands that secrete sweat and oil. Those fluids help decrease the pH on the surface of your skin to help kill microorganisms. The enzymes in your sweat can digest bacteria.

The skin works with the **excretory system** by the removal of dead cells and sweat, which contains waste products. Skin also works to release waste, including water, salts, and urea, a toxic substance formed in the body's production of energy. Waste travels through the sweat gland and out of the body through sweat pores, which are located in the epidermis.

By helping to synthesize and absorb vitamins A, D, E, and K, the integumentary system works with the **digestive system** to encourage the uptake of calcium from our diet. These substances enter the bloodstream through the capillary networks in the skin.

The integumentary system also works closely with the **circulatory system** and the surface capillaries through your body. Because certain substances, such as hormones, can enter the bloodstream through the capillary networks in the skin, patches can be used to deliver medications in this manner for conditions ranging from heart problems (nitroglycerin) to smoking cessation (nicotine patches). Capillaries near the surface of the skin open when your body needs to cool off and close when you need to conserve heat.

Your skin plays a vital role in your body regarding the sense of touch. The **nervous system** depends on neurons embedded in your skin to sense the outside world. It processes input from your senses, including touch, and initiates actions based on those inputs. For example, when you stub your toe, nerve cells in the foot send signals up the leg, through the spinal cord, and up into the brain. The nerve cell connections in the brain sense these signals as pain. As well as interacting with the body

## Part 1: Skin Form and Function

systems as explained above, the integumentary system also contributes to numerous physiological processes, especially those involved in the regulation of the body's internal environment, to maintain stable conditions. Examples of the way that the skin helps in temperature regulation are changes in the pattern of blood supply to the skin and sweating. Other examples of physiological process involved in maintaining stable internal conditions are the regulation of the amounts of water and minerals in the body, the inhaling of oxygen, and the exhaling of carbon dioxide.

### Tattoos

Many people see the skin as more than a protective shield; they also see it as a palette on which to express their thoughts, feelings, and creativity. Tattooing and body piercing are the main methods employed for self-expression on the skin. Some scientists believe that markings found on the world's oldest mummified human remains, the Iceman, are tattoos. If so, then tattoos have been around for over 5,000 years. Egyptian and Nubian mummies, dated 2000 BC, have also been found to bear tattoos. Considering how long they have been around, the process should seem simple, but people still have a lot of questions—especially about the safety of tattoos.

In order to form a permanent tattoo, the skin must be pierced. A needle is inserted about 1/8 of an inch into the dermis. Unlike the cells in the epidermis, the skin's outer layer, which constantly shed, the cells of the dermis are stable. This is why once the ink is inserted into the dermis the tattoo is permanent unless a surgeon removes it with lasers, "sanding," or a knife.

Whenever the skin is pierced, the body is vulnerable to infection from **bacteria** and other pathogens. Because skin is pierced, blood often touches tattooing tools, which increases risk of exposure to diseases that

can be transferred through bodily fluids, like Hepatitis B and HIV. It is important to make sure that tattoo parlors are clean. That means making sure that new and sterile needles are used, that the ink used is new and not recycled, and that the tattooist uses gloves that touch nothing but the tattoo. The FDA also states that a machine called an autoclave, which uses heat to clean tattooing tools, should be on the premises of the tattoo parlor.





# Part 2: Healthy Skin

## A lifetime of skin

As with the rest of our body, our skin changes throughout our lives. This chapter will look at the way skin changes from infancy to the teen years to adulthood.

### *Babies' skin*

At birth, a baby's skin is very soft—thus the saying, “as soft as a baby's bottom.” This is because

babies' skin has a thinner epidermis and a thicker subcutaneous tissue layer than it will as they grow. Their skin also has more **hyaluronic acid**, which retains 1,000 times its weight in water. Finally, babies also regrow the top layer of skin in as little as two weeks, while the same process can take more than a month for a middle-aged adult. When babies are born, their skin is usually smooth and puffy.



## Skin: The Science Inside

Within a few days, the baby's color will even out, and red marks, scratches, or bruises caused by delivery will go away. Babies may continue to look blotchy because of blood circulation at the surface of the skin, but this is normal. It is also normal for their lips, hands, or feet to turn a bluish color when they are cold (but that should go away if you move their limbs or move them into a warmer location). Their skin may also change color when they cry, or when they have a bowel movement. All of these conditions will go away as they get older.

Some babies do have **birthmarks**. These can be temporary—such as the salmon patches (sometimes called “stork bites” or “angel kisses”) some light-skinned babies have on the back of their necks or the bridge of their noses or the Mongolian spots found on nearly half of all African-American, Asian, and Native-American babies. These birthmarks are patches of bluish stains found on a baby's back or bottom. Other birthmarks are permanent—such as port-wine stains (large, flat, reddish-purple colored **lesions**) or pigmented nevi (brown or black moles)—that



Lanugo



Milia



Mottling



will not go away and that should be watched by a dermatologist as a child grows up.

During the first few days of life, babies' skin will become dry and flaky. In fact, the top layer of skin is shed and replaced during their first week.

Infants may also have pale, fine, soft hair that covers their forehead, cheeks, shoulders, and back. This hair is called **lanugo** and develops when a baby is in the mother's womb as an insulation layer. It will fall off sometime during the baby's first month.

A baby is also more prone to getting mild skin **rashes** during the first few months of life. **Milia**, or enlarged oil glands, may appear as little yellow or white dots on the chin, cheeks, and nose. **Neonatal acne** can be caused by maternal hormones passed on through breastfeeding. It can be made worse by lying on sheets cleaned in harsh chemicals or on bedding that has been spit up on.

Babies will occasionally get **diaper rash**, which occurs when a child's skin remains in contact for a long time with wet or soiled diapers. Prevention is the best method for treating this condition: change a baby's diaper often and rinse the baby with water

only. Spending some time not in a diaper can also prevent diaper rash from developing. Putting children in disposable diapers, or in stay-dry liners inside a cloth diaper, may also help prevent the condition. If diaper rash does develop, try to rub the affected area as little as possible, allow the area to dry thoroughly before putting a new diaper on, and use a thick layer of ointment or cream that contains zinc oxide or petroleum jelly to coat the skin in the affected area. If the rash develops **blisters** or pus-filled sores, or if it doesn't go away after three days, contact the child's doctor.

### *Teenagers' skin*

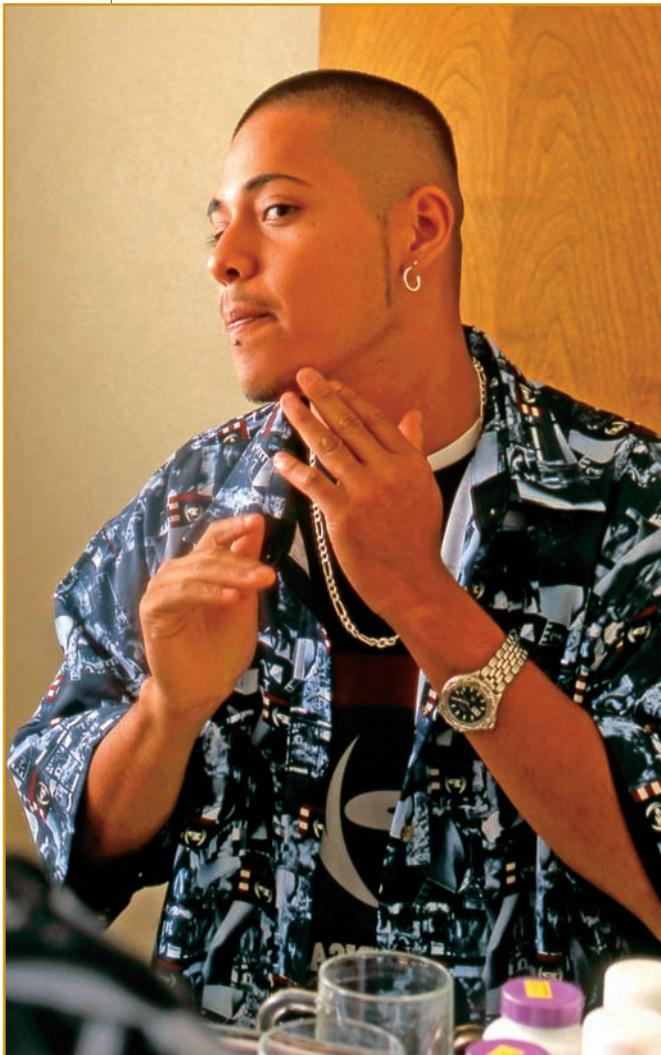
As children grow into teenagers, they begin to enter **puberty**. During puberty, a teenager's hormones begin to change his or her body. A girl will grow breasts and begin menstruating. A boy's voice will lower and he will begin to produce sperm. Both will go through growth spurts and develop underarm and pubic hair. Most teens will develop acne.

Some of the same hormones that cause the body to change also cause the body to begin producing more oil in the skin. This oil can clog pores, causing acne. Oil production begins to slow as we age, and most teens will find acne

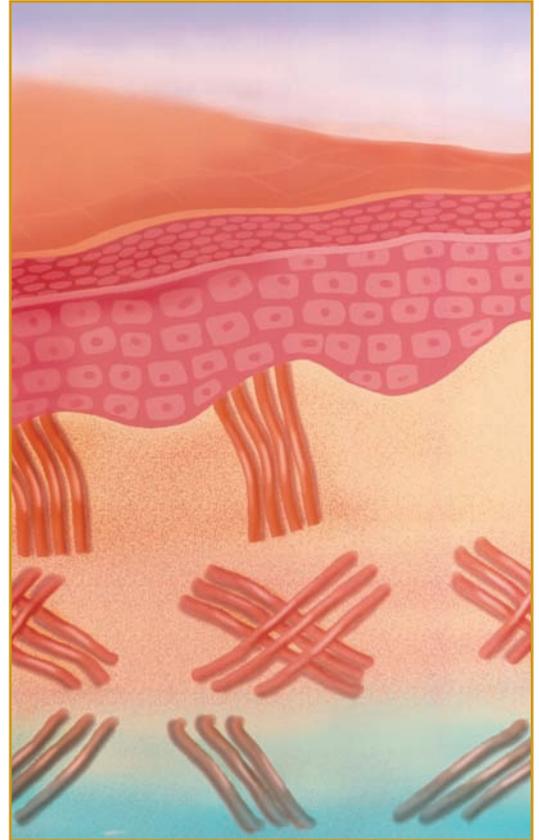
## Skin: The Science Inside

becomes less of a problem as they head toward their twenties. Although adults also can have acne outbreaks, they are usually less frequent and less severe by the early 30s.

We will talk more about acne in the next section, “Skin Disorders and Treatment.” The discussion of acne begins on page 28.



*This artwork shows a cross-section of healthy young skin with its regular arrangement of collagen fibers (brown). The collagen supports the dermis (the middle layer, in pink), giving it tone and strength. In elderly skin, the fibers break down, leading to wrinkles.*



### **Adults' skin**

As adults grow older, their skin ages both from the inside and from the outside.

Within our skin, collagen production slows and elastin becomes less resilient. New skin cells are produced less quickly, and dead skin cells are not shed as often. These changes begin in our 20s, but are

not usually noticeable until our 40s. These changes can be delayed by using sunscreen with SPF 30 or higher or moisturizers. In addition, regular cleansing and use of topical anti-aging moisturizers can help to reduce the appearance of aging.

Our skin also has a harder time preventing moisture loss as we age because the production of sebum or oil from the sebaceous glands slows over time. This can cause dry skin, particularly on our extremities.

Signs your skin is aging include:

- Wrinkles
- Thinner and more transparent skin
- Hollows in the cheeks and eye sockets and looser flesh on the neck and hands, due to a loss or redistribution of fat in the subcutaneous tissue
- More prominent veins and bones
- Dry skin
- Slow healing when injured

External skin aging is more within our control, but still not entirely so. While we can control how much sun exposure we get (the number one cause of premature aging), we cannot control gravity.

Photoaging, or the amount of aging your skin undergoes

because of sun exposure, depends directly upon a person's skin color (lighter skin tones are more at risk) and the person's history of sun exposure (the more time you spent in the sun, particularly at its most intense, the more likely you are to suffer ill effects through photodamage). The sun's UV light damages elastin, making the skin less stretchy, which may contribute to forming wrinkles. The skin surface may become rough and leathery, and darker spots or freckles may appear.

The changes the skin goes through due to this process can include:

- Freckles
- Age spots or “**liver spots**”
- Spider veins on the face
- Rough or leathery skin
- Wrinkles
- Blotchy complexion
- Precancerous growths
- Skin cancer

We will talk more about sun exposure and skin cancer in Part 4, which begins on page 31.

Other things that contribute to external skin aging include smoking, sleeping in the same position every night (for those who sleep on their sides or stomachs), facial expressions, and gravity (particularly as we reach our 50s).

## Skin: The Science Inside



*Skin ages, just as the rest of one's body does. Spending time in the sun can speed along the process. Signs of external skin aging include liver spots, wrinkles, and rough or leathery skin.*

### Healthy Hair and Nails

Hair and nails consist predominantly of keratin just like skin.

#### *Hair*

Hair serves as an extra layer to keep us warm—about 90% of our body's heat is lost through the head. Nose hair, eyebrows, eyelashes, and the hair in your ears help keep dust and other particles from getting into sensitive areas. Eyebrows and eyelashes also help protect our eyes by filtering light before it reaches them. There is some question about the purpose that pubic and underarm hair serve. Studies of animals (including other primates) suggest that this hair

helps to retain pheromones, or chemicals secreted by the body to attract a mate, but there is no proof this is the case with humans.

As mentioned in the first chapter, hair grows out of follicles located in the skin, and is found everywhere but on our palms, soles, and lips. Each hair consists of a **hair shaft** (the part above the skin) and root, which ends in a bulb that sits in a follicle. Each hair has three layers: the cuticle, or outside protective layer, that is covered with a protein called **keratin**; the **cortex**, or main layer, where the pigment is found; and the **medulla**, or soft center layer.



## Skin: The Science Inside

The root, the part of the hair that is located below the surface of the skin, is alive. The hair shaft itself is no longer alive and does not receive any nourishment.

Hair grows approximately 1/4 of an inch every month and, in its active growing phase, will continue to grow for two to six years before it falls out and is replaced by a new hair. Hair follicles determine the width of each hair—thick hairs grow out of bigger follicles and thinner hairs grow out of smaller follicles. As you age, fewer hairs grow as follicles start to become inactive and the hair goes gray. Follicles that die no longer produce hair, which can lead to baldness.

Baldness, or **alopecia**, can result from a stress to the body, such as illness, chemotherapy, or severe burns. Typical baldness seen in some men (called male pattern baldness) is passed down through a person's genes and cannot be prevented. Medication may slow hair loss, and surgery can transplant healthy hair follicles to replace dead ones.

Some people believe that if they shave hair off, their hair is more likely to grow back thicker. This belief just isn't true. A new hair growing out of the skin may appear thicker for a short period of time, but that's just an optical illusion.

### **Nails**

Nails exist to protect the sensitive tips of your fingers and tops of your toes from injury, as well as providing structure to those areas. They also help us pick up small items and serve as a way for us to protect ourselves.

Nails grow from the **matrix**, which is the root of the nail and which lies below the skin-nail fold called the **cuticle**. Cells from the epidermis just below the matrix slowly move up to the surface of the skin. Because of the matrix, cells at the tips of your fingers and toes get crushed tightly together and form into layers, pushing your nail forward. Nails above the cuticle are not alive and are made of keratin, just like your hair.

The half-circle at the base of each nail is called the **lunula**. It is part of the nail plate. White spots may develop on fingernails indicating a temporary change in the rate the nail is growing.

Fingernails grow 1/8 of an inch a month, three to four times faster than toenails. Nails will continue to grow back if torn off as long as the matrix isn't damaged. As you age, nails grow more slowly, become brittle, and sometimes thicken.

### *When changes in your nail mean more*



**SPOON NAILS:** If your nails are soft and concave, this may be a sign of **anemia**, a deficiency of iron in the body

**YELLOW NAIL SYNDROME:** Slow growth of the nail allows the nails to thicken and turn green or yellow. This may be a sign of a respiratory condition, like bronchitis, or of swelling of the hands.



**TERRY'S NAILS:** If your nails look opaque, but have a darker band just below the fingertip, this could be just a sign of aging, but is also a **symptom** of cancer, congestive heart failure, liver disease, and **diabetes**.



**PITTING:** Small pockmarks that appear in your nails may be a sign of psoriasis.

**BEAU'S LINES:** If your nails have a horizontal line running across them, it means that a serious illness, such as a heart attack, interrupted the growth at the matrix. It is also a sign of malnutrition.



**CLUBBING:** When the tips of your fingers get larger and your fingernails curve around your fingertips, this may indicate lung or liver disease. This can also be genetic.



**ONYCHOLYSIS:** When your fingernails become loose and separate from the bed, it may be a sign of something minor like an injury or a reaction to a nail hardener or acrylic nails, but also could signify thyroid disease, fungal disease, drug reactions, or psoriasis.



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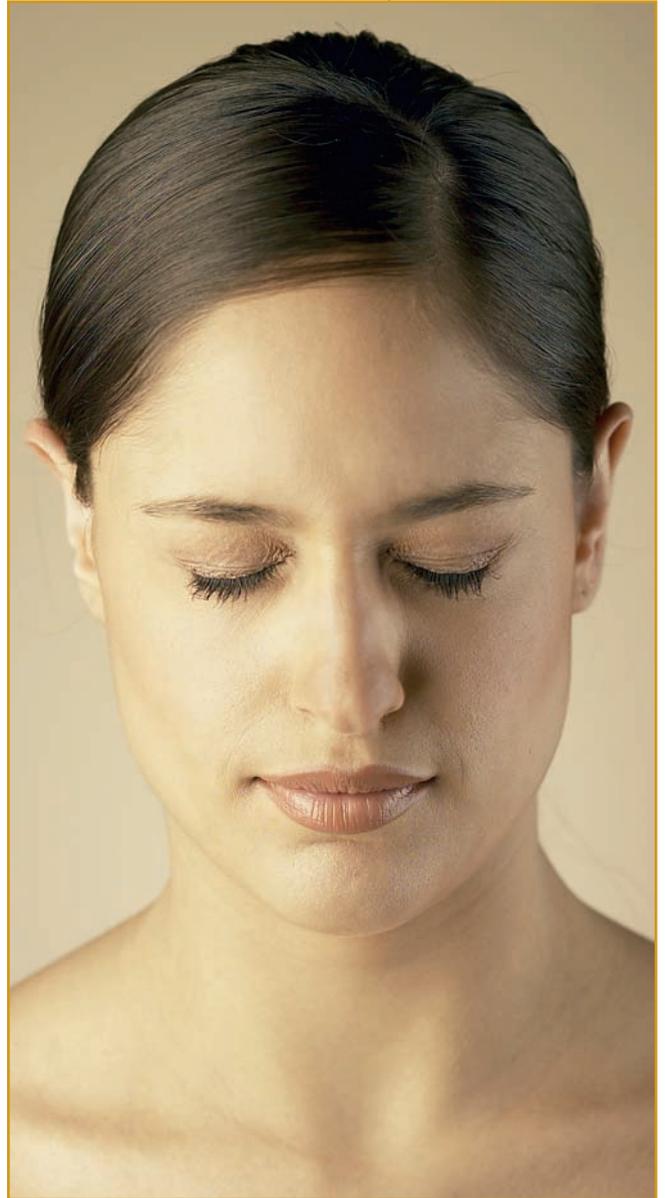
# Part 3: Skin Disorders and Treatment

**W**e tend to pay attention to our skin most when there is something wrong with it—when it itches, when it turns an odd color, when it breaks out in some way. And this happens frequently, if the 11.8 million times a year Americans visit a doctor because of skin rashes is any indication. This section of the book will talk more about the problems we can have with our skin.

## Skin Allergies

An **allergy** is the body's overreaction to certain substances, called **allergens**. An allergic person responds differently to allergens than does a person with no allergies. A person with allergies should avoid allergens that are known to cause symptoms. People who have experienced severe allergic reactions should be under the care of an allergist—a physician who specializes in the treatment of allergies.

When a person is having an allergic reaction to something, cells located in the nose, eyes, lungs, and gastrointestinal tract release chemicals called **histamines**. These chemicals are responsible for producing the symptoms of the allergic reaction—runny nose, watery eyes, or itchy skin, for instance. Inflamed tissues might



## Skin: The Science Inside

grow more inflamed as these chemicals draw other swollen cells to the area. Medicines called **anti-histamines** can be given to prevent histamines from taking effect.

Allergies are not **contagious**.

### Eczema

**Eczema** is the common name for atopic dermatitis. While it gener-

ally starts showing up when a person is a baby, it can develop later on, particularly among people with hay fever. A red, scaly, itchy rash, eczema usually affects the face and behind the elbows and knees. The rash will sometimes ooze and sometimes will be very dry.

Common triggers include overheating or sweating; contact with irritants such as wool, pets, or soaps; emotional stress; certain foods; and secondary staph infections. To prevent the rash from itching, patients should remove the irritants and may want to use a **corticosteroid** cream. Prolonged scratching will make the rash worse.

### African American skin and moisture

Dry skin does not discriminate, but it is more noticeable in some people. African Americans, and others with dark skin, may find that they suffer from dry skin flaking that appears gray or ashy against their complexion.

A warm (not hot) bath with some ground-up oatmeal added to it may relieve some of the discomfort associated with ashy skin and may be effective at helping the skin retain moisture.

Using moisturizers can help, but be sure to choose a product that is designed not to clog pores (**non-comedogenic** moisturizers). Pomades may make a scalp less dry, but if they come into contact with your forehead, they may also lead to a bacterial infection called **folliculitis** that can cause hair loss. If you start to notice red or bumpy skin, contact a dermatologist.



### Contact dermatitis

Contact **dermatitis** is a red, itchy rash caused by an irritant coming into contact with the skin. There are two kinds:

- Allergic contact dermatitis occurs only where an allergen touches the skin, and tends to flare up after touching a plant such as poison ivy or poison oak. Allergic reactions can occur one to two days after coming into contact with the irritant and will take 14 to 28 days to totally clear up. In addition to the common poisonous plants that cause this reaction, irritants may also

include nickel, perfumes and fragrances, dyes, latex, and certain cosmetic ingredients, as well as some medications.

Corticosteroid creams may help relieve the itching if only a small part of the body is affected; a corticosteroid pill may be prescribed if the rash is over a large part of the body. To prevent a reaction from recurring, avoid contact with the irritant.

- Irritant contact dermatitis is more often painful, instead of itchy, the way allergic contact dermatitis is. It is caused by an irritant actually damaging the skin where it comes into contact with it. The longer the irritant touches the skin, the worse the reaction will be. Because water with added soaps and detergent is the most common cause, this rash generally appears on the hands. People with eczema are particularly at risk for this rash. People with this problem should take care to avoid whatever causes the reaction.

### Hives

**Hives** are red, itchy, raised welts that appear on the face or body. They are usually caused by an allergic reaction, most frequently to a **virus**, drugs, food, or latex.



### *The science of allergies*

A person with allergies has an **immune system** that overreacts to substances that do not produce symptoms in most people. Substances that are otherwise harmless, such as animal dander or dust, can trigger a severe allergic reaction in a person who is sensitive to them.

A healthy immune system would normally ignore these substances. But for those people who are allergic to them, their immune system believes that the substance is an invader that must be fought off. Scientists do not know why some substances are allergens for some people and harmless for others.

A person can be allergic only to something to which he or she has been exposed. The first time an allergen enters the body of a person who is likely to develop allergies, a certain type of allergen-specific **antibody** is produced. This antibody travels to cells in certain areas of the body and waits for an invasion by a particular allergen. If the allergen does enter the body, the antibody will capture it and the cells where the antibody have been staying release chemicals such as histamine. These chemicals are responsible for producing the symptoms of an allergic reaction.

The exact cause of allergic reactions is not known. However, there does appear to be a hereditary component to the more common allergies.

## Skin: The Science Inside

### Common causes of skin irritations and allergies include:

- Poison ivy, sumac, and oak
- Metals, including nickel or nickel alloys; cobalt; chromate; and gold
- Latex or rubber
- Acrylates (found in artificial nails, nail repair kits, eyeglass frames, and dental resins)
- Hair dyes
- Pine resin or colophony (found in some mascaras, among other things)
- Bee, wasp, and hornet stings
- Mosquito, flea, and mite bites
- Fragrances and preservatives in cosmetics and skin care products
- Herbal remedies containing certain plants

### Immune system connection

Skin is more than just a way to keep our organs in place. It acts as the first barrier against disease and infection, forming a seal against harmful agents. When swelling, bumps, and inflammation of the skin occur, this is often a sign that the skin has been opened in some way and that an infection has gotten into the body.

Mosquito bumps, for example, are the body's reaction to the saliva that a mosquito leaves in the blood. Many of the skin's reactions, such as itching, swelling, and bumps, are a result of some sort of bacteria or other irritant entering the body.

Along with acting as a defensive barrier, the skin also has some weapons of its own. The epidermis uses Langerhans cells to trap antigens and transport them to the **lymph** nodes where white blood cells fight infection.

*Eczema rash on the back of a sixteen-month-old girl. The rash is across her shoulders where she is scratching and the lower right side of her back.*



While mild cases of hives can be treated with an antihistamine, hives may be a sign of a deeper allergy to something and can be a symptom of **anaphylaxis**, a severe allergic reaction which can quickly lead to death if left untreated. Other symptoms include fever, difficulty swallowing or breathing, nausea, vomiting, diarrhea, abdominal or uterine cramping, congestion, swelling, a feeling of having to urinate, swelling of the lips or joints, severe anxiety, headache, itching, sneezing, coughing, or wheezing. The most dangerous symptoms are low blood pressure, breathing difficulties,

shock, and loss of consciousness. Anaphylaxis should be treated with an injection of **epinephrine**, a chemical form of the hormone adrenaline, in addition to antihistamines and steroids, and the person should be taken to the hospital as soon as possible. (You should never drive yourself if you think there is even a possibility you are suffering from anaphylaxis, because you could pass out while you are driving and cause an accident.) The sooner the person is treated, the less severe the symptoms will be.

Hives are common, affecting nearly a quarter of the U.S. population sometime during their lives.

### Psoriasis

**Psoriasis** is not actually a skin disease; it's actually a disease of the immune system. The cause is not well understood. It is characterized by skin cells that reproduce much faster than they are supposed to—every three to four days instead of every 28 to 30 days—and that fail to shed properly.

As a result, the outermost layer of skin thickens because of the increased schedule of cell building, and, on the surface, a white

scaly or flaky rash shows up over red, irritated skin. The red skin comes from the increased blood flow needed to feed the reproducing cells, while the white rash is the dead skin cells, which are piling up faster than they normally would.

A lifelong disease that affects 4.5 million Americans, psoriasis has an unpredictable cycle of flare-ups, improvement, remission, and recurrence. Triggers for flare-ups include emotional stress, injury to the skin, some types of infection and reactions to certain drugs, and may also include weather, diet, and allergies.

Psoriasis can affect the whole body, but generally is found on the knees, scalp, elbows, and torso.



## Skin: The Science Inside

In addition, 10–30% of those affected by psoriasis also suffer from psoriatic arthritis, where their joints are inflamed, as well as their skin. Neither condition is contagious.

While there is no cure for psoriasis, there are treatments to help calm outbreaks. These include shampoos, creams, light therapy, and drugs (given as pills or shots). Small amounts of sun exposure may help to clear flare-ups, but sunscreen should be used everywhere the psoriasis hasn't affected.

### Acne

**Acne** occurs when the skin's hair follicles become blocked by dead skin cells that have not shed properly but have become sticky with sebum. When this happens, the oil that usually travels freely up to the surface of the skin along the hair follicles is blocked. Once the follicles are plugged, bacteria can grow, causing infections and inflammation.

Scientists do not know the exact cause of acne, but believe it to result from a combination of factors, including hormonal fluctuations, genetics, the use of certain drugs, and exposure to certain compounds.

The blemishes of acne can be divided into five main types:

**Blackheads** occur when the hair follicle is partly blocked on the surface of the skin. The top surface darkens.

**Whiteheads** occur when the hair follicle is totally blocked. They bulge out from the skin.

**Pustules** are raised red pimples or blocked pores with pus present in the center.

**Papules** are red inflamed tender bumps that do not seem to have a head.

**Nodules** or **cysts** occur when the wall of a plugged hair follicle breaks deep in the skin. These pus-filled lumps are larger than pimples and can be quite painful.

While acne is most common amongst teenagers, it may continue into the early 30s. Some people may suffer from acne outbreaks even into their 50s.

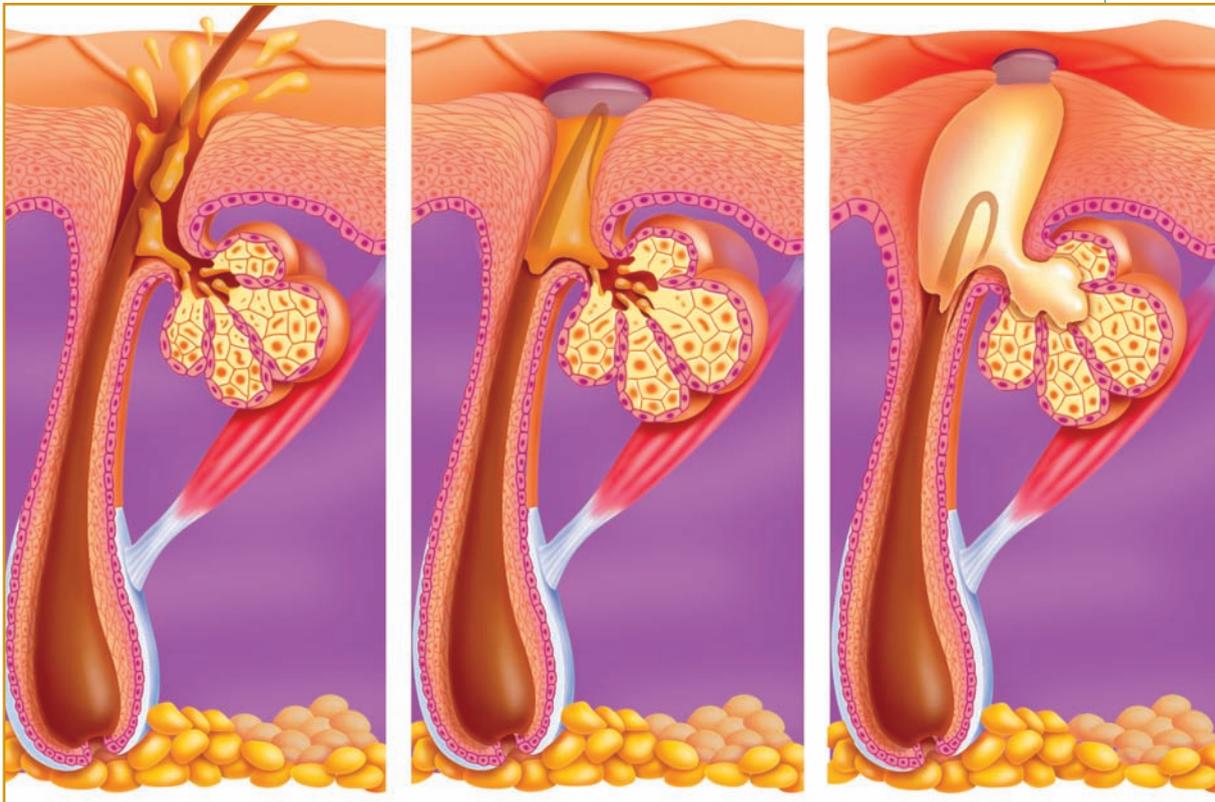
It should be noted that acne is not the same as **rosacea**, which is sometimes incorrectly referred to as adult acne. Rosacea is a separate skin disorder that is characterized by persistent redness in the center of the face. Rosacea has no cure, but can be treated through a combination of diet modification (such as avoiding hot drinks, caffeine, alcohol, and spicy foods) and medication.

## Part 3: Skin Disorders and Treatment

Some myths persist when it comes to acne. It is not true that bad acne means bad personal hygiene. Sweating also does not cause acne, nor does chocolate. Acne can be worsened, however, by picking at blemishes; oil-based makeup, suntan oil, hair gels, and hairspray; hormonal fluctuations, such as a menstrual period; contact with oil and grease from hair, cooking oils, or the environment; and hard scrubbing of the skin.

To help prevent acne, clean the skin gently with a mild cleanser and warm (not hot) water and rinse thoroughly; shampoo regularly; avoid rubbing, touching, or picking at skin irritations; shave facial hair carefully; avoid sunburns or suntans, particularly if you are taking an anti-acne medicine that increases your sensitivity to the sun; and use only oil-free cosmetics.

*Artwork showing the formation of acne. A hair follicle and its sebaceous gland (pale yellow) are seen in the skin. The sebaceous gland produces sebum, an oily substance which waterproofs the hair (seen at left) and is especially active during adolescence. If the hair follicle becomes blocked (center), the sebum builds up in the follicle, leading to an acne spot, or whitehead (right).*



## Skin: The Science Inside

### *Psychological/sociological effects of acne*



Acne usually develops at the onset of puberty, due to hormonal changes. There is a lot of debate about the ultimate cause of acne, but there is no doubt that having it can make you feel less confident about yourself.

Because the condition of their skin is one of the first things that we notice about someone else, conditions that affect the skin often have social and psychological impacts. Acne is one of those conditions that we spend a lot of time thinking and worrying about. It can make us feel bad

about ourselves, so bad that we choose to be alone rather than to be in places where people can see it. People with acne often try to hide from the world, at a time when it is most important to learn how to interact with those around them. About 85% of the population between the ages of 12 and 25 develops acne. Yet, despite the fact that it is a problem that most people have to endure, many acne sufferers feel as if they are alone.

### *Healthy options for making acne less noticeable*

Despite the fact that acne is a common problem, no one really wants to live with blemishes if they don't have to. Luckily, there are some healthy options for treating acne and for making it less noticeable.

For mild acne, washing the affected area twice a day and using an over-the-counter cream with benzoyl peroxide or salicylic acid may help. More severe cases may

require light therapy, chemical peels, drainage, injections, or surgery by a **dermatologist**. They may also be treated with prescription medicines, including birth control pills (for women only), certain oral **antibiotics**, or medicated creams.

The FDA recognizes these ingredients as safe and effective for the treatment of acne in over-the-counter skin care products:

- Benzoyl peroxide
- Resorcinol and sulfur combination
- Salicylic acid
- Sulfur or sulfur-based drugs

It should be noted that benzoyl peroxide and salicylic acid can be used to help prevent future outbreaks. Products containing these ingredients should be applied to the entire face or body, not just to the pimple to get maximum benefit.

As with all treatments, there are no quick fixes. While improvements in acne can be seen very quickly, weeks are generally required before maximum results will be seen.



# Part 4: Sun Exposure and Skin Cancer

## Sun and your skin

**T**he sun gives life. In addition to warming and lighting the earth, it also helps plants, the bottom rung of the food chain, to grow. Additionally, there is research that suggests exposure to sunlight may help reduce depression, particularly during the winter months.

Sunlight is the source of ultraviolet rays, which can be divided into two types, Ultraviolet A (UVA) and Ultraviolet B (UVB). UVB rays help the body produce and process vitamin D, which is necessary for strong bones.

Unfortunately, UV rays also are responsible for suntans, **sunburns**, and premature aging. They also cause skin cancer and eye damage.

UVA rays penetrate more deeply into the skin and are partially able to penetrate through even heavy clouds, glass, and smog.

Ultraviolet exposure over time can cause the destruction of individual cells in the skin and eyes.



Sometimes the UV exposure can cause a defect in the DNA of a cell. When that happens, it will keep on dividing and copying the error in the DNA into future versions of itself. The new cells may divide and grow wildly, becoming a skin cancer.

Melanin, or the pigment in the skin, absorbs radiation from UV rays. Therefore, it acts as a sunscreen to the cells below it. People with dark skin have a lot of melanin in their skin naturally. Lighter-skinned people must produce extra, which is why they tan and burn when exposed to a lot of sun. However, no matter how much melanin you have in your skin, it is not enough to

## Skin: The Science Inside

### *A guide to sunscreen*

**Sunscreens** are important to use on a regular basis. Here are a few things to keep in mind about them:

- The chemicals in sunscreen that absorb UV rays need approximately 20–30 minutes to seep into your skin. Apply it at least 20–30 minutes before you are planning to be in the sun.
- Unless it is labeled as “broad-spectrum,” a sunscreen will best protect against UVB rays, not against UVA rays.
- SPF stands for “Sun Protection Factor.” The higher the number, the better.
- Doctors recommend a sunscreen with an SPF of 30 or higher at all times.
- Reapply sunscreen frequently; every 90 minutes is a good timeframe.
- Even waterproof sunscreen will wash off over time. Don’t forget to reapply.
- Cloudy skies do not completely stop UV rays from reaching the ground. Therefore, wear a sunscreen even on cloudy days.



screen out all the UV rays, and some will damage your skin. You can help limit the damage by using sunscreen.

### What is skin cancer?

Sun damage to your skin can cause the skin’s cells to change and grow out of control—a condition known as skin cancer. Catching the cancer early is a key to treating it, so you should perform regular checkups of your skin to make sure it hasn’t changed. Skin is damaged below the surface for a long time before the problems make their way to the surface, so you shouldn’t delay if you notice something wrong.

There are three types of skin cancer:

- Basal cell carcinoma
- Squamous cell carcinoma
- Melanoma

Basal cell **carcinoma** is the most common form of skin cancer and of cancer, in general. It is slow growing (it may grow only one to two centimeters over several years’ time) and usually does not spread far or fast. Early treatment offers excellent recovery rates.

Basal cell carcinoma grows in the basal cells, which are at the bottom of the epidermis. It is a result of chronic exposure to sunlight, so

it is most commonly found on exposed parts of the body—the face, ears, neck, shoulders, and back—and on the scalp. On rare occasions, tumors will grow on unexposed areas, on areas that have come into contact with arsenic or radiation, or on the site of old burns, **scars**, vaccinations, or tattoos.

The most common characteristics of a basal cell carcinoma are:

- An open sore that oozes, bleeds, or crusts over and refuses to heal for three or more weeks. This is the most common symptom.
- A reddish patch or irritated area that may crust over, itch, or hurt. This is most frequently found on the chest, shoulders, arms, or legs.
- A shiny bump or nodule that is pearly or translucent. Although usually pink, white, or red in color, the bump can also be darker, particularly in those with darker coloring.
- A pink growth with a slightly raised rolled border and a crust-ed over indentation in the middle. Blood vessels may appear on the surface over time.
- A scar-like wound, scab, or spot in an area that hasn't been injured. Generally the scar-like area is white, yellow, or waxy and has vague borders. The skin of the scar looks shiny and

tight. This symptom can be the sign of an aggressive tumor.

Two or more of these characteristics are often found in one tumor. In rare cases, though, basal cell carcinoma resembles another skin condition. It is best to give yourself regular self-exams (especially if you have a skin condition) and to see a skin doctor regularly.

Until recently, this type of skin cancer mostly affected older people, particularly men who had worked outside. But now, 800,000 Americans are affected by basal cell carcinoma every year and are

### *What is cancer?*

**Cancer** is a large group of diseases that are caused by abnormal **cells** growing out-of-control. These cells grow and divide into new cells very rapidly, and eventually they move into and infect new areas of the body.

Cancer is caused by damage to the DNA in cells. While the body is normally able to fix damaged DNA, for some reason, cancerous cells' DNA is unable to be repaired.

Most cancers (although not all) begin as tumors or growths. Tumors that are malignant are ones that spread and that eventually can be fatal. Benign tumors do not spread and generally are not considered dangerous.

Cancers are treated differently depending on what kind they are. Skin cancer is treated differently than lung cancer or other types of internal cancers.

While doctors nowadays believe that you are never cured of cancer, they do believe it can be treated so it does not come back. Remission rates depend on how early you detect the disease and how aggressive it is, so going to the doctor as soon as you notice a problem is very important.

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being diagnosed younger and younger. More women are getting the disease than in the past, but this skin cancer is still more common among men.

Squamous cell carcinoma is the second most common type of skin cancer. It is not as slow growing as basal cell carcinoma, but is not as aggressive as melanoma. It will eventually spread to other areas of the body.

Squamous cell carcinoma grows in the squamous cells that are in the middle layers of the epidermis. It is mostly found on parts of the body that get sun exposure and frequently targets the lower lip and the rim of the ear, but it can occur anywhere on the body, including the mucous membranes. This type of skin cancer also can occur anywhere the skin has suffered an injury or been exposed to X-rays or chemicals, as well as in those who have a **chronic** skin

*Squamous  
cell  
carcinoma*



*Basal cell carcinoma*

inflammation or a suppressed immune system.

Symptoms of a squamous cell carcinoma:

- A wart-like growth that crusts over and bleeds.
- A persistent, scaly red patch with irregular borders that sometimes crusts over or bleeds.
- An open sore that bleeds and crusts over and refuses to heal.
- A cone-like growth.
- A raised growth with a depression in the middle that sometimes bleeds. This type of growth may grow quickly.

Squamous cell carcinoma affects more than 200,000 Americans a year. While dark-skinned African Americans are less likely to develop skin cancer, 2/3 of their skin cancer cases are squamous cell carcinoma, usually on the site of a

previous burn injury or inflammatory skin condition. This type of skin cancer is more common among people over the age of 50.

People should pay attention to certain signs because they mean a person is at higher risk to develop this type of skin cancer:

- **Actinic or solar keratosis:** these are rough, scaly, slightly raised growths that appear mostly on older people.
- **Actinic cheilitis:** a type of actinic keratosis that occurs on the lips that causes them to become dry, cracked, scaly, and pale or white.
- **Leukoplakia:** white patches on the tongue or inside of the mouth.
- **Bowen's disease:** a persistent red-brown scaly patch that may resemble psoriasis or eczema.

Squamous cell carcinoma has a high cure rate if it is caught before it spreads to other parts of the body.

**Melanoma** is the most serious and the most deadly form of skin cancer. That said, if it is caught early and removed while it is still thin and limited to the epidermis, it is almost always curable. Because this cancer spreads quickly and is difficult to treat once it spreads past the skin and

lymph nodes, if you notice symptoms, you should call your doctor immediately.

Melanoma is a cancerous tumor that originates in melanocytes, the cells that produce the pigment that colors our skin, hair, and eyes. Because of this, most melanomas are brown or black (although some may stop producing pigment and may be skin-colored, pink, red, or purple). It is directly related to sun exposure, particularly severe sunburns during childhood. It is most common among people with fair skin, light eyes, and red or blond hair.

There are four main types of melanoma:

- **Superficial spreading melanoma** travels along the top layer of skin and is usually flat or only slightly raised. Irregular in shape, the patch has varying shades of black, brown, tan, red,



*Melanoma*

## Skin: The Science Inside

blue, or white. Sometimes an older mole will change color or shape in this way. It is the most common type of melanoma and affects mostly Caucasians. It can occur at any age and anywhere on the body, but is most likely to occur on the trunk in men, the legs in women, and the upper back of both.

- Lentigo maligna melanoma also remains close to the skin's surface for quite a while. It usually appears as large areas of flat or slightly elevated mottled tan, brown, or dark brown color. It is most common in the elderly. It occurs where the skin has been weathered by the sun—particularly on the face, ears, neck, arms, and upper trunk.
- Nodular melanoma is the most aggressive kind of skin cancer because it penetrates the skin and moves to other parts of the body quickly. It is generally a black bump or raised area, but can be blue, gray, white, brown, tan, red, or skin-colored. It generally is found on the trunk, legs, and arms, usually of older people, as well as on men's scalps.
- Acral lentiginous melanoma is the least common form of skin cancer. It also spreads along the surface of the skin, but generally appears as a black or brown discoloration under or along the

nails, on the palms or on the soles of the feet. It is the most common melanoma among African Americans, Asians and others with dark skin. It is least common among Caucasians.

During the last 10 years, the number of cases of melanoma has increased more than any other type of cancer, with 51,000 new cases every year. In the United States, one in 85 people will develop melanoma at some point during their lives. Melanoma is the top cause of cancer death in women between the ages of 25 and 30.

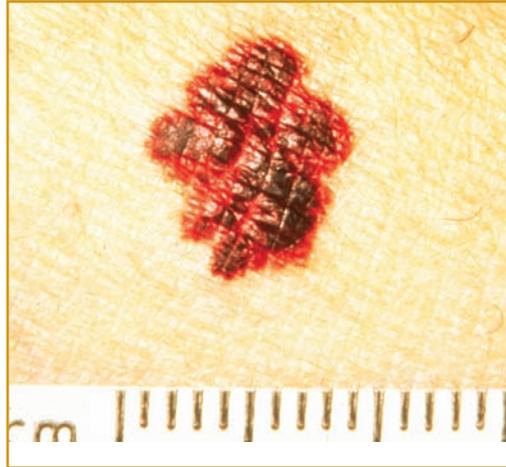
You are most at risk for melanoma if you:

- have a family history of the disease;
- have light hair or skin;
- have multiple birthmarks;
- develop a precancerous growth (actinic keratosis);
- have freckling on the upper back;
- have three or more blistering sunburns before you turn 20;
- work at an outdoor job for three or more summers as a teenager; or
- have high levels of exposure to strong sunlight.

Generally, if you have warts, moles or other skin growths, you should check them regularly and contact a doctor if they change shape, size, texture, or appearance or if they begin to hurt, swell, bleed, or itch.

Recognizing melanomas early is the only way to survive them. If you notice any of the following four ABCD symptoms, contact a doctor immediately:

- **Asymmetry:** the two halves of the abnormal area are different from each other.
- **Borders:** the growth is oddly shaped.
- **Color:** the color of the growth varies or is mixed.
- **Diameter:** the spot is bigger than a pencil eraser.



*Borders*



*Color*



*Asymmetry*



*Diameter*



# Part 5: Promising Research: The Skin Care of Tomorrow

**T**he thing to remember about skin cancer and skin conditions is that while they can be scary or intimidating when you're first diagnosed with them, scientists are working hard to improve prevention and diagnosis and to find treatments and cures for all of them.

Here's a look at some of the research on the horizon:

## The basics of skin growth

Scientists are figuring out how skin forms in order to perform all of its various jobs. Using mouse embryos, they have found that the epidermis starts as a single layer of cells attached to a membrane of proteins. The membrane communicates with the cells to separate them from other tissue below. Each cell divides into two new cells, with the one in charge of cell growth staying attached to the membrane and the other cell, which can be involved in the skin's other jobs, gradually mov-



ing outward toward the skin's surface, where it is eventually shed. By understanding this process, scientists expect to figure out at what point skin diseases begin to form and why.

## The genetics of skin diseases

One doctor is attacking skin diseases through a variety of studies into the genetics of inflammatory, or autoimmune, skin disorders. She is using the most current molecular techniques to find and examine the genes that cause ailments ranging from atopic

## Skin: The Science Inside



dermatitis and psoriasis to **lupus** and the hair-loss disease **alopecia**. She is using a new technology called “gene chips” to screen for thousands of genetic sequences at once. Ultimately, her goal is to discover what makes people susceptible to these diseases in order to find out who is most at risk and how, eventually, to treat their cases.

Researchers at the National Institutes of Health recently discovered that overproduction of a specific protein that helps link cells to one another causes the skin (or another tissue, like in the nose and lungs) to stop being such a protective barrier. This can allow allergens to enter the body, causing a variety of illnesses—from asthma to eczema—and triggering inflammation that again reduces the skin’s effectiveness. The discovery of this cycle will allow scientists to look at ways to rein-

force the skin temporarily, such as with an allergen-blocking cream or ointment, in order to let the skin heal thoroughly and reproduce its normal barrier to the world.

### Psoriasis

Several recent studies indicate there is a glimmer of hope when dealing with psoriasis. Researchers have found there is a link between a person’s susceptibility to psoriasis and to atopic dermatitis. The same study found that the presence of a certain gene indicated whether someone who had psoriasis was at risk of developing psoriatic arthritis.

Other researchers are also looking at the genetics of the disease. One group has discovered that a gene that regulates growth in the vascular system may add to one’s susceptibility to psoriasis. This finding may eventually lead to a new approach to treating the illness. Another group is using a genealogical database, genetic material, and clinical information from patients to better understand the role genes play in the development of the disease. Learning how the psoriasis begins and progresses can help doctors prevent it or treat it at its earliest stages as well as figure out who is at risk for developing it.

Another group of scientists is studying psoriasis at the molecular level. They are working out how a molecule helps cause the painful lesions associated with the illness. Their research also focuses on the link between this molecule and the immune system malfunction that causes psoriasis.

Meanwhile, a group of researchers is using psoriasis as a model to identify the substances found in the body that trigger an immune response for autoimmune diseases.

Finally, scientists are developing new ways to treat the condition through **biologics**, which are drugs synthesized from living organisms or their products and used medically. Biologics are being used to target the reactions that cause psoriasis, to control the condition, and to prevent flare-ups. Patients have found there to be fewer side effects with these new treatments.

Currently three biologics have been approved by the FDA to treat psoriasis. A fourth is currently in the third stage of **clinical trials**.

Dozens of other drugs—in pills, shots, and creams—as well as light therapies are in the process of being tested for their safety and



*Allen G. Li, M.D., Ph.D of Oregon Health and Science University is among the scientists who are advancing psoriasis research.*

effectiveness. Some stop or slow cell growth or spreading. Others help to reduce inflammation.

### Skin cancer

Doctors and researchers are also working on ways to prevent and treat skin cancer. Some scientists want to find out the causes of skin cancer and how to prevent it from forming. One scientist, who is looking at the genetics of basal cell carcinomas, is trying to find out what role genes play in the formation of benign and cancerous tumors in order to help other researchers develop diagnoses and treatments that can help people earlier. Another study being run by scientists in Tennessee uses focused light therapy to remove

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pre-cancerous skin lesions. This is an alternative for someone who can't handle other removal procedures, like freezing, or who has multiple areas that need treatment at one time.

Other studies focus on treating cancer. One clinical trial in New York City is trying to find a better drug treatment than the standard chemotherapy treatment that is being used to treat advanced melanomas. Researchers are

hoping that the new drug will increase the number of people who survive advanced melanoma. Another New York City research team is injecting cancer patients with drugs that are designed to stimulate the immune system. Their hope is that the immune system will then recognize and destroy melanoma cells. Researchers in Texas have found that injecting interferon, a protein that stimulates the immune system to help fight cancer, directly into a



basal cell carcinoma tumor may be as effective as other methods of treating the cancer. Further tests are being done to find out which treatments are best for whom.

Additionally, a group of Boston scientists has discovered a genetic abnormality in the cells of some melanoma patients. The presence of the gene makes the cancer much harder to treat. Scientists are hopeful that this discovery will give them new ideas about targeting the gene in treatments. This study may offer up hope to some people who otherwise would not have good odds of beating their cancer.

Still other researchers are looking at ways to improve sunscreens. Some want to create sunscreens that feel lighter when you put them on to encourage people to wear them every day or that are in different formulas (a stick as opposed to a lotion, for instance). Others are trying to increase sunscreen's ability to block UV rays—both in how much they block and for how long. Still others are examining how effective certain sunblocks are at higher elevations where the sun is more likely to burn skin more quickly than at lower altitudes.

### Acne

Researchers also are focusing their attention on skin conditions that are annoying but not life-threatening, such as acne.

Michigan scientists are attacking the problem at a molecular level. They are exploring the role of cells and chemicals under the surface of the skin and are evaluating new therapies to treat the condition. Specifically, this group of researchers is looking at the molecules that attract the inflammatory cells that cause the skin to become red and bumpy. They're also looking at what effect acne may have on the skin's collagen and its ability to repair itself. Finally, they're exploring a variety of treatment options from a woman's use of birth control pills in combination with topical agents (which they've found to be successful) to the use of pulsed dye laser therapy (which they found didn't work).

One Pennsylvania researcher is looking at the role that hormones play in causing acne: whether there are differences in hormone production between those who suffer from acne and those who don't and what changes occur in the skin that result in adult acne. Having found new information

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about the role of enzymes in the skin that produce hormones in the oil glands, this scientist is now also collaborating with other researchers to develop new acne treatments.

Still other researchers are finding newer and better ways to prevent and treat acne and to reduce the scarring it can cause. Some create new and more effective cleansers. Others create treatments for acne that has become inflamed.

### **The important role of volunteers**

Advances in skin care cannot happen without volunteers. Some people share information about their own and their family's medical conditions. Others donate skin tissue for researchers to work on. Still others agree to participate in clinical trials. Clinical trials are research projects involving volunteers. They test medical treatments, medicines, or prevention strategies to see how effective they will be. A clinical trial usually is only conducted after a drug or therapy has been successful in a laboratory setting. Over the years, hundreds of thousands of Americans have volunteered to

take part in clinical trials; these trials have helped create today's cancer treatments, acne medicines, and sunscreens.

Treatments don't work the same for everyone, however, so it is very important to get a wide variety of people to take part in clinical trials. Children and teens (with their parents' or guardians' permission), adults, men, and women from all races and ethnic groups, lifestyles, and ages are needed to participate in order to make sure treatments and preventions work for everyone. As with any medical decision, though, you should think about a decision to take part in a clinical trial before you agree to it. There are questions to consider in Appendix 2 on page 48.

Without volunteers, advances in skin care—both for healthy skin and for unhealthy skin—are not possible. Those who help out get the satisfaction of knowing their involvement in clinical trials may some day offer new prevention methods or treatment options for the members of their family or community.

# Conclusion: What You Can Do to Have Healthier Skin

**Y**our skin is important to your well-being. Treat it well and it will continue to protect you from danger and from infection. Here are a few tips to keep in mind:

**Stay out of the sun.** Avoid the hours of direct sunlight: 10 a.m.–3 p.m. The sun is at its strongest at this point and skin is more likely to burn. Remember that harmful UV rays can penetrate clouds, so this is true even on overcast days. Those who live at higher elevations or closer to the equator should pay particular attention to the amount of sun they get, but even those who live at sea level or close to the poles need to be careful.

**Use sunscreen.** Doctors recommend a sunscreen with an SPF of 30 or higher. Apply the sunscreen 20–30 minutes before you go outside. Reapply sunscreen every 90 minutes to prevent it wearing off. Wear sunscreen even on cloudy days.



**Wear protective clothing.** Wear a hat with a wide brim to keep the sun off your face, scalp, and neck. Wear sunglasses with UV protection to keep your eyes from being damaged. Wear light-

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colored clothing to reflect the light and long pants and shirts when possible to protect your skin from exposure to harmful UV rays.

**Do skin self-exams.** Your skin can change quickly and subtly without a lot of notice. The best way to learn how your skin changes over time is to begin doing regular self-examinations of your skin. Look at all moles and birthmarks. Know their size, shape, texture, and color. That way, if they change, you will

notice. Make sure you use a mirror to see your back and other body parts that might be hard to see.

**Keep your skin and hair clean and well moisturized.** Skin and hair require regular cleaning to do their job properly. Wash your skin gently with warm water twice a day to remove dead skin cells and excess oil. If you are prone to dry skin, apply lotion while your skin is still damp to seal moisture in. If you are prone to break outs use products on your skin that say they are non-comedogenic. Wash your hair regularly to keep grease from building up.

**Don't wait to talk to a doctor.** Skin conditions and skin cancer are treatable. Waiting to see a doctor about changes in a mole or birthmark could limit your options for treatment and ultimately could make it hard to prevent it from spreading to other parts of your body. Waiting to see a doctor about a skin rash or condition will mean it takes longer before you get relief or know how to prevent future outbreaks.

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# Appendix 1: Questions to Ask Your Doctor about Your Skin

1. I've never had any problems with my skin. Should I be worried about the future?
2. Should I be concerned about this spot?
3. If I have skin cancer, what kind is it?
4. Someone in my family has had a skin condition. Am I more likely to have it too?
5. How do I know if I have a skin condition?
6. Why are the symptoms of my skin condition worse some days?
7. How can I tell if I have a skin allergy?
8. How soon should I see results from this treatment?
9. Will I grow out of this allergy?
10. Will I grow out of my acne breakouts?
11. During an allergic reaction, how will I know when I should go to the emergency room?
12. How can I manage my condition to prevent flare-ups?
13. Should I change my lifestyle at all?

# Appendix 2: Taking Part in Research Studies—Questions to Ask

A research study is a way of finding answers to difficult scientific or health questions. Here are some important questions you should ask of anyone who wants you, or members of your family or community, to be part of a research study:

1. What is the study about?  
Why are you doing the study?  
Why do you want to study me or people like me? Who else is being studied?  
What do you want to get out of the study?  
What will you do with the results?  
Have you or others done this type of study ever before? Around here?  
What did you learn?
2. Who put the study together?  
Who is running or is in charge of the study?  
Whose idea was the study?  
How were people like me part of putting it together?  
Who are the researchers? Are they doctors or scientists? Who do they work for?  
Have they done studies like this before?  
Is the government part of the study? Who else is a part of the study?  
Who is paying for the study?  
Who will make money from the results of the study?
3. How can people like me share their ideas as you do the study?  
How will the study be explained in my community?  
Who among people like me will look at the study before it starts?

Who among people like me are you talking to as you do the study?  
A Community Advisory Board?

Who from the study can I go to with ideas, questions, or complaints?

How will people like me find out about how the study is going?

4. Who is going to be in the study?

What kinds of people are you looking for? Why?

Are you trying to get minorities into the study?

Are you including people younger than 18 years old?

How are you finding people for the study?

Is transportation or day care provided for people who take part in the study?

Do I need to sign anything in order to participate?

Will you answer all of my questions before I sign the consent form?

Can I quit the study after signing the consent form? If I quit the study, will anything happen to me?

5. What will I get out of the study?

What are the benefits?

Is payment involved? How will I be paid?

Will I get free health care or other services if I participate? For how long?

Will I get general health care or psychological care if I participate? For how long?

6. How will I be protected from harm?

Do I stand a chance of being harmed in the study? In the future?

Does the study protect me from all types of harm attributable to it?

If I get harmed, who will take care of me? Who is responsible?

If I get harmed in any way, will I get all needed treatment? Who pays for treatment?

7. How will my privacy be protected?

Who is going to see the information I give?

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Will my name be used with the information?

What happens to the information I gave if I quit the study?

Is there a written guarantee of privacy?

8. What do I have to do in the study?

When did you start the study? How long will it last?

How much of the study have you already done?

Have there been any problems so far?

Will I get treated the same as everyone else?

What kinds of different treatments are offered in the study? Are there both real and fake treatments?

9. What will be left behind after the study is over?

What will happen to the information people give? How will it be kept?

What are you going to do with the results of the study?

How will the public learn about the results? Will results be in places where the public can see them?

Are you going to send me a copy of the results? When?

What other studies are you planning to do here?

*The questions above are from a pamphlet developed by Project LinCS (Linking Communities and Scientists), Community Advisory Board (Durham, N.C.), and Investigators (University of North Carolina Center for Health Promotion and Disease Prevention) in cooperation with the Centers for Disease Control and Prevention, Atlanta, Ga. For copies of this brochure, contact the CDC National Prevention Information Network at 1-800-458-5231.*

# Appendix 3: Other Skin Conditions

There are other skin conditions we haven't mentioned earlier in the book, but about which you may be curious. We include some of them here:

## ABSCESS

An **abscess** occurs when your skin is injured in some way (an ingrown hair, for instance) and becomes infected. Pus and other infected material develops in or under the skin and can cause an infection to become worse and to spread to other parts of the body. If an abscess is not treated, the infection that has caused it could lead to the skin tissue around the abscess dying. Your doctor can drain the abscess and treat the infection with antibiotics.

## ATHLETE'S FOOT

**Athlete's foot** is a common condition caused by mold-like fungi. The fungus is contagious and prefers damp areas, like showers and locker room floors. The fungus causes the affected areas, usually the soles of your feet and between your toes, to itch and turn red. If your feet are affected and you touch them and then another part of your body (particularly your palms, groin area, or underarms), the infection can move to that part of the body too.

The infection usually can be treated with over-the-counter medicines. To avoid developing the infection, dry your feet with a clean towel after you get them wet, wear beach shoes or flip-flops in public showers, and avoid wearing damp socks.

The fungi that cause athlete's foot also cause ringworm, which often affects your scalp, and jock itch, which affects the groin area. You can get this on your forehead a lot, too, which little kids commonly do.

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### **COLD SORE**

A **cold sore**, also known as a fever blister, is caused by a herpes virus. (Herpes is a family of viruses. The one that causes cold sores is not the same one that causes the sexually transmitted disease, genital herpes.) The virus causes small and painful blisters or a rash to show up on an infected person's lips, gums, mouth, and the skin around the mouth. Most people who suffer from cold sores are infected by the herpes virus when they are newborns or as young children. Outbreaks are triggered by a number of causes, including sun exposure, a fever, menstruation, and stress.

The herpes virus is contagious; if you suffer from cold sores, you should be very careful not to affect other people (by sharing infected razors, towels, or other objects or by having oral sex during an outbreak) or to transfer the infection from your mouth to your eyes. Herpes eye infections are one of the leading causes of blindness. The virus is particularly contagious when you can see or feel blisters, but because the virus lives in the nerves of the face, you do not need to be able to see a cold sore to be contagious.

Untreated, the cold sores will go away after a week or two. Antiviral medicines can shorten that time. There is no cure for cold sores.

### **KELOID**

A **keloid** is a raised, reddish scar at the site of a healed injury caused by too much collagen being deposited there. It is most common in those with African and Asian ancestry.

Some keloids can be partially removed, but it is common for them to come back. Most keloids aren't dangerous to your overall health, but if a person has a lot of keloids, they could eventually affect the person's mobility.

### **SCLERODERMA**

**Scleroderma** is a symptom of a group of chronic diseases that cause inflammation and pain in the connective tissues of your body. These diseases can cause your body to overproduce collagen, which causes your

skin to thicken, tighten, and harden. This can make it difficult to bend or straighten your fingers.

There are two main types of scleroderma: localized and systemic. The localized version affects only the skin and its related tissue and will not affect your internal organs. Localized scleroderma can go away over time, but it also can be serious and disabling, because the skin conditions caused by it can become permanent. The systemic version affects more parts of your body, including your other organs and can be limited or diffuse. If it is limited, it develops slowly and affects the skin of only a limited area. If it is diffuse, it comes on quickly and will spread and worsen and will affect other parts of your body, including your heart, lungs, and kidneys.

In addition to skin hardening, scleroderma can also cause painful ulcers, poor circulation in the hands and feet, and difficulty swallowing.

Scientists do not know what causes scleroderma. There is no way to prevent or cure the condition.

### **STRETCH MARKS**

**Stretch marks** are skin defects that appear when the skin stretches rapidly, particularly after a person gains or loses a lot of weight or during pregnancy or puberty. These red, glossy streaks on the skin develop when collagen doesn't form properly.

Stretch marks will fade to white over time and may eventually disappear, but otherwise there is no way to treat them.



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# Resources

## **American Academy of Dermatology**

*This organization offers consumer health information related to all aspects of skin and dermatology through their news updates, web site, and magazine. They also offer a number of public programs, including free skin cancer screenings, as well as sponsoring a camp for children who suffer from serious skin disorders.*

P.O. Box 4014

Schaumburg, IL 60168-4014

Phone: (847) 330-0230

[www.aad.org](http://www.aad.org)

## **American Burn Association**

*Dedicated to promoting and supporting burn-related research, education, care, rehabilitation, and prevention.*

625 N. Michigan Ave., Suite 2550

Chicago, IL 60611

312-642-9260

[www.ameriburn.org](http://www.ameriburn.org)

## **American Cancer Society**

*Dedicated to eliminating cancer as a major health problem by preventing cancer, saving lives, and diminishing suffering from cancer through research, education, advocacy, and service.*

Atlanta, GA 30329

1-800-ACS-2345/TTY: 1-866-228-4327

[www.cancer.org](http://www.cancer.org)

## **American Osteopathic College of Dermatology**

*Offers a database of various skin ailments as well as additional information about skin.*

[www.aocd.org/skin/](http://www.aocd.org/skin/)

## **Centers for Disease Control and Prevention**

Division of Cancer Prevention and Control

*Conducts, supports, and promotes efforts to prevent cancer and to increase early detection of cancer.*

## [Skin: The Science Inside](#)

Division of Cancer Prevention and Control  
Mail Stop K-64, 4770 Buford Highway, NE  
Atlanta, GA 30341-3717  
1-800-CDC-INFO/TTY: 888-232-6348  
FAX: 770-488-4760  
*[www.cdc.gov/cancer/index.htm](http://www.cdc.gov/cancer/index.htm)*

### **ClinicalTrials.gov**

*A web-based resource for finding clinical trials in need of volunteers.*  
*[www.clinicaltrials.gov](http://www.clinicaltrials.gov)*

### **Combined Health Information Database**

*A web-based service that combines resources on health and disease topics from several federal agencies. A service of the National Institutes of Health.*  
*[chid.nih.gov/simple/simple.html](http://chid.nih.gov/simple/simple.html)*

### **Healthy People 2010**

*A nationwide health promotion and disease prevention campaign sponsored by the Department of Health and Human Services. One of the goals of the campaign is to reduce health disparities.*  
Office of Disease Prevention and Health Promotion  
200 Independence Avenue, SW, Room 738G  
Washington, DC 20201  
*[www.healthypeople.gov](http://www.healthypeople.gov)*

### **MEDLINEplus**

*A comprehensive source of health information provided by the National Library of Medicine.*  
*[www.nlm.nih.gov/medlineplus/](http://www.nlm.nih.gov/medlineplus/)*

### **Herpes Resource Center**

*Increases education public awareness, and support to anyone concerned about herpes.*  
American Social Health Association  
P.O. Box 13827  
Research Triangle Park, NC 27709  
919-361-8400  
*[www.ashastd.org/herpes/herpes\\_overview.cfm](http://www.ashastd.org/herpes/herpes_overview.cfm)*

### **Melanoma.com**

*Offers information about preventing, diagnosing, and treating melanoma.*

*[www.melanoma.com](http://www.melanoma.com)*

### **National Cancer Institute**

*The Federal Government's principal agency for cancer research and training.*

6116 Executive Boulevard

Room 3036A

Bethesda, MD 20892-8322

1-800-4-CANCER/TTY: 1-800-332-8615

*[www.cancer.gov](http://www.cancer.gov)*

### **National Center on Minority Health and Health Disparities**

*Promotes the health of racial and ethnic populations through research and education and through support of minority involvement in research careers. Affiliated with the National Institutes of Health.*

6707 Democracy Blvd., Suite 800

MSC 5465

Bethesda, MD 20892-5465

301-402-1366/TTY: 301-451-9532

*[ncmhd.nih.gov](http://ncmhd.nih.gov)*

### **National Eczema Association**

*Improves the health and quality of life for individuals with eczema through research, support, and education.*

4460 Redwood Highway, Suite 16-D

San Rafael, CA 94903-1953

1-800-818-7546/Fax: 415-472-5345

*[www.nationaleczema.org](http://www.nationaleczema.org)*

### **National Institute of Arthritis and Musculoskeletal and Skin Diseases**

*Supports research into the causes, treatment, and prevention of arthritis and musculoskeletal and skin diseases.*

National Institutes of Health

Bldg. 31, Room 4C02

31 Center Dr. - MSC 2350

Bethesda, MD 20892-2350

301-496-8190/Fax: 301-480-2814

*[www.niams.nih.gov](http://www.niams.nih.gov)*

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### **National Psoriasis Foundation**

*Improves the quality of life of people who have psoriasis and psoriatic arthritis by promoting awareness and understanding, ensuring access to treatment and supporting research that will lead to effective management and a cure.*

6600 SW 92nd Ave., Suite 300  
Portland, OR 97223-7195  
800-723-9166/Fax: 503-245-0626  
[www.psoriasis.org](http://www.psoriasis.org)

### **National Rosacea Foundation**

*Improves the lives of people with rosacea by raising awareness, providing public health information and supporting medical research.*

800 S. Northwest Hwy., Suite 200  
Barrington, IL 600100  
888-NO-BLUSH  
[www.rosacea.org](http://www.rosacea.org)

### **National Vitiligo Foundation**

*Educates the public about vitiligo and encourages, promotes, and funds increased scientific and clinical research on its cause, treatments and ultimate cure.*

76 Garden Rd.  
Columbus, OH 43214  
614-261-8145  
[www.nvfi.org](http://www.nvfi.org)

### **Native American Research Centers for Health**

*Research centers that link the Native American community with health research and that work to increase the number of Native American scientists and health professionals.*

National Institute of General Medical Sciences  
National Institutes of Health  
45 Center Drive MSC 6200  
Bethesda, MD 20892-6200  
(301) 496-7301  
[www.nigms.nih.gov](http://www.nigms.nih.gov)

### **Nevus Outreach, Inc.**

*Offers support and information to those with nevi, improves awareness and education of the condition, and encourages and sponsors research that will lead to effective treatments and a cure.*

600 SE Delaware Ave., Suite 200  
Bartlesville, OK 74003  
877-4-A-NEVUS/Fax: 281-417-4020  
[www.nevus.org](http://www.nevus.org)

### **New York Online Access to Health**

*A searchable health information resource in English and Spanish.*  
[www.noah-health.org/index.html](http://www.noah-health.org/index.html)

### **Office for Human Research Protections**

*A source of information on the guidelines and ethics of research studies with humans.*

Department of Health and Human Services  
1101 Wootton Parkway, Suite 200  
Rockville, MD 20852  
1-866-447-4777/301-496-7005  
[www.hhs.gov/ohrp](http://www.hhs.gov/ohrp)

### **Office of Minority Health Resource Center**

*Serves as a national resource and referral service on minority health issues. Affiliated with the U.S. Department of Health and Human Services.*

P.O. Box 37337  
Washington, D.C. 20013-7337  
1-800-444-6472  
[www.omhrc.gov/omhrc/](http://www.omhrc.gov/omhrc/)

### **Phoenix Society for Burn Survivors**

*Helps anyone affected by the devastation of a burn injury through peer support, education, collaboration, and advocacy.*

835 R.W. Berends Dr., S.W.  
Grand Rapids, MI 49519  
800-888-2876/Fax: 616-458-2831  
[www.phoenix-society.org](http://www.phoenix-society.org)

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### **The Skin Cancer Foundation**

*Educates the public and the medical profession about skin cancer, its prevention by means of sun protection, and the need for early detection and prompt, effective treatment.*

149 Madison Ave., Suite 901

New York, NY 10016

1-800-SKIN-490

*www.skincancer.org*

### **Sunguard**

*Offers teachers and students information about sun safety and skin cancer.*

*www.sunguardman.org*

### **Sunwise**

*Aims to teach the public how to protect themselves from overexposure to the sun through the use of classroom-, school-, and community-based components.*

U.S. Environmental Protection Agency

1200 Pennsylvania Ave., NW (6205J)

Washington, DC 20460

202-343-9591

*www.epa.gov/sunwise/*

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# Glossary

**ab•scess:** a pus-filled skin infection.

**ac•ne:** a skin condition that arises when hair follicles become clogged with dead skin cells and oil.

**al•ler•gen:** any substance that causes an allergic reaction in susceptible people.

**al•ler•gy:** the body's overreaction to certain substances, such as medications, foods, animals, and plants.

**al•o•pe•ci•a:** loss of hair; baldness.

**an•a•phy•lax•is:** a sudden, severe allergic reaction that can have a variety of symptoms which can involve major areas of the body at the same time, such as the skin, the respiratory system, the gastrointestinal tract, and the cardiovascular system. Anaphylaxis can be fatal if not properly treated.

**an•ti•bi•ot•ic:** a drug that kills bacteria.

**an•ti•bod•y:** disease-fighting agent in the blood.

**an•ti•his•ta•mine:** a medication that prevents a histamine—a chemical that the body produces during an allergic reaction—from taking effect.

**ap•o•crine glands:** glands that develop during puberty and produce sweat during times of stress or high emotion.

**ath•lete's foot:** a contagious fungal infection that usually affects the feet.

**bac•te•ri•a:** tiny organisms that survive on living and nonliving surfaces, performing many chemical functions. Some bacteria cause diseases in people.

**ba•sal cell:** a type of cell found in the deepest layer of the epidermis.

**bi•o•log•ics:** drugs made from living organisms.

**bi•op•sy:** the removal and examination of a sample of tissue from a living body.

**birth•mark:** a mole or blemish present on the skin from birth.

**black•head:** type of acne where the hair follicle is partly blocked.

**blis•ter:** a swelling of the skin that contains watery fluid and is caused by burning or irritation.

**blood ves•sel:** the pipeline through which blood travels to all parts of the body.

**can•cer:** a disease in which the body's own cells start to grow and divide in an out-of-control manner. Left untreated, cancer cells can spread and shut down the body's functions.

**car•ci•no•ma:** an aggressive form of skin cancer that can attack basal cells or squamous cells.

**car•o•tene:** a yellow-colored pigment in the skin's dermis.

**cell:** the smallest unit of production in a living thing.

**chron•ic:** long-lasting and ongoing.

**clin•i•cal tri•als:** research tests performed using people. Trials determine the success of a medical treatment, medicine, or prevention strategy. A clinical trial usually is conducted only after the test has been successful in the laboratory and on animals.

**cold sore:** a small blister on the lips or face caused by the herpes simplex virus.

**col•la•gen:** a protein found in the connective tissues of skin.

**con•ta•gious:** transmitted from one person to another by direct or indirect contact.

**cor•tex:** the middle layer of hair.

## Skin: The Science Inside

**cor•ti•co•ster•oids:** also known as steroids, these strong medications are used in a cream form to treat skin conditions.

**cu•ti•cle:** the strip of hardened skin at the base and side of fingernails and toenails.

**cyst:** a sac that contains a gas, liquid, or semi-solid substance.

**der•ma•ti•tis:** inflammation of the skin.

**der•ma•tol•o•gist:** a skin doctor.

**der•ma•tol•o•gy:** the study of the skin.

**der•mis:** the middle layer of skin.

**di•a•be•tes:** a set of illnesses characterized by improper amounts of glucose (sugar) in the blood.

**dia•per rash:** a skin irritation of a baby's bottom and/or genitals caused by prolonged exposure to waste.

**ec•crine glands:** glands that produce sweat when we're hot, stressed, or experiencing heavy emotions.

**e•las•tin:** a protein found in the connective tissue of skin.

**ep•i•der•mis:** the top layer of skin.

**ep•i•neph•rine:** an injection of the hormone adrenaline used to treat life-threatening allergic reactions caused by insect bites, foods, medications, latex, and other agents.

**ec•ze•ma:** an allergic reaction with symptoms that affect the skin. This itchy, reddening, flaking, and peeling of the skin often begins in childhood.

**eu•mel•a•nin:** the melanin that produces a brown to black color in the skin.

**fol•lic•u•li•tis:** inflammation of a hair follicle.

**fun•gus:** a living thing that decomposes dead plant and animal material. Some skin conditions are caused by fungi.

**gland:** a cell that produces a secretion for use elsewhere in the body.

**hair fol•li•cle:** the pit that encloses the root of the hair.

**hair shaft:** the part of the hair visible above the skin.

**his•ta•mine:** a chemical present in cells throughout the body and released during an allergic reaction.

**hives:** an allergic reaction in which the skin becomes covered with small or large clusters of itchy, red bumps. It can occur as a result of an infection, eating a certain food, or taking a certain medication.

**hy•a•lu•ron•ic ac•id:** substance naturally found in the body that helps to lubricate the joints.

**im•mune sys•tem:** the coordinated responses of the body that serve to protect it against outside invaders such as viruses and bacteria.

**im•pe•ti•go:** a contagious bacterial skin infection.

**in•fec•tion:** invasion of body tissue by a virus or harmful bacteria, resulting in disease.

**in•teg•u•men•ta•ry sys•tem:** the bodily system consisting of the skin and its related parts.

**jaun•dice:** a yellowish discoloration of the skin or eyes that is a symptom of an underlying illness.

**ke•loid:** red, raised scar tissue.

**ker•a•tin:** a tough protein that is found in the epidermis, nails and hair.

**Lan•ger•hans cells:** part of the immune system found in the epidermis.

**la•nu•go:** pale, soft, fine hair that covers a newborn's body.

**le•sion:** an infected or diseased patch of skin.

**liv•er spot:** a harmless discoloration of skin caused by sun-damage often occurring in old age.

**lu•nu•la:** the half-circle at the base of each nail.

## Glossary

**lu•pus:** a set of diseases that affect the skin and joints.

**lymph:** a clear bodily fluid containing white blood cells that removes bacteria from the tissues, transports fat from the small intestine, and supplies mature lymphocytes to the blood.

**ma•trix:** the root of the nail.

**me•dul•la:** inner core of certain body structures, including hair.

**mel•a•nin:** dark pigment found in skin and hair.

**mel•an•o•cytes:** cells that produce the melanin, the pigment that colors our skin, hair, and eyes.

**mel•a•no•ma:** a fast-growing, dangerous, malignant skin cancer.

**mil•i•a:** enlarged oil glands.

**mole:** congenital growth on the skin.

**ne•o•na•tal ac•ne:** acne that affects newborns.

**nerves:** the network of cells that transmit signals from all parts of the body to and from the brain.

**non-com•e•do•gen•ic:** not tending to clog pores.

**or•gan:** a group of tissues that perform a specific function.

**phe•o•mel•a•nin:** the melanin that produces a red to yellow color in the skin.

**pig•ment:** skin coloring.

**pim•ple:** a hair follicle clogged with sebum and skin cell debris.

**pore:** small opening in the skin.

**pso•ri•a•sis:** a skin condition where the skin cells reproduce too quickly.

**pu•ber•ty:** the stage of adolescence where a person can sexually reproduce.

**rash:** skin outbreak.

**ro•sa•ce•a:** skin disease that makes the face look red.

**scab:** crust over a wound.

**scar:** mark left on the skin after a wound has healed.

**scle•ro•der•ma:** an internal disease whose symptoms include hardening of the skin.

**se•ba•ceous:** secreting an oily substance.

**se•bum:** oily substance that is secreted by the sebaceous glands.

**skin:** the organ that covers the outside of the body.

**squa•mous cell:** part of the epidermis.

**stra•tum cor•ne•um:** the outer layer of the epidermis, consisting of dead skin cells.

**stretch mark:** a shiny line on the skin caused by the prolonged stretching of the skin and the weakening of elastic tissues.

**sub•cu•ta•ne•ous tis•sue:** the fatty bottom layer of skin.

**sun•burn:** skin inflammation caused by sun exposure.

**sun•screen:** a cream or lotion used to protect the skin from the damaging ultraviolet rays of the sun.

**symp•tom:** a sign of a problem, such as a disease.

**vi•rus:** a tiny organism that carries disease. It spreads throughout the body by using the body's cells to make copies of the virus.

**vit•i•li•go:** skin disorder that causes the skin to lose pigment.

**white•head:** type of acne where the hair follicle is totally blocked.

**wrin•kle:** line or crease in the skin, usually caused by age or over exposure to the sun's radiation.



# Acknowledgements

## Dermatology Content Reviewers/Advisors

**Hassan Galadari, MD, MBBS**

Resident

Department of Dermatology, Boston Medical Center, Tufts-New England Medical Center

**Sidney Hornby, MS**

Group Leader – Scientific Affairs  
Neutrogena Corp.

**Pamela Strumpf Norden, MD, MBA**

Assistant Professor and Director of Medical Student Education  
Department of Dermatology, Tufts University School of Medicine,  
Krauss Dermatology

## Author

**Kirstin Fearnley, AAAS**

## Project Staff and Consultants

**Bob Hirshon**, Senior Project Director

**Suzanne Thurston**, Project Manager

**Ann Marie Williams**, Art Director

**Maria Sosa**, Editor-in-Chief

**Renee Stockdale-Homick**, Program Associate

**Kirstin Fearnley**, Program Associate

**Sarah Ingraffea**, Senior Project Coordinator

**Heather Malcomson**, Review Coordinator

**Amani Rushing**, Project Associate

**Maggie Johnson Sliker**, Photo Researcher

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