Skin - An Architectural Marvel

The skin is the primary organ of the integumentary system. It is one of the most important and certainly one of the largest and most visible organs. In most individuals the skin composes some 16% of the body weight. Consider the incredible number of structures fitting into 1 square inch of skin: 500 sweat glands; over 1000 nerve endings; yards of tiny blood vessels; nearly 100 oil or sebaceous glands; 150 sensors for pressure, 75 for heat, 10 for cold; and millions of cells.

The layers of the skin are supported by a thick layer of loose (areolar) connective tissue and adipose (fat) connective tissue called subcutaneous tissue. Fat in the subcutaneous layer insulates the body from extremes of heat and cold. It also serves as a stored source of energy for the body and can be used as a food source if required. In addition, the subcutaneous tissue acts as a shock-absorbing pad and helps protect underlying tissues from injury caused by bumps and blows to the body surface.

Accessory structures of the skin - hair, glands, and nails - perform vital function. Hair on the head guards the scalp from injury, eyebrows and eyelashes protect the eyes from foreign particles, and hair in the nostrils protects against inhaling insects and foreign particles. Nails help us grasp and manipulate small objects and provide protection to the ends of the fingers and toes. Sweat glands function to regulate body temperature through evaporation. As sweat evaporates, large amounts of heat leave the body surface.

Subcutaneous Injection

Although the subcutaneous layer is not part of the skin, it carries the major blood vessels and nerves to the skin above it. The rich blood supply and loose, spongy texture of the subcutaneous layer make it an ideal site for the rapid and relatively pain-free absorption of injected material. Liquid medicines such as insulin, and pelleted implant materials are often administered by subcutaneous injection into this spongy and porous layer beneath the skin.
Habits and Hair Loss

Many people accept the fact that hair loss is genetic and usually associated with males. However, the genetic condition called male-pattern baldness is only one of many causes of hair loss. In Canada, Northern Europe, and the United States, physical stress is a major cause of hair loss. Hair loss in women is particularly associated with physical stress due to childbirth, illness, injury, and pregnancy. Too much exercise can also place the body under physical stress. Hair loss is actually a slowing down of hair growth and replacement. When the body is using its energy to cope with physical stress, hair growth is placed at a lower priority for cell resources. Malnutrition and undernutrition also lead to hair loss. This is especially true for diets low in essential amino acids. Too much exercise can exacerbate the bodily effects of an inadequate diet.

Another cause of hair loss includes rising hormone levels in males. Some dermatologists have discovered that certain hair styles, such as tight braids, pull off hair faster than it is able to be replaced. Excessive hair combing and styling does the same thing. Most physicians agree that hair growth remedies available without a prescription most likely have no effect on hair growth or replacement. Surprisingly, emotional stress seems to accelerate hair growth.

Acne

Acne is an inflammation of sebaceous glands that usually begins at puberty, when the sebaceous glands grow in size and increase their production of sebum (oil). Androgens from the testes, ovaries, and adrenal glands play the greatest role in stimulating sebaceous glands. Acne occurs predominantly in sebaceous follicles that have been colonized by bacteria, some of which thrive in the lipid-rich sebum. The infection may cause a cyst (sac of connective tissue cells) to form, which can destroy and displace epidermal cells. This condition, called cystic acne, can permanently scar the epidermis.

Treatment consists of gently washing the affected areas once or twice daily with a mild soap, topical antibiotics (such as clindamycin, and erythromycin), topical drugs such as benzoyl peroxide or tretinoin, and oral antibiotics (such as tetracycline, minocycline, erythromycin, and isotretinoin). Contrary to popular belief, foods such as chocolate or fried foods do not cause or worsen acne.

Classification of Burns

The classification system used to describe the severity of burns is based on the number of tissue layers involved.

First-degree burns, or superficial partial-thickness burns, cause minor discomfort and some reddening of the skin. Although the surface layers of the epidermis may peel in 1 to 3 days, no blistering occurs, and actual tissue destruction is minimal. Second-degree burns, or deep partial-thickness burns, involve the deep epidermal layers and always causes injury to the upper layers of the dermis. Although deep second-degree burns damage sweat glands, hair follicles, and sebaceous glands, complete destruction of the dermis does not occur. Blisters, severe pain, generalized swelling, and fluid loss characterize this type of burn. Scarring is common.

Third-degree burns, or full-thickness burns are characterized by complete destruction of the epidermis and dermis. In addition, tissue death extends below the primary skin layers into the subcutaneous tissue. Third-degree burns often involve underlying muscles and even bone. The fluid loss that results from third-degree burns is a very serious problem.
Tattooing is a permanent coloration of the skin in which a foreign pigment is deposited with a needle into the dermis. It is believed that the practice originated in ancient Egypt between 4000 and 2000 B.C. Today, tattooing is performed in one form or another by nearly all peoples of the world, and it is estimated that about one in five U.S. college students has one or more. Tattoos are created by injecting ink with a needle that punctures the epidermis and moves between 50 and 3000 times per minute and deposits the ink in the dermis. Since the dermis is stable (unlike the epidermis, which is shed about every four weeks), tattoos are permanent. However, they can fade over time due to exposure to sunlight, improper healing, picking scabs, and flushing away of ink particles by the lymphatic system. Tattoos can be removed by lasers, which use concentrated beams of light. In the procedure, which requires a series of treatments, the tattoo inks and pigments selectively absorb the high-intensity light without destroying normal surrounding skin tissue. The laser causes the tattoo to dissolve into small ink particles that are eventually removed by the immune system. Laser removal of tattoos involves a considerable investment in time and money and can be quite painful.

Sunburn and Skin Cancer

Burns caused by exposure to harmful UV radiation in sunlight are commonly called sunburns. As with any burn, serious sunburns can cause tissue damage and lead to secondary infections and fluid loss. Cancer researchers have stated that blistering (second-degree) sunburns during childhood may trigger the development of malignant melanoma later in life. Epidemiological studies now show that adults who had more than two blistering sunburns before the age of 20 have a much greater risk of developing melanoma than someone who experienced no such burns. This explains the dramatic increase in skin cancer rates in the United States. Those who grew up sunbathing and experienced sunburns in the 1950s and 1960s are now, as older adults, exhibiting melanoma at a much higher rate than in previous generations.

Skin Color

Melanin, hemoglobin, and carotene are three pigments that impart a wide variety of colors of skin. The amount of melanin causes the skin’s color to vary from pale yellow to reddish-brown to black. Melanocytes are the cells which produce melanin. Albinism is the inherited inability of an individual to produce melanin. Most albinos do not have melanin in their hair, eyes, and skin. Dark-skinned individuals have large amounts of melanin in the epidermis. Consequently, the epidermis has a dark pigmentation and skin color ranges from yellow to red to tan to black. Light-skinned individuals have little melanin in the epidermis. Thus, the epidermis appears translucent and skin color ranges from pink to red depending on the amount of oxygen contained in the blood moving through capillaries in the dermis. The red color is due to the oxygen-carrying pigment hemoglobin. Carotene is a yellow-orange pigment that gives egg yolks and carrots their color. These pigments, from a carotene-rich diet, can accumulate in the dermis and subcutaneous layer giving the skin an orange color.
Exercise and the Skin

Excess heat produced by the skeletal muscles during exercise increases the core body temperature far beyond the normal range. Because blood in vessels near the skin’s surface dissipates heat well, the body’s control centers adjust blood flow so that more warm blood from the body’s core is sent to the skin for cooling. During exercise, blood flow in the skin can be so high that the skin takes on a redder coloration.

To help dissipate even more heat, sweat production increases to as high as 3 L per hour during exercise. Although each sweat gland produces very little of this total, over 3 million individual sweat glands are found throughout the skin. Sweat evaporation is essential to keeping body temperature in balance, but excessive sweating can lead to a dangerous loss of fluid. Because normal drinking may not replace the water lost through sweating, it is important to increase fluid consumption during and after any type of exercise to avoid dehydration.