

Conclusion

God's handiwork in creation is evident in everything He has made—even our skin. Like so many other things, we take the protective functions of skin for granted. But let us thank God for our skin, which is so essential for our very lives. Most of all, let us thank our Lord and Savior who endured those who pressed a crown of thorns through the skin of His brow and lashed the skin of His back to shreds. By His stripes we are healed from sin, death, and hell (1 Peter 2:24).

“For I know that my Redeemer lives, and He shall stand at last on the earth; and after my skin is destroyed, this I know, that in my flesh I shall see God, whom I shall see for myself, and my eyes shall behold, and not another. How my heart yearns within me!” (Job 19:25–27).

...If you call out for Insight...

You will understand the fear of the LORD and find the knowledge of God.
Based on Proverbs 2:3-5

Skin - Our Living Armor

by David Menton*

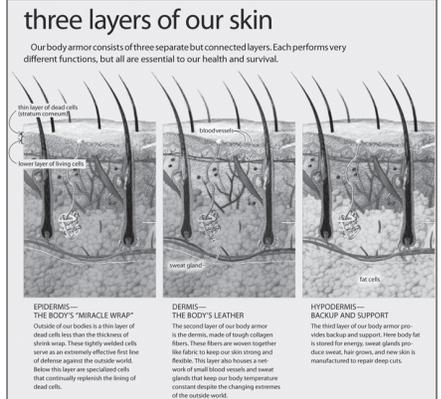
Only a few millimeters of skin separate our bodies from the dangers of the outside world. Yet skin's multilayered design provides us with the perfect combination of strength, flexibility, and durability. Unlike any spacesuit or body armor designed by man, this protective covering is alive, constantly repairing and renewing itself.

You have perhaps heard that “beauty is more than skin deep.” While that is certainly true, the skin itself is beautiful and tells us a lot about people. For example, we recognize one another mostly by the skin on our face.

The skin's blood supply and facial muscles even permit us to tell on sight when people are happy, sad, angry, or embarrassed. The skin is the largest organ in our body (weighing about 10 pounds [4.5 kg] in the adult) and covers the entire surface of our body, including our eyes, where the skin covering is conveniently transparent. Being on the surface, skin is the most accessible organ of our body, and thus must be marvelously resistant to our vain efforts to “improve” it with pigments, chemicals, punctures, and tattoos.

Skin, Thick and Thin

Skin is generally classified as thick skin (on our palms and soles) and thin skin (on the rest of our body). With callouses, thick skin can reach thicknesses of nearly half an inch (13 mm). Thin skin varies in thickness from about 0.5 mm on the eyelid to about 2 mm on the back (1 mm is about the thickness of a dime). Skin is made up of three major layers called the epidermis, dermis, and hypodermis. Each of these layers serves its own vitally important functions.



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Epidermis - The Skin's Outermost Layer

The body's "miracle wrap"

The outer layer of our skin, the epidermis, is subdivided into two layers: a thin surface layer of dead cells, called the stratum corneum, and a deeper layer of living cells. The stratum corneum is made up of tightly connected dead cells called corneocytes that form a barrier between the living cells of our body and the outside world.

If we suddenly lost our stratum corneum, death would quickly follow from massive fluid loss and bacterial invasion. Amazingly, over most of the surface of our body, this critically important dead layer measures less than half the thickness of refrigerator shrink wrap. Indeed, we might call the stratum corneum "miracle wrap."

In thin skin, the dead cells are flattened like thin pancakes and are stacked on top of one another in precise columns (Figures 1 and 2). Each cell is tightly attached to its neighbors on top and bottom by over a hundred little "spot welds" called desmosomes. This tight bond is necessary for the dead layer to resist wear and tear.

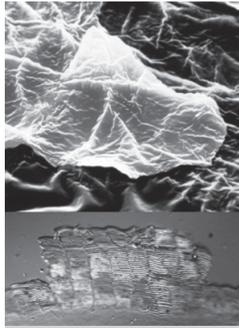
In the thick skin on our palms and soles, the epidermis, and particularly the stratum corneum, is much thicker than thin skin. Here the corneocytes themselves are thicker and interlock like jigsaw puzzle pieces (Figure 3). Thick skin is designed to provide high resistance to wear and shearing on the much-used surfaces of our palms and soles.

Cell turnover in the epidermis

The main function of the living layer of the epidermis is to produce the dead cells of the stratum corneum. As they mature, these cells become filled with strong protein fibers called keratins. It takes about 28 days for the new cells produced in the lowest level of the living epidermis to rise up to the surface of the skin.

If the epidermis just kept adding new cells, our skin would grow thicker and thicker. To prevent this, the dead cells on the outer surface must regularly loosen their tight bonds and fall off the surface of the skin in a precisely controlled manner. In fact, every minute we lose about 30,000 to 40,000 dead corneocytes from the surface of our skin. That comes to about 9 pounds (4 kg) of dead cells every year! We are not aware of the loss because normally these cells fall off individually.

The outer cells can't fall off too quickly, however. If cell loss exceeded cell production by only a few percent, we would quickly lose our stratum corneum and die. Amazingly, cell loss precisely matches cell production.



Figures 1 & 2: Thin Skin

Most of our body is covered with a type of skin called "thin skin." It is made of special cells (above) that are designed to die and lock together into precisely arranged columns (bottom). Each cell is tightly attached to its neighbor by over one hundred little "spot welds," called desmosomes, which give the skin amazing strength.



Figure 3: Thick Skin

The palms of our hands and soles of our feet experience much more wear and tear than thin skin. So they have a special type of skin called "thick skin," made of much thicker cells that lock together like a jigsaw puzzle.

Dermis - The Second Layer of Skin

The body's "leather"

The dermis, which lies just below the epidermis, is comprised of very strong fibers made of a protein called collagen. The collagen fibers are exquisitely woven into a very complex tissue that in animals, such as cows, serves as our source of leather. The dermis accounts for most of the skin's strength and is highly resistant to tearing. While the dermis must be strong, it must also be elastic and flexible to permit us to move comfortably. Though the collagen fibers themselves are very inelastic, the way they are woven permits the skin to stretch much like a double-knit fabric. Special elastic fibers woven through the dermis help restore stretched skin back to its relaxed condition, much like the rubber strands in the elastic waistband of underwear.

The body's "radiator"

Another important function of the dermis is regulating our body's temperature. When our body gets too warm, heat in our blood needs to reach the surface of the skin so that it can dissipate into the air. To control how much heat reaches the surface, blood vessels in the dermis have valves that can divert the blood into smaller vessels (capillaries) in different levels of the dermis (Figure 4). Under control of the brain, blood is diverted to fill these capillaries and dissipate heat. The regulation of heat is further aided by sweat glands that pass through both the dermis and epidermis. We have about three million sweat glands in our skin that can secrete up to about three quarts of sweat per hour. Sweat, which is largely water, evaporates off the surface of our skin, giving a cooling effect.

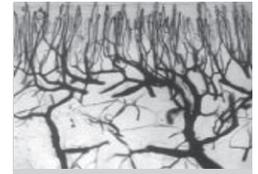


Figure 4: Heat Regulation

The second layer of skin, the dermis, is filled with a complex network of blood vessels and valves. They allow the body to divert blood near the skin to release heat and cool the body. The many loops increase the surface area, like an efficient radiator.

Photo courtesy of David N. Menton

Hypodermis - The Skin's Deepest Layer

The hypodermis, the skin's deepest layer, can vary immensely in thickness. Most of this layer is body fat that serves as the principal source of energy when we are deprived of food. Strands of collagen pass through the fat of the hypodermis, anchoring the skin to underlying muscle and bone, limiting the mobility of our skin.

Most of the length of our hair follicles and sweat glands resides in the hypodermis. Indeed, it is here that hair grows and the sweat glands produce their sweat. When we lose skin in a deep abrasion, the surviving sweat ducts and hair follicles serve as a source of new skin. Without these numerous sources of new skin cells, we would require a skin transplant for even a skinned knee.