The Evolution of Human Skin

W. MONTAGNA

Man’s skin is unique among land mammals in that it appears to be largely hairless. Whereas our skin bears millions of hairs, some so small as to be nearly invisible, hairs generally grow vigorously and prominently on men’s faces, and particularly on the scalp, axillae, mons, and anogenital areas of both sexes. Except, as we shall see, for sensory perception, most of the hairs on the human body serve no discernible function (those on the head can protect the scalp from the elements), and since all body hairs are to some degree sustained by androgens, their main purpose is likely to be ornamental and epigamic. Lacking adequate protection from hair, human skin has developed adaptive structural changes that give it greater strength, resilience, and high sensibility.

With notable exceptions, the topographic, anatomical, and physiological properties characteristic of human skin are not found in the skin of other primates. The differentiation of man’s scalp and forehead, the facial disc, axillae and, for that matter, the skin over the entire body, are all uniquely human. Our skin is thicker than that of most other primates, tougher, more taut, and more elastic. Tunneling through this thick skin is a vast and intricate network of arteries, veins, and capillaries, with a blood supply far in excess of its own biological needs. The skin of all nonhuman primates we have studied, including that of the great apes, is by contrast relatively ischemic.

The characteristic features of human skin change constantly during a lifetime, more so than in other primates; beginning with its differentiation in utero, skin undergoes uninterrupted changes into and through old age. In addition, human skin has distinctive sexual dimorphic differences which are much more conspicuous than they are in other primates.

Since all nonhuman primates are covered with fur, the adaptations that have occurred in their skin differ only slightly if at all from those in other furred mammals. Like the latter, the primates from birth onward are buffered from the environment, and their skin, thus protected, need not be adapted to the environment. And it follows that all the major changes that have taken place in man have occurred concurrently with the loss of hair cover, hence are truly geared to the environment.

If the uniqueness of man’s skin is to be appreciated, the cutaneous system has to be considered not only in toto but in specific detail because it does not possess a single major structure that is not also found in the skin of some other primate. Viewed
anatomically and uncritically, human skin, like that of other primates, has hair follicles and sebaceous glands, nails, sweat glands, and apocrine glands. This is an apparent contradiction to what I have said above, but it is the specific properties of each of these structures that constitute the uniqueness of human skin.

Man's relative hairlessness, or the miniaturization of the hair over much of his body, marks his major divergence from the other primates, and all of the differences found in his skin are in some way related to this fact. And, these departures must have coincided with man's attainment of an erect bipedal posture and locomotion, and be interwoven and related to the total biological needs of an erect body; a "hairless" skin must have accompanied bipedality pari passu. The connection is fairly logical. Man is a large animal whose body mass must be balanced vertically to prevent its toppling over. His skeletal muscles are continuously expending energy to maintain attitudinal, postural, and righting reflexes. This energy in turn creates heat that must be dissipated lest we perish. The loss of hair cover eminently accommodated this need, but it left the body exposed to environmental hazards. To cope with these imperilments, the human organism had need of a superlative tactile sensibility that would keep it constantly informed of external conditions. This acute cutaneous sensory system in turn could develop only with the acquisition of a large brain that could accommodate all the signals coming to it and that could determine instantly which course of action to pursue. Thus, nakedness, vascularity, and increased modalities of sensibility cannot be regarded as separate phenomena but as necessary and related adjuncts of the gestalt of the evolving human skin.

Bipedality in hominoids is relatively ancient, going back more than 3 million years according to recent paleontological findings (Leakey and Hay 1979). But even though human skin has been adapting to bipedality for a long time, only the broadest accommodations have been achieved, leaving some of the finer adjustments still in a makeshift manner.

Man maintains his orientation in space by virtue of the continuous action of interrelated postural reflexes, which supported by two pillars are far more complex than those in quadrupeds which are supported by four. Even when a human being is standing still, sitting, squatting, or lying prone, most of the skeletal muscles of the trunk, limbs, and head must maintain a degree of tone by working synergistically lest the body collapse. Therefore, except during unconsciousness, much of our muscle mass is continuously using energy and generating heat that must be dissipated. And it is to this very task that human skin has been primarily tailored. Dissipation of heat is the function that most conspicuously distinguishes human skin from that of all other mammals.

The loss of hair cover has placed on human skin the burden of performing many functions not demanded of hairy skin. To begin with, the epidermis, which is thicker in man than in all other primates, has a substantially thicker horny layer than that in furry animals. Moreover, over the entire body it is criss-crossed by many lines whose characteristic patterns reflect the direction of pull and stretch to which the skin is subjected. These congenital wrinkles seem to have two purposes: they expand the body surface and allow the skin to be stretched without reaching a breaking point too quickly. Since none of the other primates have such surface imprints, it is assumed that they do not need them. On its inner surface or underside in contact with the dermis,