INTRODUCTION

Our skin mediates the most important transactions of our lives. Skin is key to our biology, our sensory experiences, our information gathering, and our relationships with others. Although the many roles it plays are rarely appreciated, it is one of the most remarkable and highly versatile parts of the human body.

Simply put, skin is the flexible, continuous covering of the body that safeguards our internal organs from the external environment. It protects us from attack by physical, chemical, and microbial agents and shields us from most of the harmful rays of the sun, while it works hard to regulate our body temperature. Far from being an impervious barrier, however, the skin is a selectively permeable sheath. It is constantly at work as a watchful sentinel, letting some things in and others out. The skin is also home to hundreds of millions of microorganisms, which feed on its scales and secretions.[1] But our skin is more than a defensive shield, a gatekeeper, and a personal zoo.

The pores and nerve endings of our skin unite us with our surround-

ings. Skin is the interface through which we touch one another and sense much of our environment. Through our skin, we feel the smooth cold of melting ice, the warm and gentle breeze of a summer evening, the annoying pinch of an insect bite, the humbling pain of a scraped knee, the soft and calming feel of a mother's hand, and the thrill of a lover's touch.

Throughout the approximately six-million-year journey of the human lineage, our skin has traveled and evolved with us, through myriad changes of climate and lifestyle.[2] In addition to providing a boundary layer between the body and the environment, the skin has taken on the new roles of social canvas and embodied metaphor in our recent evolutionary past. Our skin reflects our age, our ancestry, our state of health, our cultural identity, and much of what we want the world to know about us. People in all known cultures modify their skin in some way, often using deliberate marking and manipulation to convey highly personal information about themselves to others.

No other organ in the body can boast so many diverse and important roles. Few people, in fact, think of our skin as an organ of the human body. The word "skin" doesn't bring to mind the same meaty image as the term "liver" or "pancreas," nor does it elicit the same queasy response. Yet the skin is, by most measures, the body's largest organ, and it is certainly the most visible.[3] Its size is about two square meters (approximately twenty square feet), and its average weight is four kilograms (about nine pounds). Unlike a heart or a kidney, skin never fails, because it is constantly being renewed.

Human skin is unique in three respects. First, it is naked and sweaty. Except for the scalp, the groin, the armpits, and the male chin, our bodies are effectively hairless. Because this phenomenon sets us apart so obviously from other mammals, it has engaged the attention of many scientists and armchair theorists, who have produced a welter of unconventional explanations. Among the many theories put forward to account for our hairlessness, the most cogent proposes that we have lost most of our body hair in order to keep cool in hot environments and during exercise. Humans

sweat to a greater degree than other mammals, and hairless skin allows sweat to evaporate quickly, more efficiently cooling the body.[4]

The second distinctive attribute of human skin is that it comes naturally in a wide range of colors, from the darkest brown, nearly black, to the palest ivory, nearly white. This exquisite sepia rainbow shades from darkest near the equator to lightest near the poles. This range forms a natural cline, or gradient, that is related primarily to the intensity of the ultraviolet radiation (UVR) that falls on the different latitudes of the earth's surface. Skin color is one of the ways in which evolution has fine-tuned our bodies to the environment, uniting humanity through a palette of adaptation. Unfortunately, skin color has also divided humanity because of its damaging association with concepts of race. The spurious connections made between skin color and social position have riven peoples and countries for centuries.

The third major distinction of human skin is that it is a surface for decoration. Our skin is not just a passive covering that betrays our age or physiological state. It is a potentially ever-changing personal tapestry that tells the world about who we are or who we want to be. And, unlike the involuntary advertising afforded by our own skin color, the decorations we place on our skin are deliberate and willful forms of advertisement—skin becomes a social placard, serving as both our "advertising billboard and the packaging."[5] No other creature exerts such extensive control over what its skin looks like. Humans expose it, cover it, paint it, tattoo it, scar it, and pierce it, telling a unique story about ourselves to those around us. In a world of increasingly globalized fashion, adornment of the skin is one of the last frontiers of individuality and personal adventure.

More than any other part of the body, our skin imbues us with humanity and individuality and forms the centerpiece of the vocabulary of personhood. The word "skin" often represents the whole body or the wholeness of the self, and its use in figures of speech can convey intensely personal feelings or strong sentiments about identity and appearance.[6] Think about the times you use the word "skin" in a figure of speech in normal conversation and how frequently you see it used in writing. It can ex-

press surprise or fear—"I nearly jumped out of my skin!" After a close call, you might exclaim, with relief, "I just managed to save my skin"; similarly, the Bible quotes Job as saying, "I am escaped with the skin of my teeth" (Job 19:20). We use the metaphor of skin to describe a person's sensitivity: "It won't bother her—she has a thick skin"; or "It's no wonder she took offense at your remark—she has an incredibly thin skin." We can dismiss others or complain about them with the words "So what if he doesn't want to go? It's no skin off my nose" or "He really gets under my skin." An extremely thin person is "nothing but skin and bones," while an attractive individual is cautioned that beauty is "only skin deep." T. S. Eliot's poem "Whispers of Immortality" opens with this image: "Webster was much possessed by death / And saw the skull beneath the skin."[7] These images and patterns of usage maintain a currency and an immediacy because we so closely associate our skin with the essence of our being. They induce empathy because of the unambiguous association of the skin with a vulnerable self.

As a teacher of human anatomy for many years, I was always fascinated by the reactions of students as they began to dissect a human body at the beginning of the academic year. Most students approached the task with hesitation, and some with great fear. For many, this reluctance was born of the simple dread of touching a dead person, something that many of them had never done before. Much of their reserve, however, derived from a sense of trepidation about trespassing a boundary they had not considered crossing. The intact skin of the cadaver, especially the skin of the face, was associated with a real person who had lived a real life of laughter and tears—a person like them, who had felt joy and sorrow just a few months or years earlier. But as they carefully began to remove the skin, their hesitation and reserve slowly disappeared. Although the body was no deader without skin, the partially flayed cadaver lacked the covering that the students associated with dynamic personhood. The veil of personality and individuality had been removed, revealing the muscles, nerves, and sinews of the human species.

A modern *écorché,* an anatomical representation of the body with the skin removed (see color plate 1), shows us that the body without skin is indeed human, but it has been stripped of its identity and personality. Lacking its inherent color, scars, decoration, and any trace of emotion, the cadaver is a human, but not a person. It beckons us to ponder the meaning of the skin as a barrier and, indeed, to consider our definition of an individual. As the cadaver proffers its skin, it arrests the viewer with the question, "Who am I without my skin?" Without its skin, however, it also portrays a universal humanity that invites us to learn more about our shared history underneath the skin. Only after my students had removed most of the skin from the body could they begin to enjoy the wonders of anatomy without reservation and to explore the body's complex and mysterious interior. They no longer felt that they were violating a person's intimate space.

Despite the importance of skin in human biology and in interactions between people through the ages, most of its rich and interesting history has not been told. This book is an attempt to do so. It is not a systematic treatise or a manual, but more an idiosyncratic guidebook, replete with personal detours into topics about skin that have most engaged me in my work over the years. As an anthropologist with training in comparative biology, I have enjoyed learning about the details of hippo and bat skin as much as I have enjoyed exploring the intricacies of human skin, so be prepared for a few unexpected and unusual facts. The main purpose of this book is to provide information rather than advice, but in a few very important areas—such as sun and skin care, and skin color and race—advice follows naturally from the information about why and how these matters came to be of importance to us today.

The first chapter looks at how skin is put together and how it works. It provides a tour of the basic aspects of the skin's structure and function with the aid of simple illustrations that relate the layered construction of skin to its varied roles. Once these are understood, the many services the skin performs in normal life start to become clear, and you will find yourself appreciating and respecting your skin perhaps more than you did before.

Chapter 2 uses the tools of comparative biology to relate the evolutionary history of skin, a story that spans more than three hundred million years. Examining evidence from comparative anatomy, physiology, and genomics allows us to reconstruct the major steps in the evolution of the skin of land-dwelling vertebrates. It turns out that the fossil record helps us only a little here because traces of skin are rarely preserved for more than a few thousand years, and fossilized skin itself is almost nonexistent. This chapter focuses especially on the evolution of the outermost layer of skin—the epidermis—and how its structure has made life on land possible, for humans and all our terrestrial ancestors.

From this general discussion of vertebrate skin, chapter 3 turns to a more detailed examination of human skin, particularly to the topics of human hairlessness and sweating. Sweating is one of the most important functions carried out by our skin. Although most people in industrialized societies view sweat as undesirable, we would be in very bad shape without it. Sweat helps to cool our bodies, including our heat-sensitive brains, an ability that was indispensable in human evolution.

We can look at the skin as a factory, that is, a place where chemical processes occur, including those generated by sun exposure. Much of what goes on in our skin from a physiological point of view is a response to sunlight and to UVR in particular; different wavelengths, or energy levels, of UVR affect different processes. Chapter 4 tells the important story of vitamin D production in the skin, while chapter 5 specifically deals with the role of melanin, the main pigment in human skin. Melanin has served enormously important functions in biological systems for at least the past four hundred million years, absorbing high-energy solar radiation and protecting our bodies from many of the harmful chemicals such radiation produces.

Chapter 6, on skin color, is closest to my heart and personal interests because I have studied the evolution of skin color in humans for nearly fifteen years. Until fairly recently, little research on the biology of human skin color had been conducted, and neither the scientific community nor the public had much understanding of the topic. In part, human skin color

was considered too socially sensitive a topic to be broached in the halls of academe or applied science; skin color remained something that everyone noticed but no one talked about. This situation has changed dramatically in the past decade as new studies have shed light on the evolutionary reasons why people have different skin colors, the genetic variations that contribute to these differences, and the significance that these differences have for people's health and well-being in various environments. Skin color warrants attention because it affects so many aspects of our lives, from our health as individuals to the way we treat each other within societies.

Chapter 7 explores the topics of skin as the organ of touch and as a vehicle for communicating information through tactile sensation. It looks not only at the importance of tactile sensitivity in the evolution of primates but also at the significance of touch in nearly every aspect of our lives, from finding and eating food to communicating our most intimate feelings to one another. This chapter also looks at human fingerprints, from their original significance in our ancestors to the use of modern technology that documents their uniqueness.

Because our skin reflects our emotions and mood states, it can betray our true feelings even when we wish it wouldn't, as chapter 8 points out. The hot, red face of embarrassment and the gray pallor and cold, sweaty palms of anxiety are familiar to all of us and are now well understood. Skin in many animals, including humans, is a natural notice-board that conveys considerable information not only about one's age, health, and emotions but also—in some species—one's degree of sexual receptivity.

Because skin indeed follows "the way of all flesh," chapter 9 explains—without most of the gruesome detail of a dermatology textbook—how our skin reacts to the ravages of age, the environment, and disease. As our "face to the world," the skin sustains injuries at different scales on a daily basis and is subject to infection and infestation by a bewildering array of organisms. This chapter also discusses our modern obsession with age-related changes in the skin, especially wrinkles.

Chapter 10 presents an overview of what humans, as complex cultural

beings, do to our skin, a topic that has been the focus of many recent books.[8] To appreciate the origins and great antiquity of skin decoration, we begin with a short history of the subject. As we survey various types of skin marking and trends in skin modification, you will discover that certain themes recur across cultures and through time. In particular, this chapter draws attention to how people have used cosmetics and paints to establish their identity and advertise their sexuality and explains how tattoos have served as ways of expressing either individuality or group affiliation in human societies.

The book's final chapter looks at future skin, from the prospects for custom-made artificial skin that can be used in clinical contexts to the expanding frontiers of communication and entertainment via remote touch. Skin and tactile communication have always been important to people, but they will soon become ever more so as we develop more sophisticated means for conveying and detecting remote touch. We are entering another brave new world in which skin will play new roles in interpersonal and broader social communication. For much of modern human history, skin has been a canvas for human creativity, setting us apart from our primate relatives with a mantle of uniqueness. So it is likely to remain.