c01.qxp 02/11/02 09:56 Page 5

1

Achieving Adaptive Normality, Your Evolutionary Birthright

Is it possible that something that makes us feel good might really not be good for us? In nature, animals are adapted to live in a particular way, and they almost certainly derive pleasure from doing the things that they do. Dogs, for example, adapted to hunting in packs, get a kick out of chasing large moving things. In the past these were always elks, moose, wildebeests, and even the odd infirm mammoth. Today, however, if a suburban dog chases down and takes a bite out of the only large prey available to him, the rolling rubber tire of a garbage truck, it could be fatal. What the dog has evolved to like to do is injurious to its health and longevity.

Sometimes even severe object lessons cannot teach the dog otherwise. A dog I had when I was six, Blackie, loved to chase cars. One day Blackie's leg was broken by a mail truck he was pursuing. The vet thought that Blackie should be put to sleep, but we had a cast put on the leg and it eventually healed. I hoped that this painful episode would convince Blackie to reform, but it didn't. Only a few months later Blackie was found smashed in the road

c01.qxp 02/11/02 09:56 Page 6

and was taken away by the sanitation workers when I was at school. I wondered for years what deep-seated desire it was that made dogs chase moving motor vehicles. After losing two more dogs, otherwise well trained, to similar highway accidents, I eventually concluded that this behavior was hardwired in them—left over from some Pleistocene adaptation that had benefited their species in the past but now was killing them.

Unlike dogs, human beings are omnivorous—scavenging, gathering, and hunting primates who can eat just about anything that crawls, walks, swims, or flies. Although few of us have a problem confusing a car with our next meal, we have a flaw as hardwired as our dogs': fat. Especially tasty to us are food items that are full of fatty acids—energy-rich molecules that become stored around our midsections in fat cells and substances craved by our voracious lipid-rich brains. We also love sugar, a predilection developed by our fruit-eating ancestors who, when they found a tree with ripe, sweet fruit, gorged on it to excess. The realities of our evolutionary past were that fats and sugars were in short supply and famine might hit tomorrow. These evolved tastes were adaptive, and it made evolutionary sense for our hominid ancestors to store up energy reserves for lean times ahead. Today, we store up dessert, eating it even after our stomachs are full, simply because it tastes so good, and building up fat cells that famine will never diminish.

Human evolution is both history and current reality. Its twists and turns have bequeathed to us inborn responses and anatomical traits that serve to adapt us admirably to our many activities and undertakings. But we also obey obviated evolutionary commands. We fear the dark, for example, not because this is a rational decision on our part, but because we are descended from millions of generations of visually oriented, day-living primates systematically preyed upon by nocturnal predators. Amazonian snakes are major predators of New World monkeys still today, and ancient leopards left bite marks on South African australopithecine fossils 3 million years ago. Over the long course of our evolution things that went bump in the night really could kill us. Fear of the dark was an evolutionary outgrowth of natural selection—the more fearful, more vigilant, and thus most quickly reacting individuals avoided being eaten by the snakes, large raptorial birds, and cats that preyed on

c01.qxp 02/11/02 09:56 Page 7

small-bodied, tree-living primates. Today, innate fear of the dark can still be of survival advantage to us, as when we become nervous and suspicious when walking down a poorly lit urban street at night. But irrational fear of the dark seems to be primarily a characteristic of children, whose small size and experience would have made them most vulnerable to predation in the past. Natural selection hardwired this primate response to danger the same as it did the "freeze-crouch" of a frightened fawn.[1]

Many human traits and behaviors that were adaptive in our evolutionary past may now be maladaptive because the environment in which we arose has changed. In fact, the habitats in which we find ourselves today have changed so drastically and so rapidly from the conditions in which we evolved that it is surprising that we live in them as well as we do. The ultimate irony is that the biggest agent of change in our environment—the architect of our various habitats on Earth—is none other than *Homo sapiens*.

The Cultural Econiche

Every species has its own econiche—a place in nature where it is at home. An econiche includes not only a physical location on Earth, but the dietary adaptations, daily activity patterns, mating behaviors, and physical attributes that adapt a species to a particular way of life. Hominids, those two-legged creatures that evolved from apes in the African Miocene about 7 million years ago, used to know their place. Their ancestral biological econiche was in the savannas and woodlands of Africa.[2] But their descendants, the human beings, have more recently wandered widely over Earth and have somehow lost this knowledge. As a species, we have lost sight of home.

Culture, the composite of all learned human behavior passed on socially, was the hominids' passport out of Africa and into Eurasia, 1.9 million years ago.[3] Culture makes human beings very adaptable organisms, and it allows humans to cope more rapidly in different circumstances than would be possible left only with their biological rate of evolutionary change. For this reason anthropologists consider that humans have now evolved to live in a new econiche, a cultural econiche.[4] Instead of slowly evolving biologically in

c01.qxp 02/11/02 09:56 Page 8

response to environmental challenges, humans now evolve biologically to bear culture, mainly with their large and complex brains, and culture in turn changes rapidly to adapt to the environment. Humans thus are somewhat unique among animal species in having a cultural econiche within their biological econiche. Traditional Laplander reindeer herders in Finland, for example, have a cultural econiche in the Far North that allows their biological selves underneath to maintain a constant 70 degree Fahrenheit tropical microhabitat inside their warm fur-lined boots and parkas. Nomads in the Negev Desert, on the other hand, wear open-necked, loose-fitting, dark woolen cloaks that shield them from the blistering sun, blowing sand, and cold nighttime temperatures. The cloaks absorb heat, creating a vertical circulation of air that keeps skin temperature at about 70 degrees Fahrenheit and body temperature normal.

The problem is, culture can adapt us to such a wide variety of conditions that there is a danger that we can diverge so much from our origins that we are in conflict with our biological econiche. Unlike the Laplanders and Negev nomads, whose cultural attributes adapt them admirably to their environments, many of our modern-day cultural adaptations may be killing us. We have to adapt culture to suit our biological needs. For example, we know that as early as 2.3 million years ago, our ancestors were wide-ranging, savanna hominids.[5] Today the automobile serves the economically practical goals of foraging for food and transport back to our home base, but our ancient expenditure of physiological energy for these purposes has been lost. We must figure out how to replace this important biological component of our lives—physical exercise—if we want to stay healthy and live long, productive lives. Learning how to shape our cultural behavior to maximize our biological existence is the major goal of this book.

The Pursuit of Adaptive Normality: Average Is Good

Because natural selection has formed them within an ecological niche, species of animals have optimal ranges of structure and function (anatomy and physiology) for all life systems. Most of the

c01.qxp 02/11/02 09:56 Page 9

individuals within a population will cluster near the mean, average, or norm (used here synonymously) of whatever measure that one looks at. For example, a population of African black-and-white colobus monkeys has an average length of tail, an average coloration pattern, and an average daily metabolic rate. Individual traits of individual colobus monkeys will vary around the mean. No one monkey will be the ideal "type," but still we will have a good idea of a general range of "normal" colobus monkey anatomy and physiology. We humans use this concept all the time when we take a person's temperature, check the health of a growing child by comparing how tall and heavy he or she is against standards for the whole population, or take our own blood pressure. But why are these values normal?

Natural selection tends to maintain an optimal average for a population. Human babies, for example, tend to weigh on average approximately seven pounds. If they are much less or much more than this weight, they have significantly more medical problems associated with their development. The individuals in a population that grow up to be the most successful at survival and reproduction then will tend to have the "average" traits. In a classic study in 1898 on English sparrows that were caught in a snowstorm, ornithologist Herman Bumpus discovered that the birds which survived were nearest the mean in terms of wing length and body size. There were disproportionate numbers of big birds and small birds killed compared to average-sized birds, a gruesome illustration of how natural selection culls individuals too far from the optimum.

Any number of natural disasters befalling a population—drought, floods, freezing temperatures, fire, or, of particular interest to us in this book, disease—may serve as the agents of natural selection. Individuals near the norm for the population tend to survive all of these onslaughts better than the outliers. This type of natural selection is known as "stabilizing selection" because it tends to keep the population on its evolutionary path when overall environmental conditions stay the same. Why exactly it is optimally beneficial for a human baby to weigh seven pounds or for an English sparrow to have a certain wingspan is a hard question to answer. It is probable that "generalists"—individuals not too big but not too slight, not too strong but not too weak—can survive

c01.qxp 02/11/02 09:56 Page 10

the widest range of hazards. They are not specialized in any one direction and thus tend statistically to survive well. Only if conditions change permanently and in one direction will stabilizing selection be replaced by directional selection, moving the average for the population to a new point.

Biologically speaking, then, average is good and, literally, "normal." Average is, in fact, the best. But extending this concept of evolutionary biology to contemporary philosophy, especially American popular culture, encounters some difficulty. This idea runs counter to many peoples' mind-sets. Asked to predict which birds would survive a storm, most people would probably say either "the strongest birds" or "the biggest birds." Asked to define "best" in human terms, most people would also say "the biggest," "the most beautiful," "the smartest," "the fastest," or "the richest." The *Guinness Book of Records* does not, after all, list *means* of achievement. No one would be interested. So we must first of all separate the ideas of "societal good" from "biological good," for which extremes can mean premature death.

"Good" in a biological sense is "adaptive normality"—a zone in which we function optimally. The unfortunate truth is that many of us operate outside this zone, and we have, by this definition, abnormal lifestyles. Abnormal lifestyles predispose us to chronic illness and "diseases of civilization." Instead, we need to be closer to the biological averages that are at the center of our adaptation as a species.

To achieve adaptive normality, then, should we emulate Neandertals, early hominids, and our ape relatives? In certain important respects, yes. But this does not mean donning a leopard skin and swinging through the trees. Adaptive normality does not imply a reversion to prehistoric cultural conditions, just a simulation of the essentially important conditions within which we evolved.

Our occupations and professions are specialized jobs within culture that deprive us of much of our evolutionary birthright. We do a small number of tasks over and over, and we become very good at them. But despite our competence we become bored with our jobs. We have evolved a complex brain, with matching physiology and anatomy, to deal with a kaleidoscope of changing conditions—threats to our survival—and the mundane sameness of our everyday modern lives creates a chronic discontent. Our

c01.qxp 02/11/02 09:56 Page 11

psychology tells us that something is wrong, but our intellect fails to analyze how to correct it. We are, in fact, operating at one of the edges of our adaptive zone—in one small place where chance, economic forces, our own interests, and culture have placed us. If we stay there, eventually our health deteriorates. Our cultural econiche adaptation is significantly off the biological norm, and, like a bird that is too big or too small, we will likely die early.

Take Sonya Haskins,[6] for example. Sonya works in a chicken processing plant in Georgia. Sonya's job is cutting off the feet of the chickens as they come down the conveyor belt, in one deft swift motion, putting the feet in one bin and replacing the now footless chickens on the belt. She works eight hours a day—ten sometimes, if she can do the overtime. She hates the work, but she has to support her two small sons. Her back, shoulders, and feet always ache after a day of this work, but she considered herself young and strong when she started and has kept at it. After six years on the job, however, Sonya's hands began to go numb and moving them became painful. She was diagnosed with bilateral carpal tunnel syndrome, underwent surgery on both wrists, and is now recuperating. Her doctor advises her to find another line of work after she gets off disability. Probably not bad advice, but Sonya's physical problem was brought on by an abnormal work environment, and anyone subjected to similar stresses would have the same ailments. What about the thousands of other Sonyas out there in similar situations? Sonya is just being asked to move from one abnormal margin of her adaptive zone to another edge—a sort of slash-and-burn approach to life and health in the modern world. Should Sonya have other options? Yes. Will she get other options? The unfortunate answer is probably no, unless she takes a longer view and moves herself to a more normal and well-balanced position in her work and life. This is what this book is about: understanding adaptive normality and how it came about, and then using that information as a life strategy.

Benton Hawthorne is a 45-year-old corporate vice president in a large city. His job is to analyze sales figures, assess performance of employees, and attend meetings. His job creates a lot of stress—people he has to confront, and even fire, trying to push others to meet goals that never get met, and keeping his superiors happy. Benton was athletic in school, but his hectic lifestyle, plus com-

c01.qxp 02/11/02 09:56 Page 12

muting two hours each day (if the traffic is not too bad), has prevented him from getting the exercise that he knows he needs. Somehow there's never time. He rarely eats breakfast, grabbing a quick coffee and doughnuts, and frequently skips lunch. Yet he is dissatisfied with his weight and his appearance, and now his stomach has begun to act up. He's afraid he has an ulcer, and the pain is beginning to keep him up at night. He hasn't told anybody, not even his wife, but he also is having problems with hemorrhoids, which make sitting through seemingly interminable meetings even more painful.

Benton is working on developing a number of modern-day medical problems simultaneously. His lack of exercise is contributing to his weight gain, and he is at risk for developing diabetes. His diet and his stressful lifestyle are contributing to his stomach pain, which is likely gastritis, preliminary to peptic ulcer. His sedentary routine is also causing a pooling of blood in the walls of his rectoanal canal, causing hemorrhoids. He can expect even more problems, such as back pain, heart disease, kidney disease, and a variety of possible cancers, unless he reverses course and changes his behavior.

Benton is on the opposite end of the economic scale from Sonya, but he is in the same boat from the standpoint of his health. It is deteriorating because of lifestyle choices. Neither Sonya nor Benton really need a doctor to tell them that what they themselves are doing is causing their maladies, that their diseases are preventable, and that their behavior patterns are changeable. The medicine they need is prescribed by our evolutionary history, and it is called adaptive normality.

Concordance and Discordance

Choosing extremes leads to a lifestyle that is "discordant" with our biological evolution. By contrast, "concordant" behaviors are those that play the same adaptive role for us in our present-day environments as they did for our hominid ancestors in their ancient environments. Concordant behaviors bring our biological econiche closer to our cultural econiche. For example, when we walk into our kitchen to make the morning coffee and step, bare-

c01.qxp 02/11/02 09:56 Page 13

foot, on a sharp piece of glass left over from a child's accident the night before, our foot immediately recoils, preventing penetration of the sharp object into our foot. This behavior is identical in context and adaptive value to an *Australopithecus afarensis* pulling back his or her foot when accidentally tredding on an upturned acacia thorn, left over from a giraffe's breakfast, while walking along the savanna at Laetoli, Tanzania, 3.6 million years ago. This foot recoil behavior is thus concordant behavior—same environmental problem, same physiological response, same physical effect.

Now let us look at some discordant behavior. After avoiding the painful acacia thorn, our australopithecine walks on a ways and starts to get hungry. He happens to see a Pliocene giant East African tortoise (now extinct) plodding through the undergrowth, and he begins to think how good the fat on the tortoise's back under the shell, the succulent organs, and the salty blood will taste. He gives chase as it were to the tortoise, kills it with a rock, and spends an hour smashing and prying open the carapace. He and his band spend the rest of the day eating the tortoise and resting in the shade. It will be a good many days or weeks before the band will again have this much good food all at once. In contrast, back in the modern world and having forgotten our early morning incident with the broken glass, we find ourselves later in the day, shopping with our seven-year-old son. He begins roaming the supermarket aisles, scanning for game. He happens to see an entire row of potato chips, and he begins to think how good these fat-soaked, salty, fried sliced tubers would taste. Acting on his ancient cravings for these tastes, he lunges and captures a bag of them. But feeding on this low-fiber, high-fat, and high-sodium junk food, coupled with the fact that almost no calories were expended in obtaining them, contributes to obesity, arterial plaque formation and high blood pressure, and diverticular disease of the colon. Our modern behavior in this case is thus discordant with our evolutionary past.

Evolutionary medicine does not advocate returning to the past. Modern medicine has indeed made major strides in overcoming infectious disease, treating trauma, and significantly reducing infant mortality. But if we moderns can consolidate these advances and live in accordance with the evolved wisdom of our bodies, we will achieve optimal health.

c01.qxp 02/11/02 09:56 Page 14

Conquering the Diseases of Civilization

The stunning accomplishment of sequencing the human genome, accomplished during the year 2000, is the capstone of an impressive array of discoveries in medically relevant genetics and molecular biology during the latter half of the 20th century. But as impressive as these strides have been, they will not resolve the scourge of modern medicine—the so-called diseases of civilization:[7] heart disease, most cancers, diabetes, and obesity.

How do we defeat diseases of civilization? These are diseases caused not by single gene defects but by the crowded, stressful, polluted, and "modern" conditions in which we human beings have surrounded ourselves in the last several millennia. The diseases of civilization will not be conquered primarily by medical advances in the genetics and molecular biology laboratories. Rather, the diseases that are killing and debilitating most Americans today are lifestyle diseases—discordances with our evolved adaptations that must be reversed by old-fashioned behavioral modification.

As medical genetic research moves rapidly forward, the genetic bases of our adaptations will one day become more fully understood. Hopefully, this understanding will help to teach us how genes function when we are healthy, rather than only how they cause disease. This ability to define the normal—that is, how our bodies and physiologies are designed to function in a disease-free state—is perhaps the major contribution that an evolutionary approach can give to medicine. Genetics should be an active partner with an evolutionary perspective in this endeavor. Throughout the remaining chapters in this book, genetics forms an important part of the evolutionary narrative. The next chapter outlines the broad scope of human evolution, providing a 17-level framework for defining human adaptive normality.