COMMENTARY

Evolution and our environment: will we adapt?

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Evolutionary medicine involves several different approaches, all of which are grounded in Darwin's theory and are now generating exciting new research. One approach, applied by Eaton and colleagues since the mid-1980s, is to consider the environment of evolutionary adaptedness for our species and to view it as the shaper of the latest draft of our genome. We must examine environments of adaptedness and consider the distribution of relevant situations in which we evolved. This approach leads us to the discordance hypothesis, which attempts to assess the disjunction between those environments and the ones we live in now and predicts points of vulnerability due to the rapidity of environmental change. In particular, several important chronic degenerative diseases have been interpreted as "diseases of civilization" because they appear to result from this disjunction. In an era when the word *natural* is frequently bandied about in relation to medicine and health, the discordance hypothesis actually gives us a scientific path to potential insights.

Nesse's analysis of obesity is a case in point. Not just human evolution, but eons of animal evolution before that occurred in a context in which it was hard to become fat and easy to starve to death. Most preindustrial human societies described in the anthropological literature had frequent or occasional food shortages that were mild to moderate in duration and severity; severe shortages also occurred. Populations that learned to accumulate body fat in times of abundance were protected against these shortages, and doubtless did relatively well.[1]

Historical and anthropological records show that the ideal of female beauty in most societies was either plump or fat. The classic painters' models of the late Renaissance would today probably hate their bodies, but they had a body mass index considered ideal by most humans who have ever lived—except for those who preferred even fatter women. Intriguingly, the body fat on a Titian or Rubens model approximates the stored energy needed to fund a pregnancy and a year of lactation.[1] Little wonder, then, that evolution caused men to find it attractive.

The discordance hypothesis also addresses fundamental disease processes. Atherosclerosis underlies most deaths from heart disease and stroke, but this condition was rare in our hunter-gatherer counterparts, who had serum cholesterol levels in the low-to-mid 100s.[2] Analysis of their diets[3,4] shows that they consumed lower levels of total fat and saturated fat than do Americans today, and indeed, the levels are even lower than standard recommendations. Extremely high fiber levels probably protected their colons from adenomas and may have lowered their serum cholesterol levels. Average salt intake of less than a gram a day from all sources may have protected them from hypertension; hunter-gatherers show no increase in blood pressure measurement with age. And without obesity, type 2 diabetes mellitus was uncommon.[2,5]

Low serum cholesterol levels and the absence of obesity could be interpreted as signs of chronic starvation, yet hunter-gatherers had higher daily caloric intake than Americans do and with much higher energy output. The normal activity levels associated with this high-throughput status produce high levels of aerobic and muscular fitness and contribute to the low prevalence rates of chronic degenerative diseases that hunter-gatherers generally exhibited.[2]

Nesse also tried to apply the discordance model to psychiatric disorders, including anxiety disorders and phobias. This approach is original and valuable, but unlike the situation in diet and exercise, we have few serious studies of emotional and psychiatric symptoms in hunter-gatherers. Those we have—for example, Marjorie Shostak's books on the !Kung San of Botswana—suggest a far more complex picture.[6,7] The anxieties of Nisa, a woman whose life Shostak probed in depth, centered on her marriage or other relationships and on fears about her children's illnesses and, ultimately, her grief over their deaths. Aging and the loss of physical attractiveness were also major concerns, familiar to us despite her exotic context. If she was anxious about predators, she had little to say about them. Clearly, more research is needed to study the relationship between anthropology and psychiatry in evolutionary perspective.[8,9]

The mention of children's death leads to the thought that we evolved in an exceedingly antigenic environment. Although this may have worsened with the rise of agriculture and its attendant crowded settlements, the burden of microbes and parasites was high for all hunter-gatherers that have been studied. This fact explains why their life expectancy was short despite low levels of chronic degenerative disease. As Nesse points out, it also explains some of our common symptoms, such as pain and fever. If these symptoms alert us to problems or help to fight infection, they would have been favored, not disfavored, by evolution.

Our long coevolution with parasites, microbes, and viruses has continued through the era of modern medicine and into the 21st century. Many of us in medicine underestimated the evolutionary resourcefulness of microorganisms—with tragic results. Quinine-resistant malaria, multiple-drug-resistant tuberculosis, penicillin-resistant streptococci and staphylococci—all are evolutionary achievements for parasites and microbes at our expense, and they depended on our cooperation through unprofessional use of anti-infectious agents. Human immunodeficiency virus, like other emerging viruses, has an origin, spread, and resistance to prevention and treatment that make no sense except in the light of evolution. One can only wonder how many lives might have been saved if Darwin's *Origin of Species* had been incorporated into medical school curricula when it was published in 1859. Or even, alas, a century later.

Would knowledge of human evolution have helped 20th-century physicians avoid the extremes of arrogance that allowed them to recommend strongly against breastfeeding and try to abolish childbirth without anesthesia? The iatrogenic cardiovascular disease patterns of the 1960s and 1970s resulted in part from the specific dietary recommendations of physicians and other health authorities that promoted the consumption of large amounts of whole milk products and beef. A bit of knowledge of our ancestors' diet and activity could have made a big difference.

With the advantage of hindsight, will we pay any more attention to evolution in the medical research and education of the future? Or will the justly admired advances in genomics and imaging usher in a new era of technologic arrogance in which we once again forget that we were, and are, in the first place, evolving animals?

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