Said Another Way

Stroke, Evolution, and the Rainforests: An Ancient Approach to Modern Health Care

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TOPIC. *The relatively new discipline of evolutionary medicine.*
PURPOSE. *To raise awareness among healthcare professionals that our modern view of illness and health care might be flawed.*
SOURCES OF INFORMATION. *Published literature in CINAHL, MEDLINE, Cochrane databases, and EMBASE.*
CONCLUSIONS. *Our modern lifestyles and healthcare paradigms (using stroke as example), may be at odds with our palaeolithic genome. The dietary regimes of remaining hunter-gatherer communities merit attention and study in this regard. Time is running out as the rainforests dwindle and hunter-gatherer communities are acculturated.*
The selective forces that resulted in the evolution of the human species were mainly environmental. Our metabolism, physiology, and genome, therefore, are geared towards survival under certain environmental parameters. With the advent of agriculture, almost 11,000 years ago, those parameters changed. Our ancestors' lifestyles transformed from wandering hunter-gatherers to sedentary consumers of more than they needed to survive. Many studies link today's prevalence of metabolic syndrome (diabetes, obesity, and cardio- and cerebrovascular diseases) in developed countries with this historic change in human behavior. If this is a valid correlation to make, then the few remaining hunter-gatherer communities in today's rainforests must surely hold the key to human health. Certainly, physiological parameters in these people are impressive, but trends are worrying. There is clear derangement of these parameters when exposed to any degree of acculturated lifestyle. In addition, the natural homelands of these communities, the rainforests, are dwindling at an alarming rate in order to maintain our acculturated norms. The race is on, therefore, to learn what we can about diet, exercise, and natural medicine from the last few humans who live lifestyles that might be closest to our natural state.

Search terms: *Acculturation, civilization diseases, Darwinian medicine, evolutionary medicine, health promotion, human evolution, hunter gatherer, metabolic syndrome, paleolithic diet, Stone age, stroke*

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Introduction

In 1859, Charles Darwin precipitated a social and religious storm by publishing *On the Origin of Species* (1985). Twelve years later he intensified the debate with a publication describing the evolution of humanity from a primitive ancestry. "Man," he wrote, "still bears in his bodily form the indelible stamp of his lowly origin." This closing sentence from *The Descent of Man* (2004, p. 689) is the basis for the argument that follows.

This article is a discussion of the nature of modern illness, using stroke as an example. In order to understand illness in its widest context, it is necessary to touch on some areas that, on first reading, appear to have little or nothing to do with health care. Hopefully, though, as the steps in the argument are examined, the conclusion will present itself as the only possible way of considering the state of modern human health. Drawing on research from the fields of evolutionary biology, archaeology, anthropology, and modern healthcare strategies, it should become clear that:

- our evolution has been driven by environmental selection
- only recently, on a geologic timescale, have we learned how to alter our environment and, consequently, our own lifestyles
- today's prevalence of obesity, diabetes, and cardiovascular and cerebrovascular diseases is a signal that we are no longer suited to our environment
- our state-of-the-art health services and strategies, while successful in the short term, may not be the best way to manage illness
- solutions to our health problems are knowable, but are on the verge of being lost to us forever.

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Darwin's Legacy

One hundred and fifty years after the publication of *On the Origin of Species*, the concept of evolution is still denied by some and misunderstood by many. Among evolutionary biologists, however, Darwinism is as strong as it has ever been.

Darwin is often wrongly credited with the idea of evolution, which had been around for at least a century before him. In fact, what he postulated was the mechanism by which living things evolve—natural selection (Gould, 1977). The oft-misused phrase, "the survival of the fittest," is still applicable today and, as we shall discover, has implications for health care. The "fittest" in this context was not the biggest or the strongest, but the most suited to its environment; so suited, that it would outbreed lesser-suited species. It is easy to see how this argument was ripe for abuse by race-supremacists and some politicians; some have tried to transpose Darwinian ideas into a sociologic context, with debatable validity. In fact, the phrase "survival of the fittest" was not actually coined by Darwin. It is attributed to the Victorian sociologist Herbert Spencer—one of the first people to try to apply Darwin's theories to the social dynamics of human populations (Jones, 1999).

Now that we know, though, that all of humanity falls into the same subspecies, *Homo sapiens sapiens*, the phrase is still valid (Dawkins, 2004). For it is in its underlying implication—that we have become unsuited to our environment—that it rings true for humanity as a species. Where the fittest (i.e., the best suited to the environment) might thrive, the unfit will struggle or become extinct. To summarize the premise, the environment extinguishes poorly adapted species: that is, nature selects.

It should be explained that the term "environment," in this context, refers to every aspect of the surroundings: food supply, water quality, social stressors, etc. It must also be emphasized that this is not about one group of people versus another; the discussion refers to the human species as a whole.

Initially, this may seem far removed from such topics as illness, health care, and nursing. But consider what happens to organisms that find themselves in hostile environments. Bacteria do not survive in an environment that contains certain fungi; the fungi naturally produce bactericidal antibiotics. Aquarium fish will sicken and die if their artificial environment is not maintained. Similarly, human illness is a sign that we are at odds with our environment. Such prevalence of the same few types of illness should be a blatant signal to us that, perhaps, we are being naturally deselected by that environment.

Our Altered Environment

Why should an environment that has allowed us to evolve to our current state now turn against us and make us ill? The answer is simple. The world of today is not the environment we evolved in. It is generally accepted that recognizable humanity evolved over a period of 2.5–3 million years. In that time, there occurred the slow evolution from *Homo habilis* to *Homo sapiens*, the latter appearing about 100,000 years ago (Diamond, 1992). This Late Palaeolithic *Homo sapiens* is who we are, with negligible genetic change occurring since then. Consequently, the lifestyle that prevailed at that time was a successful one. It has been estimated from isotope studies of fossils and dental remains that the diet of these people comprised 65% vegetable and 35% animal (di Costanzo, 2000). In evolutionary terms, this way of life allowed humanity to flourish and become the most dominant and adaptable species on the planet.

We were so successful, in fact, that we learned how to change our environment. With the advent of agriculture, estimated at 9,000–11,000 years ago, people settled into static communities and the Neolithic period was born. With food growing around them, people no longer had to expend the same amount of energy in order to eat. Thus was born the beginnings of the sedentary lifestyle. Ten millennia later, farming techniques have improved greatly and food was routinely produced in large quantities. With the Industrial Revolution of the eighteenth and nineteenth centuries, machines replaced people in many areas of industry, particularly food production (Diamond, 1997). Unemployment, poverty, and disease were rife then and, in many places, still are.

The upshot is that modern humans exist in an environment that is saturated with refined substances, processed mass-produced genetically altered foods, polluted air, water, and earth, and a rat race so stressful that mental illness is probably more prevalent than we realize.

Nowadays, food is mass-produced, chemically and genetically altered, and packaged in man-made containers for convenience. The result is that we have changed from outdoor, active consumers of no more than we need, to sedentary consumers of a high-energy, low expenditure diet of mainly grain and meat. To summarize, we evolved successfully by adhering to a fresh vegetable and wild meat diet for almost 3 million years; for the last 10,000 years, a blink of an eye in evolutionary terms, we have farmed and consumed captive meat and grain-based carbohydrates; in the last 200 hundred years our carbohydrates have been stripped of their nutrients as refining processes developed; only in the past 50 years have we been consumers of processed food.

The upshot is that modern humans exist in an environment that is saturated with refined substances, processed mass-produced genetically altered foods, polluted air, water, and earth, and a rat race so stressful that mental illness is probably more prevalent than we realize. Essentially, we are unchanged from our Late Palaeolithic ancestors, but we have created an environment that generates lifestyles that render us unfit to function healthily: "In the absence of significant mutations since that period, actual nutrition appears to be no longer adapted to our physiological potentials" (di Costanzo, 2000).

Modern Disease: The Price of Civilization

The modern noncommunicable diseases that plague developed and Westernized populations are all too familiar to us: obesity, diabetes, hypertension, heart disease, and stroke: many are the sequelae of such conditions as hyperinsulinism and insulin resistance, resulting from habitual excessive consumption of refined carbohydrates (Cordain, 2002). Known collectively as metabolic syndrome, more and more researchers refer to them as the "civilization" diseases.

The management of one particular "civilization" disease, stroke, has, in recent years, become more structured. The National Clinical Guidelines in England and Wales (Intercollegiate Stroke Working Party, 2004), and SIGN Guidelines in Scotland (Scottish Intercollegiate Guidelines Network), go a long way towards describing the care and treatment sufferers should expect to receive. One particular area of stroke management, secondary prevention, has had a dramatic effect on reducing the recurrence of stroke and is supported by a vast and growing evidence base.

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The onset of stroke flags up two issues for the clinician: that the patient has unstable cardiovascular or cerebrovascular disease and that there is a risk of recurrence. Reducing this latter risk (i.e., secondary prevention) involves a structured, prompt approach involving several measures. The three staples of secondary prevention in stroke are antiplatelet agents, antihypertensives, and statins (SIGN, 2004). Each one significantly reduces the risk of further events and together their effect is multiplicative. All patients who present with transient or persistent, embolic or ischemic stroke, are discharged on this triad, regardless of blood pressure (BP) values or serum lipid profiles.

Correcting each individual clinical aberration with drugs certainly seems to have a beneficial effect on rates of recurrence, but it is hardly a holistic approach.

An antiplatelet agent is introduced as soon as CT scanning reveals a stroke-like event to be nonhemorrhagic. The first line here is aspirin, although there are alternatives in case of intolerance or sensitivity (clopidogrel, dipyridamole). This prolongs the clotting time significantly enough that the relative risk of recurrence is reduced by around 13% (Koennecke, 2004).

Irrespective of whether BP and serum cholesterol values lie within "normal" limits, antihypertensives and cholesterol-lowering statins are almost always prescribed. This may be because what we consider to be normal is really only a distribution of observed values for our population and, therefore, not necessarily an indicator of health.

True to tradition, conventional medicine has adopted a positivist-reductionist approach to the management of risk factors. Correcting each individual clinical aberration with drugs certainly seems to have a beneficial effect on rates of recurrence, but it is hardly a holistic approach. We tell patients that their BP, serum cholesterol, or body mass index (BMI) are too high, too low, or just fine, and treat accordingly. We also make allowances for BP and BMI to increase naturally with age. The question, therefore, must be asked: how can we know what is normal for these parameters in *Homo sapiens*? In any other species, values for wild populations could be compared to those for captive or domesticated breeds. Is this a methodology that could be applied, with equal validity, to people?

So far, the argument can be summarized thus. Humanity has evolved so successfully that, having changed our environment by trying to control it, we have changed our behavior in tandem. This altered environment is so different from the one in which we evolved that, due to the forces of natural selection, we have become unfit to survive in an optimum state of health. Consequently, this environmental deselection is manifested as widespread illness. The approach of modern medicine is to try to correct each individual clinical aberration, thus reducing the risk of recurrence of such events as stroke and heart attack. The environment, however, remains hostile and the "civilization" diseases do not abate.

The Truth Is Out There

The problem is summarized beautifully in the title of a paper by O'Keefe and Cordain (2004): "Cardiovascular Disease Resulting from a Diet and Lifestyle at Odds With Our Paleolithic Genome: How to Become a 21st-Century Hunter-Gatherer."

In answer to the questions posed above, some researchers have drawn conclusions from studies of the few truly hunter-gatherer societies that continue to live a paleolithic lifestyle to this day. These rainforest-dwellers subsist mainly on fruits, vegetables, nuts, and

seeds with occasional addition of the leanest meats. Added to this dietary regime is the amount of activity involved in obtaining their food. This kind of lifestyle, it could be argued, is closest to our natural state (Baschetti, 1991), and it might prove valuable to compare longevity, BP, and cholesterol values with those of Westernized city-dwellers. Such figures are available and, while there are no great surprises, there are real implications for how healthcare professionals should approach not just secondary prevention of heart attack and stroke, but also primary preventive health promotion.

In one hunter-gatherer community, the Yanomami of Brazil, BP in adults was a mean 104/70 mmHg in men and 94/63 mmHg in women (Crews & Mancilha-Carvalho, 1993), with serum cholesterol typically 3.0–3.6 mmol/L (Pavan et al., 1999). Also, BP and BMI did not increase with age (Mancilha-Carvalho, Sousa e Silva, Carvalho, & Lima, 1991). Similar studies of other hunter-gatherer communities from around the world generate similar figures. Interestingly, one study demonstrates how such a community can be contaminated and their clinical parameters adversely altered. Kesteloot, Ndam, Sasaki, Kowo, & Seghers (1996) studied pygmy communities in Cameroon, and their interaction with local Bantu farmers. The pygmies there trade wild produce for salt and firearms. Introducing salt into the diet and reducing physical activity by shooting their game has had detrimental effects on health: not only was BP generally higher than in nearby unacculturated pygmy communities, but it also increased with age in the females.

In general, though, hunter-gatherer values, particularly those for BP and serum cholesterol, are significantly and consistently lower than those quoted as normal in modern textbooks. They are also worryingly different from the target values suggested by our clinical guidelines. Since the same researchers conclude that these observed values are a reflection of how things should be (Mancilha-Carvalho, Carvalho, Lima, & Sousa e Silva, 1992), then it looks as though our working "normal" ranges are actually too high and, consequently, constitute significant cerebrovascular and cardiovascular risks. Introducing antihypertensives and statins in the presence of what we would consider to be normal BP and serum total cholesterol values, therefore, might seem like a good idea. In the wider context of our paleolithic genome, though, we can barely afford to rely on such a reductionist approach. For, if any of this is true, then it might be the case that antiplatelets, antihypertensives, and statins simply postpone, rather than prevent, further strokes.

An important intervention, and one where nurses come into their own, is Health Promotion.

Conclusion: Nurses vs Natural Selection

As healthcare professionals, everything we do is done to counter the selective effects of our environment. In other words, we try to negate natural selection. In the wild, a sick animal would, most likely, die. Every human intervention, however, from the slightest 30° tilt to major surgery, is a reaction to, or prevention of, the effects of natural selection. Whether straightforward altruism or evidence of the divine in us, it is an innate facet of our nature that we intervene in this way.

An important intervention, and one where nurses come into their own, is health promotion. It would be unthinkable for us to return to a Late Stone Age way of life, but the nutritional requirements of the twenty-first-century human remain paleolithic. Therefore, educating people on diet and exercise, appropriate to our Stone Age genome, has to be the way forward. We can learn a lot about nutrition, and lifestyle in general, from the hunter-gatherer communities of today:

mainly, that any effective health promotion, with regards to stroke and myocardial infarction, must be based on studies of their lifestyles. Critics might claim that such a conclusion lies beyond the premises discussed here. This would mean that the argument is not wholly deductive and, therefore, lacks validity. Further study of recurrence rates for stroke may, or may not, show that subsequent cerebrovascular events are only postponed rather than prevented. Valid conclusion or not, the data are real and the implications massive, both for the future of health care and for the restoration and conservation of our environment.

Assimilating this knowledge into everyday health education practices might be more of a challenge, however, and many clinicians may still need convincing. Time may be running out for us, though. As the rainforests shrink by our own doing, and the remaining hunter-gatherers are assimilated into acculturated communities, we might lose the sources of the solutions to our problems. As we continue to change our environment, and these people disappear, we must learn from them while we still can; for we share with them the same "lowly origin" that Darwin first observed in our species.

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