

HUMAN EVOLUTION & AN AGING SOCIETY

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The title of this paper is *Human Evolution and an Aging Society*. It is a paper about evolution and, in fact, a paper about what is *wrong* with evolution. That is not to say that it is an argument for or against evolutionary theory. The proposition that species change over time is hardly a contestable proposition any more, and biologists now have sufficient information about the process to understand how it works. This paper is about how and why evolution, as it applies to the human species, is not working right.

Those who reject the theory of evolution on religious grounds like to say that the human body is so perfect that it could only have been developed by a higher intelligence, i.e., it had to be planned, or it could not have developed its present state of perfection. But that is a *terrible argument* for intelligent creationism, because the human body is far from perfect! Indeed, my opinion about evolution is somewhat like my opinion of democracy. It has been said that democracy is a very inefficient, if not to say absurd way to run a country, but I don't know of any better way to do it. Evolution is not a good way to develop a species, but there seems to be no other way to do it.

Indeed, the older I get the more deeply impressed I am with all the things that can and do go wrong with the human body – all the things that even one with my limited intelligence could have improved upon, had I been the creator. Consider the following extensive, though by no means exhaustive list of things that go wrong with what is referred to as a normal human body.

By what is now called mid-life, human beings begin to go down hill in numerous ways. Consider our sensory abilities, for example. By age 40 most people begin to experience *presbyopia*, a normal condition in which the lens of the eye starts to harden, losing its ability to accommodate as quickly as it did in youth, impairing our near vision, and ability to adapt to glare and darkness. Nearly half the people over 65 have *cataracts*, while *glaucoma* and *macular degeneration* affect a smaller number but with more severe disability.

Degeneration of hearing ability, or *presbycusis* starts even earlier, usually in the 30's, and by age 50 some 25 to 30 percent of the population have difficulty understanding a whisper. At about age 50 the sense of smell typically starts to decline and by age 65 most people have a noticeable loss of both taste and smell.

Muscles and joints also suffer with age. As early as age 30 muscles begin to atrophy, and muscle loss leads to an increase in body fat, so that by age 50, it is said that we must eat 240 fewer calories per day than we ate at age 25 to avoid gaining weight. Muscle mass decreases by as much as 20 to 40 percent. After age 35, bones begin to become less supple, more brittle, and begin to lose their density. Osteoarthritis, a normal degeneration of joint tissue, affects nearly everyone by the fifth decade of life.

Other body flaws that show up increasingly with age include spinal disks that become less spongy and prone to rupture or bulge; leg veins that are prone to varicosity that can lead to pain and life threatening blood clots; a progressive loss of muscle tone in the esophagus that can lead to food getting lodged in the trachea or windpipe; an average 40% drop in maximum breathing capacity by age 70; changes in collagen, a connective tissue, causing skin to lose elasticity in later years; a narrowing of the diameter of blood vessels, with a 20 to 25 percent increase in systolic blood pressure; and a 10% drop in the speed of nerve impulses between age 40 and 80. By age 75, Americans have a 10% chance of having Alzheimer's Disorder. By age 85, the probability is 25%.

And then there are the biochemical changes. With increasing age, there is a marked decline in the production of hormones, such as the human growth hormone (HGH), and a substance called melatonin (which affects sleep patterns), as well as an unpronounceable one called by its acronym, DHEA (dehydroepiandrosterone that affects the immune system). A 60 year old man will secrete only about 25 percent as much HGH, as a 20 year old, and there are similar declines in other endocrine gland secretions. HGH has been used successfully to treat growth problems in children, but it is now being used by a large number of wealthy senior citizens as a way to retard the aging process, even though such compounds have not been proved to be beneficial and may even be harmful. So far, we cannot be sure whether the aged body actually benefits from taking such hormones or whether it simply has no use for them. Their widespread use may be seen, however, as an example of the medicalization of the aging process.

Most of these problems affect men and women alike, to varying degrees. But consider some of the gender related defects. At about age 50 women, in western societies, experience menopause, the cessation of the menstrual cycle, an aspect of which is a profound drop in the production of the female hormones, particularly estrogen. After menopause women become more vulnerable to heart disease, osteoporosis, and incontinence. Though these conditions may, and often should be treated medically, they are actually normal reactions to the body's reduced production of sex hormones, and today's women in our society must weigh several medical pros and cons for hormone replacement therapy.

And consider what happens to older male human beings. There is such a thing as male midlife change. Typically, men do not experience a sudden cessation of sex hormone production, the way women do, so the idea of a "male menopause" may be dismissed as a social myth. But the production of testosterone, the principle male hormone, reaches its zenith at about age 35, then begins a slow but steady decline, being down about 75% by age 75. About 50% of American men over age 40 experience *some degree* of erectile dysfunction, and the incidence increases with advancing age, and has recently made the developers of the drug Viagra wealthy. I won't dwell on that well known problem of aging men, enlargement of the prostate (a small gland at the base of the bladder) but its enlargement affects almost all men in our society by age 60. A more serious problem is the occurrence of prostate cancer, the most common malignant cancer in North American men.

But what do all of these problems of aging have to do with evolution, and why would I say that they *give evidence that evolution does not work right*? When I say that “evolution does not work right,” I mean that it does not work to the advantage of the older population. Until the last 100 years, that did not make much difference, because there was not much of an “older population” as we know it today. In 1900 the life expectancy in this country was less than 50 years. Today the average American born has a life expectancy of 77.2 years (and climbing), and if one makes it to age 65, the longevity estimates are an additional 17 years. But we must live those last 20 to 35 years with bodies that have not evolved to last that long. In other words, for nearly half our lives, we have to make do with a body that is out of date. Unlike automobiles and computers, which are up-dated frequently, our middle aged and older bodies are essentially the same as those our forebears had in the horse and buggy days!

To understand why that is true, you must consider how evolution works. The basic elements of evolution are adaptation and reproduction. If an organism can adapt to its environment long enough to reproduce itself, it then passes on to its offspring its own genes. If, for some reason, an organism cannot adapt or cannot reproduce, then it has no offspring, and its genes die with it. We call this process *natural selection*, the force that molds our genetically controlled traits. And, unfortunately for those of us who are living longer, natural selection does not work to guarantee physical perfection or endless good health. It works for survival of the species.

Traits that seriously hamper survival in youth are weeded out (i.e., selected against), because most affected individuals will die before having a chance to produce offspring. But traits that become disabling only after the reproductive years have passed will continue to be spread within the population. If an individual has a gene that leads to a disability that does not show up until after the reproductive years (something like enlarged prostate or Alzheimer’s disorder, for example), that genetic defect does not prevent the individual’s procreation, and thus may be carried forward in the next generation. Thus, the mechanics of evolution have no way of weeding out the defects of aging, since those defects do not affect procreation.

Had it not been for the great advances in medical science that have increased our longevity, we might never have known this. But with modern surgery, pharmaceutical developments, and health insurance, not to mention infectious disease immunization and other public health measures, longevity has been extended greatly in spite of the forces working against it (such as war, industrial pollution, the fast food industry, and HMO’s). So today people are surviving, on the average, 50 to 100 percent more years than their not too distant ancestors. But medical science cannot make the body evolve more rapidly into a better physical specimen. It can only work to preserve and extend the life of the human body as it presently exists. Our situation may be analogous to what the automobile industry would be if cars had not been improved noticeably since the development of the T-model Ford. We might have skillful mechanics and body repair men to keep the old flivvers running for a long time, but they would still be T-model Fords. We have modern surgery and new medications that help to prolong life, but we are stuck with the human body as it is, because we have no alternative.

Thus, among today's long lived population, death comes not from infectious diseases, which were the scourge of our ancestors. Today we succumb to what are known as "life style diseases," i.e., diseases that are assumed to be our own fault. Most people die of cancer, cardiovascular and cerebrovascular disorders, chronic obstructive pulmonary disease, or traffic accidents – all of which are, to some degree, preventable. Traffic accidents are the result of carelessness, on somebody's part, and the life style diseases are said to be due to bad habits, such as smoking, eating too much fattening food, and not exercising regularly. So one might say that it's our own fault if we don't all live to be 100. The leading causes of death 100 years ago hardly make a dent in our mortality statistics now. Death from diphtheria, typhoid, scarlet fever, small pox, or tuberculosis is rare. Medical science has done much to help us live longer, but there are limits to what can be done with the human body in its present evolutionary state.

Among gerontologists, there are several theories about aging and longevity, and they fall into two main camps. First there are those who follow what is known technically as the *wear and tear* theory, which says the human body is only built to last about 85 years, and in late years even trivial events that would not bother a younger person may result in death to someone whose body is worn out with age.

Still another point of view, known as the *longevity assurance* theory, postulates that among mammals, including humans, some individuals live longer than others do, because natural selection favors genes that repair cells, while weeding out genes that impair cell functioning. But the cell repair capacity lessens with age, and passing on of these "cell repair genes" to another generation ceases when reproduction ceases, so presumably there will be no natural selection of the individuals who have genes that determine better cell repair qualities in later life.

Of course, we might be able to change the course of evolution slightly by increasing the child bearing years, causing some of the inherited defects that appear late in life to be selected against. Drugs that relieve the erectile dysfunction problem might cause more men to procreate somewhat later in life, and the expanding field of *assisted reproductive technology* has made it possible for women to have children even after menopause. Indeed, some stem cell research with mice, reported in Nature just this year suggests the possibility that women might be made to produce eggs later in life and might even be able to stave off menopause. We could eventually have to decide whether we want to continue raising children in our 70's and 80's or whether we would prefer to just keep things the way they are. I cannot imagine that many people would want to do this, but even if we have such a choice – the way evolution works – we would probably not see any benefit in less than a thousand years. You and I would still be stuck with the model-T bodies!

The result is that society must cope with the problems posed by an ever-growing aging population. Today the number of 65+ year olds is about four times that of 60 years ago, having increased from less than 10 percent to more than 15 percent of the total. By the year 2030, thanks to our young friends, the Baby Boomers (who really are not so young

anymore), it is estimated that the number will approach 70 million, and will be more than 21% of the population. By then it is likely that geriatricians will outnumber pediatricians.

On the basis of personal experience, I can vouch for the fact that this growing segment of society will be made up of people who have less ability to cope with the complexities of modern life. Of course, people in late adult life today are generally more competent, both physically and mentally, than were the generation of our grandparents, but as the elderly population increases, we must eventually face certain truths: we can exercise ourselves to skin and bone, we can eat nothing but broccoli, we can pay the plastic surgeon, we can dye our hair, we can date younger men and women, and we can even boogie the night away. *But we cannot stop time.*

And a population whose average age is ever increasing leads to certain inevitable problems, such as: there will be more people who cannot drive their own automobiles safely and cannot prepare their own meals; social security and other retirement plans will be hard put to provide pensions sufficient for these people to remain self supporting; the proportion of the population fit for military service will be smaller; health insurance costs will continue to rise to pay for the more pressing medical needs of the elderly; prisons will contain an increasingly large population of older inmates who will require custodial care; and the epidemic of Alzheimer's and other geriatric disorders may become a national crisis. And then there is one that has social and political implications: senior citizens – whether or not you consider this a good or bad development – will be an ever increasing voting block, determining public policy and the allocation of public funds.

During the comment session – since my thesis is that evolution won't solve these problems – the floor will be open for suggestions from members and guests as to what measures should be taken to meet the challenges posed by these probable developments.