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Grow Old with Me

Opinion

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Opinion

The here are various theories, or models, of ageing.

The gerontological model sees the different signs of aging driven by a single underlying process, leading to pre-programmed death [1,2]. According to the epidemiological model, ageing occurs semi-independently in different tissues and organs due to internal and external factors and stresses, which lead towards disease and ultimately death as tissues and organs move towards catastrophic failure [3,4]. Epigenetic 'clocks', annoyingly, show features of both models …

The evolutionary senescence model holds that errors and problems accumulate in later life because natural selection, which generally removes anti-survival traits, only operates up to the end of breeding age plus, in humans, a few more years to cover extended child care. A variant of this, antagonistic pleiotropy theory, suggests that natural selection gives us genes which are positive in early life but negative in old age.

Other genes confer longevity. Uniquely among species, humans show disproportional brain development, delayed juvenile growth and a long post-reproductive lifespan. We formerly transferred ideas and technologies between up to 3 generations, creating cumulative culture. In this context genes which supported longer-lived individuals, who accumulated and transferred the most prior learning and past experience, likely had an evolutionary advantage; conferring a disposable soma that lasts long enough to pass that crystallized knowledge on to the grandchil-dren.

If this is true, breeding later in life would eventually filter through as increased average life expectancy.

Given the importance of crystallized knowledge, one could also argue that the first evolutionary impulse toward greater encephalization which, for some accidental reason was rewarded (because it has not happened in other species), eventually became the main driver for humans' long life span. And if the same or overlapping genes are responsible for greater intelligence and longer life, one would predict that more intelligent individuals should, on average, live longer.

The new field of cognitive epidemiology shows that this is indeed the case i.e. [5,6]. A person with an IQ of 115 is 21% more likely to be alive at age 76 than a person with an IQ of 100 [6]. By age 79, those in the top 10 percent of childhood intelligence are two-thirds less likely to have died from respiratory disease than people in the bottom 10 percent. They were half as likely to have died from heart disease, stroke, smoking-related cancers, digestive diseases, and outside causes such as injury [7].

Some say that smarter people make healthier life choices but in my own experience and having had the privilege of working with individuals who were/are far smarter than I am, this is not necessarily true. Real life is more complex. In a recent paper [8], Mensink and Cohen suggest that the necessary complexity of life itself is necessarily self-limiting. They quote evolutionary biologist George Williams: 'It is indeed remarkable that after a seemingly miraculous feat of morphogenesis a complex (life-form) should be unable to perform the much simpler task of merely maintaining what is already formed.' [9] and redraft it as: 'Clearly, after the miraculous feat of morphogenesis, many complex (life-forms) are unable to perform the virtually impossible task of maintaining what was formed.' This makes sense to me.

Maintenance involves constant monitoring and creative destruction, ie the breakdown and removal of damaged elements and their replacement with new and functional ones, starting with proteostasis and extending outwards and upwards to supra-cellular and anatomical levels. These processes are energy-dependent, and their complexity means that they can be overwhelmed by increased damage and/or decreased repair and/or insufficient available energy i.e. [10]. In these circumstances otherwise robust complex systems, from cells to individuals, are pushed towards dysfunction (disease) and failure (death).

If we all had perfect nutrition and healthy lifestyles, optimized molecular maintenance would allow us to explore the further limits of ageing theory. In reality, we never get there. Today's degraded diets and lifestyles, which increase damage and hamper repair, lead to an accumulation of errors in otherwise robust complex systems which force them to move toward premature failure. Our species fails to explore the limits of healthy ageing because we are picked off prematurely and exponentially, as described by epidemiology theory and catastrophe theory.

This is not so much a theory of ageing, however, as a description of current events, and it centers on our most extensive and intimate interface with the external world: that part of it we ingest, namely food. Leaving quality issues aside for a moment, consider quantity.

During the course of an average life, the average human consumes roughly 60 tons of food [11] containing macro- and micronutrients, calories, catalysts and co-factors, metabolic supporters and disruptors. Judging by our very high incidence of obesity and degenerative disease, it cannot be the right food.

Animals in the wild are not thought to experience significant amounts of degenerative disease. Neither do humans who consume a traditional diet. Before Westernization, coronary artery disease hardly occurred in the Arctic Inuit [12-14], Kenyan Kikuyu [15], Solomon Islanders [16], Navajo Indians [17], Masai pastoralists [18], Australian aborigines [19], New Guinea Highland natives [20], Congo pygmies [21] – and the mid-Victorian English [22,23].

For most of us, however, the slow death of chronic degenerative disease is deeply embedded in our lives. It is visible in our parents, in ourselves and increasingly in our children [24]. We deny it, of course. We avert our gaze from the slow-motion holocaust created by the food multinationals, wallow in the warm marketing bath prepared for us by those same companies and wait for the drug round.

It is easier to overlook the fact that industrial food production leads directly to industrialized death because the model has been, in its own terms, so very successful. Modern methods of food production have allowed the world to accumulate 300 million tonnes of human biomass [25]. This success, admittedly, comes at a cost. At least 10% of human tonnage is excess adipose tissue, and the bulk of it is diseased [26], but keep your eyes shut and your mouth open and everything will be fine. For a while.

Keep chewing, however, and the multiple metabolic stresses caused by the industrial diet inevitably impact on health and life expectancy; not all at once but slowly and incrementally until an organ or tissue, stressed beyond breaking point, fails. We may receive warning of impending failure such as pain or debility, but by that stage a substantial amount of damage has been done. Modern scanning technology can provide earlier warning, but pharmaceuticals can only slow the rate at which we circle the drain.

This is both unfortunate and unnecessary, because we inherited a perfectly good gene set. A thousand centuries ago Neanderthals, apex predators from Northern Europe, migrated south and injected genes conferring strength, speed, stamina and enhanced repair systems into less robust Denisovans in the MENA region [27] before slowly merging with them, and other early humans, into us.

The problem is, Homo sapiens is a moving target. There is something about the primate lifestyle that permits (or possibly requires) a high rate of genetic drift [28]; the average newborn has 50–100 new mutations, and 1 to 4 of those are harmful [29]. We compensate for these to some extent via our sexual preferences [30,31] but the very complexity of our culture, like the complexity of our cellular workings, works against us. For our species to survive we must, like all life forms, work ceaselessly against entropy.

Unlike other life forms, humans manifest and inhabit transgenerational social strata.

Throughout much of history individuals with higher socioeconomic status and education, which are rough proxies for intelligence [32], had higher numbers of surviving offspring than those with lower status [33, 34]. After the mid-19th century, however, the abundant resources provided by the agricultural and industrial revolutions ended that differential advantage. Successful reproduction was now available to all, and selection for intelligence paused. Then, some say, it went into reverse.

Towards the end of the 19th century the polymath Francis Galton predicted that intelligence would start to fall, due to the tendency of more intelligent folk (like himself) to spend more time learning and less time breeding [35,36]. This hypothesis, termed 'dysgenic fertility', is supported by Michael Woodley and other scientists who have reported declining visual reaction speeds, complex vocabulary usage, working memory, color acuity and mental 3D rotation ability over the last century i.e. [37-39].

The case for dysgenic fertility remains unproven i.e. [40], but our appalling diet is certainly driving intelligence down via neurodevelopmental problems, neuroinflammatory stress, neurodegenerative disease, epigenetic shift and obesity [41-43]. In a nutshell, the industrial diet is degrading what few brains we have [44].

To make matters worse, crystallized inter-generational knowledge has lost most of its value, and therefore its life-and health-spam significance. It is being exponentially replaced by Bing, Bard and ChatGPT. Our species' genetic imperative towards greater intelligence is likely fading, and due to scientific and technical progress, we may be losing other good genes too [45-47].

Until the early 20th century, genes predisposing to Type 1 diabetes were filtered out of the gene pool because individuals born with those genes tended to die young. Banting and Best's work with insulin removed that filter, and the genes for Type 1 are no longer eliminated. This is just one specific and oft-cited example of a more general case. Thanks to modern medicine, which keeps many people alive today who would previously have died before breeding, deleterious genes are likely increasing in frequency [29,42,31].

What can We Do? Before It Is Too Late to Even Formulate Such a Question?

Salvaging our species using CAS9, TALENS and ZFNs to restore a more vigorous genome is an intriguing idea, but the intense interactivity of the genome makes it a high-risk endeavor. If we wish to slow our mental and physical decline I can think of two other courses of action, at least one of which would be less hazardous.

We could push ultra-processed foods to the side of the plate, opt for a simpler and less neuro- and epigenotoxic diet, and make it possible for more folk to develop their full biological potential.

Alternatively, we could reduce the quality of our diet further and select for fitness in our time. We should look for individuals who can thrive on ultra-processed food and solve complex mental arithmetical problems in 3 languages while bench-pressing 200kilos. Individuals who meet these requirements will be given license to breed, but only after reaching their 50th birthday. The rest of us will step out of the gene pool and head off to the showers.

To make this system even more effective all supplements will be made illegal, the healthcare system will be closed down and all doctors will be retrained as bookies. Let natural selection rip!

Equally unpalatable options include trans-humanism, and the continuing slow decline of our species.

Some have suggested a parallel between the aging of an individual and the ageing of a species, at least among mammalian vertebrates [43]. Both processes involve the progressive accumulation of mutations. Mutations accumulate both within reproductive and body cell lines until reaching a functional threshold, when the sheer number of deleterious genes in the individual and the gene pool trigger individual and social collapse. The proliferation of non-socially contributory individuals and groups in Western societies today seems analogous.

If you wish to enjoy your golden years, and especially if you are fortunate enough to have someone you like to share them with, go hoe a different row. Grow a vegetable patch. Keep chickens. When the weather turns cold and you can no longer afford to heat your home, burn down the Reichstag, for warmth this time and to illuminate the epidemiological dying of Old Europe.

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