

there is little natural selection to live forever in an environment where risks from disease, predation and accidents make immortality impossible. Environments vary in the level of hazard that they impose, and the age structure of the populations that inhabit them will vary accordingly. Mutations in the germ line that reduce survival rates at later ages (such as Huntington's disease) can therefore persist, because they cause little loss of reproduction. Also, any mutations that produce health and vigor in the young at the expense of

survival rates in the old will have a net benefit. Viewed this way, different species will come to have a genetic endowment that allows them to reach only the ages that their environment routinely permits. In a risky environment, we expect rapid aging, while with a safer lifestyle we expect a more leisurely decline. Is there anything we can do to improve our lot? Although cognitive decline, atherosclerosis and fragile bone fracture may seem to have little in common, there may be some general mechanisms of aging, and hence prospects for effective intervention. Austad gives a lively account of oxidative and glucose damage as widely shared candidates.

Austad questions whether menopause is an adaptive, evolved trait, or an epiphenomenon, unmasked only when environmental risk is reduced. He plumps firmly for the second explanation, on the grounds that it has so far proved difficult to make plausible theories of an adaptive menopause. But it is easy to see that a woman who is declining in vigor through aging may do best to use her resources for the care of existing offspring, rather than compromise her own survival by further pregnancies when she may not survive to rear the children to independence. Austad suggests that an adaptive menopause would imply that we should not interfere with it by hormone replacement therapy. However, women in industrialised societies now inhabit an environment very different from that in which menopause evolved. These life history traits are extremely labile in response to variables such as nutrition, so evolutionary bets are off.

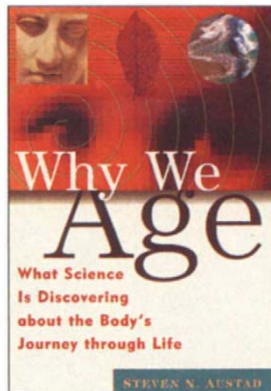
I have rarely read such a hilarious demolition job as Austad's treatment of various remedies for aging, from emulsi-

fied goat testicles through royal jelly to melatonin. None of them work. True, some may give an extra couple of years by improving survival rates in middle

age, but not by reducing the rate at which we age. Exercise is one example. Austad puts it: "Think of it as God offering you two extra years of life provided that you spend them jogging". Austad also discusses the role of dietary restriction. Countless studies have shown that restricting the calories that rodents consume causes them to live longer because they age less

rapidly. This is a remarkable finding, even more so because we do not have the foggiest idea of the mechanisms responsible or whether the effect applies to humans. There is little doubt that obesity is a health risk in humans, although it does not increase the rate of aging; but it is far less clear whether under-feeding is beneficial or reduces aging.

It is hard to find fault with *Why We Age*; even where I found myself mildly disagreeing, the arguments were so clearly put that it was a pleasure to read them. One can always point to minor differences of taste. I found that Austad's personality sketches of some of the big-name researchers in the field grated a bit, but I was fascinated to learn that Walford had done dietary restriction experiments on himself by alternating days of feast and fast—and it was apparently extremely dangerous to get between him and the food on feast days. Austad is an optimist: he really does believe that that the genome revolution will allow us to take a leaf out of the book of species that age less rapidly than we do, and to make useful genetic interventions. I doubt I shall live to see any of it, but I shall enjoy participating in the pursuit for as long as possible, and my enthusiasm got a shot in the arm from Austad's excellent and highly recommended book.



ERRATUM

The identification of Leilani Muir, mentioned in the book review of *Eugenics in the Deep South* in the November issue, should have read that she is of Polish and Irish parentage.

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