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## Book Reviews

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*Longevity, Senescence and the Genome.* By CALEB E. FINCH. University of Chicago Press, Chicago and London. 1994. 922 pages. Paperback. Price £39.95 and \$51.75. ISBN 0 226 24889 5.

Prior to viewing this book, I noted a press report on the research of a gerontologist/psychologist studying the 'Super Young', defined as individuals who look younger than their age. Not surprisingly, I suppose, 'regular exercise and an active sex life, preferably with a younger partner, were the two reasons most often given for feeling good and staying young'. Of course the 50-year-old gerontologist may not live long enough to find if the Super Young outlast their cohort, but that is the implication of his press brief, as reported. So long as the aging wealthy sponsor longevity research as a better, more practical, investment than prayer we shall have a very uneven lot of studies like that one, and Caleb Finch's massive survey of ca. 3,500 papers is cluttered to an extent by some of them, and one feels for the problems this creates with respect to the clarity of his exposition. But he has added to this complexity by also covering all the relevant data derived from the whole range of living organisms, and we shall have to ask what merit this has.

Perhaps there is, initially, a more important distinction concerning aging research which should have been stated more clearly. Gerontologists, as in the above example, are concerned with the aging of *individuals*, with the physiological changes which antecede their death. Geneticists, on the other hand, are interested in *populations* and the action of natural selection on the age-characteristic fitness of organisms due to their intrinsic physiological deterioration: i.e. they view aging as a problem in population genetics which like size, for example, can be selected for or against. Of course both approaches focus ultimately on the molecular genetics of the ebbing physiology; and this, in part, is the justification of comparative studies, although there is no reason to assume a single cause; no likely discovery which might lead to the development of a universal anti-aging pill!

These comments should not be taken as a criticism of this masterly survey of the longevity literature, for it is amazing how the author has built a coherent structure from such disparate parts: truly a labour of

love. No one interested in the subject, directly or indirectly, can afford to be without this book.

The author sets out his stall in the first chapter, starting with the Gompertz model for mortality rates (i.e. the formula describing the age-group specific population mortality with time). This 'model' is a relic of the century-old practice of curve fitting done in the expectation that identification of its coefficients would indicate the primary processes involved; but after more than 150 years it has told us little not obvious from the raw data. Finch opts for two different measures: the Initial Mortality Rate, or mortality prior to puberty, supposedly reflecting the age-independent death rate, and the post-pubertal Mortality Rate Doubling Time, taken to be a fundamental measure of senescence. This is not much of an improvement over Gompertz and, like it, ignores reproduction which is an essential feature of the population genetics model of aging, which is briefly described. The reader should go to the first two chapters of Rose's (1991) *Evolutionary Biology of Aging* for a better formulation of the genetic approach to life history variations, but he will get a more critical view of it from Finch.

The three chapters which follow are devoted to surveys of the organisms showing rapid senescence and sudden death, gradual senescence and a definite life-span, and negligible senescence. Since these chapters are full of well-organized material, including very useful tables and graphs they can scarcely be summarized; one can say only that they raise so many issues, such a multitude of unexplored problems, that longevity studies will surely not themselves show signs of senescence for a long time to come. When organisms from the same class are found in all three of the above categories one may draw only the most general of conclusions; that anything that upsets the homeostatic mechanisms of a creature will lead to its aging. But that is not much of a conclusion, so we should also note that the presence of iteroparous species in the non-senescent group confronts theoretical geneticists with a serious test of their hypotheses. There is much to do on both fronts.

An older gerontological approach to the causes of senescence has been to examine correlated characters, to ask why, for instance, larger organisms generally

have a longer lifespan? With the development of biochemical and genetic techniques this approach can now be pursued down to cells (their rate of division etc.) likely to determine the 'rate of living' which has long been thought of as a longevity correlate. A full chapter is devoted to summarizing correlations, mostly from mammals. It is suggested that transgenic organisms (mice) may be used to alter these correlates meaningfully, but you still need to know what you are looking for and the extant data do not provide that clue. So the next chapter explores genetic influences, particularly age-related diseases. In most instances, polymorphisms make interpretation difficult, and except for the *age I* gene of *Caenorhabditis* no genetic locus has been found which significantly increases lifespan.

A second 'shot-gun' approach has been to look at the biochemical changes and, particularly, the stability of the genome during aging. The most striking general conclusion is the remarkable quantitative and qualitative differences in the biochemistry of the various aged cell types of the organism (e.g. in the accumulation of lipofuscins); and the post-translational 'degeneration' of enzymes through racemization and the like. But since some of these changes may be environmentally induced there is little to be gained here, and the same is true of chromosomal changes (aneuploidy, breakage etc.) associated with age. We knew long ago that aging must be linked to changes in macromolecular synthesis. But which? Again, environmental manipulation of the life span provides no clues. All these areas of study are carefully documented, and anyone looking for this kind of information will find it here.

The penultimate chapter is particularly interesting and brings together such data as we have on the influence of phylogeny and evolution on senescence and lifespan. This survey exposes so many gaps in our knowledge that researchers into life histories will find that dozens of approachable projects suggest themselves. As earlier chapters imply, senescence is polyphyletic in origin. Sometimes, as in the case of mammals, similar changes of senescence patterns occur over a wide range of lifespans (thirty-fold in this case) so one must assume either a persistent early genetic pattern, or convergent evolution. In other cases stability is not the arrangement, and for the American shad semelparity is environmentally determined, with northern populations having a high proportion of iteroparous members. This, and other like cases, taken with the ease with which *Drosophila* aging can be selected for, suggest that aging is a very plastic phenotype and its expression limited and determined by the organisms' bauplan. If this is correct, since gerontology is concerned primarily with humans, the comparative approach (except for mammals) is unlikely to be profitable. Over 40 years ago Medawar classed aging as an unsolved problem of biology. It still is despite all the documentation in this

book, and that probably implies that it is being looked at in the wrong way. Medawar also emphasized that the power of natural selection weakens with age, allowing late-acting deleterious genes to survive in populations. Finch questions this thesis at many points, but we shall take it as axiomatic. It does not follow that in heterogeneous populations the same inherited defect is always the cause of a metabolic taint which leads to decline and death. The wealth of data about humans shows that there are many and varied proximal causes of aging, and this should direct research towards their genetic causes. Unfortunately Finch does not pursue these points but, instead, suggests that 'organismic aging and senescence be considered as aspects of a nascent subject, *the biology of extended time*'. This harks back to an idea, popular in Carrel's laboratory in the 1930s, that there was some special life parameter called 'biological time'; a senile idea by now.

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*Embryos – A Color Atlas of Development.* By JONATHAN BARD. Woolfe Publishing Ltd. 1994. 224 pages. Price £49.95. ISBN 0 7234 1740 7.

As more and more genes important in key developmental decisions are discovered, they are found often to be conserved across a range of organisms. As the molecular technology continues to become more sophisticated, finding new developmental genes and their homologues in other species becomes easier. However, finding the precise function of these new genes in developmental processes is often difficult. Analysis of expression patterns of genes during development is necessary, yet many of the recently trained molecular biologists lack the essential background in developmental biology and embryology needed to interpret these expression patterns. It takes an even greater understanding of developmental biology to see when something has gone wrong in a mutant or an organism designed to mis-express a gene. Furthermore, because of the conservation of these molecules between organisms it is becoming important to be able to follow the development of a number of species of embryos, not just one's chosen research organism.

Jonathan Bard has recognized this and filled a gap in the literature to cope with it. The book describes the embryology of the most studied developmental systems in use at the moment. The organisms covered are the mouse, human, chick, sea urchin, *Xenopus*, *Drosophila*, zebrafish, molluscs, the nematode, *Arabidopsis*, the leech and the 'honorary embryo' *Dictyostelium discoideum*. I cannot think of any organisms that should have been included as well, and I am very glad to see such a broad selection.

The most outstanding aspect of the book is the high