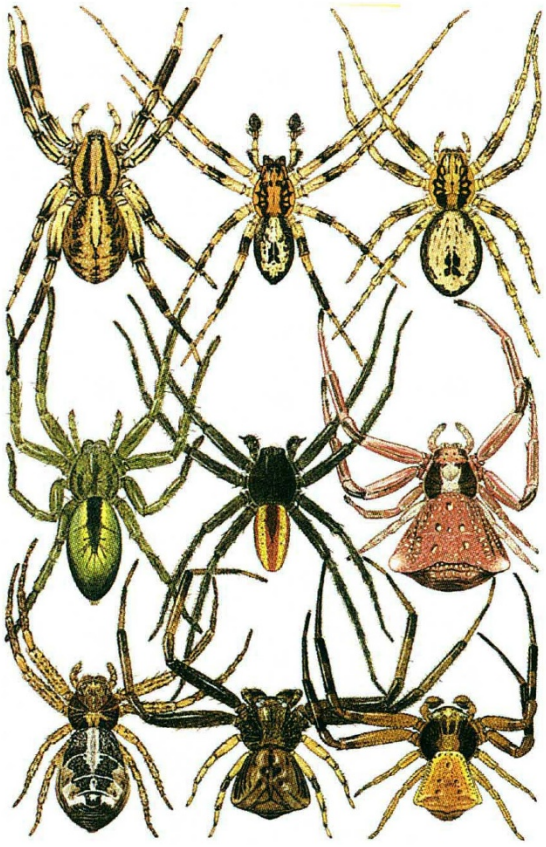
Immortal longings

Leonard Hayflick

Ageing: A Biomedical Perspective. By Denis Bellamy. *Wiley: 1995. Pp. 410. £35.*
Understanding Ageing. By Robin Holliday. *Cambridge University Press: 1995. Pp. 207. £35, $64.95 (hbk); £14.95, $24.95 (pbk).*



An array of spiders from the *Collins Field Guide to Spiders of Britain and Northern Europe* by Michael J. Roberts. This compact book covers 450 species, all thoroughly illustrated, and is packed full of information on the structure and biology of spiders, as well as their courtship, hunting and web-making behaviour. The author also describes a clever new method for restraining live spiders that is simplicity itself. HarperCollins, £14.99.

AGEING is an aberration of civilization. Its extreme manifestations affect only humans or those animals we choose to protect. We have learned how to eliminate most causes of youthful death, allowing most people in developed countries to live long enough to experience ageing — a phenomenon that, teleologically speaking, we were never intended see.

Remains of old prehistoric humans have rarely been found. Similarly, feral animals do not usually live long enough to age: after reproductive success, they incur physiological losses that increase their vulnerability to predation, disease or accidents. When feral animals do reach old age, it is often because humans have disturbed their ecological niche.

Because we have learned how to prevent most early deaths, ageing is happening on a scale never before experienced by humans. Not only are the numbers of old people increasing in developed countries but life expectation at almost every age is advancing. The political fallout from these events, together with the resulting availability of significant research funds for the first time, is one of the reasons why biogerontology has emerged suddenly from a scientific backwater to become a fashionable pursuit.

Denis Bellamy makes a heroic and largely successful effort to present a balanced survey of most of the salient beliefs that underpin the field. This is not an easy task. The complexity of biogerontology is staggering because it embraces events from conception to death, from the molecular level to the whole animal, and it even encompasses entire populations.

Robin Holliday offers a superb overview with emphasis on the cellular and molecular biology of ageing — an aspect today enjoying immense popularity. Excitement has been sparked by the twin discoveries of cell-cycle inhibitors and the shortening of the telomeric ends of chromosomes as cells age both *in vitro* and *in vivo*, marking what may be the first demonstration of a molecular clock. Holliday advances several bold personal views, including his belief that the biological basis of ageing in its broad outline is now well understood; it is only the fine detail that remains to be revealed. Despite his compelling arguments, others may not be as optimistic, including Bellamy who prefers to examine the field critically and in encyclopaedic dimensions.

Holliday claims that the anatomy and histology of many tissues and organs are incompatible with indefinite survival. Yet some biogerontologists have argued that animals that do not reach a fixed size at maturity do not show obvious age changes.

The Galapagos tortoise, sharks and many other fish are examples, as is the American lobster: a 55-year-old specimen weighing 44 pounds has been observed to close its claw as fast as a juvenile. In animals that, like humans, reach a fixed size at maturity, reaction time increases with age. Animals that do not age are not immortal. They eventually succumb to a steady risk of death from predation, disease or accidents.

Both authors discuss ageing as a phenomenon distinct from, and similar to, a disease process. The resolution of this dilemma is important. If ageing is a disease, then we can assume that its remedy is both possible and desirable. If it is not, then perturbing the process may be impossible or, more importantly, undesirable. Unlike ageing, no disease occurs universally and only after reproductive maturity, nor does any disease cross virtually every species barrier. Finally, most age changes are not usually thought of as pathologies. No one has ever died of grey hair or wrinkled skin.

Both authors present cogent arguments that address the fundamental question in this field: why does ageing occur? A compelling response is that ageing, as distinguished from longevity determination, is a by-product of natural selection, the forces of which diminish greatly after reproductive maturity. Species survival is best guaranteed by selecting individuals with the greatest chance of reaching reproductive maturity rather than of achieving longevity.

Survival to reproductive age is increased by selection that favours greater physiological capacity than would be minimally required. How long individuals will then survive depends on the rate of entropy loss, a process characterized by increased vulnerability to disease, predation and accidents. Thus the amount of excess physiological capacity determined by the genome and reached at maturity is species-specific and determines longevity, but only indirectly. There were never enough old feral animals present for natural selection to favour a genetic programme that directly orchestrates longevity or age changes. □

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