On the beam

O. S. Heavens

The Laser in America 1950–1970. By Joan Lisa Bromberg. *MIT Press: 1991. Pp.310. $30, £26.95.*

THE period leading up to the production of the first working laser in 1960 by Theodore Maiman was one of frantic excitement for all groups involved. Tongue-in-cheek forecasts that lasers would be operating at "3.15 p.m. on such and such a date" were liable to be taken seriously.

It is ironic that around this time, graduates with even a modest grounding in optics were in short supply. The Columbia Radiation Laboratory could provide the latest hardware for microwave experiments, but a convex lens was hard to find. Optics had indeed become unfashionable in the physics curricula of universities, a decline that probably began even before the Second World War. Maxwell had 'done' optics at the end of the preceding century. It had become a case of "no new fundamental particle, no Nobel Prize".

At the same time, however, journals began to be filled with articles proposing how a laser might be built, often with diagrams showing scant respect for the rules that a light ray had to obey when traversing an optical system. There is more than a suspicion that the rejection by *Physical Review Letters* of Maiman's article describing the first working laser may have been due to its being misread as "another God damn laser proposal" rather than the landmark account that it proved to be. Not that the excitement was quite over at that point. The ruby was a pulsed laser: we still needed a continuous-wave model. Thus the first gas laser. Then we needed a semiconductor laser, which produced another thrilling race (with a strong gallic input). Then a tunable laser. And so on.

With the successful operation of the first few lasers, the number of new laser transitions increased explosively. Gone was the excitement of wondering if the next meeting of researchers would include the announcement of a new type of laser. Soon it was a matter of how many new ones would appear, then merely a listing of the next hundred or two, most of which were doomed never to be of any further interest.

In *The Laser in America*, Bromberg deals with the period leading up to the laser's invention as well as the subsequent decade of developments. She traces the way in which a remarkably small number of possible lasers eventually won out, tempting one to speculate on whether the present scene would be much different if by chance others had been chosen. Would the helium–neon laser still reign supreme as a general laboratory tool if, for example, comparable effort had gone into designing a laser better matched to the maximum of the eye's sensitivity? Some proposed lasers, including Charles Townes and Arthur Schawlow's original potassium laser, have never worked. Others worked often without being clearly understood and were eventually forgotten.

Bromberg concentrates mainly on the factual side of the events of the period, which were confined mostly to the United States. The physics involved is discussed with both clarity and accuracy. She shows brilliantly how the laser and its developments markedly influenced many areas of post-war American policies, affecting education, research planning, the relation between large and small companies and much more. The sad but not uncommon controversies over "who thought of it first?" are reported without comment. It might be said that these were irrelevant in view of the explicit statement of the idea in a paper by Fabrikant that predates all the other claims. The question is raised (not for the first time) of why, given that the fundamentals of stimulated emission were first described in 1917 and that results were explained in these terms in 1932, it took until the sixth decade of the century for the maser and laser to appear. I believe that few will agree with Dunskaya's view that "the concept of stimulated emission was not fully understood in the earlier period". The same view was expressed in many early discussions for the concept of coherence. Although not understood by some participants of conferences, such concepts were quite clearly set out and discussed long before the laser era.

The book is a delightful read and will be enjoyed by anyone with a passing interest in the history of the laser. Even for those not fortunate enough to have been involved in the early work, it will evoke much of the excitement of a period unique in the discovery and development of this remarkable device, whose value is in no way diminished by its current use in the supermarket checkout. □

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■ The rapid progress of laser science is attested to by the publication of three new books: *Lasers in Chemistry* by David L. Andrews (2nd edn, Springer, £22 (pbk)); *Laser Interaction and Related Plasma Phenomena Vol. 9* edited by H. Hora and G. H. Miley (workshop proceedings) (Plenum, $150); and *Optical Lasers and Amplifiers* edited by P. W. France (Blackie, £69). □

Tales of old

Thomas B. L. Kirkwood

The Biology of Life Span. By Leonid Gavrilov and Natalia Gavrilova. *Harwood Academic: 1991. Pp.385. $120, £62.*
Evolutionary Biology of Aging. By Michael Rose. *Oxford University Press: 1991. Pp.221. £28, $35.*
Biology of Aging. By Robert Arking. *Prentice Hall: 1991. Pp.420. £51.35, $66.25.*

ONE of Aristotle's many claims to fame is as the great grandaddy of gerontological science. "It is not clear whether in animals or plants universally it is a single or diverse cause that makes some to be long-lived, others short-lived." Thus mused Aristotle some 23 centuries ago in his *De Longitudine et Brevitate Vitae*. It is still a good question today, highlighting the core issues with which gerontology has grappled for so long.

The Biology of Life Span is a spirited plea that for too long the quantitative analysis of life span has been done both badly and not enough. As an updated translation of a work originally published five years ago in Russian, it provides a window into the extensive Soviet literature on ageing. It is also an optimistic book, describing with evident pride the Soviet Ministry of Health's special scientific programme on "extension of life". The specific thrust of Gavrilov and Gavrilova's argument is that an underexploited richness of information lies scattered in the literature on demography and biology, which if read the right way could have answered many key questions of gerontology "some thirty years" ago. An appendix gives references to good-quality, published life-tables for as many species as Gavrilov and Gavrilova could discover.

There is interesting material examining the secular trends in human mortality, particularly the changing differences in survival between women and men, and exploring comparative aspects of life-span distributions. Later, the authors press for using reliability theory as a model for ageing. This idea is not a bad one, although it has been around for some time and needs to be carried through into carefully designed experiments. I found a bit tedious the extended discussion on whether life-span distributions really fit the normal distribution, and whether a species such as our own actually has a maximum life span. A modest dose of biostatistical common sense could have cut this discussion short.

A welcome addition to the bookshelf is *Evolutionary Biology of Aging*, which forcefully champions the relevance of

evolutionary theory to all aspects of research on this subject. In the first half, Rose deals directly with evolutionary issues, from explaining the theory, through to describing experimental tests of the evolutionary theories and genetic mechanisms for the evolution of altered life span. Particularly interesting are the experiments of Rose and others with *Drosophila melanogaster*, where selection for late reproductive ability results in increased life span. The finding is in accordance with the 'antagonistic pleiotropy' theory, which comes principally from a landmark paper by George Williams that was published in 1957. The idea is that genes conferring a fitness-advantage early in life will be favoured even if they cause the deleterious effects of senescence later on. The second half of the book deals briefly with the comparative biology of ageing, organismal theories of ageing, and cellular and molecular theories. Some of this material is a bit dated.

Biology of Aging is aimed at those requiring an introduction to the field. The style is engaging and light, and the book covers the main subject areas fairly well. Arking leads off with a comparative approach, dwells in some detail on human senescence, dips into various theories on the mechanisms of ageing, and concludes with a synthetic view of ageing as a "genetically determined, environmentally modulated, event-driven process". What this means, in simple English, is that Arking sensibly recognizes that the control of longevity is best understood as a blend between genetic factors, such as genes that programme the efficacy of cell maintenance systems like DNA repair, and stochastic or environmental factors, such as those causing the lesions needing to be repaired. On the negative side, the book draws rather heavily on a few key sources, is weak on life-history theory, and spells people's names wrong rather often. But the pluses well outweigh the minuses, and the book should encourage bright students to study ageing further.

One swallow does not make a spring. Aristotle wrote that, too, in his *Nichomachean Ethics*. Similarly, three good new books on ageing do not herald the end of gerontology's problems. They are, however, a healthy sign. Understanding the mechanisms of ageing is one of the greatest challenges confronting biological and medical research. A great deal of hard science and a good measure of interdisciplinary cooperation will be needed to crack it. □

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Eccentric behaviour?

David W. Hughes

Comet Halley: Investigations, Results, Interpretations. Vol. 1: Organization, Plasma, Gas. Vol. 2: Dust, Nucleus, Evolution. Edited by J. W. Mason. *Ellis Horwood: 1990. Pp.295 (Vol. 1), 275 (Vol. 2). Each £62, $105.50.*

AFTER the 1910 apparition of Halley's comet, astronomers had to wait some twenty-one years before Nicholas T. Bobrovnikoff at the Lick Observatory produced a comprehensive review of the results. Things have speeded up and expanded since then, and the thirtieth recorded apparition of the comet in 1985–1986 saw more of the world's scientists turn their attention to this once-in-a-lifetime visitor than ever before. We must congratulate John Mason on getting into print within four years.

Mason has assembled 39 detailed review articles into two volumes by calling on the expertise of a host of the world's top cometary experts and space scientists. The two volumes are targeted at the professional cometary astronomer. Other astronomers, including amateurs, will still have to wait for a more digestible account of the changes in our understanding of comets brought about by our observations of Halley.

Between January and March 1986, Halley's comet passed inside the Earth's orbit. For over two years around this period, many of the world's great telescopes were turned towards the comet. The astronomers in 1910 were confined to the use of the narrow visual band of the electromagnetic spectrum; 1986 saw full use of the ultraviolet and the infrared parts. Advantage was also taken of the new technologies of the space-age, an armada of six spacecraft rushing past the comet as it moved through the descending node of its orbit. No longer were cometary observers compelled to flatten their quarry onto the plane of the sky. They could now, for a brief moment, add the third dimension. They could also escape the confines of Earth and move very much closer.

The main success of the enterprise was to achieve the first-ever imaging of the cometary nucleus. The model of the central, kilometric sized, dirty snowball as the fount of all cometary activity, placed on a firm foundation by Fred L. Whipple 35 years before, was transformed into a reality.

The new collection of reviews is divided into six sections. The first looks at the organization and coordination of the scientific effort, involving the cooperation of the European, Soviet and Japanese space agencies and the setting up of the International Halley Watch. The second section concentrates on plasmas and the complicated interaction between the solar-wind plasma streaming away from the Sun and the cometary plasma escaping from the vicinity of the sublimating snowy nucleus. Many fine images of disconnection events in the plasma tail are shown and much is made of the influence of the cometary plasma on the interplanetary magnetic field. The third section deals with the gas emitted by the comet, its flux, composition and spatial distribution. Next comes a section on the dust, with chapters on tails, jet morphology, size distribution, meteoroid streams and composition. The fifth section considers the nucleus, its shape, roughness, activity, mass, surface temperature distribution and spin state. The final section investigates the orbital evolution of comet Halley over the last few millennia and its physical evolution during that time.

We are presented with a detailed overview of what was discovered about the comet during its last apparition. The two volumes are superbly produced, lavishly illustrated, well referenced and usefully indexed. But to my mind there are two important deficiencies. First, too little attention is drawn to our ignorance. For example, the first tantalizing glimpses of a cometary nucleus resulted in a resolution of only about 150 metres and we have no idea as to the macro-properties of the dust and snow on the active and inactive regions of the comet's surface. Also, the spacecraft, moving at 150,000 miles per hour, could quantify only the fragments of the emitted cometary molecules and dust particles, and our detailed knowledge of their composition is negligible. The mass of the nucleus is known to a factor of four at best, and its internal dust, snow and density structure is still a complete mystery.

Second, there is no mention of the relationship between Halley's comet and all the other comets. We have benefited greatly from a fleeting glimpse of Halley, but have no firm idea about how typical it is. We are forced to use it in the calibration and interpretation of other cometary events, but it might be in itself quite unusual: we just do not know. □

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Correction

Hormones edited by Etienne-Emile Beaulie and Paul A. Kelly (reviewed in *Nature* **351**, 362; 30 May 1991) is distributed by Chapman and Hall in the United Kingdom, the Commonwealth, the United States and Canada (£47.50, $62.50 (pbk)). Hermann has all other European rights. □