even if men and women have inclinations to behave differently, there are no fixed and irreversible differences, and, as Alcock points out, sensible sociobiologists do not believe there are. All human behaviour is influenced by culture and can be modified by education.

It is not certain, however, that the best course for the well-being of men and women is to refute possible intrinsic differences and implement educational rules aimed at making men adopt a more 'woman-like' behaviour, or vice versa. Rather, it might be more helpful to acknowledge any differences and to formulate a policy that prevents social discrimination of one sex over the other.

Alcock also addresses the criticism that sociobiologists tell 'just-so stories'. He correctly points out that evolutionary theory makes predictions that can be tested. For that reason, he argues, sociobiology is just as rigorous as any other scientific field. Here I would add a note of caution. It is very difficult to test whether human behaviour is adaptive (or was in the past), not all studies are solid and there are publication biases.

Take the example of facial and body symmetry. There is evidence that greater asymmetry reflects higher stress during development as the result of a less favourable environment and/or 'bad' genes. Some sociobiologists thus predicted that females should be more attracted by more symmetrical males because they would potentially be better fathers. These predictions are supported by some studies, primarily in birds and humans, but Richard Palmer showed that this is a good example of selective reporting. Studies that found a negative association between male asymmetry and reproductive success were more likely to be published in scientific journals (not to mention the general media) than those that did not. Sociobiology, and evolutionary biology as a whole, would greatly benefit if selective reporting could be prevented. The risk of just-so stories would also be much lower if formal replicative studies were performed more often.

I was surprised by the book's title, as many readers probably will be. But it soon becomes clear that Alcock is not implying that sociobiologists are all correct and their critics all wrong. Rather, his point is that a large body of work now shows that animal behaviour, and to some extent human behaviour, has been shaped by natural selection. Thus, the debate should no longer focus on the merit of sociobiology *per se*, but should move on to more interesting issues such as the study of interactions between genes, social environment and culture. An even more challenging task, in my view, will be to acknowledge that we are not all identical, free of the influence of our genes, culture and education, while ensuring that this does not lead to social discrimination between ethnic groups, genders and individuals. ■

Laurent Keller is at the Institut d'Ecologie, Bâtiment de Biologie, Université de Lausanne, CH-1015 Lausanne, Switzerland.

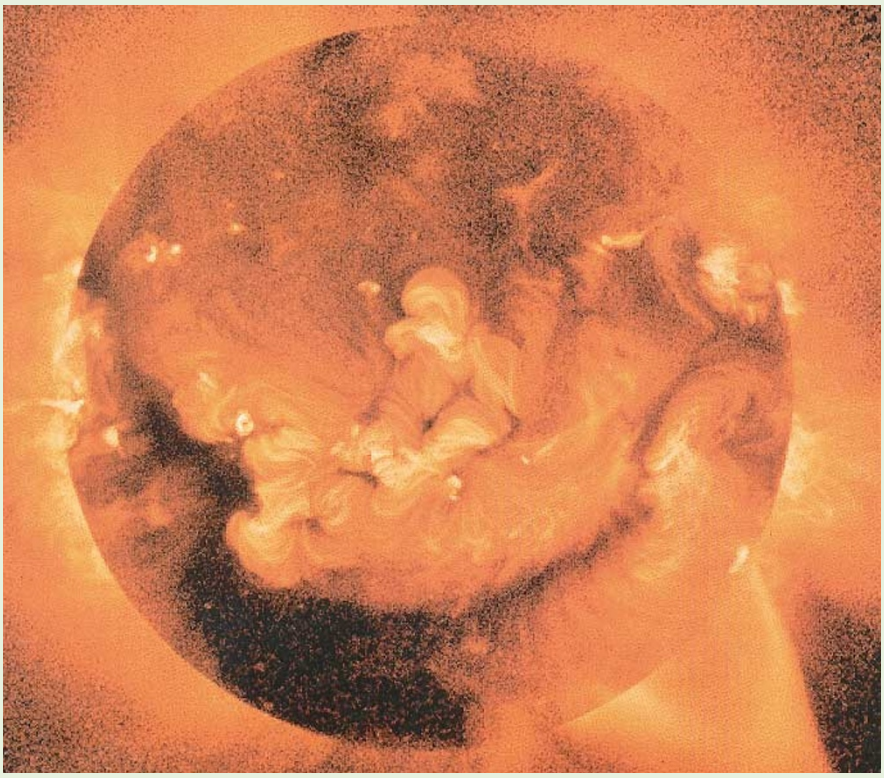
Shedding light on a golden age

Nearest Star: The Surprising Science of Our Sun
by Leon Golub & Jay M. Pasachoff
Harvard University Press: 2001. 267 pp. $29.95, £20.50

John H. Thomas

Solar physics is in something of a golden age. Recent observational results from highly successful space missions have significantly altered our understanding of the Sun's outer atmosphere, its magnetic-activity cycle and its influence on the Earth and the near-space environment. The new technique of helioseismology — the probing of the solar interior using observations of oscillations at the solar surface — has given us a much more complete and accurate picture of the Sun's internal structure and dynamics. Measurements of the flux of neutrinos from the Sun are forcing changes in our understanding of fundamental particle physics.

Nearest Star beautifully presents these and other recent advances for the general reader, while also giving a good historical perspective on our study of the Sun. The authors are especially well qualified to write a popular book on this topic. Leon Golub is an astrophysicist at the Harvard-Smithsonian Center for Astrophysics. He has carried out observations of the Sun using rockets and satellites in space for more than 30 years, most recently as an investigator for NASA's Transition Region and Coronal Explorer (TRACE) spacecraft. Jay Pasachoff is professor of astronomy at Williams College in Massachusetts and an experienced writer of astronomy textbooks, who has observed 31 solar eclipses.



Explosive secrets of the Sun

Images of coronal mass ejections such as this one, obtained using the Soft X-ray Telescope aboard the *Yohkoh* spacecraft, are helping to explain how such sudden explosions occur. These events, which come about when plasma and magnetic fields are transiently ejected from the Sun's corona — the outermost region of the solar atmosphere — produce intense shock waves, accelerating vast quantities of energetic particles. When directed at the Earth, coronal mass ejections can cause strong geomagnetic storms, disrupting communications. Magnetic changes that occur before this energy release may act as a warning of imminent ejections. More on this and many other aspects of the Sun can be found in *The Cambridge Encyclopedia of the Sun* by Kenneth R. Lang (Cambridge University Press, £29.95, $49.95).

The science of solar physics has two distinct aspects, one emphasizing the astronomical side of the subject (the 'solar–stellar connection') and the other the relationships between the Sun and the Earth. Both aspects are well covered in this book. On the astronomical side, the authors vividly describe the evolution of the Sun, drawing on current knowledge of star formation and evolution. The story runs from the Sun's birth in a collapsing interstellar cloud, through its youth and long middle age as a main-sequence star, its passage through the red-giant phase and the ejection of a planetary nebula, and finally to its slow death as a cooling white dwarf formed from the solar core.

The text provides remarkably clear explanations of some quite complicated things, such as the Sun's sharp edge, limb darkening, the formation of absorption and emission lines in the solar spectrum and the three-dimensional, dynamic nature of the solar chromosphere. There are also clear descriptions of the workings of several solar instruments, including the spectroheliograph and the birefringent filter. Interesting historical nuggets enliven the text throughout.

The authors are naturally at their best in discussing their own research specialities, solar eclipses (Pasachoff) and the solar corona (Golub). They give the reader a good feel for the careful planning, risks, tension, joys and frustrations of a solar-eclipse expedition or a space experiment. Several remarkable TRACE images of the solar corona, showing the beautiful, fine structure created by the Sun's magnetic field, enhance the volume, as do some important results from the Solar and Heliospheric Observatory (SOHO) and other recent space missions.

The book does have a few shortcomings. In their discussion of helioseismology, the authors fail to point out the basic fact that the waves causing the oscillations are sound waves. Subsurface magnetic fields are detectable not, as the authors state, because the magnetic field decreases the propagation speed by lowering the local temperature, but rather because it increases the propagation speed directly through magnetic restoring forces. There is little or no discussion of recent advances in high-resolution observations from ground-based telescopes, such as the use of image-restoration techniques or adaptive optics. But these are minor quibbles; overall, the coverage is broad and complete and the level of accuracy very high.

A timely feature of the book is its excellent chapter (entitled "Fire and Ice") on the Sun's influence on the Earth's climate. This chapter contains a thoughtful discussion of the climate system and global warming and shows why we need to have a better understanding of the effects of solar variability on our climate before we can sort out the man-made effects.

With the publication of this book, Harvard University Press continues a tradition of excellent books on the Sun for general audiences. *Nearest Star* is an up-to-date, authoritative and entertaining introduction to the Sun for the general reader. It represents popular science writing at its best — expert authors writing in a clear and lively style, without oversimplification, engaging the reader's creative thinking and imagination. ■

John H. Thomas is in the Departments of Mechanical Engineering and of Physics and Astronomy, University of Rochester, Rochester, New York 14627, USA.

Techy in fuzzy clothing

Operators and Promoters: The Story of Molecular Biology and Its Creators
by Harrison Echols, edited by Carol A. Gross
University of California Press: 2001. 466 pp. $65, £45

Horace Freeland Judson

Textbooks in the sciences are typically ahistorical — hardly a word about how the science was created. Scientists and their textbook publishers are sceptical of a historical approach. It might do for undergraduate courses for non-scientists — in American terms, for fuzzies, non-science majors — but serious would-be scientists, the techies, haven't even got time for all the real stuff. In 1965, in his textbook for undergraduates *Molecular Biology of the Gene,* James Watson presented the science as though it were a mediaeval cathedral, the edifice inspiring, its artisans and architects anonymous (with exceptions including himself and Francis Crick). The book went through multiple editions.

Yet the alternative has occasionally been attempted. In 1971, Gunther Stent published *Molecular Genetics: An Introductory Narrative.* "The evolutionary origin and essentially pedagogic purpose of this book are reflected in the narrative presentation of the material in the historical sequence in which it actually came to be known (and in the occasional burdening of the reader with long-abandoned theories)," Stent wrote. "I happen to believe that an understanding of molecular genetics can best be taught in an organic (rather than logical) manner." Helped, to be sure, by muscular writing and Stent's immense acquaintanceship with the artisans and architects, the book stands as a vindication of the historical approach. It sold well enough to warrant a second edition before the subject grew too cumbersome.

Now we have Harrison Echols' *Operators and Promoters.* Its subtitle claims that it's a history; its very format raises doubts. It weighs in at a kilogram, with heavy paper, margins fully as wide as the column of type, and a pricey illustration programme. Yet the book asserts that historical claim repeatedly, in a foreword by Arthur Kornberg, an afterword by Tom Cech and a long, laudatory preface by Carol Gross, Echols' widow and editor.

At the University of California, Berkeley, Echols was at one of the nodal points in the worldwide network of the research he has written about. In 1986, he learned he had cancer. For the next six years, Gross writes, his overriding aim was to complete "a personal account of the development of the biological paradigms that we now take for granted". But when he died, in 1992, he left a mass of materials, unfinished and unpolished. Echols' widow, herself a molecular biologist at the University of California, San Francisco, took it on. Echols wrote, Gross says, from his own scientific work, from his encounters and interviews with other biologists, and "with the eye of a physicist, the knowledge of a biologist, and the soul of an artist".

With respect, the history of science demands more than the careful ascription of results to individuals, leavened with the

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