BOOK REVIEWS

A King's Observator

The Correspondence of John Flamsteed, the First Astronomer Royal. Vol. 1, 1666–1682. ERIC G. FORBES, LESLEY MURDIN, and FRANCES WILLMOTH, Eds. Institute of Physics, Philadelphia, 1995. I, 955 pp., illus. $280 or £140.

King Charles II of England usually paid little attention to science, but he was prepared to listen to his favorite mistress, Louise de Keroualle, Duchess of Portsmouth. Louise, through her patronage of one Le Sieur de St. Pierre, played a significant part in one of Charles's most important creations, the Royal Observatory at Greenwich.

St. Pierre claimed that through a simple series of astronomical observations and computations he could determine longitude at sea. In 1674, Charles II appointed a Royal Commission to check if Le Sieur was right. If he was, it would certainly be of exceptional consequence for a maritime nation such as England. A young astronomer, John Flamsteed, shortly thereafter became an assistant to the commission.

Flamsteed concluded that though Le Sieur's proposed method might work in theory, in practice it would be badly inaccurate. Further, even for Flamsteed's preferred technique of "lunar distances," the basic observational data available on the positions of the stars and the motion of the moon were so poor that longitude calculations at sea would be off by hundreds of miles. After speaking with advisers and most likely receiving a copy of Flamsteed's report too, the King proclaimed that the determination of the positions of the stars, sun, moon, and planets "in order to the Discovery of the Longitude" must be executed "in royal fashion." "He certainly did not want," Flamsteed later recalled, "his ship-owners and sailors to be deprived of any help the Heavens could supply, whereby navigation could be made safer." Flamsteed became Charles II's "astronomical observator." A site for an observatory where Flamsteed could secure the desired data was soon selected, construction begun, and the astronomer's career set on a new trajectory.

Although his reputation would later be badly dented by bitter quarrels with Edmond Halley and Isaac Newton, Flamsteed was by any standards a first-rank astronomer. His extensive surviving correspondence also contains material of enormous interest, particularly on the practice of astronomy in the decades around 1700. Some of this correspondence has appeared elsewhere, but the publication of the three projected volumes of *The Correspondence of John Flamsteed* will mark the first time that all of Flamsteed's letters will be available in print. Volume 1 covers the period from 1666 to 1682 and so deals with, among much else, the origins of the Royal Observatory, as well as Flamsteed's well-known dispute with Hevelius on the use of telescopic sights for astronomical measurements. Where a letter was not written in English, an English translation is given in addition to the original. There is a series of biographical notes as well as an excellent index to guide the reader.

The task of copying, collating, and bringing the correspondence into publishable form was begun by the late Eric Forbes, author of a major history of the early Royal Observatory and the leading 20th-century student of Flamsteed's career. It was then completed by Lesley Murdin and Frances Willmoth. The result is a big and beautifully produced volume that not only whets a reader's appetite for volumes 2 and 3, but also stands as a fine tribute to Forbes's scholarship.

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The Solar Wind

Interplanetary Magnetohydrodynamics. LEONARD F. BURLAGA. Oxford University Press, New York, 1995. x, 256 pp., illus. $70 or £50. International Series on Astronomy and Astrophysics, 3.

The existence of the solar wind has been accepted for almost 40 years. Although the particle flux from the sun carries negligible mass, it does carry significant angular momentum and represents a third important mode of interaction, after gravity and electromagnetic radiation, between the sun and the planets. Geomagnetic substorms, for example, are often directly attributable to features in the solar wind.

The solar wind is magnetized, the magnetic field being an extension of the magnetic field of the solar corona. Many properties of the wind are understandable only in terms of the magnetic field. Burlaga's *Interplanetary Magnetohydrodynamics* is a detailed description of hydromagnetic structure in the solar wind, primarily as observed by in situ spacecraft probes.

The main strength of the book is the wealth of observational data it provides. Burlaga has made many important contributions to the analysis and interpretation of such data over the years, and he writes with authority. Chapters on interplanetary shocks, solar wind streams, and magnetic clouds include not only the phenomenology of these structures but also attempts to integrate results from laboratory plasma physics and theory of turbulence into their interpretation. Literature through 1994 is cited, and the book represents the observational state of the art up to but not including data sent back by the Ulysses spacecraft, which, as it orbits outside the plane of the ecliptic, is extending our picture of the heliosphere to three dimensions.

As Burlaga's book is fairly specialized, it will be useful primarily to other researchers in interplanetary magnetohydrodynamics. It could have been more useful to a wider audience if its content had been placed in a wider context. An introductory chapter on magnetohydrodynamics, for example, together with a critical assessment of its validity in the solar wind, would have made the book more accessible to students and researchers outside of space physics. Although the important equations are written down and discussed, they are not collected in one place. The best introduction to the basic physics of the solar wind is still A. J. Hundhausen's *Coronal Expansion and Solar Wind* (1972), although some portions of it have been superseded by more recent results.

Similarly, given that much of the structure in the solar wind derives from the structure of the solar corona in space and time, it would have been useful to include more material on solar physics, particularly on topics such as flares, coronal holes, and transient mass ejections, which have signatures in the solar wind. Remote probes of interplanetary turbulence, such as observations of interplanetary scintillation, which complement in situ measurements, would also have enriched the picture.

The book contains a number of typographical errors, the most glaring of which is the persistent replacement of "vortex sheet" by "vortex street." It also uses a fair amount of mathematical terminology, such as the characterization of interplanetary space, not including the sun, as "E3 minus a

point" (p. 5), which is gratuitous in that once introduced the term never appears again. Mathematical usage of this type provides no new insights and does not buttress physical arguments. Despite these drawbacks, *Interplanetary Magnetohydrodynamics* is a detailed and useful compendium for the specialist and a rich guide to the literature.

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Lepidopterans

The Tent Caterpillars. TERRENCE D. FITZGERALD. Comstock (Cornell University Press), Ithaca, NY, 1995. xvi, 303 pp., illus., + plates. $37.95 or £29.95. Cornell Series in Arthropod Biology.

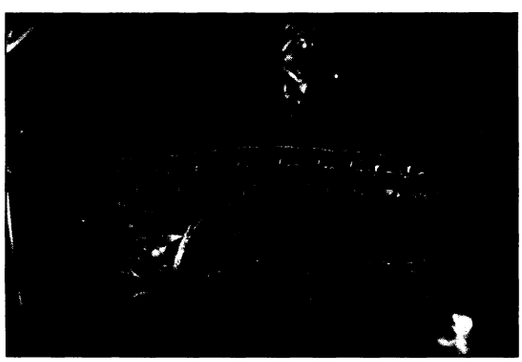
This book is a prodigious synthesis of a large and varied literature on the lives and times of tent caterpillars, lasiocampid moths in the genus *Malacosoma*. It expands upon and follows in the tradition of Dethier's popular treatise *The World of the Tent Makers* (1983) on the eastern tent caterpillar, *Malacosoma americanum*.

Fitzgerald focuses heavily on the two common and economically important species found in North America, the eastern and the forest (*M. disstria*) tent caterpillars. The body of published information on these two species is several orders of magnitude greater than that available for the other two dozen or so described species combined, but whenever possible Fitzgerald tempers the unavoidable attendant bias with comparative discussions launched from ecological and evolutionary perspectives. The result is a welcome and fresh approach to a subject that could easily have given rise to a daunting traversal and distillation of the expansive (and often colorless and parochial) applied entomological literature.

"Tents of the southwestern tent caterpillar, *M. incurvum*, on a tree defoliated by multiple colonies." [Terrence D. Fitzgerald]

The most interesting segment of the book is Fitzgerald's analysis of caterpillar sociality and its evolutionary history. This is a fairly new field of inquiry that he has successfully nurtured and championed during the last several decades, and he clearly finds his forte in the chapters on caterpillar aggregation, foraging behavior, tent-building, and thermoregulation. Many new and intriguing insights will be forthcoming from work in these areas, and Fitzgerald's apt final sentence (p. 272) in the book calls for "studies of the foraging behavior of a broad diversity of species, sufficiently detailed to allow us to begin to assess the range of communicative interactions that occur among social caterpillars." Indeed, this plea can and should be generalized further, as our ability to use Lepidoptera effectively as test organisms is limited by a worldwide lack of larval life-history data for the vast majority of nonpest species.

The Tent Caterpillars is also a literary treasure trove of citables—in a decidedly nonrandom survey of five comparable lepidopteran works in my office, it took first place, with 443 references and 161 tables or figures tucked into 272 pages. We should all be thankful that *Calasoma* beetle larvae (predators on *Malacosoma*) are only a few centimeters long, since we discover (p. 171) that they may move 2.9 kilometers in 72 hours and eat 41 full-grown caterpillars during their 14 days of hunting. And those who haven't previously observed the effectiveness of pheromonal communication can become converts by looking at the caterpillars shown (p. 129) marching dutifully in a "figure 8." Variants on this and related themes can be observed any springtime in North America and elsewhere, to the delight of grade-school children. Such opportunities are not lost on Fitzgerald, who devotes his last chapter to discussing simple ways in which tent caterpillars can be used to reveal the workings of biological principles. *The Tent Caterpillars* is thus a useful teaching tool at several levels of inquiry and should be welcome on the bookshelves of more than just lepidopterists.



"Nonpigmental coloration of the cuticle of the eastern tent caterpillar. The white middorsal stripe and the subdorsal blue areas are produced by the selective filtering of light by transparent microtubules." [Terrence D. Fitzgerald]

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Books Received
Reprints and New Editions

The Adapted Mind. Evolutionary Psychology and the Generation of Culture. Jerome H. Barkow, Leda Cosmides, and John Tooby, Eds. Oxford University Press, New York, 1995. xii, 666 pp., illus. Paper, $24.95. Reprint, 1992 ed.

Air and Water. The Biology and Physics of Life's Media. Mark W. Denny. Princeton University Press, Princeton, NJ, 1995. xx, 341 pp., illus. Paper, $24.95 or £19.95. Reprint, 1993 ed.

The Anatomical Exercises. *De Motu Cordis* and *De Circulatione Sanguinis*, in English Translation. William Harvey. Geoffrey Keynes, Ed. Dover, New York, 1995. xvi, 202 pp., illus. Paper, $8.95. Reprint, 1953 ed.

Ancient Inventions. Peter James and Nick Thorpe. Ballantine, New York, 1995. xxiv, 675 pp., illus. Paper, $17.50. Reprint, 1994 ed.

Aquatic Chemistry. Chemical Equilibria and Rates in Natural Waters. Werner Stumm and James J. Morgan. 3rd ed. Wiley, New York, 1995. xvi, 1022 pp., illus. $79.95; paper, $59.95. Environmental Science and Technology.

The Archaeology of Disease. Charlotte Roberts and Keith Manchester. 2nd ed. Cornell University Press, Ithaca, NY, 1995. xii, 243 pp., illus. $39.95.

Aurora. The Mysterious Northern Lights. Candace Savage. Sierra Club, San Francisco, 1995. 144 pp., illus. Paper, $20. Reprint, 1994 ed.

Bioorganic Chemistry. A Chemical Approach to Enzyme Action. Hermann Dugas. 3rd ed. Springer-Verlag, New York, 1996. xviii, 699 pp., illus., + plates. $49.95. Springer Advanced Texts in Chemistry.

Cancer Biology. Raymond W. Ruddon. 3rd ed. Oxford University Press, New York, 1959. xiv, 520 pp., illus. $75; paper, $47.95.

The Cave Bear Story. Life and Death of a Vanished Animal. Björn Kurtén. Columbia University Press, New York, 1995. xii, 163 pp., illus. Paper, $11.95. Reprint, 1976 ed.

Chaos in Wonderland. Visual Adventures in a Fractal World. Clifford A. Pickover. St. Martin's Griffin, New York, 1995. xvi, 303 pp., illus. Paper, $18.95. Reprint, 1994 ed.

Chemistry in the Laboratory. A Study of Chemical and Physical Changes. J. A. Beran. 2nd ed. Wiley, New York, 1995. xiv, 402 pp., illus. $42.95.

Chromatin. Structure and Function. A. Wolffe. 2nd ed. Academic Press, San Diego, 1995. xii, 299 pp., illus. $50.

Computers and Thought. Edward A. Feigenbaum and Julian Feldman, Eds. AAAI Press, Menlo Park, CA, and MIT Press, Cambridge, MA, 1995. xiv, 535 pp., illus. Paper, $18. Reprint, 1963 ed.

Descartes' Error. Emotion, Reason, and the Human Brain. Antonio R. Damasio. Avon, New York, 1995. xx, 313 pp., illus. Paper, $12.50 or C$16. Reprint, 1994 ed.

Diabetes in America. National Diabetes Data Group. 2nd ed. National Institutes of Health, Bethesda, MD, 1995 (distributor, National Diabetes Information Clearinghouse, Bethesda, MD). xvi, 782 pp., illus. Paper, $20. NIH Publication no. 95-1468.