African Carnivores

Kalahari Hyaenas. Comparative Behavioural Ecology of Two Species. M. G. L. MILLS. Unwin Hyman, London, 1994 (U.S. distributor, Chapman and Hall, New York). xvi, 304 pp., illus. $112.95 or £48.

The Kalahari is a nearly two-million-square-kilometer, sand-filled basin (sandveld) in Botswana, Namibia, and South Africa, subjected to irregular rainfall and large daily and seasonal temperature fluctuations (−10° to 40°C). The southern Kalahari, the setting for this study, is a semidesert where free-standing water is found only temporarily on pans (old lake beds) and along river beds after exceptionally heavy rains. Between 1972 and 1984, M. G. L. (Gus) Mills, a wildlife biologist from the National Parks Board of South Africa, studied the comparative biology of the brown (*Hyaena brunnea*) and spotted (*Crocuta crocuta*) hyenas in the Kalahari Gemsbok National Park (South Africa) and the Gemsbok National Park (Botswana), a 36,190-square-kilometer "pristine" wilderness. Mills has been diligent in keeping carnivore biologists "in the picture" by publishing progress reports and papers covering aspects of his work as it has progressed. In this book, he brings the whole enterprise together and provides a framework for judging hyena conservation needs and predicting the impact management actions can be expected to have upon them.

In the Carnivora family Hyaenidae, the *Crocuta* and *Hyaena* lines have been separated since the late Miocene. Today, *Crocuta* is found in Africa south of the Sahara, except for the Congo Basin. The brown hyena has a more southern Africa distribution. The male brown hyena (40 kg) is slightly larger than the female (38 kg), and both are considerably smaller than the sexually dimorphic spotted hyena (males 59 kg, females 71 kg). By following hyena tracks for 4700 kilometers and (with radio-collars aiding in their location) by directly observing the animals for a total of 4000 hours, Mills has produced a remarkable contrasting portrait for these two group-living hyenas. He begins his comparative analysis by detailing differences in feeding ecology and continues with chapters on comparative foraging and feeding behavior, social structure and spatial organization, communication patterns and social interactions, comparative denning behavior and development of cubs, the role of the individual in hyena society, and relations between species and management considerations. He has included appendixes on the trends in the number of ungulates living in the study area, criteria for determining the ages of ungulates, methods used to measure territory sizes, and degree of relatedness between clan members in both species. Each chapter is summarized, usually by means of a comparative table, and statistical tests are grouped at the end of each chapter.

A 14-month-old brown hyena cub emerging from its den. [From the dust jacket of *Kalahari Hyaenas*]

"Six spotted hyena cubs and two adult females at a den in the Nossob river bed." [From *Kalahari Hyaenas*]

Hyenas live at very low density in the Kalahari: 1.8 brown hyenas per 100 square kilometers and half that for the spotted hyena. Brown hyenas live in female-bonded groups or clans (up to 10 adults and subadults) on territories that average about 300 square kilometers. Males born in the clan always leave at some point in their life, and some females also emigrate. An occasional immigrant male will join a clan, but mating with clan females is primarily by nomadic males. Spotted hyenas also live in female-bonded clans (up to 16 adults and subadults) on territories that average about 1100 square kilometers. Males born in the clan emigrated and females were integrated. Mating was by immigrant males living in the group. Spotted hyenas den communally, hunt in groups (averaging three), and specialize in killing large and medium-size mammals. Brown hyenas use solitary dens and primarily forage alone. They are opportunistic foragers, with poorly developed hunting behavior. Both species forage nocturnally, traveling about 30 kilometers a night. The large group territories of both were determined by mean travel distance between meals, averaging about 9 kilometers between meals for brown hyenas and 33 for spotted hyenas. Both species mark their territories with "latrines" (fecal piles) and with secretions from their anal glands deposited on grass blades and clumps or "pasting," but the brown hyena marks about 20 times more frequently than the spotted.

Even in the vast reaches of the Kalahari, rabies is an important mortality factor, especially for spotted hyenas, and spotted hyenas traveling to agricultural areas at the edge of the parks returned with traps on their legs. Spotted hyenas dominate brown hyenas, but because of their low numbers their effect on brown hyenas was small. The population of brown hyenas was more secure than the spotted hyena population because of the nomadic nature of the spotted hyenas' primary prey species, large ungulates. However, the provision of more permanent water sources could alter this relationship. Mills believes it is possible to accommodate brown hyenas in some agricultural areas, but spotted hyenas, because of their stock-killing capabilities, are not tolerated in agricultural areas and require large conservation areas for long-term survival. He stresses the importance of managing the southern Kalahari as a single ecological unit. With the care and effort Mills has invested in this study, this book should serve as a model text for similar studies. It is, however, a book for specialists and not a quick read for general audiences.

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Stellar Fields

Cosmical Magnetism. D. LYNDEN-BELL, Ed. Kluwer, Norwell, MA, 1994. xii, 215 pp., illus. $89 or £63 or Dfl. 160. NATO Advanced Science Institutes Series C, vol. 422. From a workshop, Cambridge, U.K., July 1993.

Upon learning that a colleague is working on an astrophysical application of magnetohydrodynamics (MHD), most astronomers' first thought is along the lines of the motto of the United Negro College Fund, "A mind is a terrible thing to waste." For

Vignette: Asocial Behavior

Henry Cavendish, the notable physicist and chemist, illustrates how schizothymic a creative genius can be. Once, when he was coerced into attending a formal occasion, he found himself about to be introduced to some scientific celebrities from the Continent. Rather than endure the social chit-chat, Cavendish abandoned all amenities, turned away from his escorts, and sped down the hall, squealing like a bat. . . .

Admittedly, Cavendish went off the deep end on this trait. Even so, other notables, scientific and artistic, are more likely to avoid the entertainments of society than to seek them out. . . . So preoccupied and dedicated must be the creative intellect that even the home hearth must not expect the attentiveness customarily due family life. Once when Karl Gauss was enthralled with a mathematical problem, a servant came in to advise him that his wife, who was quite ill, was about to breathe her last. He could only mutter, "Tell her to wait a moment till I'm through." Gauss was clearly deficient in Guilt Proneness and Group Superego as well!

—*Dean Keith Simonton*, in *Greatness: Who Makes History and Why* (Guilford Press)

repeat offenders, they may recall Dan Quayle's version, "A mind is a terrible thing to lose." The equations of MHD have a beguiling beauty and their solutions a captivating complexity. There is little doubt that they determine the answers to many of the central questions of astrophysics: how do stars form, why do pulsars shine, how do quasars shine? So why is it that so few astronomers encourage such research and so many might support the creation of a Betty Ford clinic for habitual abusers of helicity and the induction equation?

Like most phobias, the astronomical community's magnetophobia arises in part from an irrational fear of the unknown and in part from dimly remembered historical events. Successful theories of astrophysical phenomena with few observational diagnostics have been simple (for example, the internal structure of nonrotating stars in hydrostatic equilibrium). Complicated theories (for example, of radiative transfer) can only be validated in applications where there are many observational diagnostics (as in stellar atmospheres or the interstellar medium). There are painfully few quantitative diagnostics of cosmic magnetic fields. Yet the theory of the fields inevitably involves the nonlinear dynamics and topology of a tensor field in which events occuring over a 10-order-of-magnitude range of scales are vitally interconnected. This unfortunate combination is the historical basis for magnetophobia.

The collection of reviews in *Cosmical Magnetism* should help dispel, or at least make rational, the magnetophobia of research students and senior colleagues interested in self-improvement. The 18 short (14 pages or less) reviews, by pundits of the field, quickly lay out the state of the art and the current frontiers. Beginners should start with the first and the last of the chapters. The first, by Keith Moffatt, gives a characteristically lucid introduction to dynamo theory and its application to the simplest and best-diagnosed cosmic source of magnetism: the Earth. Its simplicity arises because the magnetic Reynolds number is low, though the fluid convection may have a high Reynolds number. Historical and fossil records of the Earth's surface magnetic field, plus Laplace's equation for the magnetic potential, allow the distribution of radial magnetic field at the Earth's core-mantle boundary to be determined over millions of years. This recently reconstructed "movie" is a valuable and suggestive test of dynamo models.

The last chapter, the longest and widest-ranging, is in many ways the most profound. This is not unexpected, for it is by Leon Mestel. The book commemorates a workshop held in honor of his seminal contributions to modern astrophysics. With his distinctive precision of thought, he examines the effects of magnetic fields on stellar rotation (on short and long time scales), dispels myths about the relation of magnetic fields to star formation, reviews Galactic dynamos and proposes an ingenious new one, discusses the magnetospheres of pulsars (the rotating magnetized neutron stars now responsible for two sets of Nobel prizes), and concludes with a discussion of magnetic energy extraction from black holes—a promising source of energy for quasars luminous in radio and gamma-rays.

Between these two chapters are others that elaborate on the subjects covered by Mestel: magnetic A-stars (Meyer), star formation (Zweibel), magnetic winds (Spruit), pulsar magnetospheres (Kahn and da Costa), active galaxies (Blandford). Five chapters cover Galactic dynamos, both observation (Davies, Wielebinski) and theory (Parker, Rees, Krause). Two chapters on the heating of the solar corona (Priest *et al.*, Heyvaerts) discuss a field in which the terrifying detail of recent observations may lead to magnetophobia of a different sort. There is a nice summary of the properties of magnetic white dwarfs (Landstreet), whose wide distribution of field strengths and rotation periods poses an outstanding puzzle. None of the reviews are comprehensive enough to equip a novice reader for research. And some are as thoroughly recycled as aluminum. But the prose and intellectual content are of the highest order, and the brevity of the reviews makes them seductive reads. The book will attract young competitors for Mestel, who is now, as he puts it, doing "what one enjoys doing without suffering the distractions inevitable during the payroll years." The beauty and importance of cosmic magnetism deserve more attention from equally great minds.

The book of non-review papers presented at the same workshop is published as *Cosmical Magnetism: Contributed Papers* by the Institute of Astronomy, Cambridge CB3 OHA, England (attn: Mrs. S. Bridgeman) at $15 or £7.50.

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Tales of Topology

The Knot Book. An Elementary Introduction to the Mathematical Theory of Knots. COLIN C. ADAMS. Freeman, New York, 1994. xiv, 306 pp., illus. $32.95.

The Knot Book by Colin C. Adams is not the only book with this title. There is also *The Knot Book* by Geoffrey Budsworth (Sterling, 1985), a compendium on practical knots by the honorable secretary of the International Guild of Knot Tyers. Budsworth's book is part of a literature on the art of forming knots and weaves whose most famous representative in book form must be *The Ashley Book of Knots* by C. Ashley (Doubleday, 1944). Books for those interested in tying knots and weaves must meet the formidable standards of *The Ashley Book*. Such a book must be visually interesting and able to compress instructions for the generation of complex objects into