

encyclopedia *Bibliotheca Universalis*, his exceptional knowledge of zoology and botany, and his editing and publishing of the unfinished work of Cordus, but also for his genial personality, which enabled him to transcend the religious controversies of his time.

The author's attention next reverts to Italy in the 16th century. Mattioli, "the Brunfels of Italy," is lauded for his excellent illustrated Italian edition of Dioscorides. The first overt attempt at a classification by "affinities" (primarily indicated by fruit and seed) is credited to Cesalpino, who is thus dubbed "the father of the science of Systematic Botany." Fabius Columna, in search of an ancient remedy to cure his epilepsy, introduced a new scientific precision to the analysis of plant structures. Greene's two Flemish selections, Dodoens and de Lobel, are more familiar than many of his Italian nominees for fame. Because he was a popularizer and a commercially successful author, Dodoens is treated somewhat ambivalently, although he is given credit for considerable progress in the perception of affinities. De Lobel, hailed as "a prophet of the new botany that was to come," was "the first to engage in serious and studied effort to create natural system." But the youthful genius he exhibited in his *Adversaria Nova* was not to be fully realized. Our author accords his prime homage to Joseph Pitton de Tournefort, "whose chief work marked an epoch in the advancement of our science that has not yet had, and probably may never have, a parallel." His accomplishment was to establish a systematic key to plant genera and to "create" genera on so sound a basis and to describe and illustrate them so skillfully that all known plants could be identified and all future discoveries be properly placed.

Although the self-consciously "literary" and measured and discursive Victorian prose is a little difficult to engage at first, I think most readers will regret that the work ends here and that the third part, which was to have dealt with British botanists and would doubtless have been controversial, was never written. We can be grateful that the two completed portions have been made available in such handsome format. Everyone connected with the enterprise is to be congratulated—there is abundant credit to go around.

Edward Lee Greene remains an enigmatic figure.

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An African Ungulate

A Territorial Antelope. The Uganda Waterbuck. C. A. SPINAGE. Academic Press, New York, 1982. xvi, 334 pp., illus. \$49.50.

Territoriality was one of the classic mechanisms proposed by V. C. Wynne-Edwards in 1962 to limit the size of populations below the level of their food supplies. With this in mind C. A. Spinage from 1964 to 1967 studied the waterbuck, a territorial antelope in savannah Africa.

Territoriality, well known in birds, is uncommon in temperate-region ungulates. In 1964 little was known about African ungulates, and Spinage's first observations of territoriality were something of a novelty. Now we know that most African antelopes are territorial. However, most recent in-depth studies of ungulates are of nonterritorial species, so this book is still one of the few detailed accounts of a territorial species.

Spinage's aims were to find out whether waterbuck were territorial and if so whether this behavior regulated the population. His main conclusion, at least on the surface, is to reject Wynne-Edwards's thesis because females, not males, determine population levels, and females are not territorial. Females expel younger animals, bringing about dispersal to new areas. Spinage postulates that female aggressive behavior is related to population density and not to food; thus his mechanism of regulation is really one of "self-regulation." His conclusion, however, is hypothetical, for he presents no evidence to support it.

What, then, is the function of territory? Spinage suggests that it is to anchor the male sector to ensure maximum dispersal of the species. Why not abandon territory in favor of cohabitation without aggression? He answers, "To ensure the continuation of a species, selection has produced a sufficiently strong sexual drive that male competition must always result." Therein lies the grounds for the main criticism of this book, for it shows that Spinage's thinking is still that of the old-style "group selectionists." Throughout the book he refers to function in terms of benefit to the population or species, without exploring alternatives of benefit to the individual. But the data are there: only males on territories obtain matings, and those 7 to 9 years old obtain disproportionately more. Still more interesting is that some males tolerate satellite males, the latter obtaining a few matings. The significance of this is overlooked. It would be interesting to know under what conditions satellites are tolerated. The closest

relatives to waterbuck are kob and lechwe, both of which have evolved mating "leks." Spinage's observations would suggest that waterbuck are in the early stages of evolving leks.

Spinage's work, done in the 1960's, will be judged in the context of more modern ideas. He is running this gauntlet to make his data available. There are chapters on growth and senescence, reproduction, parturition, population dynamics, food and habitat preferences, and the social organization of females and males. The book ends with a discussion of territorial concepts and function, which is somewhat tortuous and abstruse. Spinage's interpretations may be heretical to some readers, but his observations are valuable.

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Toxicology

Cellular Systems for Toxicity Testing. G. M. WILLIAMS, V. C. DUNKEL, and V. A. RAY, Eds. New York Academy of Sciences, New York, 1983. xii, 484 pp., illus. Cloth or paper, \$95. Annals of the New York Academy of Sciences, vol. 407. From a conference, New York, Oct. 1982.

Cellular Systems for Toxicity Testing results from a conference held to examine in detail the most advanced systems for the study of general cytotoxicity, genotoxicity, mutagenesis, and carcinogenesis. In the opinion of this reviewer, the objective was overly ambitious. Despite the breadth of topics covered, however, the book succeeds in conveying an excellent overview of the field and substantial "inside" detail not readily obtainable from periodical literature. Noteworthy are several chapters that begin by giving a historical perspective on the development of the major biological systems used in the field. Included among them are the papers of H. J. Evans, Sheldon Wolff, Michael J. Prival, Ernest H. Y. Chu, and Blumberg *et al.* These papers include valuable accounts of the scientific contributions that have resulted in the armamentarium of cellular systems now available.

The volume begins with a consideration of xenobiotic metabolism and the metabolic properties of *in vitro* systems. Dunkel contributes a concise introductory paper, "Biological significance of end points." The reports in the following section, on general cytotoxicity, are well done, but the section is rather incom-