

Book Reviews

Pheromones of Social Bees

John B. Free

Chapman & Hall, 1987
218 pp.

This is an extremely useful and well-referenced book summarizing our present knowledge of honeybee pheromones. The role of the various pheromones regulating and integrating colony behaviour is emphasized. The title is somewhat misleading as little work has been done on the pheromones of social bees other than honeybees. Two chapters are devoted to bumblebees while relevant paragraphs on the pheromones of stingless bees and sweatbees etc. have also been included.

The chapters are divided according to the function of the pheromone in particular categories of behaviour, for example: Communication of the queen's presence; Inhibitory effects of queens on queen rearing; Control of worker ovary development. Although this provides a coherent account, repetition and a lack of detail are evident, particularly with respect to the queen substance, 9-oxo-2-decanoic acid. Details concerning pheromone biosynthesis and the histology of these exocrine glands are also lacking. However, the author has succeeded in demonstrating the difficulties associated with studying honeybee pheromones, many of which have multiple functions and often act synergistically with others. Details concerning the perception and integration of the pheromone signals by the receiver are missing, and this further highlights areas requiring investigation. It is clear that although some of the pheromones are well known, a number of 'grey' areas still exist. At the end of each chapter the ways in which the synthetic pheromone can be applied to improve beekeeping efficiency are mentioned.

The interested beekeeper and students of apiculture would find this a most enlightening book. It is a good reference which accurately documents our present knowledge of (in particular) honeybee pheromones.

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Insects – Plants

V. Labeyrie *et al.*

Dr. W. Junk Publishers, The Hague, 1987
459 pp.
Price: U.S. \$121,50; U.K. £89,50

Insects-Plants, the Proceedings of the 6th International Symposium on Insect-Plant Relationships, is edited by V. Labeyrie *et al.* and published by W. Junk as Series Entomologica volume 41. It contains around 50 articles based on papers read at the conference, plus over 50 more that are summaries of poster presentations. Given that they occupy only about 450 pages, the papers are necessarily short. They are grouped into seven wide-ranging chapters which cover such diverse topics as co-evolution, plant resistance, population genetics and olfaction.

A list of some of the better known authors provides some idea of the wealth of papers published in this volume. Contributors include E.A. Bell, S.B. Vinson, E.A. Bernays, R.J. Prokopy, T. Jermy, P. Feeny etc. etc. Two of the review articles which caught my attention were those by Southwood and Bergstrom. The first of these describes how plant variability influences herbivorous insects and how at the community level, features of the local environment may not only determine which insects will find a plant, but also the degree of impact a given amount of herbivory will have on it. Bergstrom's review covers one familiar aspect of plant variation – the widely differing scents of flowers. The bee orchid pollination syndrome is a particularly dramatic example of the uses a plant can make of its smell. Volatiles released by the orchid mimic chemicals present in its bee pollinators and draw in males which think they have detected a potential mate. The stimuli which attract the insects appear to be complex, with certain compounds acting as long distance attractants while others serve to get the bees excited once they are in contact with the flower.

A strength of these proceedings is that continental European workers are well represented, particularly in the posters section. Amongst these, Roques describes a detailed study of the importance of shape and colour in determining the efficiency of sticky traps for insects. Working with cone-feeding species in the French Alps it was found that the preferred colours were a little garish to the human eye – yellow with purple stripes. Perhaps the numerous yellow sticky traps used to monitor pest populations in South African citrus orchards might benefit from just a hint of purple!

Taken as a whole, this volume provides a rather broader view than one normally sees of the 'state-of-the-art' plant-insect studies and there will certainly be something of interest here for anyone active in this field.

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The Ecology of Woodland Rodents: Bank voles and wood mice

Edited by J.R. Flowerdew, J. Gurnell and J.H.W. Gipps

The Zoological Society of London
Clarendon Press, Oxford, 1985
418 pp.
Local price R203,30

This multi-authored volume represents the proceedings of a symposium on the same topic held at the Zoological Society of London on 23 and 24 November 1984. The book comprises 14 chapters which cover the key aspects of the behavioural and evolutionary ecology to two extensively researched, temperate small mammals, the bank vole *Clethrionomys glareolus* and the wood mouse *Apodemus sylvaticus*. Charles Elton and his colleagues at Oxford initiated the primary studies of these small woodland rodents over 60 years ago, while in the 1960s and '70s about 60 dissertations were submitted on various aspects of the biology of these two species in Britain, and many more in Europe. This volume maintains and develops the traditional high standards that we have come to expect of the Symposia volumes of the Zoological Society of London. The most impressive and significant contribution made by this book is that it represents not only an up-to-date cohesive and comprehensive synopsis of the ecology of two common woodland mice but it is also a review of current theory pertaining to many aspects of the ecology of non-commensal rodent populations in general. This work compliments Petruszewicz's 'The ecology of the bank vole' and Stenseth's 'The behaviour and ecology of *Clethrionomys*'. Nineteen acknowledged experts in their fields contributed the 14 keynote presentations which formed the 14 chapters of the book. At the symposium, 28 posters developed and expanded upon the theme.

Berry's account of the evolutionary and ecological genetics of the two species was superbly presented, both at the meeting and in its written form. He skilfully explained the most parsimonious explanation to account for the creation of island races and concluded that it is time that small mammal ecologists took seriously the fact that 'everything the ecologist looks at is the result of evolution'. Particularly fascinating were the accounts and use of karyotypic and DNA variation, and protein and enzyme variation, in current studies of population genetics of rodents.

Clarke handled aspects of reproduction in an authoritative and thoroughly professional manner, dealing consecutively with maturation and breeding seasons; social factors and genotype; ovulation, egg wastage, foetal mortality and litter size; but I was personally disappointed that there was scant coverage of life-history styles.

Several chapters dealt with behaviour. Gipps provided an excellent bibliography of the general ethology of bank voles while Montgomery and Gurnell presented a more

factual account of the behaviour of wood mice, that contained fewer hypotheses and less inductive reasoning. Stoddart and Sale's duet on the olfactory and acoustic biology respectively of wood mice and bank voles was succinct, precise and lucid. The chapter summarized current information in a nutshell.

Hansson and Grodzinski presented complimentary chapters on the food and energetics of woodland rodents with special reference to the subject species. Both authors have worked imaginatively and effectively in their sub-disciplines for many years and their experience was evident in their presentations. Hanson indicated that the wood mouse is a typical granivore while the bank vole is intermediate between pronounced granivores and folivores; for details of local and seasonal variations, and methodologies to be employed you should refer to this stimulating chapter which is a pleasure to read. Grodzinski's detailed presentation is full of sound information and indicates that the two rodent species have different energetic strategies which can be related to diet, and which affect winter weight dynamics/thermoregulation, and production efficiency. In contrast to woodland mice, bank voles have a lower digestive efficiency, a lower assimilation of food energy and greater metabolic scope.

Diseases and parasites, and predators, were the subject of study of the next chapters by Healing and Nowell, and by King respectively. Although competently written and researched, it is clear that less information is available on these aspects of woodland rodent ecology. In the former chapter an attempt was made to discuss the effects of parasites on the survival, productivity and behaviour of host species and of the various castes within those species, and their overall effects on the dynamics of host populations. Further research is clearly needed and several approaches are possible. King showed that the hunting techniques of predators, and the anti-predator defences of the rodents, determine which and how many rodents are killed. The effect of the combined force of predators on the population fluctuations of the rodents depends on whether their collective functional and numerical response is sufficiently extensive and rapid. This is greatly influenced by the supply of alternative prey and the heterogeneity of the habitat. As yet we are far from predicting prey responses to predators but King does suggest future avenues for research.

Spatial distribution and movements were admirably covered by Wolton and Flowerdew who also reviewed methods of recording movements and determining home range size and shape. Wood mice and bank voles appear to have patterns of social organization that are, in view of their phylogenetic and morphological differences, remarkably similar. More data are required, however, before we can claim to understand the social organization or movements of these species with clarity; directions for future research were highlighted.

Possibly the key papers of the symposium were those dealing with the population dynamics of bank voles, by Alibhai and Gipps, and of wood mice, by Flowerdew. The authors indicated that the fluctuations of bank vole

populations are of two categories, namely, annual fluctuations found in the southern parts of the species's distribution, and multi-annual cycles which are common in northern Fennoscandia. The role of demographic parameters in bank vole population dynamics were reviewed, and as far as population regulation was concerned it was stressed that any hypothesis postulated should take into account both annual and cyclic fluctuations. Wood mouse populations are non-cyclic and show evidence of density-dependent regulation. The aggressive behaviour of males appears to be an important factor in limiting juvenile recruitment but territoriality in breeding females may also be significant. The start of the autumn increase is linked with the loss of overwintered males and improving food supplies, while peak numbers may be limited by food shortage, dispersal and the cessation of breeding. These were fascinating and very readable summaries of a complex and intricate field of research endeavour.

In the penultimate chapter, Stenseth reviewed the role of mathematical modelling and its contribution to population studies on small rodents. In particular, he presented a general model for studying the effects of developmental lag in a population with female territoriality since these parameters are now considered to be of significance in population dynamics. He concluded that demography resulting from the female territorial system is fairly stable but may be destabilized by seasonality, by an age-dependent hierarchy in individual's ability to acquire vacant territories, and by large litter sizes. Recommendations for further theoretical and empirical work were provided.

In his account of woodland rodent communities in the final chapter Gurnell examined the possible competition and definite coexistence between not only wood mice and bank voles, but several other woodland rodents. It was concluded that bank voles and wood mice often coexist but niche overlap is usually small and minimized by micro-habitat, food and time partitioning. However, he emphasized that there is a distinct shortage of descriptive and experimental field studies aimed specifically at competition and coexistence within communities of woodland small mammals and this area provides many opportunities for future research.

Despite the cost, I strongly recommend this book to all small mammal ecologists, even if they are only interested in African species. I say this because all the major areas and theoretical issues current in small mammal ecology are excellently reviewed and referenced in this authoritative and readable book.

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Visual behavior in salamanders

Gerhard Roth

Springer-Verlag, Berlin, 1987

301 pp.

Price: DM198,00

This is the 14th definitive publication in the series '*Studies of brain function*', and is a detailed neuroanatomical analysis of visually guided behaviour in salamanders. The focus is on the neural basis of feeding behaviour of members of the family Plethodontidae. A brief introductory chapter on the taxonomy, biogeography, and ecology of salamanders precedes the second chapter which deals with visually guided behaviour in plethodontids. The author has chosen to focus on feeding behaviour, and for this reason includes a section on the anatomy of the head and tongue. Releasing stimuli for, and learning components of feeding are covered, with a section on the neuroethology of feeding. Only limited mention, however, is made of feeding in nature (chiefly a list of prey items).

The third chapter details the morphology of the eye and retina, and includes accommodation, miniaturization, and visual acuity. Eye degeneration in troglitic salamanders is covered briefly. The following chapter is devoted to the anatomy of the salamander brain, and cytoarchitecture of the central visual system. In addition, motor neurons associated with feeding and visual afferents are included. The chapter concludes with a comparison of the visual and visuomotor pathways of salamanders and frogs. Chapter 5 contains the electrophysiology of vision, and includes responses to prey-like items, and colour coding.

The final chapter attempts to integrate information on the neural guidance of visual behaviour relating to feeding. Neural mechanisms of prey recognition, the tectal cells involved in this process, and the problems of stimuli, size, and distance are incorporated in a model to this end. The ultimate goal of the author is, however, restricted by the paucity of field data on feeding in salamanders. In spite of the apparent significance of such a detailed integration, I would have personally preferred to have seen the same approach used to analyse the visual basis of mate recognition rather than feeding in salamanders. This might well have increased the heuristic value of the study. The use of this important book in South Africa is somewhat limited by the absence of salamanders in Africa.

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Digestive Physiology and Nutrition of Marsupials

Ian D. Hume

Monographs on Marsupial Biology
Cambridge University Press, 1982
256 pp.

This series of monographs represents critical and detailed reviews of particular aspects of marsupial biology. Topics are selected that have reached a sufficiently advanced stage to warrant critical review and synthesis, and where marsupial research can make a unique or particular contribution to general theory.

The book is about the way in which marsupials utilize different food resources, and the wide range of digestive and metabolic adaptations exhibited amongst the marsupials. The theme of the book is on the interrelationships between nutrition, anatomy, digestive physiology and other animal functions such as reproduction, and their effects on demography.

Two developments prompted Ian Hume, an Associate Professor at the University of New England, Armidale, Australia, to write this book. The first was the rapid growth of interest in and knowledge of marsupial biology, and the second was the increasing awareness among physiologists and nutritionists of the value of comparative studies of different digestive systems. The utilization of fibrous plant material by macropodid marsupials and by eutherian ruminants is one example of such a problem. This book will be of interest to zoologists concerned with marsupial biology and to nutritionists studying comparative nutrition, mainly at postgraduate level.

The book is organized into two general chapters (Chapter 1 on marsupial metabolism and nutrient requirements, and Chapter 8 on mineral and vitamin nutrition) together with six chapters devoted to digestion and nutrition in various trophic guilds of marsupials.

In the first chapter several aspects of general metabolism of marsupials are compared with monotremes and eutherians. This is a fascinating comparative account, the best chapter by far, and makes the book appealing and useful to all mammalogists with an interest in ecophysiology. The consequences of a low BMR are examined in relation to requirements of marsupials for energy, protein and water. In most instances a close relationship is demonstrated between maintenance requirements for these nutrients and basal metabolism, although habitat is shown to have a far greater effect on the standard water turnover rate of an animal than on its BMR.

In Chapter 2, Hume shows that the digestive tract of all marsupial carnivores, in common with that of eutherian carnivores, is relatively short and simple. Consequently the rate of food passage is rapid. However, digestibility of dry matter and gross energy of natural food items is high. Some specific adaptations of small dasyurid species are described. These include the

use of torpor, nest sharing and fat storage, and the ability of some desert species to concentrate their urine in order to conserve water.

Three groups of marsupial omnivores are considered with respect to dietary habits and digestive tract morphology in Chapter 3. Most species are shown to exhibit a larger caecum and longer colon than do carnivores. In two species the caecum has been shown to be unusually large for an omnivore which is explained in terms of the diet which consists partly, and in some seasons of the year, largely of *Acacia* gums. It is suggested that these gums are more difficult to digest than other plant exudates, and their utilization is thought to be based on bacterial fermentation in an enlarged caecum.

In Chapter 4, the non-macropodid herbivorous marsupials are distinguished by their dependence on microbial fermentation in their hindgut (rather than the foregut) for utilizing fibrous food. This fibrous food is grass in the case of wombats, and *Eucalyptus* foliage in the case of arboreal folivores; the Koala has been studied in detail. It is demonstrated that the utilization of *Eucalyptus* foliage is potentially limited by low nutritive value and the presence of secondary metabolites. Hume speculates that the folivorous marsupials have evolved mechanisms for metabolizing many xenobiotics and that the low nutritive value of *Eucalyptus* foliage is the primary factor limiting its exploitation by arboreal species.

After indicating that the outstanding feature of the digestive physiology of macropodines is that they are all foregut fermenters, like the ruminants, Hume goes on to demonstrate that there are numerous features of the macropodine gut which are very different from those of ruminants. Chapter 5 compares and contrasts the gastric anatomy and physiology of these two successful mammalian herbivore groups most effectively. Estimates of fermentation rate and microbial protein production suggest that microbial fermentation in the macropodine forestomach is at least as efficient as it is in ruminants.

Hume uses Chapter 6 as an opportunity to extend the laboratory findings discussed in previous chapters to the animal in its natural habitat. For example, comparison between the Euro and the Red Kangaroo illustrate two ways, one largely physiological and the other largely behavioural, in which an animal can adapt to heat and frequent shortages of food and water during extended periods of drought. Unfortunately, the interpretation of laboratory findings with many species is limited by an incomplete knowledge of the animal's food habits and nutrient requirements in the wild.

In Chapter 7 Hume explains that little can be said about the adaptive significance of many features of the digestive system of the supposedly primitive rat kangaroos because of our incomplete knowledge. Although food storage as part of a predator avoidance strategy has been suggested as one function of the large sacciform region of the forestomach, the extent to which potoroides rely upon microbial digestion for their nutrient supply is unknown. Several species are known

to be highly specialized in their feeding habits in that hypogeous fungi form a major part of the diet.

The mineral and vitamin nutrition of marsupials is reviewed in the final chapter, particularly of herbivores, since they can be subject to much wider fluctuations in their supply of these nutrients than omnivores or carnivores. This brief chapter provides information not supplied in previous chapters and brings a cohesive conclusion to the comprehensive treatment of digestive physiology and nutrition of marsupials.

This book achieves its stated aims, reviews current literature and techniques, provides detailed accounts of selected case studies, compares field and laboratory studies, and ties together aspects of marsupial anatomy, physiology, ecology and phylogeny in a useful synthesis.

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Neurobiology and Behavior of Honeybees

Edited by Randolph Menzel and Alison Mercer

Springer-Verlag, 1987

334 pp.

Price: DM129,00

'Whilst Darwin and other well-known entomologists such as Bethe, Buttel-Reepen, Forel, and Lubbock experienced no difficulties in describing such activities as orientation to landmarks, color vision, scent perception, learning and memory, the rigorous scientific work required to substantiate such observations was first undertaken by Karl von Frisch. ... Today, research is directed not only towards analysis of the behavioral, perceptual and learning capabilities of the bee, but also towards an understanding of the neuronal mechanisms involved.' This short extract from the preface of this compact and well-illustrated volume defines the scope of its contents. These comprise, largely, short articles outlining recent research and speculation in these fields.

In general, the articles achieve a nice balance between the readability and general interest of a good review, and the detailed if rather dry precision of formalized scientific communications. While probably not destined to become popular with weekend naturalists and beekeepers, this volume should have fairly wide appeal within the scientific community amongst those interested in bees (not necessarily honeybees), entomology, and such fields as neurophysiology and behaviour.

Following an introduction and fitting tribute by Martin Lindauer to Karl von Frisch, to whose memory it is dedicated, the book is divided into seven sections. The 'Evolution and genetics' section concentrates on issues pertaining to taxonomy, geographic distribution, and behavioural genetics. Section two, 'The foraging honeybee' deals with modern models and experimental

approaches to one of the oldest areas of interest in bee research. In the third section, 'Physiological aspects of behavior', sensory physiology, thermoregulation, sleep research, and a behavioural and pharmacological comparison of the stinging response of Italian and Africanized bees are introduced. The sensory physiology theme is extended into the fourth section on the 'Visual system' of the bee, where it accompanies thoughts on the anatomy and organization of the visual system, visual information processing, visual neuroanatomy, and functional aspects of the honeybee's vision. This is followed by a fairly extensive discussion of 'Neuroanatomy and signal processing in the brain', and a section entitled 'Development' which deals with more physiology, this time the regulation of age polyethism by juvenile hormone, and an article on the olfactory system. The concluding section comprises a fascinating pair of articles on the functioning and neurophysiology of bees' 'Memory'.

Very few books can appeal to all, and this compendium too has its weaknesses. Principally, in order to cover as wide a field as it does, it is in parts, necessarily sketchy. Similarly, in order to appeal to specialists hungry for factual details, entire sections may remain unintelligible to many readers. It is, and claims to be, neither an exhaustive and definitive text on honeybee neurobiology and behaviour, nor an introductory text into the field for the novice. However, for the reader with a keen interest in experimental biology or in honeybees who is not abreast of the current literature, it offers a wealth of insights expounded by authorities in their respective fields.

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Ecology and Productivity of an African Wetland System

G.A. Ellenbroek

Dr W. Junk Publishers, Dordrecht, 1987

267 pages

Price: U.S. \$125,00

The wetland system in question is the Kafue Flats, Zambia, 7000 km² of annually flooded plain along the borders of the lower Kafue River, a major tributary of the Zambezi. Dams have been built upstream and downstream of the Flats, allowing regulation of the hydrology of the floodplain. The floodplain is mostly grassland used for seasonal grazing by the Ila and Tonga tribes. Annual flooding prevents most other land uses, except on the dryer areas. The floodplain is still inhabited by communities of large wild ungulates in two wildlife sanctuaries, and is rich in fish and bird life, as a result of the high primary production.

The purpose of the research was to gather quantitative

data on the productivity of the grasslands on the floodplain in order to make a case for maintaining the natural flooding regime in the face of the management plans of the Zambia Electricity Company.

The first chapters of the book describe the climate, geology, and hydrology of the Kafue Flats, as well as introducing the major vegetation zones. The bulk of the book (185 out of 267 pages) is then devoted to detailed descriptions of the phytosociology, phenology, structure, and production of the different types of vegetation of the floodplain, including an investigation of the relationship between above- and below-ground growth. Three short sections on decomposition, an estimate of net annual production, and the role of fire in defining some of the plant communities complete the book.

The book is the result of three and a half years fieldwork, followed by three years of analysis and writing. It provides an invaluable database on one of the few large wetlands of southern Africa which has remained in a relatively undamaged state, all the more useful because the Kafue Flats are under threat of change now. The detailed description of the different types of vegetation will be a blessing to those researchers whose job it will be to assess the changes to the floodplain in future studies. As documented by the author, this project was carried out with the minimum of logistical support, and in the face of considerable organizational difficulties, which makes his achievement more remarkable.

The project obviously involved a great deal of work, but the value of much of this work may be lost to most readers because of the way in which it has been written up and published. The book is very narrowly defined, with little attempt either to relate conditions on the Kafue floodplains to findings for other southern African wetlands such as Okavango and the Pongolo floodplain, or to provide an overview of ecological conditions on the Kafue Flats which would provide guidance to those charged with the task of planning the future management of the system. The Pongolo system, in northern Natal, is a directly comparable case of a floodplain used for subsistence agriculture and nature conservation, threatened by an upstream impoundment. An excellent synthesis of research on the Pongolo system, by Heeg and Breen (1982), is not mentioned in Ellenbroek's book, but would have made a good model for its contents and organization. The text is written in an awkward style, perhaps because it is in English, which is not the author's first language. This and the lack of an index, combined with the absence of a synthesis or concluding chapter, make it very difficult for the reader to find his way through the book, or to look up any particular subject. The book reads like a thesis, which it may well have been, and is therefore a bit indigestible.

These criticisms do not alter the fact that this is a very relevant piece of research, on a topic (wetlands) and in a place which are both of extreme importance to ecologists. Because of the way it is written and organized, this book will not be widely read by those

outside its immediate interests, but it will be invaluable to those who work on wetland ecology.

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Reference

- HEEG, J. & BREEN, C.M. (1982). Man and the Pongolo floodplain. South African National Scientific Programmes Report No. 56. 117 pp.

Biological Surveys of Estuaries and Coasts Estuarine and Brackish Water Sciences Association Handbook

Edited by J.M. Baker and W.J. Wolff

Cambridge University Press, 1987
449 pp.

This book is the third of a series of handbooks sponsored by the Estuarine and Brackish Water Sciences Association. It is a multi-author volume, although the editors contribute to six of the 15 chapters. The scope of the book is wide and topics covered include planning biological surveys, remote sensing, salt marshes, flora and macrofauna of intertidal sediments, macrofauna of subtidal sediments using remote sampling, processing sediment macrofauna samples, meiofauna, intertidal rock, subtidal rock and sediments, bacteria and fungi, plankton, fish, birds, identification and finally safety.

Each of the above chapters is extensively subdivided with appropriate subheadings. The subheadings in turn are all listed in comprehensive contents pages; this makes the book very easy to use. In the preface the editors state that the book has been written to provide an introduction to surveying techniques for a wide variety of habitats. I felt that the book achieved this aim and as such it may be of use to first and second year ecology students. However, I cannot support the claim by the editors that the book will be of use to research workers; it is not detailed enough. Certainly most established research workers should be very familiar with the sampling and surveying techniques given in the book. Nevertheless each chapter contains numerous references to published papers and research workers may find this aspect of the book useful.

The information in the book is extensively European and this is highlighted in the chapter entitled Identification. This chapter simply directs the reader to identification keys for the various groups of plants and animals. Most of the keys listed are European keys and thus the value of this chapter to non-European research workers is questionable.

In summary I feel that this book will be of limited use

to South African research workers and students and will not become a standard reference text on biological survey methods.

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Caste Differentiation in Social Insects

Edited by J.A.L. Watson, B.M. Okot-Kotber and C.H. Noirot

Pergamon Press, Oxford, 1985

399 pp.

Price: £77,00

This book which constitutes Volume 3 of *Current Themes in Tropical Science*, is based on the International Study Workshop on Termite Caste Differentiation held at the International Centre of Insect Physiology and Ecology in Nairobi, Kenya in November 1982. Approximately 80% of the book is devoted to the Isoptera and the remaining 20% to other social insects. The book presents a panoramic view of the various facets of caste differentiation and relates the process to both intrinsic (within colony) and extrinsic factors.

Section A (Chapter 1) is devoted to the memory of Martin Luscher (1917–1979) and gives an interesting insight into the career of one of the outstanding experimental biologists of our time. Not only is it a history of his work but also retraces the caste differentiation research trail over a period of some 40 years. Section B (Chapters 2–7) is concerned with caste development pathways in the principal termite groups. In Chapter 2, sex determination, genetic relatedness and altruism in the Isoptera are compared with that of the Hymenoptera. The remainder of this section is devoted to case studies of caste development ranging from primitive to higher termites. The morphological characters used to distinguish various developmental lines are described in detail and provide essential background information for potential researchers.

The role of the environment in regulation of caste composition is examined in section C (Chapters 8–15). Particular attention is given to factors which influence the production of the neotenic (Chapters 8–10) the latter being thought to play a central role in the reproductive strategy of some species. The role of primary reproductives (pairs or multiple replacements) in *Kaloterme*s and several groups of higher termites is discussed in Chapters 11–15.

Section D (Chapters 16–22) is devoted to the role of primer pheromones and hormones in caste differentiation. Both pheromonal stimulation of reproductive and soldier production, and the inhibition exerted by the reproductives on supplementary reproductive differentiation come under the spotlight. Particular attention is

given to the role of the juvenile hormone (JH) in morphogenesis, social polymorphism and reproduction. Many of the conclusions are based on the results of experiments using JH analogues as test materials. This underlines the lack of data concerning the JH-profile in 'normal' colonies and its relationship to the composition of the colony. Incipient colonies may provide ideal experimental units for research of this nature. The role of ecdysteroids is apparently restricted to oocyte maturation and embryogenesis.

The remainder of the book (Section C, Chapter 23–27) is devoted to caste differentiation in ants of the genus *Pheidole*, the honeybee and social wasps. In the final chapter it is argued that 'JH is the operator in all caste systems whether Isopteran or Hymenopteran'.

This book is highly recommended for anyone interested in the developmental biology of the social insects and in particular the Isoptera. The bibliography alone justifies its purchase. Furthermore it will provide a useful background for insect biochemists/physiologists who are interested in the action of hormones at the molecular level.

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Sistematica, filogenia y biogeografía de la subfamilia Gibbiinae (Coleoptera, Ptinidae)

Xavier Bellés

Treballs del Museu de Zoologia, 1985, No. 3, Barcelona

94 pp.

The Ptinidae or spider-beetles are a rather small family in the Cucujoidea superfamily, but have considerable importance both from an economic and scientific point of view. Members of the family are generally scavengers and feed on decaying vegetation material or on excrement of vertebrates.

The subfamily discussed here, the Gibbiinae, includes species which become pests in a variety of stored products and they have large or almost cosmopolitan distributions. Of particular interest in Southern Africa is that some of the members of this subfamily are closely associated with our desert areas such as the genus *Damarus* which is found in the Namib. Other genera seem to be endemic to parts of southern Africa from the south-western Cape to Natal and to Zimbabwe.

The subfamily, in the diversity of its taxa, has a worldwide distribution. Its detailed study in the subcontinent would undoubtedly contribute to our historical biogeographical knowledge both in intercontinental and in regional context.

Bellés's revision of the subfamily Gibbiinae provides a solid foundation for further studies. The revision is

introduced with chapters on methodology, after which the habitat selection of the taxa is discussed and biological observations summarized.

The chapter on the systematics of the group is introduced by a detailed critical evaluation of morphological characters and concludes with descriptions of the known taxa. Identification keys are provided to each level of taxa from tribes down to the species. Characters of every genus are illustrated on excellent habitus and detailed diagrams.

The phylogenetic treatment of the group is based on cladistic analyses. Transformation series of evaluated characters are given in tabulated form and the results of the analyses are shown on cladograms.

This revision of the Gibbiinae is a good starting point for the systematic study of the group in southern Africa.

S. ENDRÖDY-YOUNGA

Transvaal Museum, Pretoria

A Biologist's Advanced Mathematics

D.R. Causton

Allen & Unwin, London
326 pp.

The word 'advanced' in the title is in relation to the same author's *A biologist's basic mathematics* (Causton 1983), and reviewed by Wilson (1988). Many of the topics in this book are taken up where the earlier book left off, and there are frequent references back to it.

The material covered is mainly at the level of first-year university mathematics courses. Chapters 1 and 2, on linear algebra, include an introduction to multivariate statistical analysis, including principal components analysis. In Chapter 3, integration (by substitution and by parts) is very briefly introduced and applied to probability density functions and to functions defined by integrals (gamma and beta functions). Chapter 4, on trigonometry, moves at a more realistic pace and concludes with a section on Fourier analysis. Chapter 5 covers four distinct topics, binomial series with negative and fractional indices, Maclaurin and Taylor series, complex numbers and numerical analysis: this last section is weak on emphasizing the importance of computers in numerical analysis. Chapter 6 deals with multivariate functions and Chapter 7 with fitting functions to data, basically linear and non-linear regression. Chapters 8 and 9 provide a sound introduction to differential equations.

These topics are deliberately not motivated by biological applications because, in the author's own words, biologists 'already have applications in mind for which they require the mathematical assistance I attempt to provide in this book.' Biological applications, when

provided, tend to follow the theory, often many pages later. There is very little biological sugar to sweeten the mathematical pill.

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References

- CAUSTON, D.R. 1983. *A Biologist's Basic Mathematics*. Edward Arnold, London.
WILSON, D.B. 1988. Review: *A Biologist's Basic Mathematics*. *S. Afr. J. Sci.* 84: 149.

Reproduction in Mammals: 5 Manipulating reproduction

Edited by C.R. Austin & R.V. Short

Cambridge University Press, London, New York, New Rochelle, Melbourne, Sydney
235 pp.

Successful research on reproduction provides answers to two problems, (i) infertility and (ii) contraception, and the contents of the book reflect this. Three of the seven chapters are devoted to contraception, one to increasing productivity in animals, one to alleviating human infertility, one to population growth and one to the future. In addition to providing information on techniques which have developed to the stage where they are, or could be, used in practice, most of the chapters present the interface between the advances in knowledge of reproduction in mammals and the possible consequences to the community of the application of this knowledge to domestic animals and man.

Inevitably this includes discussion of the probable effect of various possible political decisions. The value of the book lies not so much in the scientific content but in the discussion of the politics by individuals with an awareness of immediate and future prospects which is not vouchsafed to most of us. The authors do not adopt a political stance but occasionally exasperation leads to forceful representations (e.g. by Short on U.S.A. policy on non-funding of projects involved with DEPO Provera).

The book was published in 1986 which means that the authors completed writing their contribution before the spectre of autoimmune deficiency syndrome (AIDS) appeared. It is probable that some of the predictions made would have been modified if they were made today, but the introduction of one more factor does not completely invalidate the assessment of the impact of the others.

It is particularly useful to have all this information in one place. Whatever the editors intended when they chose the title, they have produced an introduction to the complexities of managing world population growth.

It is to be hoped that the balance shown here will hinder particular factions from under or over emphasizing aspects of the problem in order to prevent decisions from being implemented which may be necessary but unpalatable.

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Vertebrate Fetal Membranes

Harland W. Mossman

Macmillan press, 1987

383 pp.

Price: £80,00

Harland Mossman belongs to the 'old school' of morphologists and is well known among reproductive biologists for his superb book (co-written with K.L. Duke), *Comparative Morphology of the Mammalian Ovary* (University of Wisconsin Press, 1973). And in the same way that the above-mentioned book has been one of the standard references for ovarian studies, so the new book will become a standard reference for those interested in vertebrate fetal membranes.

Two important features of this book are, firstly that it has a very strong morphological bias, and although, as the author notes in the preface, morphology often uncovers and delineates physiological problems, few aspects of placental physiology are discussed. And secondly, although two thirds of the text are devoted to description and discussion of the fetal membranes of eutherian mammals, there are comprehensive sections on the fetal membranes of the anamniotes (Cyclostomata, Osteichthyes, Chondrichthyes, Amphibia) and the Amniota, excluding the Eutheria (Reptilia, Aves, Monotremata, Marsupialia). Mossman argues convincingly that a knowledge of the fetal membranes of vertebrates other than eutherian mammals is essential to an understanding of the fetal membranes of the Eutheria.

The detailed section on eutherian mammals covers topics from the anatomy of the female reproductive tract, and the diversity of form of the blastocyst, through to the establishment, and types, of fetal membrane systems and placentation.

There is a short section in which the author departs from the descriptive approach and discusses the evolution of fetal membranes and their possible value in phylogeny, and the structural changes in fetal membranes associated with the adoption of viviparity. This is followed by an extensive synopsis of available data on the fetal membranes of specific eutherian taxa, which is concise, easily understood, and hence an ideal reference tool.

There is an excellent glossary, essential in a field such as the study of fetal membranes which is full of complex terminology, and a good bibliography.

In conclusion, this is not a book to be read by the fireside, but an invaluable (yet readable) reference source for students of fetal membranes.

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Avian Physiology (Fourth edition)

Edited by P.D. Sturkie

Springer-Verlag, New York, 1986

516 pp.

Price: U.S. \$59,00

Sturkie's *Avian Physiology* was first published in 1954 and subsequent editions have appeared at approximately 10-year intervals. Three decades of research have resulted in considerable advances in our knowledge of animal physiology in general and many of these advances stem from research conducted on birds. Such new information has, through the years, resulted in the addition to the original volume of several new chapters and substantial revision of others. The fourth edition is no exception, and contains two new chapters and yet further revisions.

Twenty-one authors have contributed to the current edition and coverage is, for a single volume, impressive. The book is introduced by two chapters on the avian nervous system, one of which is devoted to the sense organs and chemical senses of birds. These are followed by the two new chapters on muscle physiology and immunophysiology. Body fluids (blood) and the heart and circulatory system are dealt with in three chapters and include discussion of blood pressure and factors which affect it, blood flow, contraction of the heart, and electrocardiography. Respiration, thermoregulation and energy metabolism comprise three chapters and are followed by two chapters on the alimentary canal. The first of these covers anatomy, regulation of feeding and motility of the alimentary canal and the second, secretion of digestive enzymes, digestion of nutrients and absorption of electrolytes and water. A chapter each is devoted to carbohydrate, protein and lipid metabolism, the kidney and osmoregulation (including salt glands) and reproduction in male and female birds.

The major endocrine glands (pituitary, thyroid, parathyroid, ultimobranchial, adrenal and pineal glands and the pancreas), and their associated hormones also receive detailed attention in five chapters. Although several authors contributed to the discussions on these glands, the same basic divisions have been adopted for each with sections covering location, embryology and morphology of the glands and the chemistry, assay and action of the hormones secreted. As pointed out by the editor in a previous edition, much information on avian physiology comes from research on domestic species

such as chickens, ducks and pigeons. However, it is pleasing to note in the current volume the increased information from studies of wild species and I, personally, look forward to the inclusion of more such results in future editions.

Numerous figures, tables and plates complement and supplement the text with many of the tables, especially, providing a concise summary of available information in the field. Each chapter is preceded by a detailed table of contents and followed by a comprehensive list of references. The addition of numerous references which post-date the previous edition, some as recent as 1984, indicate that most chapters have been revised. An index concludes the book.

With so many contributing authors it was not surprising to find striking differences in the content level of each chapter. Although most chapters were easily understandable with only a basic knowledge of physiology, several others assumed extensive background knowledge and understanding of the specific topic covered. Notable

among the latter were the two new chapters on muscle physiology and immunophysiology, but several other chapters also left me with the feeling of having missed out on something. Naturally, different readers will enjoy different chapters but overall, even chapters of peripheral interest to me provided stimulating reading. Some typographical errors have slipped through in the present edition but the few I picked up in no way detracted from the excellence of the volume. Although there are differences in avian and mammalian physiology, these are emphasized throughout the book, making it a valuable reference even for readers whose research or teaching subjects have fur instead of feathers. I have no hesitation in recommending the book to anyone with a more than casual interest in animal physiology.

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