Book reviews

Journal of Agricultural Science (2004), **142**.
doi:10.1017/S0021859605214946,

Reptilian Incubation. Environment, Evolution and Behaviour, ed. D. C. Deeming. xiii + 349 pp. Nottingham: Nottingham University Press (2004). £50 (Hardback) ISBN 1 897676 11 5.

Reptiles share with birds and mammals the characteristic of producing eggs in which the embryo is enclosed in an amniotic membrane. In most mammals, egg development is internal and not yolk-dependent, and the amnion remains as a fine membrane with little protective function. In birds, the other homeothermic amniotes, eggs have large yolks and the amnion is calcified to create a rigid and relatively impervious survival capsule. Reptiles, which are heterothermic, produce yolky eggs enclosed in an embryonic membrane but defy almost any other generalization of egg-related features, be it the extent of calcification, the mechanism of fluid balance, the structure of the nest and degree of parental investment in incubation, or the gestational effects of temperature and other environmental variables.

This valuable book attempts to gather together and summarize our current knowledge of Reptilian eggs and incubation. Its aim is to provide an understanding of the Reptilian reproductive world and to inform current research on Reptilian evolution, physiology, behaviour and environmental survival. This presents a significant challenge: the diversity of reptile species makes the collection and collation of information inherently difficult, and the task is made even harder by the large gaps that exist in our knowledge of many parts of the Order. The strategy, a sensible one, has been to seek reviews by experts on particular topics and to allow their interests and knowledge to determine the depth and breadth of content.

The result is that some parts of the book are more compendium than review. Thus we have chapters on the structural features of eggs, replete with lists of compositional variables and energy values for individual species and groups, alongside descriptive summaries of developmental patterns and the influences of incubation temperature on rates of hatchling development. This is valuable reference material, organised and presented in a readable and accessible form. Besides saving researchers and students a great deal of library time, it will serve to indicate where the gaps in the informational stamp collection are located and where further descriptive research effort could be best deployed.

Other parts of the book take a more physiological and adaptational approach to their subject matter. Two particularly fascinating chapters discuss the effects of temperature in determining sex and post-hatching phenotype, preceded by a chapter on the extraordinary ability of Reptilia to adjust their parental behaviour to an unpredictable environment. A short chapter on artificial incubation emphasizes the importance of recognizing species characteristics when establishing optimal conditions for captive breeding and conservation.

The theme of developmental plasticity permeates the book as a whole, giving us the sense that Reptilia have survived and prospered through flexibility, rather than by adopting defensive strategies or being resistant to change. As with all comparative biology, making the inductive jump from observations on phenotype to conclusions about the mechanisms of adaptational advantage requires care. The authors contributing to this volume have been suitably cautious, as has the editor in his helpful book-end overviews of current understanding. Nevertheless, the Darwinian insight into evolution teaches us that the existence of diverse phenotypes represents the successful colonization of an equally diverse range of ecological niches. By this measure, the adaptational success of the Reptilia has been profound. In fact, the difficulty, nay impossibility, of trying to make generalizations about Reptilian reproduction leads one to wonder if it is taxonomically helpful to study them at the level of Order at all. Whether the reptiles will continue to survive under currently accelerating rates of environment change is a question which will only be answered by hindsight.

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Journal of Agricultural Science (2004), **142**.
doi:10.1017/S0021859605224942,

Biostatistics for Animal Science, by M. Kaps & W. Lambertson. Xiii + 445 pp. Wallingford: CABI Publishing (2004). £35.00 (US$60.00) (Paperback). ISBN 0 85199 614 0.

This statistics book written 'to serve students and researchers of the animal sciences' aims to cover the

statistical methods most commonly used in the animal sciences for the analysis of continuous and categorical variables. It also aims to present sufficient basic statistics to enable the reader to understand these methods 'without having to switch to another book of introductory statistics'.

The introductory first eight chapters: summarizing data; probability; probability distributions; population and sample; parameter estimation; hypothesis testing; simple linear regression; correlation, total 153 pages; more than many statistics textbooks. The more advanced chapters 9–22 occupy a further 265 pages. The North American feel created by the cover picture of a tagged white-faced steer being tended in a corral by a moustachioed man in a Stetson, is continued by the use of SAS statistical software throughout for the worked examples.

Despite my familiarity with the material presented, I found the early chapters to be surprisingly heavy going. The authors assume from the outset that the reader will be able to cope with algebra involving subscripted variables, powers, equations, inequalities, factorials, intersections, unions, probabilities, conditional probabilities, Bayes theorem, expectations, functions, limits, integration, differentiation, partial derivatives, finding the maximum of a function, logarithms, least squares, likelihood, maximum likelihood estimation, matrix algebra and other mathematical topics. The authors explain many of these topics but any animal scientists who lack practice in mathematics may find that in order to avoid the switch to another book of introductory statistics they have to consult books of introductory mathematics.

A strength of this book is its abundance of worked animal-science examples. The basic theory is relevant to any biological science. This is also the case for chapters 9–11 on multiple linear regression, curvilinear regression and one-way analysis of variance. The matrix algebra used to describe the statistical models may appear to dominate these chapters' 100 pages but many important topics are described in the text including sums of squares, likelihood ratio test, power, problems with regression, choosing the best model, polynomial regression, nonlinear regression, fixed effects, random effects, maximum likelihood estimation, REML mixed models.

The remaining chapters are on the design and analysis of experiments. Every animal scientist should read the brief chapter 12 on the concepts of experimental design. The following chapters build on this and deal with blocking, change-over designs, factorial experiments, hierarchical or nested designs, multiple blocking, split-plot, covariance, repeated measures, numerical treatment levels and finishes with chapter 22 on discrete dependent variables. A comprehensive description of the features and the analyses of each design, including SAS programs and explanations of their outputs, make each chapter valuable for animal scientists planning and analysing experiments or interpreting published results. Too few biologists realize that even if a treatment produces a real effect, an experiment of a given design will only detect the effect as statistically significant on a proportion of the occasions such an experiment is run. Therefore it is good that this book includes the power calculations that enable this proportion to be calculated as an integral part of the design and analysis of experiments.

In conclusion this book covers a wide range of statistical topics, many in depth and would suit experienced animal researchers who wish to update their statistical skills, new researchers who need to know more about experimental design and analysis, anyone interested in applying power calculations to standard experimental designs, and animal science lecturers who use SAS in their statistics teaching.

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https://doi.org/10.1017/S0021859605214946 Published online by Cambridge University Press