

any significant impact on the welfare of performing animals. Moreover, continuing debate in and out of parliament over the last ninety years has achieved precisely nothing. A Private Members' Bill (The Wild Animals in Circuses Bill) was introduced to the UK Parliament in 2014 but was prorogued at the end of the last parliamentary session and will make no further progress.

The record of human attitudes and actions, in the circus and the theatre, in parliament and the press, takes up about 80% of this book. Wilson is a diligent and honest historian. The record is comprehensive and at all times he dutifully records all sides of the argument. Readers looking for a champion for their particular cause will not find it here. The 20% that relates directly to animal welfare appears in the chapter entitled 'Means and ends', which considers the acquisition, confinement, movement and training of animals for the entertainment industry. Here again, this section deals mostly with human attitudes to these practices, and mostly with the actions of humans whose perceptions and prejudices in matters of animal welfare have been expressed in the absence of any attempt to consult the animals. The application of science to the training of performing animals and our understanding of their welfare is given very little space. He describes the work of Keller and Marian Breland, former pupils of BF Skinner, who sought to apply his (outdated) principles to the training of performing animals. He also gives proper recognition to the work of Marthe Kiley-Worthington, who the RSPCA sponsored to carry out a scientific study of the welfare of animals in circuses, but did not publish her report (although the work was later published by Marthe in her book *Animals in Circuses and Zoos: Chirons World?* (available at http://the-shg.org/Kiley_Worthington/).

This could be viewed as a disappointing book because it appears to have no happy ending. For this, of course, the author is not to blame. It has been meticulously researched and it is very well written. It is also thought-provoking. One phrase that ran constantly through my mind while reading this book was UFAW's mission statement "Science in the service of Animal Welfare": the need not just to practise animal welfare science but to breathe through the wind and fire of rhetoric our still small voice of reason. My other constant thought was, in fact, resolved in the closing lines of the Wilson's book. "Animals were now worthy of respect, as well as being sources of curiosity: their activities and behaviour in the natural environment became more fascinating than in the artificial one". Amen to that. The power of public opinion exceeds that of the legislators. One cannot however escape the irony that our respect for animals in the wild has been largely nourished through a diet of moving pictures of animals in the wild observed from the comfort of our own sofas.

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Zookeeping: An Introduction to the Science and Technology

Edited by MD Irwin, JB Stoner and AM Cobaugh (2013). Published by The University of Chicago Press, 1427 E 60th Street, Chicago, Illinois 60637, USA. 816 pages Hardback (ISBN 978-0-226-92531-8). Price £66.50.

The difficulty in constructing a book along these lines is the diversity and depth of subjects that need to be covered in order to provide a strong reference guide for a modern zookeeper. In addition, there is a large amount of cultural and legislative difference when the role of a zookeeper is considered on a global level. With a few notable exceptions this book has a strong Americano-centric feel. While this is not an issue in many respects, it does leave some gaps within the knowledge base, particularly in terms of legislative processes. It is unrealistic to expect a book like this to cover the range of legislative processes even just across major countries; however, a caveat to the reader on checking legislative concerns within their own region would be useful. This is particularly important (but not exclusively so) when talking in terms of veterinary interventions. There are assumptions made about European keepers and European situations which do demonstrate a lack of understanding of the European (or for that matter Australian or Asian) Zoo Community. In particular, there is little mention of the charitable status of many European zoos, and an assumption that a 'good zoo' equates with a large zoo with multiple staff. There are very many small zoos that are able to take on the mantle of a good zoo.

Although strongly Americano-centric, there is an impressive list of contributing authors, representing much of the western knowledge of the role of a zookeeper. For many junior or new keepers (or zoo enthusiasts) who would benefit from this book, a short biography for each author would have been beneficial and given a clearer understanding of the reason why they were appropriate to author those chapters. However, the range of contributing authors has allowed the production of a work of clear value to the zookeeping world.

The title of the book describes "an introduction to the science and technology of zookeeping", and as already stated it is difficult to cover the range of relevant subjects in any depth. However, I was somewhat disappointed in the omissions of some elements from the book, particularly in terms of new innovations in technology, and the lack of a future direction for a 21st century zookeeper.

This book is divided into ten sections, devised to provide detail within defined 'chunks' allowing the reader to dip into a subject as necessary. The chapters are diverse, ranging from information on applying to zoos and aquaria, to legislation in various regions. The second chapter of the book is a welcome surprise, focusing on the process leading up to employment as a zookeeper. This is very much unrecognised information for those looking at a career in zookeeping. Part two of the book moves into more familiar territory with the 'Evolution of zoos',

charting the history of zoos. Subsequent chapters detail opinions on the modern zoo. Despite this quite comprehensive background to the modern zoo, I again was somewhat disappointed to see nothing new in the chapters and sections of this book. This omission, I believe, misses a superb opportunity to speculate on the future role of zoos. It is without doubt that the zoos and aquaria of today will need to evolve to survive into the future.

There are difficulties in the book. It follows standard taxonomic mammal-centric emphasis with six chapters on mammals with one each on birds, reptiles, amphibians and terrestrial invertebrates. The chapter on fish includes marine and freshwater and includes aquatic invertebrates as well. Whilst these are going to provide the key sections for many readers, the breakdown does inevitably mean that these chapters are inevitably somewhat reduced in depth of information, despite the stated intentions of the chapter authors. However, much of the information provided gives a sound basis for the reader to begin with and there are some clear references and suggestions in the back of where to find further details. The editors have made a point of bringing in the personal experiences of the chapter authors, giving an invaluable resource of experience, something we do worry will vanish from zoo and aquarium circles. The provision of information boxes containing examples of these 'gems' of experience allows clear identification of where personal experience is coming into play.

Despite claiming to provide a review of science and technology there are some notable omissions. For example, the chapter on reproduction does not talk about the differing hormone levels during the cycle, so when talking about contraception there is no real information on how the different contraceptive products work. There is also no mention of the AZA WCC (or the associated European group) who have, over time, gathered and made available a large body of data concerning contraception. The chapter also makes some recommendations that would not necessarily be upheld by the WCC now.

Within the book is an invaluable chapter on ethics and welfare. This is a difficult subject and many people, both within and outside the profession, find it difficult to differentiate between these two subjects; this leads to confusions that can be exploited by those with an anti-zoo agenda. Again, this chapter provides an excellent introduction to the complexities of animal ethics, animal welfare and animal rights. While this could have been enhanced with some constructed arguments, to exemplify the different arguments within particular subjects, it again allows a firm basis the reader can build upon.

The chapters following this move onto the subjects of animal behaviour, welfare and behaviours of concern. These works are well-constructed and reinforce the basic principles needed by the modern zookeeper. Working from this

book would certainly allow a keeper to understand the need and broad principles in assessing behavioural aspects of welfare. However, no mention is made of other indices of welfare assessment, such as cortisol measurement. This is a growing field that has been taken onboard by the zoo community in many situations, giving further dimensions to our understanding of welfare assessment of our animals, and as such is a marked omission from the book. A modern zookeeper will need to have a greater understanding of the complexities of welfare science and the difficulties in assessing animal welfare.

I was also very disappointed to see no mention in the 'Stress and distress' chapter of the differences between chronic and acute stress. Whilst due attention has to be paid to reducing stress and distress for captive animals, the role of acute stress as a normal factor of life, and on occasion promoting positive benefits should not be ignored. This is a somewhat contentious subject for zoos as it implies the need to introduce 'low' levels of stress to an animal's life in order to stimulate natural responses. However, with an increasing body of literature drawing together information on positive benefits of acute stressors, this becomes an opportunity to discuss relevant subjects. Again, there was an opportunity here to be forward-thinking in terms of what we try to achieve with zoo animals.

Finally, there is a lack of context for where a keeper in a zoo impacts on the wider zoo community. While cursory mention of the national, regional and global zoo associations (AZA, EAZA, BIAZA, WAZA and others) has been made throughout the book, particularly in terms of breeding programmes, a greater input into the role of a keeper, through the associations, in the wider zoo and aquarium community would have been a valuable addition to this volume.

While it must be remembered that this book appears to be written for a primarily US audience, this is still a relevant text to many working or studying within the zoo and aquarium profession.

In recent years there have been a small number of books produced focusing on this subject, many of them cited within this text. It is hard for the purchaser to differentiate between these texts, which cover similar ground perhaps with some bias towards the region they were produced in. I was hoping with this volume that the focus would move beyond what we already know about zookeeping, into what we may expect from a zookeeper in the future and where the 'science and technology' of this field may take us. After all, it is the zookeeper who is often on the front line of the profession, often the direct contact with the public, and therefore needs to have a broad knowledge of issues.

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