

From an animal welfare perspective, such de-animalised terms (although probably professional jargon), makes it more difficult for the untrained reader to understand the processes taking place. The chapters describe hunting types that can be controversial (eg, helicopter culling or night culling) from a very functional perspective, but these are not, or only very superficially, discussed in terms of animal welfare.

The last chapter of the book could also have been the first, as this text looks back but also ahead in time. It might, thus, be advantageous to read this chapter first — also from an educational context — since it provides a very nice historical overview of the development from slaughtering single animals to sustain families to the industrial-scale slaughter of today. This is the first time the concept of ethics is introduced; prior to this point animal welfare is mainly described in terms of accommodating requests from consumers. The chapter acquaints the reader with more socio-economical aspects of animal slaughter, including a review of how slaughterhouses emerged as a unique institution in the early 19th century as part of a large transition from an agrarian to an industrial system, accompanied by increased urbanisation and technological advancements, and how they went from objects of city pride to largely being hidden away in large plants, that are seldom or never visited by ordinary people.

This book, however, does the opposite of hiding what goes on when animals are slaughtered for human consumption. As demonstrated above, the book uses words and pictures to describe the involved processes — and is a great example to follow for its openness and transparency. Although the different procedures tend not to be discussed primarily in terms of animal welfare, the manner in which they are presented cleverly integrates concerns related to welfare, meat quality and productivity, imbuing the reader with a concise understanding of why the different processes are performed as they are.

In conclusion, *Preslaughter Handling and Slaughter of Meat Animals* is a comprehensive book that would be a valuable addition to the library of those with an interest in how animals killed for human consumption are managed, and how these processes relate to animal welfare, meat quality and productivity. Parts of the book are not easily accessible due to the high technical level which perhaps preclude its effectiveness as a stand-alone for beginners or a broad readership. For those who can understand the technical terminology (such as students being schooled in animal production) the book offers a unique, open, science-based overview of procedures and practices, and why they are carried out, when different animal species are killed for their meat.

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Much Like Us: What Science Reveals about the Thoughts, Feelings, and Behaviour of Animals

N Sachser (2022). Translated from the German by Ruby Bilger. Published by Cambridge University Press, Cambridge CB2 1SZ, UK. 154 pages Hardback (ISBN: 978-1-108-83849-8). Price: £17.99.

Guinea pigs were how Norbert Sachser found his way into behavioural biology. In the 1970s as a student he was taught that when a population increases and space becomes scarce, stress levels in humans and mammals rise. Individuals become more aggressive, mothers less caring and health declines within the population. This pattern had been observed in mice, rats and rabbits, so young Sachser decided to study it in guinea pigs.

Guinea pigs, however, showed none of the signs of the expected density stress. They seemed happy crowded together in their enclosure. They formed themselves into stable bonded groups of a manageable size and the alpha males in each group rarely fought each other. About this time measuring the level of cortisol, a stress hormone, became available and Sachser's guinea pigs had normal levels whether they were top of or low down in the hierarchy — as long as the group was stable.

What was buffering the individuals against density stress were stable social bonds. Taken out of his group and put in a new group or paired with a strange female, a male guinea pig had soaring cortisol levels. Taken out of the group in the company of a bonded comrade, his stress levels were buffered. Individual behaviour and stress levels were also strongly affected by their early social experience with their own kind. Guinea pigs brought up in large groups could cope better with joining a new group.

To some readers of Sachser's book this will not be news, because studying species-specific societies and stressors should be part of any university's syllabus. However, his theme is to show not just how there has been a revolution in our scientific study of animal behaviour, but also to give a summary of the major changes in our understanding. His relatively short book takes a wide look at the changes and how they occurred.

From Aristotle onwards, human supremacism has seen animals as separate from and lower in value than humans. It is a view still widely held not least because it makes both scientists and non-scientists feel more comfortable in their use of animals for food, research and entertainment. In the early years of the last century it allowed biologists to ignore Darwin's book on animal behaviour, *The Expression of Emotions in Man and Animals*, while reverencing his *On the Origin of Species*, even though this in a different way highlights the similarities between humans and the other mammals.

Sachser's first chapter takes the reader briskly through the history of behaviour studies, through the emphasis on fixed action patterns of animal instinctive behaviour studied by ethologist Konrad Lorenz and through Nikolaas Tinbergen's work including his basic framework of the four questions about behaviour — mechanism, ontogeny, function and phylogeny. After the guinea pig chapter on behaviour and stress he moves onto the next chapter on emotions and well-being, focusing on the complications of assessing welfare from observations of an animal's behaviour and touching on displacement and vacuum behaviours, stereotypies and play. The super-enriched housing that he and a research team designed for laboratory mice not only reduced aggression between the inmates but also encouraged play. (I looked up an illustration in one of his papers and it really was super-enriched with platforms, ladders, and climbing frames). He also mentions preference tests and cognitive bias (whether an animal is depressed or optimistic) testing, warning against the simplistic idea that conditions in the wild are a blueprint for good welfare in domestic species. This chapter is less about animal emotions, more a beginners' guide to welfare assessment.

If I was left wanting more in that welfare chapter, it is because there are huge topics to follow, and this is a book with broad brush strokes. In the next chapter, 'Nature versus nurture', he outlines the historical conflict between ethologists' emphasis on innate behaviour and the behaviourists' focus on learning. He points out, for instance, that there seems to be an innate human response to a baby's face, triggered in the same area of the brain that in an alcoholic is activated by a whisky bottle! His historical approach allows him to move from the early behavioural insights laboriously gained from cross-breeding species to observe the behaviour of the offspring, to modern behavioural genetics. In a mere 20 pages the reader moves from pigeons Jack and Jill, trained to tell each other which button to press for a food reward, to epigenetic changes in a grandfather's sperm! The interplay between genetics and environment has come up with some amazing examples where an animal's experiences can change not only its own DNA but that of its offspring. If a male mouse is taught to avoid a particular scent, his offspring will be hypersensitive to the same scent, and even the next generation has the same scent sensitivity.

From there it is just a chapter step to animal cognition. From personal experience I know how boring and even mystifying learning theory can be to those who are not committed dog trainers. Sachser introduces the reader to this topic by starting with a good animal story — Rico, the border collie, that could recognise the word for about 77 different toys and fetch the correct one, then leading onto the familiar tale of Pavlovian associative learning and operant conditioning. Earlier attempts to study animal thinking at the start of the last century had given way to strict behaviourism, with its emphasis on studying outward behaviour only. Behaviourists had little or no interest in an animal's inner mental processes, until at end of the 1980s an American zoologist, Donald Griffin, raised it in a book about animal

thinking. Now there is a specialist journal, *Animal Cognition*, devoted to the topic and the hours committed to conditioning pigeons to play football are now spent studying tool use, animal culture and whether a species can recognise itself in a mirror.

Even so, neither mirror self-recognition nor tool use are easy areas from which to make inferences about animal intelligence. The book takes us through the mirror self-recognition test. Very young children and most mammals do not recognise their own image in a mirror and react as if their reflection is another animal. In the classic mirror test, a coloured spot is painted on the animal's body in an area where it cannot be seen by that animal, except in a mirror. An animal that recognises itself in a mirror will then try to touch or examine that spot on its body. So far, elephants, great apes, dolphins and magpies have shown they can recognise their own reflection. There is, however, an argument, made after this book was originally written, that a mirror test is not fair to some animals. Dogs, for instance, can distinguish the scent of their own urine from that of other dogs and perhaps this too is evidence of some degree of self-recognition. Tool use may also be a poor measure of cognition, as it has been claimed for both ants and crocodiles. Reptiles and insects are not within the boundaries of this book, but this chapter does mention the surprising cognitive abilities of birds. Darwin's tree of life metaphor, popularised with humans at its apex of cognitive evolution, is beginning to look somewhat anthropocentric.

For me, one of the most interesting chapters was the sixth which deals with animal individuality. In my area of interest, domestic cats, the individuality of their behaviour is essential for recognising good welfare. Once again, Sachser's historical approach makes for clarity of understanding. Harry Harlow's cruel experiments, in which he deprived rhesus monkeys of mothers, giving them instead a wire mother that produced milk, showed that mothering was more than simply lactation. Mothering by a parental figure of the same species (it need not be a biological mother) is important, enabling an individual to grow up as a balanced member of its own species: it can have lifelong effects on an individual temperament too. Indeed, even before birth pre-natal experiences in the womb due to the physical and social welfare of the mother, can influence lifelong behaviour. Sachser's colleague, Sylvia Kaiser, found that female guinea pigs born to a mother who had lived in an unstable environment while pregnant, grew up to show masculine behaviour. The pre-natal environment of the mother had also affected her male offspring who were slow to mature and 'infantilised.' This was the result of her surging stress hormones affecting the fetuses in her womb, during her pregnancy in a difficult environment. Thus, the offspring were being adapted to the unstable environment, in which assertiveness in the female might be an advantage while infantile behaviour on the part of a male might appease rival males, giving the individual time to mature into an alpha male.

Given similar experiences pre-natally and post-birth, if individual siblings differ from one another (and they do) then the genes they inherit must also play a part. The study of individual personalities in animals has also become part of modern behavioural biology. Insects, amphibians, sticklebacks and great tits have all shown evidence of long-lasting temperament differences between individuals. These differences show themselves early and persist over time. Even more fascinating were the results of a research investigation of 40 genetically identical female mice. These were kept in an enriched environment and, despite having the same genes and living in the same environment, different character traits emerged between the individuals. I would have liked more discussion of this amazing finding.

It is a bit of a jump from animal personalities to the chapter on sociobiology and the problem of altruism among animals. Sachser bypasses the controversy of how far sociobiology explains human behaviours, and simply takes the reader through Darwin's theory of natural selection, called Darwinian fitness, whereby the genes of best adapted individuals are preserved in a population, and the genes of those less successful are not. Yet some individuals behave in an altruistic way — lions and mice will suckle the offspring of other females, for instance, when it would 'pay' them to concentrate only on their own offspring. Such altruism runs counter to the idea of the individual survival. However, at the level of gene rather than individual preservation, kinship can explain altruism. If animals act altruistically towards their relatives, they are helping preserve the genes that they have in common. This explains how wolves in a pack, usually a family group, will co-operate to rear the pups of the alpha female. Helpers that are not the pups' parents but are the aunts and uncles or adult siblings of the pups, so share some of the family genes. Another explanation for altruistic behaviour among animals is that it is reciprocal: individuals will share food with an individual who will reciprocate in the future. You scratch my back, and I will scratch yours.

There is an intriguing twist in this chapter. If altruism is found among other warm-blooded mammals so is its opposite. Male lions taking over a pride of females will kill any cubs, so that the mothers are more quickly ready to mate and produce the new male's offspring. There is conflict too among suckling siblings, if the mother's milk is limited, sometimes resulting in death of the weakest. Adult males' struggles in competition for females can be fatal while different groups of chimpanzees will engage in warfare that can result in the death of not just males but also females and children in the losing group. Nor are females the passive participants in sexual competition. When sexual behaviour is studied closely, what looks like male rivalry may be more a matter of female choice. Yellow-toothed guinea pig females, a species from the same cavy genus as the domestic guinea pig, give birth to young that have different fathers, increasing the likelihood that some at least will result from the best available male sperm.

My only criticisms of this book are that it has no index, the references given for each chapter are not numbered in the text, and no attempt has been made to translate even the easy German references. Otherwise, it is a remarkable *tour d'horizon*, accessible to the common reader, prepared to google the occasional science word, and remarkably cheap for a hardback. If I had had this book some years ago when I was an applied animal behaviour student, it would have put the different lectures I attended into one coherent whole. As Sachser declares: "the more we investigate, and the closer we look, the more we see the humanity in our fellow creatures." This closeness between human and beast has important implications for animal welfare.

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Handbook of Laboratory Animal Science: Essential Principles and Practices, 4th edition

Edited by J Hau and SJ Schapiro (2021). Published by CRC Press, Boca Raton, FL 33487, USA. 994 pages Hardback (ISBN: 978-1138341807). Price £141.64.

This is the revised 4th edition of the well-regarded handbook, first published in 1994. This edition is bound as a single volume, rather than the previous three-volume format, which is welcomed in making it easier to manage and navigate.

Within the single volume, the book is divided into four sections: 'Principles of laboratory animal science', 'Practices', 'Animal models', and 'Structures.' The book's editors, Professors Jann Hau and Steven Schapiro, have assembled contributions from over 90 expert authors in the field, with chapters focusing on specific aspects of laboratory animal care and use, as well as more broadly on some basic principles relevant to the field.

The intention is that individual chapters can be read as stand-alone texts on the particular subject, so that the reader can easily find up-to-date and relevant information on the topic of interest and this design works well to produce a reader-friendly handbook of reference.

Part I – Principles of laboratory animal science

In keeping with the 3Rs as the starting point for considering all animal-based research, the book begins with a chapter on ethical issues, including discussion of deontological and utilitarian approaches, before developing the latter in discussion of maximising benefits of the research whilst minimising harms to animals. Garner's therioepistemological approach to analysis of the validity of a proposed model and its imperfections is discussed, together with the current issues of communicating results effectively, including infrequent publication of negative data. The concept of harm-benefit analysis is discussed in light of the 'Five Freedoms', although discussion regarding the evaluation of positive welfare attributes (rather than just freedom from negative ones) and more recent concept of ensuring that animals have 'a life worth living' would have enhanced this section and brought it up-to-date.