available earlier than in 1994, ie seven years after the conference in Stony Brook. As a foreigner I should mention that the rules and regulations discussed in the book concern only the United States; despite this, the themes raised are of great interest for all behavioural scientists around the world.

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Principles of Laboratory Animal Science: *A Contribution to the Humane Use and Care of Animals and to the Quality of Experimental Results*
Edited by L F M van Zutphen, V Baumans and A C Beynen (1993). Elsevier Science Publishers BV: Amsterdam. 389pp. Obtainable from the publishers, PO Box 211, 1000 AE Amsterdam, the Netherlands (ISBN 0 444 81270 9 hardback; 0 444 81487 6 paperback) Price Dfl325 hardback; Dfl135 paperback post-free.

Most European countries require specific training in laboratory animal science for researchers involved in animal experimentation. The aim of this new book: *Principles of Laboratory Animal Science* is, according to the editors, to cover the theoretical components of such a training course.

In the introductory chapter the 3Rs of Russell and Burch are once again promoted as the guiding torches of laboratory animal science. Although it is 36 years since the 3Rs were first introduced, few true alternative methods have evolved, and those which have can hardly be attributed to laboratory animal science. The advantage of reducing the number of animals is often doubtful from a welfare point of view, since smaller experimental groups require higher doses of harsher treatment to show significant differences to the control group. It is definitely in the last R – refinement – that the greatest contributions from laboratory animal science have appeared. The first chapter also briefly mentions the highlights of the history of animal use and recent statistics from the United Kingdom and the Netherlands. One important factor is missing: the fact that the majority of laboratory animals are used for purposes required by legislation. This is an aspect rarely mentioned in the ethical discussions concerning animal experimentation.

The second chapter, on legislation, is introduced by the sweeping statement that the United Kingdom was the first and for many years the only country with legislation protecting laboratory animals. I am not aware of the legislative history of the European countries, but it is a fact that in Denmark such legislation was established as early as 1891, when the first professor in physiology was appointed at the University of Copenhagen. The chapter mainly deals with the European Community Directive, which is a little strange since this Directive is restricted to experiments undertaken in industry only. It would seem more appropriate to have emphasized the *Council of Europe Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes,* since this document applies to *all* uses of laboratory animals and to a wider range of countries.

Chapter three, on biology and husbandry, contains useful information for the scientist on environmental requirements and physiological parameters of several species of animals, including species that are less frequently used in the laboratory. The chapter is also well

illustrated – in contrast to most of the other chapters – although one picture, Figure 3.3a, has unfortunately been turned upside down. The suggestion on page 23 that mice can be marked by toe amputation should have been omitted in a book that emphasizes animal welfare, and the statement on the effect of penicillin on Gram-negative bacteria (p 37) should have been spotted by the editors.

The chapter on behaviour, stress and well-being is a very interesting summary of behavioural research and the physiology of stress and adaptation. Its relevance for animal experiments, however, is not very clear, and only stated in general terms. A more specific discussion of environment- and stress-induced changes of metabolism would have been useful for the toxicologist or pharmacologist engaging in animal experiments.

Standardization of animal experimentation is covered in Chapter 5, offering an excellent review of 'between-experiment' and 'within-experiment' variations. Some more practical examples, however, would have been useful for fully appreciating the importance of environmental control, general hygiene and social interactions between animals and between man and animals.

The following chapter on nutrition and experimental results focuses on the nutritional requirements of the different species of laboratory animals. This is of great importance for those producing diets and for those responsible for feeding the animals, whereas it is less important for the average experimenter. Only the last page of the chapter is devoted to influences of feed composition on the experimental results.

Subsequent chapters on genetic and microbiological standardization contain important information for the investigator. The chapter on diseases is restricted to the most important ones. Helpful, however, would be a thorough description of post-mortem examinations and sampling techniques, since most investigators – except perhaps veterinarians – have little or no experience of performing autopsies.

Design and statistical evaluation and management of animal experiments are very well covered in Chapters 12 and 13. The section on safety in the animal house, however, is too brief. It deals with zoonotic infections and hazardous substances, whereas allergy – the most important hazard when working with laboratory animals – is not mentioned at all.

Recognition of pain and distress in laboratory animals is dealt with rather theoretically in the next chapter, and the reactions to acute and chronic pain in the different species should have been described in more detail. It is, for example, not mentioned that animals suffering chronic pain will stop eating and drinking. Drugs for pain relief are listed in the chapter on anaesthesia.

Anaesthesia, analgesia and euthanasia are well covered, with tables giving doses of different compounds for different laboratory animals, including less frequently used species. The advantage of artificial ventilation and the dangers of neuromuscular blocking agents are mentioned. The section on post-operative care emphasizes mainly analgesic treatment, and to a lesser extent prevention of post-operative pain by proper surgical technique, asepsis, fluid balance and acid–base balance. It should also be emphasized that since animals in pain stop eating and drinking, analgesics administered in feed or drinking water are of little use.

Experimental procedures, including injection and sampling techniques, and surgical procedures are covered in only 19 pages. Considering the importance of proper techniques and procedures for both animal welfare and experimental results this chapter is disappointing. It should be realized that textbooks on laboratory animal science are mainly for medical and biology graduates, with no experience in handling animals, carrying out even the simplest procedures, or performing surgery.

The brief chapter on alternatives to animal experiments adds little to the usual arguments carried forward by those opposed to animal experiments. Some of the examples mentioned are strange, eg that the production of monoclonal antibodies is an alternative method to standard antibody production in rabbits. Using this method, mice rather than rabbits are immunized and in addition hybridoma cells are inoculated into the peritoneal cavity of other mice, causing severe pain and distress to the animals. It is very difficult to see this as an improvement to animal welfare compared to the conventional method of producing polyclonal antibodies by immunization and bleeding rabbits. If a true alternative were to be suggested, it could be the production of antibodies in birds and the extraction of the antibodies from their eggs.

The final chapter in the publication deals with ethical aspects of animal experimentation. In my opinion this should have been the first one in the book. Being at the end, the reader may be less inclined to read it thoroughly: this is a pity since an important purpose of courses in laboratory animal science is to change attitudes, but especially because it is a well-written, unbiased chapter.

As stated in the preface, the target group for this book is scientists responsible for the design and conduct of animal experiments. In spite of the minor critical points mentioned, I feel that the book is suited as a basic textbook for such courses. It should, however, be mentioned that the most important parts of such courses are the practical exercises in handling the animals, including injection and sampling techniques. The students should also be given practical training in anaesthetizing animals, in performing basic surgical procedures, and in doing post-mortem examinations.

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Refinement and Reduction in Animal Testing

Edited by Steven M Niemi and John E Willson (1993). Scientists Center for Animal Welfare: Bethesda. 138pp. Paperback. Obtainable from the publishers, 4805 St Elmo Avenue, Bethesda, MD 20814, USA. Price US$40.

This book contains the proceedings of a conference held by the Scientists Center for Animal Welfare on 17-18 September 1992, in Philadelphia, Pennsylvania. After a brief introduction on the '3R's' of Russell and Burch (who, I suspect, would join me in lamenting the intrusion, yet again, of that totally unnecessary apostrophe), in which one of the editors explains that the meeting was not about *replacement,* but about the neglected 2Rs, *reduction* and *refinement,* the book is divided into five sections.