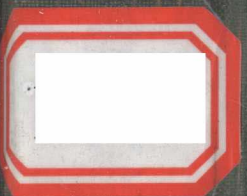


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THE UFAW HANDLE  
*The Care and Management of Labo*



# THE U F A W HANDBOOK ON THE CARE AND MANAGEMENT OF LABORATORY ANIMALS

*With an Appendix on Statistical Analysis*

EDITED BY

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## FOREWORD

EVERY scientist who correctly appreciates the part played by laboratory animals in research work recognizes the importance of using the right technique in their maintenance and handling. Not only is the accuracy of our results at stake, but we are under an obligation to show the utmost consideration for the animals themselves. It behoves us, therefore, to see that they are produced and maintained under conditions that will conform to a high standard of humaneness and will at the same time ensure that our conclusions shall be thoroughly reliable.

Many of us have attempted to improve on the older methods of rearing and keeping laboratory animals and doubtless in some cases our efforts have been successful. The information has, however, been largely confined to the place in which the knowledge was gained, and only exceptionally has it been available to other laboratories.

In this handbook there is brought together a mass of information which will satisfy a long-felt want. It provides a collection of knowledge gained by first-hand experience, and even the most knowledgeable among us will find in it something which will be of value to him. At any time we may have to make use of species with which we have hitherto been but poorly acquainted, and we now have a reference book which will guide us in this important subject.

The Universities Federation for Animal Welfare is to be congratulated on its choice of writers, and the collaborators on the able manner in which they have presented their subjects.

T. DALLING.

WEYBRIDGE.



## PREFACE

THIS handbook, which has been produced by the Universities Federation for Animal Welfare (U F A W, 284 Regent's Park Road, London, N.3), is intended as a practical introduction to the husbandry of laboratory animals, for use both by research workers and by technicians. It is not to be regarded as a manual of experimental technique.

The method adopted in its compilation has been to secure, wherever possible, an expert worker to draft the chapter on each subject, species or group of species, and to obtain supplementary information by means of a questionnaire. This questionnaire was sent to all holders of a British licence for animal experimentation and to a number of persons and bodies in the United States of America, the Soviet Union, Canada, India, South Africa, Palestine, Sweden, Algeria and elsewhere. U F A W is indebted to various scientific journals (including *Science*, *Lancet*, *British Medical Journal*, *Veterinary Record*, *Journal of the American Medical Association*, *Canadian Medical Association Journal* and *Canadian Journal of Comparative Medicine*), to the British Council (through Mrs. E. M. Malley, of the Science Department), to its late President, Sir Peter Chalmers Mitchell, F.R.S., and to Dr. Leptesa (of the Soviet Red Cross and Red Crescent) for their kind assistance in the search for information.

The war interfered, in some cases perhaps rather seriously, with the carrying out of this plan. Many experts were unable to undertake the drafting of chapters or even the provision of information, while a few potential contributors, including Lieut. N. A. W. Hayward, R.M., of Exeter, were killed in action. Death has ended also the participation of contributors in civilian life. The late Mr. R. M. Ranson, of the Bureau of Animal Population, Oxford, had undertaken to draft three chapters and to assist in many other ways, while Miss Phyllis Kelway, of Huddersfield, completed the preliminary draft, upon which Chapter 7 was to have been based, only two days before she died. The late Mr. D. L. Roberts, of Weybridge, had fortunately submitted his contribution to Chapter 4 before his untimely death.

Certain species have been omitted deliberately, except for the brief notes and references in Chapter 23. It was felt that little useful purpose would be served by attempting to deal in the limited space available with the monkey, dog, cat, horse and other ungulates as laboratory animals, and invertebrates also have been but scantily noticed. In a later publication it might be possible to extend the list of species, but for present purposes information of the type given in Chapter 23 is regarded as more helpful in connection with them.

An index has been provided, although for all practical purposes the contents of the book are clearly listed on pp. xi to xiv. It must be stressed here that references to many further sources of general information are to be found in Section 8 of Chapter 2, pp. 42-45.

Several members of the staff of the National Institute for Medical Research (and in particular Dr. C. H. Andrewes, M.D., F.R.S., and Mr. R. E. Glover, M.A., F.R.C.V.S.) were kind enough to read the first drafts of the various chapters and to make valuable suggestions; in many instances it has been possible to make alterations or additions accordingly. Mr. Charles Elton and

his colleagues at the Bureau of Animal Population, Oxford University, have also afforded considerable assistance in the revision of certain chapters and in tracing Mr. Ranson's notes. Dr. G. Lapage, of the Institute of Animal Pathology, Cambridge University, has helped to handle the Russian contributions. Mr. E. W. Shingfield, of the drawing-office staff, Army Operational Research Group, has re-drawn figs. 15, 17, 22, 24, 38, 45-47 and 64-70. My personal thanks are due also to Dr. F. Jean Vinter and Major C. W. Hume, of U F A W, who have rendered invaluable assistance in editing, and to my father, Dr. C. N. Worden, for preparing most of the manuscript for the press.

ALASTAIR N. WORDEN.

EAST BARNET,

May 1945.

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RENEWED thanks are due to many of those mentioned above, in particular to members of the staff of the National Institute for Medical Research and of the Bureau of Animal Population, Oxford. It has not been possible to take advantage of many kind offers to read the proofs but I am most grateful to Mr. S. J. Edwards (Agricultural Research Council Field Station, Compton), Dr. C. Horton-Smith (Ministry of Agriculture, Veterinary Laboratory, Weybridge) and Dr. J. R. M. Innes (Imperial Chemical Pharmaceuticals), for their assistance in this respect and to my secretary, Miss M. Joan D. Addyman, who has shared in all the tasks at this stage. The following include those who have helped in many ways but to whom adequate acknowledgement or reference is not made elsewhere in the book :—

Prof. E. D. Adrian (Physiological Laboratory, Cambridge), Dr. G. Alexander (Department of Surgical Neurology, Edinburgh), Mr. F. D. Asplin (Ministry of Agriculture, Veterinary Laboratory, Weybridge), Prof. F. G. Bartlett (Psychological Laboratory, Cambridge), Dr. A. Beck (Public Health Laboratory, Burnley), Dr. S. Beck (Glasgow Royal Cancer Hospital), Dr. D. B. Blacklock (Liverpool School of Tropical Medicine), Major J. A. Boycott (R.A.M.C.), Mr. A. Brownlee (Agricultural Research Council Field Station, Compton), Messrs. Warren E. Buck and E. S. Ward (Meems Bros. and Ward, New York), Prof. J. H. Burn (Department of Pharmacology, Oxford), Dr. H. Burrows (Chester Beatty Research Institute, London), Prof. E. P. Cathcart (Physiological Department, Glasgow), Prof. G. A. Clark (Faculty of Medicine, Sheffield), Miss A. S. Cloe (King's College, London), Dr. T. V. Cooper (County Pathologist, Dorchester), Prof. D. P. Cuthbertson (now at the Rowett Research Institute, Aberdeenshire), Sir Henry H. Dale, P.R.S. (Royal Institution, London), Sir Jack C. Drummond (now Scientific Director, Boots, Nottingham), Prof. A. N. Drury (Lister Institute of Preventive Medicine, London), Dr. F. J. Dyer (College of the Pharmaceutical Society, London), Dr. I. S. Farrel, Dr. J. S. Faulds (Cumberland Pathological Laboratory, Carlisle), Mr. D. A. Finlayson (Ogilvie Flour Mills Co., Winnipeg), Mr. J. R. Finlayson, Dr. Myron Gordon (New York Zoological Society), Mr. R. F. Gordon (Ministry of Agriculture, Veterinary Laboratory, Weybridge), Dr. W. S. Gordon (Agricultural Research Council Field Station, Compton), Prof. James Gray (Zoological Laboratory, Cambridge), Dr. A. Haddow (Chester Beatty Research Institute, London), Prof. J. B. S. Haldane (University College, London), Dr. John Hammond (School of Agriculture, Cambridge), Dr. M. F. Harbord (Howmill, Carlisle), Dr. Evelyn Hewer (London School of Medicine for Women), Prof. F. G. Hitch (Royal Naval Medical School, Greenwich), Dr. F. D. M. Hocking (Royal Cornwall Infirmary, Truro), Prof. A. StG. Huggett (St. Mary's Hospital, London), Mr. W. T. Hunt (Department of Physiology, Edinburgh), Miss Ina Jones-Allen (Department of Animal Health, Aberystwyth), Prof. E. L. Kennaway (Chester Beatty Research Institute, London), Dr. E. H. Koerner (Royal Herbert Hospital, London), Dr. A. J. Leigh (Ruthin Castle, North Wales), Prof. R. T. Leiper (London School of Hygiene and Tropical Medicine), Dr. J. T. Lewis (Universidad Nacional del Litoral, Argentina), Mr. H. W. Ling (Department of Pharmacology, Oxford), Dr. E. C. Lowe, (Southport Infirmary), S/Ldr. B. J. B. Lucas

(then at R.A.F. General Hospital, St. Athan), Dr. Catharine Lucas (London School of Medicine for Women), Dr. R. A. McKail (Ballochmyle Hospital, Ayrshire), Dr. Douglas McClean (Lister Institute of Preventive Medicine, Elstree), Prof. Wm. C. Miller (then at the Royal Veterinary College, London), Dr. E. M. Morland (then Editor of the *Lancet*), Dr. S. B. Morgan (Antigen Laboratories, London), Major J. O. Oliver (then at the Command Laboratory, Campbell College, Belfast), Dr. H. J. Parish (Wellcome Physiological Research Laboratories, Beckenham), Dr. P. R. Peacock (Glasgow Royal Cancer Hospital), Dr. N. W. Pirie (Rothamsted Experimental Station, Harpenden), Dr. G. Pontecorve (Department of Genetics, Glasgow), Mr. W. A. Pool (Imperial Bureau of Animal Health, Weybridge), Dr. L. I. Pugsley (Department of Pensions and National Health, Ottawa), Miss M. M. Rayner (Royal College of Veterinary Surgeons, London), Dr. E. G. Rawlinson (Royal Institute of Public Health and Hygiene, London), Mr. F. Ridley (95, Harley Street, London, W.1.), Mr. R. W. Roach (now c/o New Zealand Government), Dr. W. F. Robertson (West of Scotland Neuro-Psychiatric Research Institute, Glasgow), Dr. Sherman Ross (Columbia University, New York), Mr. W. I. Rowlands (Veterinary Investigation Officer, Bangor), Dr. F. F. Rundle (68, Thames Street, Twickenham), Dr. H. Russell (Christie Hospital and Holt Radium Institute, Manchester), Dr. Norah H. Schuster (formerly at the Royal Chest Hospital, London), Mr. H. A. Scott (Purina Mills, St. Louis), Surgeon Lieut-Commander D. Shute (then at the Royal Naval Auxiliary Hospital Liverpool), Dr. M. J. Stewart (School of Medicine, Leeds), Prof. W. J. Tulloch (Medical School, St. Andrews), Dr. C. C. Twort (Portslade), Dr. F. W. Twort (Brown Institute, London), Dr. Janet Vaughan (then at London Blood Supply Depot), Sir Cecil Wakeley (then at Royal Naval Hospital, Gosport), Dr. Walther (Whipps Cross Hospital), Dr. M. A. Watson (Rothamsted Experimental Station, Harpenden), Dr. R. Wien (May & Baker, Dagenham), Prof. G. S. Wilson (London School of Hygiene and Tropical Medicine), Dr. L. B. Winter (University of Sheffield), Dr. G. M. Wishart (Institute of Physiology, Glasgow), Dr. D. R. Wood (Somerset County Laboratory, Taunton), Prof. J. G. Wright (School of Veterinary Science, Liverpool), The National Veterinary Medical Association and the Institute for Medical Laboratory Technology (Mr. S. J. Denyer).

Sincere apologies are offered for any omissions in this list and for failure to take advantage of all the kind offers to assist in the preparation of the handbook.

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# CHAPTER 1

## LAW AND PRACTICE : THE RIGHTS OF LABORATORY ANIMALS

By Major C. W. HUME, M.C., B.Sc.

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### 1. Historical Note

**The British Association and British Medical Association.** At its Liverpool meeting, 1870, the British Association for the Advancement of Science requested the Committee of Section D :

to consider from time to time whether any steps can be taken by them, or by the Association, which will tend to reduce to its minimum the suffering entailed by legitimate physiological enquiries ; or any which will have the effect of employing the influence of this Association in the discouragement of experiments which are not clearly legitimate on live animals.

At the Edinburgh meeting in the following year a committee appointed by Section D presented the following report, which was adopted by the General Committee :

- (i) No experiment which can be performed under the influence of an anæsthetic ought to be done without it.
- (ii) No painful experiment is justifiable for the mere purpose of illustrating a law or fact already demonstrated ; in other words, experimentation without the employment of anæsthetics is not a fitting exhibition for teaching purposes.
- (iii) Whenever, for the investigation of new truth, it is necessary to make a painful experiment, every effort should be made to ensure success, in order that the suffering inflicted may not be wasted. For this reason, no painful experiment ought to be performed by an unskilled person with insufficient instruments and assistance, or in places not suitable to the purpose, that is to say, anywhere except in physiological and pathological laboratories, under proper regulations.
- (iv) In the scientific preparation for veterinary practice, operations ought not to be performed upon living animals for the mere purpose of obtaining greater operative dexterity.

Signed : *M. A. Lawson*, Oxford. *G. M. Humphry*, Cambridge.  
*John H. Balfour*, *Arthur Gamgee*, Edinburgh.  
*William Flower*, Royal College of Surgeons, London.  
*J. Burdon Sanderson*, London.  
*George Rolleston*, Secretary, Oxford.

In 1871 a Committee of the British Medical Association reported in the same sense. Although it is now agreed that these recommendations did not go far

enough, nevertheless when we remember that they represent the first informed attempt to arbitrate between the claims of science on one hand and the rights of animals on the other, that the signatories were parties to the suit, and that Britain had only recently discarded such things as colonial slavery and the sweating of children, we must pay homage to the breadth of mind and humanity of the men of science who laid such a foundation for the subsequent developments which will now be described.

A petition calling for legislation was signed by Darwin, Huxley, Jenner, Owen, the Presidents of the Royal Colleges of Physicians and Surgeons, and other leaders of scientific thought, but on 14 April, 1875, Darwin wrote to Hooker: "We now think it advisable to go further than a mere petition." A Bill was accordingly drafted by his son-in-law, R. B. Litchfield, and entrusted to Lyon Playfair, F.R.S., afterwards Lord Playfair. The possessor of this apt patronymic was M.P. for the Universities of Edinburgh and St. Andrews, had held a Chair of Chemistry in Edinburgh, as Gladstone's Postmaster-General had introduced halfpenny postcards, had invented the incendiary shell and the gas shell, and as a Commissioner of the Great Exhibition had helped to found the Royal College of Science.

It would be unfair not to mention that attention had first been called to the subject by a lay movement organized by Miss Frances Power Cobbe, with encouragement from Queen Victoria, F.R.S., Froude, Tennyson, Carlyle, Lecky, Martineau, Lord Shaftesbury, Cardinal Manning, the Lord Chief Justice, the Lord Chief Baron, and others. The anti-vivisectionists were inspired by humane feelings that deserved respect, but the methodology of scientific research lay beyond their comprehension and they rested their case on an extraordinary claim to the effect that animal experimentation must be useless, though Miss Cobbe herself wisely protested against their doing so (*Life*, vol. 2, p. 292). Moreover they refused to discriminate between callous and humane research workers, and held all alike up to execration as monsters of cruelty. In this way they alienated sympathizers, and even Darwin, who was too humane to fish with live worms and had written to Ray Lankester (22 May, 1871) that vivisection was a subject that "made him sick with horror" and kept him awake at night, felt compelled to publish a rebuttal of the anti-vivisectionists' sweeping allegations. He wrote to Romanes (22 April, 1881): "I thought it fair to bear my share of the abuse poured in so atrocious a manner on all physiologists." Tempers were lost on both sides, and the discussion degenerated into a dogfight. In fact, the dogs have gone on barking and scuffling for three-quarters of a century with all the zest and gusto that those engaging animals do bring to that sort of employment. One result is that animal protectionists as such have no voice in implementing the legal rights that have been accorded to laboratory animals. Another is that the constructive discussion of Home Office practice, *sine ira ac studio*, cannot be carried on in public. Another is that public opinion in scientific circles, which in the eighteen-seventies befriended animals as a matter of course, has until recently been rendered allergic to any reference to the prevention of cruelty. Then animals enjoyed the open patronage of scientists as such, but subsequently they were largely deprived of it by the polemical intemperance of those who intended to act as their champions.

**The Cardwell Commission.** In May 1875 Lyon Playfair introduced his Bill in the Commons, but a week earlier a Bill promoted by anti-vivisectionists had

been introduced in the Lords. On the advice of Disraeli's government both Bills were therefore withdrawn, and a Royal Commission was appointed. The Chairman was that Viscount Cardwell who as Secretary for War had founded the Army Reserve. The other members were T. H. Huxley, P.R.S., some time Hunterian Professor at the Royal College of Surgeons, and Fullerian Professor of Physiology at the Royal Institution; Sir Eric Erichsen, F.R.S., some time Professor of Surgery at University College, London; W. E. Forster, who had been the minister responsible for the Elementary Education Act of 1870; Lord Winmarleigh, formerly Chief Secretary for Ireland; Sir J. B. Karslake, who had held office as Solicitor-General and Attorney-General; and R. H. Hutton, who had been Professor of Mathematics at Bedford College, London, and joint editor of the *National Review*, the *Economist* and the *Spectator*.

The main report of this weighty Commission was unanimous, but Mr. Hutton added a minority report to the effect that certain species which are popular in this country should be exempted from experiment. The main report stated, *inter alia* :

that the infliction of severe and protracted agony is in any case to be avoided; that the abuse of the practice (of vivisection) by inhuman or unskilful persons . . . is justly abhorrent to the moral sense of Your Majesty's subjects generally, not least so of the most distinguished physiologists and most eminent physicians and surgeons.

With reference to the infliction of any pain that was not absolutely necessary they referred to Charles Darwin's dictum that "it deserves detestation and abhorrence" and added :

This principle is accepted generally by the very highly educated men whose lives are devoted to scientific investigation and education. . . .

On the other hand, Huxley, Erichsen and their five colleagues unanimously recorded the following opinion :

Besides the cases in which inhumanity exists, we are satisfied that there are others in which carelessness and indifference prevail to an extent sufficient to form a ground for legislative interference. . . . Cases may not improbably arise in future in which the physiologist may be disposed to underrate the pain inflicted. . . .

The Commission's proposals for legislation were consistent with the British Association's report, and are embodied in the present statute with minor changes and provision for administrative machinery. The concluding paragraph of the unanimous report of the Cardwell Commission was as follows :

We believe that by such a measure as we have now proposed the progress of medical knowledge may be made compatible with the just requirements of humanity. In zeal for physiology the country of Harvey, Hunter, Bell and Darwin may well endure the test of comparison. We trust that Your Majesty's Government and the Parliament of this Kingdom will recognize the claim of the lower animals to be treated with humane consideration, and will establish the right of the community to be assured that this claim shall not be forgotten amid the triumphs of advancing science.



**The Act of 1876.** The ensuing Government Bill, which became the statute that is in force to-day, was introduced in the Lords by the Earl of Caernarvon on 15 May, 1876. In its original form it appears to have been drafted without sufficient knowledge of the way in which research is done, but it was amended in Committee of the Lords to meet the objections raised on behalf of science. In moving the second reading in the Commons on 9 August (Hansard, vol. 231) :

Mr. Assheton Cross (Home Secretary) said [col. 890] that they were endeavouring to put in practice and carry out simply the resolutions of the British Association ; and [col. 894] that the Bill, if passed, would set an example to the world that the medical and scientific men of this country had put down the infliction of unnecessary cruelty and pain under the guise of scientific enquiry.

The Bill was attacked on behalf of the anti-vivisectionists by Mr. Holt, and in defence of the reputation of the medical profession by Dr. Ward and by Robert Lowe, F.R.S. The latter, afterwards Lord Sherbrooke, was one of Bright's Adullamites, the first M.P. for the University of London, and an ardent advocate of bicycling.

Mr. Lowe (University of London) said the language of the Bill " was such as to lead to the supposition that the persons against whom it was directed were unworthy of trust and had wicked propensities." He then turned to the general law against cruelty to animals and pointed out that " the law did not say a word in favour of non-domestic animals ; so far as they were concerned, their charter of freedom and mercy had not yet begun to be written in the legislation of this country." (Later, in the Committee stage of the Bill, he was to move, without success, the addition of a clause dealing comprehensively with all forms of cruelty and imposing severe penalties on anybody who should " cruelly abuse or torture *any* animal.")

Sir John Lubbock also condemned, by contrast with " the general sentiments of English men of science, the dreadful sufferings of animals which are caught in traps, and which have so often been known in their torment to gnaw off the limb by which they were held fast." Honour having been satisfied, all parties agreed to the second reading, which took place without a division after a significant intervention by Lyon Playfair.

Mr. Lyon Playfair (Universities of Edinburgh and St. Andrews) said [col. 921] : " We propose to regulate one minute corner of the vast field of the cruelty of the world. When we do so we are bound to survey the whole field for legislation on a future occasion. . . . I know of nothing more cruel than the mode of supplying rabbits to the Billingsgate market. They are caught in traps, and struggle through the whole of the night in cruel anguish, often with broken legs. . . . Now if one of our dozen physiologists was to describe a single experiment made with such reckless disregard of animal suffering he would be scouted by his brother physiologists and driven out of the Kingdom.

" There are, however, well-grounded reasons for legislation, and these operated upon me last year when I introduced a Bill on the same subject. . . . It was in reality prepared by very eminent physiologists, among whom I may mention Mr. Darwin, Mr. Huxley, and Dr. Burdon Sanderson,