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Animals and Alternatives in Toxicology: Present Status and Future Prospects. Edited by Michael Balls, James Bridges and Jacqueline Southee. Macmillan Academic and Professional Ltd, Basingstoke, England, 1991, 390 pp., £55.

It is now over 21 years since the foundation of the Fund for the Replacement of Animals in Medical Experiments (FRAME). This book is a record of the proceedings of a conference held in London during November 1990 where the recommendations made in the Second Report of FRAME's Toxicity Committee were discussed. The terms of reference for the 19 members of the Toxicity Committee who prepared the report were, broadly, to assess progress since 1982, to discuss the development and validation of non-animal alternative methods in toxicology, to consider the need for rationalization and harmonization of regulatory guidelines with a view to reducing demands by regulatory bodies for duplicate animal tests and/or tests of dubious value, and to recommend how best to bring to the notice of scientists and others information about the availability and value of alternative test methods. A copy of the Second Report appears as a 34-page Appendix in the book.

I can do no more in this brief review than highlight a few of the conclusions and recommendations in relation to some of the main topics considered:

1 *Acute oral toxicity testing*: There is no need for an LD_{50} to be calculated with mathematical precision. However, a need for *in-vivo* testing for acute toxicity in some form remains.

2 *Non-animal methods for testing skin and eye irritancy*: The numbers of animals involved in such tests could be reduced by harmonization of regulatory guidelines, and by making better use of indications of irritancy observed in tests other than those specifically designed to test for it.

3 *Chronic toxicity testing*: There is still scope for further progress in the area of harmonization of regulatory requirements. Surprisingly, the Committee did not make an all-out attack on the principle of requiring the MTD to be used as a top dose in carcinogenicity studies, although Venitt (pp. 111–115), in the capacity of discussant, does address this issue.

4 *Genotoxicity testing*: *In-vivo* genotoxicity testing should, as far as possible, become a part of 28-d and 90-d feeding studies, thus avoiding the need for separate studies. Better bio-monitoring methods for the detection of genetic damage to somatic cells in humans exposed to test substances are needed. Toxicologists need better training in molecular biology.

5 *Neurotoxicity testing*: The development of a stepwise *in vitro* neurotoxicity test battery is proposed, but alternatives to *in vivo* neurotoxicity testing seem still to be a long way off.

6 *Immunotoxicity testing*: The complexity of the immune system cannot be precisely duplicated in a non-animal system, an *in-vitro* cell culture, or in a culture of a lymphoid cell line. However, appropriate *in-vitro* tests can serve as valuable adjuncts to *in-vivo* tests. For the prediction of allergic potential, whole-animal studies are likely to be needed for some time to come.

7 *Reproductive toxicity testing*: A review of the protocols for the preliminary sighting studies needed to determine the doses to use in definitive studies could lead to reduced animal usage. This could also be achieved by harmonizing and rationalizing regulatory requirements. However, there seems little prospect of substituting *in-vivo* by *in-vitro* testing.

8 *Toxicity data derived from man*: Some progress has been made towards collecting more reliable data from studies in humans and towards making better use of such data.

9 *Ecotoxicity*: A better understanding of mechanisms of detoxication and of toxic action in different species could lead to an improvement in testing procedures.

10 *Computer modelling*: A range of pattern recognition systems is now available as an aid to the prediction of toxicity.

This book should be required reading for bigots on both sides of the fence: i.e. both those who claim that animal tests are useless and/or unnecessary and those who preach that *in-vitro* tests can never be a substitute for *in-vivo* ones. Its contents, to which a large number of well-informed, compassionate and dedicated people have contributed, make it clear that progress has been made in many areas of toxicology towards reducing the use of animals and, more importantly, towards avoiding the potential suffering of animals and that there is still scope for further progress in both these directions. If the book has a fault, it is that it does not say loudly enough that the vast majority of animals presently used in toxicity tests are subjected to negligible suffering or no suffering at all. In the future, therefore, emphasis should be, not simply on cutting down on the total number of animals used, but much more on how the risks of suffering can further be reduced.

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