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Animal Testing in Infectiology

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6 figures, 6 in color, and 5 tables, 2001
In Remembrance of
Edward Jenner (1749–1832),

who performed animal tests in order to establish a vaccination strategy against smallpox. In 1798, the year when the first vaccination was performed, he published his scientific results in London in ‘An Inquiry into the Causes and Effects of the Variolae Vaccinae’.
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Animal testing has a long history and the resulting knowledge has brought about a significant contribution to the improvement of health and welfare of mankind and animals. Even in the First Book of Moses (1:26–1:28), advice is given to take human benefit from living creatures at the same time keeping their suffering at an absolute minimum. By today’s ethical obligations, shameless methods were applied in ancient times such as vivisection and invasive testing on fully conscious animals. Overall, the knowledge gained from tests on animals is vast and therefore we have to be cautious with general enthusiastic refusals of in vivo testing. Federal regulations concerning the carrying out of animal testing have become much stricter worldwide over the last decades, thus ensuring that only significant animal testing with a minimum of animal suffering is performed.

Animal testing covers a broad range of indications, especially in the biosciences and also including research and diagnosis of infectious diseases. Apart from fundamental in vitro studies or clinical trials, animal testing still seems indispensable for research on infectious diseases. It offers the opportunity to either study the parasitic forms of the infectious agents in a complex infection process including the assessment of specific host-defense mechanisms. Another important setting for animal test is the in vivo evaluation of substances in infection models in order to discover and develop new anti-infective agents. These tests for example focus on pharmacodynamic, pharmacokinetic as well as toxicological aspects. Further, animal testing still has some importance in the diagnosis of infectious diseases. As the insight into different pathomechanisms of infectious processes as well as specific mechanisms of action of anti-infective agents is steadily growing, many animal models are meanwhile going to be replaced by in vitro techniques. New technologies in microbiological diagnostics have also replaced the indications for the majority of animal tests in this field.
A significant improvement of animal testing has been achieved over the last few years due to new techniques; major improvements include for example better controlled breeding, new genetically targeted and transgenic animals and more distinctive readout systems such as implanted biosensors and better sophisticated scores. Further, new substance application techniques, for example by implanted minipumps, have been established. Research on infectious diseases also profits from these fundamental innovations.

The social pressure on animal testing has dramatically increased in recent decades, which in our opinion is mainly due to two major aspects: First, it became evident for the public that innumerable animal tests were being performed for which the significance of scientific benefits still remained questionable. On the other hand, a mass of polarized (mis)information has been spread by the mass media – especially on TV and shocking magazine photodocumentations on suffering animals – so that the individual did not have the opportunity to develop his or her own opinion on this topic on an objective information platform. Further, the public was (mis)informed that pets were also being kidnapped and sold for animal tests. This all formed a vicious circle between the scientific need for the performance of animal tests and the massive, often aggressive and powerful protest against every kind of animal test arising from different public and political groups.

Alternatives to the use of whole living animals provide a practical approach to minimizing animal use. The concept of the ‘three R’s’ (refinement, reduction and replacement) was first developed by Russell and Burch in 1952 and is further specified and brought up to date by FRAME, the ‘Fund for the Replacement of Animal Experiments’. Refinement aims to minimize suffering and distress of laboratory animals. Reduction may be achieved through more appropriate pre-experimental designs and biometric considerations in order to obtain the maximum information from the smallest possible number of animals. Replacement is the ultimate goal however. In vitro/in vivo correlations and the validity of in vitro testings for the corresponding question have to be taken into consideration. It must be noted that relative replacement, which still requires animals to be killed in order to obtain cells or tissues, is also a significant contribution to the reduction of suffering of laboratory animals. These factors always have to be taken into consideration in animal testing strategies, including infectious disease models.

The aim of this book is to provide a comprehensive overview concerning animal testing in the four major fields of infectiology – bacteriology, virology, mycology and parasitology. Additionally, new and innovative techniques and their efficacies will be introduced and critically discussed. A major topic is further to show ways and possibilities to refine, reduce and replace tests on animals in infectiological research, so that the reader will be able to acquire objective
information on the efficacy and limitations of animal testing in infectiology together with suggestions for valid alternatives. This book is not a laboratory handbook for the performance of animal tests but instead gives an overview of the interdisciplinarity of animal testing, ethical aspects and alternatives in research on infectious diseases. The chapters have been written by outstanding experts in the corresponding fields and we thank them all for their excellent and efficient collaboration despite their many other duties and responsibilities. The staff at S. Karger AG, Basel are gratefully acknowledged for their fruitful and professional handling of this book project.

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