Animal Models in Biomedical Research

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Introduction

The concluding 20th century. in general and the past few decades, in particular, have witnessed many revolutionary developments in the field of biomedical sciences. There has been a tremendous increase in the basic information concerning the health related areas like immune-interactions, pathophysiology and moiccularbiology. These advances have led to many important discoveries which served as a foundation for improvements in diagnostic and therapeutic practices[1-3].

Almost all the improvements in biomedicine, involved initial studies on laboratory animals as models for human beings and the fundamental biomedical research still heavily relies on their use for experimental purposes[2,4]. Fifty-four out of 76 Nobel prizes in medicine and physiology during 1901-1982, have been awarded on the basis of work involving animal studies[5].

Complementary to the advances in diverse areas of life sciences, there have been some extraordinary developments in the laboratory animal science itself[6]. In this article, we have discussed and evaluated various aspects concerning the present status and future needs ofanimal studies inbiornedical research.

Types of laboratory animals

Both vertebrates and invertebrates are used in research according to the specific requirements of the individual study. The vertebrates which are mostly used, include mice, rats. rabbits. guineapigs. dogs and monkeys. The invertebrates which arc used for experimental purposes include annelida, aschelminths, arthropoda, echinodennata, mollusca, platy helminths and protozoa. Vertebrates are usually used as the models of humans for basic research and development and toxicity studies, while invertebrates, serve the purpose of reservoirs or vectors of pathogens or for ecological and environmental investigations.

Production and availability

Availability of healthy and pathogen free animals for research. was a problem sometime back, but development of new procedures, has greatly alleviated many obstacles encountered earlier[7]. The devclopment of gnotobiotic and specific pathogen free colonies of animals, is a major breakthrough in the large scale production and availability of healthy animals[8].

Housing and care

The animal house should be specially designed, constructed and well equipped as an independent unit having all the necessary facilities. The design should provide its isolation from general public, with proper decontamination and disinfestation facilities. The animals must be provided with relevant wholesome food and water. Housing should satisfy criteria of animal room design, isolation, quarantine, environment controls including temperature, humidity, ventilation, noise and lighting[9-14].

Biosafety measures

Animal facilities must be equipped with properfacilities to deal with the biosafctv risks associated with animals themselves, their parasites and different hazardous agents under investigation. The important factors which should be taken into account, include the nature of animals, their aggressiveness and tendency to bite or scratch, their natural ecto and endoparasites, the zoonotic diseases to which they are susceptible and the possible dissemination of allergens. Infectious diseases are quite prevalent in animals, which can cause high mortality in lahoratoiy animals also. Isolation and proper maintenance of housing. regular fumigation and provision of other hygienic facilities, is essential to ensure the

safety of animals[15,16].

Ethics of animal use

Ethical aspects of animal research, are of great concern for the humanity and the researchers in particular[17,18]. Although the rapidly growing scientific opportunities need the use of animals as models of humans but at the same time threaten to greatly increase the laboratory animal sufferings. Almost all animal applications involve experiments which cause pain, distress and other forms of sufferings to animals. It is of common concensus that all the procedures/parameters which cause distress to humans, also distress the animals. Therefore, a critical approach based upon careful assessment of pain and distress in animals, is necessar and all investigators automatically become ethical ly bound to treat the animals (including anesthetizing and killing them) humanly.

Legislative protocols

Many countries have formulated protective legislations for the welfare of research animals on their own or under some regional setups which show the level of public concern. It is the moral responsibility of all the nations/governments to strictly monitor the number and species of animals to be used, procedures adopted and qualification and skill of the investigators. All animal research activities should be carried out under proper protective legislations[19].

Future scenario

The prospects of future discoveries using animals, are very bright. Use of animals, will continue to be the essential need in biomedical research. More knowledge and continued progress is expected to flourish in the areas of safety, conservation and genetics which are the major concerns of the future. Safety will continue to be the prime concern in the animal handling and care while emphasis on the ethical aspects will remain another burning issue. In addition to the original research, the appropriate training of staff appears to be the best wayoutto handle and deal with all types of laboratory animals[19]. Specific efforts are yet needed to handle infected animals. More and more, consistent research will be needed to control animal diseases and other sufferings during various experimentation. Different new' diseases are consistently emerging for which preventions are critically needed, for example, the rodents made susceptible to HIV infection, are likely to present new challenges in biocontainment[20].

There should be a serious consideration about the direct and non- invasive studies on human volunteers rather than the animal models[21]. An important advancement of molecular and cell biology which is likely to alter the trend in original biomedical research, is the utilization of isolated body organs/fluids/cells/tissues for in-vitro studies instead of the whole animal in-vivo. In similar way human body parts may also be conveniently used to a limited extent. It would provide an extra advantage to avoid problems associated with species difference and uncertaint of animal-human extrapolation. Toxicity tests including acute and chronic toxicity checks of food additives, industrial and environmental pollutants etc., is however, a special case but on the whole it is similar to other fundamental kinds of research. The introduction of non-animal procedures of various kinds in the toxicity testing too, can now pave the way to the reduction in animal procedures[22]. However, full replacement of animal tests is et to be achieved buta considerable progress is visible in this direction. Thanks to certain advancements in computer sciences, much can now be achieved through the use of computer models in the original and basic research. It is time to adopt and familiarize the in-vitro tests atleast for educational amid training purposes.

In conclusion, research and development efforts are not yet enough and additional and much more consistent attention is still needed about education, safety, conservation, genetics, reduction, refinement and replacement of laboratory animals. Future of laboratory animal science, largely depends upon the real and genuine scientific needs, the attitude of the researchers towards the use of animal models. the public awareness regarding the necessity and safety considerations and the efforts by government/public and private activities related to animal usc in research.

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