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Animal Experimental Studies: Controversies, Alternatives and Perspectives

Roxana FOLESCU¹, Egidia MIFTODE², Carmen Lăcramioara ZAMFIR³

Abstract

There is long evidence about the multiple implications of animal experimental studies- an open and complicated problem, a source of controversies and debates. In our days, the pronounced change in the attitude of the scientific community regarding the animal-based research is the result of the continuous public concern; the most appropriate reaction of the researchers was to identify techniques to replace the animal-based research with alternatives of similar scientific value, but without involving animals. The defenders of the animal experimentation sustain that we can never completely eliminate animal experimentation, as long as the human benefits are too important; the opponents of animal research promote the animal rights, sustain the irrelevance of animal models for scientific research and demand for the introducing of the non animal studies. Discerning between these options means to take into account an alternative, reducing the social impact of animal experimentation. Nowadays, an ever-increasing number of specialists argue and sustain a new strategy, based on alternative methods which replace the laboratory animals with modern competitive exploratory techniques. This option may be the source of consensus, responsibility and respect for life.

Keywords: animal-based research; public concern; benefits; alternative; consensus.

¹ University of Medicine and Pharmacy “Victor Babeș” Department of Anatomy, 2 Eftimie Murgu Square, 300041, Timisoara, ROMANIA. E-mail: roxanafolescu@yahoo.com

² University of Medicine and Pharmacy “Gr.T.Popa”, Department of Infectious Diseases, 16 University Street, 700015 Iasi, ROMANIA. E-mail : emiftode@yahoo.co.uk (correspondent author).

³ University of Medicine and Pharmacy “Gr.T.Popa”, Department of Histology, 16 University Street, 700015, Iasi, ROMANIA. E-mail: zamfircia@yahoo.com

Introduction

There is a longstanding scientific consolidated opinion holding that animal experimentation is of direct relevance to humans. Worldwide, millions of animals are used every year in experimental studies. The estimated evaluation is impressive, thinking this is only a part from a huge overall number across the time. The animals were used in biomedical experimentation for human and veterinary medicine, dentistry and fundamental sciences, for production and quality control of products for the same domains, in toxicology, immunology, oncology, pharmacology, virology and genetics. Animal experimentation seemed to be for a long time the unique available way to decipher the structure and the mechanisms through which every organ performs its functions. We can appreciate the existence of a very significant connection between the widely and focused animal studies and the advance of clinical medicine; nowadays, laboratory animals are already considered as an effective component of the research process, but the implications of this fact raise pertinent controversies, sociological debates and are highly disputed.

The relevance of animal experimentation

The reflection of animal experimental studies in human pathology and physiology has to be reconsidered from social perspectives. Despite their incontestable value, more than ever it is necessary to carefully debate the analysis of benefits versus harm in experimental models (Balls, 2003; Baumans, 2004). A simple review of the extremely numerous domains involving animal experimentation highlights its particular availability to facilitate the investigation of medical conditions affecting humans. The advances in human and animal medicine are intimately related to high standard animal studies. If initially animals were used for anatomic and physiologic correlations, in time the studies increased, became invasive, justifying successive direct clinical observations (Benatar, 2000). The informations provided by animal use in research, teaching or testing were indispensable to the substantial expansion of some of the most important medical discoveries, realized by means of exploration and experiments (Birke, 2012). Life-changing therapies: vaccines, organ transplants, cancer therapy, diseases as diabetes cancer arthritis, HIV, post traumatic epilepsy, nervous system repair, amyotrophic lateral sclerosis (ALA), asthma and many other diseases were decoded and integrated in the current medical practice using animal models. With a long history across the time in the medical research, the animal experimentation was considered of great significance especially for the basic sciences, but also for the clinical approach. Different types of experiments, regarding the main functions of the human body were elaborated, analysed and correlated with the existing data, carrying out an

extensive work to continuously improve the scientific knowledge (Dirnagl & Lauritzen, 2011). In these terms, animal experimentation has to be considered useful only if the results can be applied to humans. The field of debate is very large: we can easily argue that the great amount of information provided by these studies led to major advances in biomedical sciences and health benefits for people, animals and society (Fabre, 2009). Distinct experiments and procedures are also designed to provide treatments and proper medications for a large number of diseases. When confronted with unsolved problems from biomedical and behavioral research, the scientists have the option of animal experimental studies (Festing & Wilkinson, 2007). With a proper management of the animal experimental studies, the results will be as suggestive as the main objective of the study demands.

Biomedical research prefers to use laboratory animals because a great number of animal reactions and their metabolic pathways are reproducible in humans. When the necessity of using a living organism is indubitable, such experiments are essential in the fundamental research, which underpins the whole extensive medical data. Cats, dogs, hamsters, mice, rabbits, birds or primates represent a viable alternative which can be used when a natural cycle is required; the similarity to humans of DNA for some species -primates especially, but also mice, is also a strong argument, together with the possibility of exploring the animals during their whole life, because of their shorter lifetime than humans (Franco, 2013). At first glance, there is still a lot of information obtained from the animal-based research which can not be extrapolated to humans with plentiful accuracy. Inaccurate or misleading conclusions that can be not reliable or reproducible in humans, events that are not predicted in animal tests are legitimate facts that determine the skepticism toward animal experimentation (Gershoff, 2009). There are numerous opinions sustaining that animals are not useful predictors of human diseases, claiming these experiments wasteful and unproductive. Predictability of human effects remains a major problem of this area of medical research- the classical example of the use of thalidomide cautions against significant differences at different levels between humans and laboratory animals. This approach seems to generate one from numerous controversies involving the animal use in medical research (Greenwood et al., 2008).

The development of a new science, Laboratory Animal Science, is the starting point in sustaining efficient coordinates of animal-based research. Inter-species variability is undeniable, but there are possibilities of attenuating this non-concordance, because the scientists take into account new methods to improve the performance of animal experimental studies. An example is the use of transgenic animals- recombinant DNA technology promotes the production of a foreign gene, deliberately inserted into the host genome to mirror human physiology more closely. The animals genetically manipulated are used for disease models which reproduce the human pathology with a relatively high reliability. The results

can significantly reduce the errors caused by species differences (Gruber & Hartung, 2004). To determine different causes of the human diseases, we have to induce specific conditions in laboratory animals, the process itself being not a very certain way to reflect the nature of the conditions that determine the human pathology (Hobson-West, 2012). Drug safety revealed by the animal experimentation recommends caution regarding human extrapolation of the toxicity data. The discrepancies in the results are a consequence of different metabolic pathways between different species. The special purpose of these experiments should be to exclude the nonfunctional or the harmful drugs for the use of humans. The uncertainty resulting from the lack of concordance in toxicological studies is one of the limits of animal studies.

Attitudes and alternatives of animal experimentation

A responsible attitude has to examine and to take into account the benefits of performing experimental animal models – a quasi permanent subject of actual debate, since the scientific world is divided in two: a part claims for completely relevance of medical concepts derived from animal experiments and another part claims for the irrelevance of these results. A new, modern strategy of research is necessary to converge both opinions (Greenwood et al., 2008). An ever-increasing number of specialists from biomedical field intend to adopt a system of alternative methods. This is a result of an unceasing effort to determine the recognition and the complex significance of these methods in replacing animal experimentation with something else, without involving of animals (Gruber & Hartung, 2004). We are speaking not only about the development of an efficient scientific programme, which select the most appropriate techniques, but also about a change in our attitude- as scientists and as humans. So long as there are considerable options for animal experimentation, there is hope for an accurate solution for animal experimentation (Hobson-West, 2013). With a high level of reliability and a high accuracy in extrapolation to human pathology, alternative methods include non invasive imaging techniques, computer models and simulations, cell- tissue cultures, statistical modeling, large scale epidemiology, or studies on human volunteers. These methods are diversified, are complex but there is much evidence supporting their performance (Holmberg & Ideland, 2002). Sometimes, the alternative methods are not accepted just because of too much inertia and conservatism - lesser or greater depending on the receptivity to a new trend in scientific research. The modern research demands more elaborated models and the alternative methods have the potential to integrate them in a complex circuit of direct relevance to humans (Holmberg, 2008).

All the proposed alternatives, according to their specific validation, provide consistent and significant information and their implementation has to be a

promptly one (Holmes et al., 2010). Non invasive imaging is based on creating images of the different regions of the body for clinical studies. The use of computer models is fully integrated in the explosive development of technology of recent years and assures the simulation of numerous distinctive pathologic structure - function relationships. The cell and tissue cultures offer the possibility of investigating cellular behaviors in a specific environment while epidemiological studies represent useful tool in identifying risk factors and collecting data about disease and health in human population. A major challenge for the proponents of these alternative methods is to argue their validity compared with that of the animal-based research which has to be replaced (Ideland, 2009).

Perspectives, sociological impact

Scientific knowledge is increasing in time, together with a pronounced sensibility towards animals, reflecting the social changes. Today, we observe a decline of public support for animal experimentation, even many improvements have been done to animal research. Different procedures and experiments were controlled by a complex and restrictive legislation and a competitive science; Laboratory Animal Science promotes firm measures to ensure the welfare of animals (Kaufman, 1994). We assist to a pronounced change in the opinion of the scientific community regarding animal experimentation, while the debate over the justification of animal experimentation is confronted with a growing public concern of the condition experienced by research animals, and the involvement of animal ethics committees has a great visibility (Koeter, 2002). As a response to this controversial problem, a whole programme of alternatives was promoted to replace the laboratory animal models. Determining whether animal testing has or not to be continued represents a difficult choice; there are many factors coming into play, arguments and counter arguments- all of them have to be evaluated, to handle the final correct decision (Lilienblum et al., 2002). If the scientists will take into account the human benefits no matter how much laboratory animals will have to pay, perhaps they legitimate the reactions of animal defenders (Miller, 2009). In front of the growing criticism for animal experimentation, a reaction perceived as a sign of implementation of a new attitude towards animals was attributed to the zoologist William Russel and the microbiologist Rex Burch in 1959, in their book ‘The principles of Humane Animal Experimentation Techniques ‘. They are the promoters of the concept of the 3Rs for animal research: Replacement, Reduction and Refinement represent a code of protocols serving to attenuate the impact of animal based-research. Their theories spread all over the world and have many supporters among researchers from biomedical domains (Mody, 2005). Replacement sustains the use of the alternative methods instead of animal models, based on modern technology (tissue culture, tissue slices, perfused

organs, cellular/sub-cellular fractions) and also encourages the use of non vertebrate species instead of high order animals. A much simpler system will ensure the same conditions but will reduce the artefacts. Reduction sustains a substantially decrease in the number of animals used in different experiments (neither too few, nor too many), by improving experimental procedures and data analysis, without affecting the scientific and the statistic validity of the research; it is also required a general projection of a competitive statistic assessment, consistent with the aim of the experiment, in order to provide a correct estimation of the animals needed for research (Olsson et al, 2003).

Refinement intends to improve living conditions and medical care for laboratory animals, to minimize their pain and suffering using analgesics, anesthetics or tranquilizers, to reduce procedures affecting the well-being of the animal, to reduce invasive procedures wherever possible. The implementation of the 3Rs depends upon the scientists' availability to implement these principles, because they have the moral duty to perform their experiments to high standards for both scientific progress and animal welfare. These principles sustain most animal - based research policy and practice. The social perception seems to be favorable to the idea of a strong correlation between a productive research, pointing its goals and the welfare of the animals (Pawlick, 1998; Piersma, 2006). A great number of medical schools from the whole world eliminated animal-based research from their educational programs, implementing instead different alternative non animal methods. This effort of integrating in a positive educational trend is a result of the social impact of animal experimentation and a first step in the 3Rs implementation, as a future projection of science.

The legal frame for improving laboratory animals' condition follows an ascendant line, with multiple implications, because the long lasting critical attitude against animal experimentation was powerful enough to change not only procedures but also attitudes. The initial scientific detachment was changed into a real concern regarding alternatives for animal research, as long as the main demand refers to a coherent strategy based on a new point of view (Pious, 1996). Progresses in the 3Rs acknowledgement were reflected in the increasing number of researchers who sustain these principles and advance a well defined strategy, as a promising perspective. The rise of moral consideration for experimenting animals, together with a new approach of animal-based research, becomes more and more significant, not only among the philosophers, but also for medical researchers. The biomedical science was faced to completely different problem-animal rights movements; scientists have to be responsible for their research, avoiding the animal exploitation in an inaccurate designed project (Pound et al., 2004). It becomes pertinent the observation that there are numerous situations when an alternative method allows a better understanding of a pathologic mechanism than an experimental study. The real progress in developing new techniques to ensure and improve the welfare of animals is intimately followed by a complex

process of creating more suitable alternatives, as a start for attending the present demand of consensus (Rusche, 2003; Wilk & Grune-Wolff, 1990).

Conclusions

Public concern regarding animal models is today correlated with the new attitude of the scientific research, as new suggestions regarding the use of the alternative methods are coming forward to sustain it. A modern perspective on experimental studies was already created, so, in years to come we have to decide if the animal experimentation should be continued or not. Embracing the concept of alternatives in biological and medical research means to adhere to actual demand of respect and care for life.

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