THE ETHICAL DILEMMA OF ANIMAL TESTING IN MODERN SCIENCE

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Annotation: Animals are integral part of people's lives as they significantly help us protect our environment. However, in modern times, animal testing has been of the most controversial topics across the world. It is clear that by using animal experiments people can achieve great results in science and medicine. However, although such tests bring several advantages, it does not always work effectively. There is no doubt that animals and human beings have several similarities, while there are also certain differencies in immune system and genetics. Consequently, although animal testing may be advantageous, it also might be harmful to some extend.

Keywords: Animal testing, animal experimentation, bioethics, ethical issues, animal welfare, laboratory animals, medical research, biomedical science, drug development, scientific validity, reliability, human trials, alternatives to animal testing, artificial intelligence, organ-on-a-chip, innovation, biotechnology, cruelty-free research, regulation.

Аннотация: Животные являются неотъемлемой частью жизни человека, поскольку они значительно помогают нам защищать окружающую среду. Однако в современном мире тестирование на животных является одной из самых спорных тем во всём мире. Очевидно, что с помощью экспериментов на животных люди могут достигать значительных результатов в науке и медицине. Тем не менее, хотя такие испытания имеют ряд преимуществ, они не всегда являются эффективными. Без сомнения, животные и люди имеют определённые сходства, однако существуют также различия в иммунной системе и генетике. Следовательно, несмотря на то что тестирование на животных может быть полезным, оно также может приносить вред в определённой степени.

Ключевые слова: Тестирование на животных, эксперименты на животных, биоэтика, этические проблемы, защита животных, лабораторные животные, медицинские исследования, биомедицинская наука, разработка лекарств, научная достоверность, надёжность, испытания на людях, альтернативы тестированию на животных, искусственный интеллект, орган-на-чипе, инновации, биотехнологии, исследования без жестокости, регулирование.

Annotatsiya: Hayvonlar inson hayotining ajralmas qismidir, chunki ular atrof-muhitni himoya qilishda katta yordam beradi. Biroq zamonaviy davrda hayvonlarda tajriba o‘tkazish butun dunyo bo‘yicha eng bahsli mavzulardan biridir. Ma’lumki, hayvonlar ustida tajribalar o‘tkazish orqali fan va tibbiyotda katta natijalarga erishish mumkin. Shunga qaramay, bunday sinovlar bir qator afzalliklarga ega bo‘lsa-da, ular har doim ham samarali bo‘lavermaydi. Shubhasiz, hayvonlar va insonlar o‘rtasida ba’zi o‘xshashliklar mavjud, ammo immun tizimi va genetika jihatidan farqlar ham bor. Demak, hayvonlarda tajriba o‘tkazish foydali bo‘lishi mumkin bo‘lsa-da, u ma’lum darajada zararli ham bo‘lishi mumkin.

Kalit sõzlar: Hayvonlarda tajriba o‘tkazish, hayvonlar ustida eksperimentlar, bioetika, axloqiy muammolar, hayvonlarni himoya qilish, laboratoriya hayvonlari, tibbiy tadqiqotlar,

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biotibbiyot, dori ishlab chiqish, ilmiy ishonchlilik, aniqlik, inson ustida sinovlar, hayvonlarga alternativ usullar, sun’iy intellekt, “organ-on-a-chip”, innovatsiya, biotexnologiya, shafqatsiz tadqiqotlar, tartibga solish.

Animal testing can offer many benefits to scientific and medical research. For many years, it has been used by scientists to develop vaccines, test new drugs, and improve surgical techniques. For example, animals are commonly used to cosmetics despite some negative impacts in modern days . Many of the medical breakthroughs that people’s lives can only be saved by using this approach. However, although such contributions happen, the practice has become increasingly controversial in recent years. The rising awareness of animal rights, combined with rapid technological progress, has led many people to question whether animal testing is still important. Critics believe that it is unethical to cause suffering to animals for human benefit, especially when alternative methods, namely computer simulations or testing on human cells are becoming available. Following scientific research, many people began to oppose animal testing. This article therefore seeks to critically examine whether animal testing should be prohibited, focusing on its moral issues, scientific limitations, and emerging alternative methods. The ethical aspect remains one of the most compelling reasons for opposing it. Each year, a large number of animals, namely mice, rabbits, dogs, and primates—are used in various laboratory experiments. These animals suffer; for example, chimpanzees are widely used in experiments, but not all trials show positive results. From a moral perspective, many people believe that animals are sentient and capable being of easily distressed. Therefore, it is clear that using them for individuals' benefit can increase moral issues. It can be argued that causing harm to animals is unjustifiable, particularly when the experiments are not essential or when alternatives exist. In addition, public attitudes towards animal welfare have changed significantly over time. Nowadays, a vast majority of people support stricter regulations and demand that animals be treated with care and respect. This shift in societal values further strengthens the argument against animal testing.

Another important argument is that animal testing cannot be successful all time. For example, evidents show that 99% animal testing failed and found harmful. Although animals and human beings have certain similarities in some organs, there are also several differences in genetics, metabolism, and immune system responses. Consequently, such differences can affect how treatments and drugs work in each species, which limits the accuracy of results obtained from animal tests. According to Encyclopaedia Britannica, a large proportion of treatments that show promising results in animals do not show positive results in humans. This means that not all drugs that work effectively in animals produce the same results in human beings and may even be dangerous. As a result, it can be time-consuming and require a great deal of money. It can also negatively affect the governments' funding. When researchers depend too heavily on traditional animal models, they may be less likely to invest in or adopt more advanced and human-based methods. Modern technologies, such as computer simulations and testing on human cells, often provide more accurate and relevant results. Therefore, minimizing dependence on animal testing could push innovation and enhance the overall effectiveness of scientific research.

Moreover, the continued dependence on animal testing may slow down scientific innovation and limit the development of more advanced research methods. When scientists rely heavily on traditional experimental models, there is a risk that they may become less motivated to explore innovative and human-relevant technologies. As a result, scientific progress may be slower, less efficient, and less focused on human-specific outcomes. In contrast, modern science increasingly emphasizes precision, efficiency, and ethical

responsibility, which require new approaches beyond animal experimentation. One of the most significant developments in contemporary biomedical science is the rapid emergence of alternatives to animal testing. Advances in biotechnology, computational science, and bioengineering have made it possible to conduct research using human cells, tissues, and advanced digital models. According to Encyclopaedia Britannica, methods such as in vitro testing, organoid cultures, and computer-based simulations are increasingly recognized as valuable tools because they can produce results that are often more directly relevant to human biology than traditional animal experiments. For instance, organ-on-a-chip technology allows researchers to recreate the structure and function of human organs on micro-engineered devices. These systems can mimic real physiological processes such as blood flow, respiration, and drug absorption, providing highly accurate and controlled experimental data. Similarly, artificial intelligence and machine learning systems are now widely used to analyze large-scale biological data and predict how different substances will interact with the human body. These technologies significantly improve both the speed and accuracy of scientific research. In addition, the European Commission has strongly supported the transition toward alternative testing methods as part of its long-term strategy for scientific innovation and ethical research. Through its research and innovation programs, the Commission promotes the development, validation, and implementation of non-animal testing methods across the European Union. This includes funding projects that focus on replacing animal models with advanced technologies such as 3D tissue models, computer simulations, and organ-on-a-chip systems. The European Commission also emphasizes that reducing animal use is not only an ethical responsibility but also a scientific opportunity to improve the quality and relevance of research outcomes. Furthermore, international scientific frameworks such as the “3Rs principle” (Replacement, Reduction, and Refinement), widely supported by Encyclopaedia Britannica and global research institutions, provide an important ethical foundation for modern biomedical science. This principle encourages researchers to completely replace animals with alternative methods whenever possible, reduce the number of animals used in experiments, and refine experimental procedures to minimize pain, suffering, and distress. Over time, this approach has become a central guideline in many countries’ scientific and regulatory systems. Despite the strong progress in alternative technologies, it is important to recognize that a complete and immediate ban on animal testing may not yet be realistic.Some fields of biomedical research, particularly those dealing with complex systems like the immune system, brain functions, and interactions between multiple organs, still depend on whole living organisms to produce reliable results. However, even in these areas, there is an increasing movement toward using alternative methods either alongside or instead of animal models whenever feasible.

In conclusion, the future of biomedical research is slowly moving away from animal testing. This change is happening because of new technology, ethical concerns, and better rules that support safer and more humane research methods. Today, many governments and organizations are trying to find alternatives to animal experiments. The European Union and other institutions support new methods such as 3D tissue models, organ-on-a-chip systems, and computer simulations. These methods help reduce animal use and improve scientific results. In addition, more people now care about animal welfare, so scientists and policymakers are trying to use more responsible methods. The “3Rs principle” (Replacement, Reduction, and Refinement) is also widely used in research. According to NC3Rs, animal use in research should follow the 3Rs principles: replacement, reduction, and refinement, ensuring minimal harm and promoting alternative methods. In the future, animal testing will

likely be minimized, and more modern technologies will be used. This will make science more ethical and bring greater achievements.

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