

Replacing Animal Models In Science by Non-Animal Alternatives In Africa: Future Direction After Covid-19 Pandemic

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Dear Editor,

Toward December 2019, a group of victims was bedded at the health care centers with a preliminary diagnosis of pneumonia whose cause was mysterious. The pathogenesis of the disease, which was later named by WHO on February 11, 2020, as Coronavirus disease (COVID-19) was traced to the seafood and wet animal wholesale market in Wuhan, China (1). However, no distinct animal groups were discovered but other countries became the victim of COVID-19 via importation as high volume of air traffic and trade betwixt China and Africa (1-3).

The causative agent (coronavirus) of the above-mentioned disease belongs to a family of viruses that causes different symptoms such as fever, pneumonia, lung infection as well as

difficulty in breathing and these viruses are mostly found in animals globally thereby creating phobia for the utilization of animals for research purpose (2).

The genesis of COVID-19 has been regarded to be zoonotic because a greater number of early patients have exposure to the wet animal market in Wuhan City where live animals are usually offered for sale (1). Two species of snake was preliminarily identified as carriers of the coronavirus though the infection can spread to the humans' substantial reports confirmed mammals and birds (1).

The genesis of the Human Immunodeficiency Virus (HIV) and Ebola Virus is also regarded to be zoonotic while HIV occurred from the cross-species transfer of simian immunodeficiency

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virus from chimpanzees discovered in Eastern and Central Africa to humans (3). Evidence from genomic sequence analysis of the COVID-19 disclosed 88% similarities with two bat-derived Severe Acute Respiratory Syndromes (SARS)-like coronaviruses thereby showing that mammals are the major connection between COVID-19 and humans which is indicative of a future pandemic.¹ In addition, the natural hosts of the Ebola virus are bats (3).

For some decades now, mammalian models have the fundamental for research and development as they serve as a prototype for human predictions to derive mechanistic, potency & toxicological guidance in agreement with the Nuremberg Code formulated in 1947 due to the trepidation of World War II (4, 5). As stated by this code, animal experiments must antecede human studies, and the outcomes derived must either give reasons for the need for or rule out succeeding clinical experimentation. This code constituted a legalized/licit structure to give a justification for the all-inclusive utilization of animals in scientific research (5). However, mammalian models have attributes of being costly, arduous and sometimes may not give results that can be extrapolated into the human living conditions (4). Regarding being costly, it was appraised globally that approximately \$14 billion were used yearly on in-vivo research demanding the utilization of greater than 115 million laboratory animals as reported by Taylor et al. 2005 study conducted in 2008 and these values remain constant till 2018 (5).

The evolution of alternative techniques to the usage of mammals has been enhanced by anticipations of transposes/switches in the scientific frameworks and the 3Rs principal Reduction, Replacement, and Refinement) (4).

The abstraction/postulation of replacing, reducing, or refining animal employ in research and experimentation was foremost reported/expressed above sixty years ago. Replacing is defined as a method that interchanges surrogate/proxy conventional animal models with non-animal models which for example makes use of less developed animal species (substituting a mouse with a worm) (6).

Ethical and social quandary/dilemma is one of the switches in the present days which has confined the usage of sacrificed mammals in science (4). In 2003, the 7th modification to the European Union's Cosmetics Directive (76/768/EEC) projected and work towards the complete termination of animal testing in the EU for cosmetic products by 2009 notwithstanding the vacancy of alternative models as at then (4). This has prompted a cooperative effort of the scientific society in Europe which also spans the world to evolve and authenticate substitute procedures thereby preventing the use of animals when possible (4).

Most countries globally are integrating the 3Rs principle into their constitutions and regulations regarding the use of animals. Specifically, countries in the European zone have better novel programs modulating or prohibiting the usage of animals in testing(4). The UK's National Center for the Replacement, Refinement, and Reduction of animals in research was also established on these principles (3Rs) to produce novel scientific norms and enhance ethical techniques on Laboratory animals thereby encouraging and employing the use of in vivo model of lesser degree on invertebrate, nematode, or immature kinds of vertebrates (6).

Compared to mammals, three conventional biomedical models including *Drosophila melanogaster* (fruit fly), the zebrafish (*Danto*

erio) and the nematode worm (*Caenorhabditis elegans*) have been gaining geometric recognition in microbiome research which is an elementary appendage of the outstanding use of the above-mentioned models to examine the basic animal procedures of development, neurobiology and immune function (7).

Furthermore, 3 traditional models mentioned above predominantly evolved as genetic models which helps to investigate evolution, neurobiology and behavior, and genetic disorders, as well as cancer (7). These models also enhance the conduct of economical and self-sustaining research during a short time, assist composite experimental blueprints and provide alternative routes imperative to animal welfare challenges instigated by researchers on the use of mammals (7). Other alternatives are the hydra and squid which assist the research on the interplay between bacteria and animal epithelia that are better obtainable than the gut epithelium. For instance, research in regeneration and morphogenesis has already espoused hydra as a research model (7).

Conclusion

Following the impact of COVID on every sector of life including the world of science, there is a need for prolific technical knowledge and ample training on the use of non-animal models and their materialization which will also help in further curtailing the spread of the virus. Education, training, and propagation of information on the three Rs to researchers, industries, academia, the scientific community, and regulatory agencies are advocated.

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