International Journal of
Animal Biotechnology and Applications

ISSN: 2455-7315
Volume 8, Issue 1, 2022
DOI (Journal): 10.37628/IJABA

http://biotech.journalspub.info/?journal=JABA&page=index

Review IJABA

Using of Rat Model Over Other Species: A Review

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Abstract

The first domesticated morphological features to be used in studies were rats. Scientists employed the brown rat Rattus norvegicus to study human biology and therapeutics two decades ago, focusing on the consequences of hunger and oxygen deprivation. Rats have been used to answer a wide range of basic science problems relevant to common human ailments in the fields of pharmacology, immunology, physiology, nutrition, behaviour, learning, and toxicity. The article gives an overview just on investigation and addresses the advantages and disadvantages of using rat studies.

Keywords: Models, rats, research, scientists, disease, human

INTRODUCTION

Rat models for illness research and experimentation have become more significant in recent years, according to research professionals all around the world. Several other species were used to research cancer and organ development, including fruit flies, Saccharomyces cerevisiae and zebrafish, recombination, and large-scale mutations, the rat model allows researchers to get insights into human disease that other species cannot. The similarity of their genetic makeup to human DNA is one of the key reasons why animals like mice or rats are chosen as models for genetic experiments. In rats, researchers have been able to study a variety of physiological and pathophysiological mechanisms thanks to their DNA and physiology, which would not be conceivable in a mouse model.

In a multitude of biological areas, the research lab rat has long become the primary model. Large numbers of inbred strains have been isolated, displaying a wide spectrum of characteristics and serving as models for human features and illnesses. Rat genome sequencing and genetics have come a long way in the previous few decades. The availability of these tools has sparked a slew of studies aimed at using positional identification to find causal illness genes. Various rat genes underlying monogenic or complex diseases have now been identified, and in many instances, such observations have been interpreted to living beings, actually results in the identification of novel disease pathogenesis susceptibility genes, assisting in the research of pathophysiological abnormalities, and recommending novel therapeutic targets. Reverse genetics techniques have also been invented. Several genome-editing technologies have been developed to induce specific mutations in genes whose function can be clarified in this way knockout mutations, for example. Furthermore, even when the illness-causing human gene was discovered without the use of a rat model, mutant rat strains, particularly KO strains were developed to study gene function and disease pathogenesis. Over 350 rat genes have been discovered as underlying diseases or as playing a vital part in crucial biological processes that are disrupted in diseases, resulting in a large number of disease models.

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Received Date: May 07, 2022
Accepted Date: May 27, 2022
Published Date: June 10, 2022

Citation: Nidhi Aggarwal. Using of Rat Model Over Other Species: A Review. International Journal of Animal Biotechnology and Applications. 2022; 8(1): 17–20p.

REVIEW OF LITERATURE

The laboratory rat (Rattus norvegicus) is larger than a mouse, as previously stated. For a long time, the mouse has been the preferred mammalian genetic model, with an initial concentration on monogenic features. Although there have been isolated rat models of monogenic features and illnesses, the rat has fundamentally been a significant model for complex trait research in domains such as cardiovascular, physiology and diabetes research, pharmacology, arthritis, cancer, neurosciences and toxicology [1–6]. In numerous circumstances, the rat seems to become a more appropriate or true model representation. For example, the physiological of such a rat is well documented, thanks to its larger body size, which allows for serial blood sampling, which is nearly impossible in the mouse; in cardiovascular research [7], sophisticated surgical manipulations, and physiological measurements such as blood pressure measurements by telemetry are easier to perform and more reliable in rats than mice [1,3–5]. The rat has long been a popular model for pharmacology and toxicology research because it has a similar toxin elimination system to humans [8]. It really is important to note both rat and human squamous cell carcinoma possess similar growth and histological properties in terms of disease research. Additionally, For both production and development, rat mammary malignancies are extremely hormonal based, mirroring human breast tumours; and no viruses seems to be implicated in rat and human mammary carcinogenesis, unlike mouse mammary carcinogenesis, which has the mouse mammary virus as its etiological agent [9–13]. The rat mammary tumour model, according to Russo, is well-suited for researching both in situ and metastatic cancers. The tumour classification is consistent with human pathology criteria and provides an adequate model for comprehending various stages of human disease" [11]. Moreover, human breast cancer highly susceptible epigenetic areas intersect substantially with rat breast cancer sensitivity regions of the genome, as well as the research lab rat would then continue to be a key model organism for studying biologically predetermined processes of mammary cancer susceptibility which may immediately translate to human sensitivity, according to the study [13]. Rats have significant anatomical and behavioural advantages over mice in neuroscience research because they are more sociable and skilled, with complex cognitive abilities; this wider range of social behaviours and a richer acoustic communication system rat models provide advantages over mouse models for studying neurodevelopmental disorders, including autism [14,15]. The rat thus produces exceptionally trustworthy models of human features or diseases (these publications contain several details underlining the significance of rat models) [16,17].

Several techniques have to be created in order to elevate the rat to the rank of a valuable genetic model, with the goal of identifying the genes underlying complex phenotypes using forward genetic approaches and analysing the associated biological pathways. This goal has been accomplished. A number of sites have been created to provide researchers with access to phenotypic, genetic, genomic, and disease-related data, as well as the software applications they need to conduct their study. Genetic and chromosome maps have been developed; the genomic sequence of dozens of rat strains has been established and several resources have been created to provide investigators with access to genetic, genomic, phenotype, and disease-relevant data as well as software tools required for their research have been established. Positional discovery of multiple rat genes underlying monogenic or complicated illnesses, as well as related features, has become possible thanks to these resources. Reverse genetic tools, on the other hand, have been developed. The isolation of many mutants, including knockout (KO) strains and references therein, was made possible via sperm N-ethyl-N-nitrosourea (ENU) mutagenesis followed by gene-targeted screening approaches [19].

Rats Have Merits In Human Disease Research

Because of their physiological resemblance to humans, rats are an excellent choice for many experiments. Rats are also more practical for many scientists and they are easier to introduce and lower in size than some other complex mammals like primates [7,11,17]. The Sequenced the Brown Norway rat in 2004 and discovered that almost all disease-linked human genes have rat analogues. Additionally, because to advances in gene mapping and genetic manipulation, now it is possible to

accurately manipulate the rat genome to make knockouts and knockins, allowing us to get a deeper understanding of human disease by creating powerful customised CRISPR rat modeling. Scientists can now employ rats in their study more frequently because to gene editing tools. Better rat modeling were effective in minimizing production costs and increase supply chain efficiency by significantly reducing rejection in clinical studies, which currently stands at over 90%. As a consequence of the genetic analysis, new therapeutic treatment sites will be uncovered [5,9,19].

Disadvantages of Not Using a Rat Model for Certain Types of Studies

Rats are often not the greatest model to use when studying disorders involving neoplasms, blood, and immunological function. However, they're more commonly used in the research of cardiovascular and metabolic illnesses, and also the start of cognitive, intestinal, and behavioural health disorders. Investigators in these domains are typically advised to start their studies with rat models, not only they are an appropriate model, but also because rats have already assisted scientists in making a few key breakthroughs [15]. The difficulty in gathering correct data, comparing data from prior studies that employed rat models, as well as drawing firm conclusions Using a new animal model for such themes in the future could have similar drawbacks [11].

DISCUSSION AND CONCLUSION

There are Various Reason for Choosing Rats

When compared to mice, their larger size makes it easier to handle, sample, and perform procedures. As a consequence of the massive amount of data, have a better comprehension of the solutions accumulated from a physiological aspect, rats have more years and routes than some other species. Some findings imply that the rat more closely resembles human physiology than other animals, and that it can better simulate human sickness in many circumstances. Mice, that according psychology sciences, are perfectly fitted to intelligence and cognition As they're more capable of grasping activities than for other animals, rats are better candidates for research. The ability of rats to learn, remember, and interact offers them an advantage over other animals, allowing researchers to gain insight into the fundamental principles of learning and behaviour, which can subsequently be applied to human behaviour and learning. It was now not difficult to manipulate its rat genomes to construct specific genomic knockdowns and knockins, along with linking the findings to our understanding of basic genetic illnesses.

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