Results and Implications for Human Disease Using Swine as a Biomedical Animal Model for T-cell Research

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Abstract

Swine is one of the most biologically important large animal models in biomedical research. Swine also provide an attractive choice both for 3R principle and One Biomedical research because of their employment as a domestic animal that can be used as a free cell/organ source for research and their high vulnerability to human diseases. The pig model's arguably limited immunological toolkit has previously been one of its most restricting characteristics. This toolkit has dramatically improved in the previous decade, such as the ability to analyse swine T-cells. The swine paradigm for scientific research is summarised in this article, with an emphasis on T lymphocytes. It compares the pig model towards the more often used mouse and nonhuman monkey models before outlining the existing capabilities for characterising and expanding our knowledge of porcine T cells. Following that, it not only considers prior biomedical T-cell research, but also expands into areas where further in-depth T-cell studies could be extremely beneficial to biomedical research. While the former should provide information on swine biomedical T-cell research results, the latter should encourage swine T-cell researchers to collaborate with researchers in other fields such as nourishment, allergy, cancer, organ transplants, infectious illnesses, or vaccine development.

Keywords

Biomedical Research, T-cells, Immunological

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Citation: Samuel V (2022). Results and Implications for Human Disease Using Swine as a Biomedical Animal Model for T-cell Research. EJBI. 18(5):44-45.

DOI: 10.24105/ejbi.2022.18.5.44-45

Received: 02-May-2022, Manuscript No. ejbi-22-64688;
Editor assigned: 03-May-2022, Pre QC No. ejbi-22-64688(PQ);
Reviewed: 17-May-2022, QC No. ejbi-22-64688;
Revised: 20-May-2022, Manuscript No. ejbi-22-64688(R);
Published: 27-May-2022

1. Introduction

„Monkeys exaggerate while mice lie.“ Vaccine researcher David Weiner is credited with this quote. While this comment may exaggerate Prof. Weiner‘s attitude toward nonhuman primates, it does highlight an important task in biomedical research: choosing the correct animal model. At least four fundamental characteristics must be met by such a model: The animal model must be accessible and economical; the disease being studied must be inducible in the animal; the condition and its treatment effects must be detectable; and the results must be applicable to the species of interest, which is a primarily human [1].

Although the mice and NHP model are the most frequently acknowledged animal models, they are on opposing sides of a „animal model spectrum“ in almost every one of these four requirements. On the one hand, mice are inexpensive and easy to obtain; they also have a large biological toolbox; nonetheless, they differ significantly from humans. Aside from their obvious disparities in size and lifespan, they also have significant variances in metabolism, physiology, and immunology: This is demonstrated by changes in transcription factor binding sites; also, Mestas and Hughes described distinctions in mouse and human immunology [2].

NHPs, on the other hand, are similar to humans, are sensitive to numerous human infections, and possess a sufficient toolkit; yet, NHP research is connected with rising expenses and complex ethical concerns. The considerable disparities between such two animal models, particularly their disadvantages, have undoubtedly contributed to the low rate of transfer from animal studies to clinical research: In cancer research, for example, only a small percentage of animal model studies lead to clinical trials. This lack of translation highlights the importance of selecting the most appropriate mouse model for biomedical research, as well as supports the search for alternative, perhaps more suitable animal models [3].

Swine have a number of characteristics that allow them to fill the gap among mouse and NHP simulations. As a biomedical animal study, swine offer three distinct advantages: Pigs are subject to human diseases and the normal host to various related and even zoonotic pathogenic organisms such as influenza. Pigs are also used as a food animal model, providing virtually unlimited access to scientific animals and unrestricted tissue for immunological

studies, reducing the need to surrender animals for research [4].

In comparison to mice, the pig immune system is more human-like. As a result, according to Dawson, „pigs represent an intermediary species for testing concepts and principles identified in transgenic mice that may have relevance to humans, particularly in the modelling of immune responses." Furthermore, „The immunology of the pig skin and its relevance as a model for human skin" summarises physiological similarities between porcine and human skin. Finally, when compared to the treated mice, the porcine immunological and physiological in immune-relevant tissues are more similar, allowing for more interpretation to the pig model and thus supporting the use of swine as a medical animal study for immunological studies, including T-cell research [5].

2. Conclusion

Finally, the swine model provides an outstanding animal model with recently developed technologies: It has a lot in common with people; it can promote One Health research and eliminate and refine ritual slaughter in biomedical research; and it can do cutting-edge immune response assessments. Furthermore, there is extensive knowledge in a wide range of biological research domains, including immunological production, cancer, allergy, infectious illnesses, and vaccine creation. There is a lot of knowledge on the involvement of T cells in many of these research domains, but there is little to none in others. As a result, swine T-cell scientists can work in whatever area of biomedicine they want, as long as they have strong connections with experts in those fields.

3. References

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