

Immune-Intact Models: A Key to Effective Therapies for Immune-Mediated Diseases

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Commentary

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DESCRIPTION

The treatment landscape for immune-mediated diseases, which encompass a wide range of conditions including autoimmune disorders, inflammatory diseases, and certain cancers, has witnessed remarkable advancements in recent years. Central to these breakthroughs is the utilization of immune competent or "immune-intact" animal models in biomedical research. These models, characterized by their functional immune systems, have proven to be indispensable tools in unravelling the complexities of immune-mediated diseases and in the development of therapies that precisely target and modulate the immune response. In this article, we explore the pivotal role of immune-intact models in advancing our understanding of immune-mediated diseases and driving the development of effective treatments.

Role of immune-intact models

Reflecting human physiology: One of the fundamental reasons immune-intact models are instrumental is their ability to replicate the intricate interactions between the immune system and disease processes in a manner that closely mirrors human physiology. Unlike immune deficient models that lack key components of the immune system, immune-intact models offer a more holistic view of how immune responses contribute to disease initiation and progression.

Advancing autoimmune disease research: Autoimmune diseases, such as rheumatoid arthritis, lupus, and multiple sclerosis, are characterized by an immune system that mistakenly attacks the body's own tissues. Immune-intact models allow researchers to explore the underlying mechanisms driving autoimmunity and test potential therapies that can re-establish immune tolerance, thereby providing hope for millions of patients worldwide.

Illuminating inflammatory conditions: Inflammatory diseases, including Crohn's disease and psoriasis, often involve dysregulated immune responses. Immune-intact models enable scientists to investigate the complex interplay between inflammatory pathways, immune cells, and target tissues, offering critical insights for developing novel anti-inflammatory drugs and interventions.

Shaping cancer immunotherapy: The field of cancer immunotherapy has been revolutionized by the use of immune-intact models. These models have played a pivotal role in testing and refining therapies like checkpoint inhibitors, CAR-T cell therapy, and cancer vaccines. By mimicking the dynamic interaction between tumors and the immune system, researchers can identify strategies to enhance anti-tumor immune responses.

Applications and impact

Drug development: Immune-intact models serve as the backbone of preclinical drug development for immune-mediated diseases. They provide a platform for evaluating the efficacy and safety of potential treatments, ensuring that only the most promising candidates progress to clinical trials.

Biomarker discovery: These models aid in the discovery of biomarkers that can predict disease progression and response to therapy. By identifying biomarkers associated with specific immune-mediated diseases, researchers can develop targeted diagnostic tests and personalized treatment approaches.

Therapeutic strategies: Insights gained from immune-intact models have led to the development of innovative therapeutic strategies. For example, in autoimmune diseases, researchers are exploring immune modulation therapies that can recalibrate the immune system to restore balance.

Precision medicine: The concept of precision medicine, in which treatment regimens are customized for specific patients, is supported by the use of immune-intact models. By understanding the nuances of the immune response in different individuals, personalized treatment strategies are becoming a reality.

While immune-intact models have revolutionized immune-mediated disease research, challenges remain. The complexity of the immune system and variations among species and individuals necessitate ongoing refinement of these models. Additionally, ethical considerations and the 3Rs (Replacement, Reduction, Refinement) principle require researchers to minimize the use of animals whenever possible, driving the development of alternative *in vitro* and computational models.

Immune-intact models have emerged as indispensable tools in our quest to combat immune-mediated diseases. Their ability to closely replicate human immune responses has accelerated our understanding of disease mechanisms and paved the way for the development of targeted therapies. As science continues to advance and ethical considerations are upheld, these models will remain key catalysts in the journey towards more effective treatments and improved outcomes for patients grappling with immune-mediated diseases.