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EDITED AND REVIEWED BY
Andres M. Perez,
University of Minnesota Twin Cities,
United States

*CORRESPONDENCE
Debbie J. Guest
✉ djguest@rvc.ac.uk
Scott J. Roberts
✉ sjroberts@rvc.ac.uk

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Editorial: Insights in veterinary regenerative medicine: 2023

Debbie J. Guest^{1*} and Scott J. Roberts^{2*}

¹Department of Clinical Science and Services, Royal Veterinary College, Hatfield, United Kingdom,

²Department of Comparative Biomedical Sciences, The Royal Veterinary College, London, United Kingdom

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Editorial on the Research Topic

Insights in veterinary regenerative medicine: 2023

The veterinary regenerative medicine field continues to grow as demand for new treatments for chronic and degenerative conditions increases. In this Research Topic we aimed to gather new insights, novel developments, latest discoveries, and recent advances in the field. In addition, we sought to identify Research Topics on the current challenges and future perspectives that could move the field forward.

Although there is a large body of *in vitro* work that is being performed in the field of regenerative medicine, the articles submitted to this Research Topic all performed *in vivo* studies. [Faydaver et al.](#) used mouse models; the other three studies all used large animals, with [Iacopetti et al.](#) and [Peláez-Gorrea et al.](#) utilizing sheep and [Andersen et al.](#) using horses. This likely reflects the advantages of using large animal models to aid clinical translation (1). However, large animal studies are expensive and therefore often involve small numbers. This limitation was highlighted by the authors who acknowledged their small sample sizes and/or the need to induce injury in multiple limbs. The use of laboratory mice enables much higher numbers of animals to be used due to both cost and space factors, but determining the effects of a therapy on tissue regeneration over time can still require very large animal numbers to enable collection of the tissue at multiple time points. [Faydaver et al.](#) tried to address this issue by predicting the recovery of tendon structure after injury in mice by utilizing high-resolution spatiotemporal data on activity patterns obtained through continuous, non-invasive home-cage monitoring. The development of such techniques could significantly refine pre-clinical studies into regenerative therapies and lead to reductions in animal numbers.

The studies in this Research Topic investigated injury and healing of skin ([Iacopetti et al.](#)), cartilage ([Peláez-Gorrea et al.](#); [Andersen et al.](#)), and tendons ([Faydaver et al.](#)). Veterinary stem cell clinical trials have been most commonly performed for musculoskeletal disorders (2), reflecting the economic and welfare burden of these conditions in veterinary species. All of the models in this Research Topic used experimentally induced, rather than naturally occurring, injuries. This reduces variability in the model, but as [Andersen et al.](#) described, it is difficult to ascertain how well such models mimic spontaneous disease/injury.

Three of the studies were testing biological products: Iacopetti et al. used either autologous platelet-rich plasma (PRP) or autologous PRP plus allogeneic mesenchymal stromal cells (MSCs) in their model of skin healing; Peláez-Gorrea et al. used autologous chondral platelet-rich plasma matrix in cartilage repair; and Andersen et al. used allogeneic MSCs selected for the marker integrin $\alpha 10$ to determine their effect on microRNA expression in an osteoarthritis model. The debate on the safety and efficacy, particularly following repeat administration, on the use of allogeneic MSCs continues (3). However, the clinical application of both allogeneic (4) and xenogenic MSCs (5) is rapidly expanding. PRP remains a popular biological therapeutic in companion animals due to its relatively low expense and ease of preparation. However, there remains considerable variability in methods of preparation, and systematic reviews in human applications have produced mixed results (6, 7). The studies submitted to this Research Topic would suggest that research into PRP and allogeneic cells is going to continue amid a rising demand for cost-effective, off-the-shelf products.

The studies submitted to this Research Topic measured outputs ranging from microRNA analysis (Andersen et al.) and histology and gene expression (Iacopetti et al.) to activity (Faydaver et al.) and clinical evaluation (Iacopetti et al.; Peláez-Gorrea et al.). This demonstrates the complexity of determining successful tissue regeneration. Furthermore, it also highlights that current high-resolution analysis techniques used in human research, such as special transcriptomics and epigenome profiling, are not yet commonplace in veterinary regenerative medicine research. It is our hope that this is due to technical challenges and not limited funding for veterinary studies.

In summary, although this was a brief Research Topic, the collection of studies has highlighted ongoing research in biological products, the use of experimentally induced animal models, and possible refinements that could be made for future studies.

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