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Cell Biology of Regenerative Medicine

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Cell Biology of Regenerative Medicine

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Stem cell research has the potential to substantially improve medical care. The prospective clinical use of adult mesenchymal stem cells holds enormous promise for improved treatment of a large number of diseases in humans and companion animals. Although the use of bone-marrow-derived mesenchymal stem cells appears to be a popular therapy; the therapy suffers from the donor-to-donor variation in the quality and quantity of harvested cells. This observation has been reported in humans, mice, dogs, and recently from our laboratory in horses. One critical biological factor that researchers and clinicians must take into account is this variability and how it may affect the clinical outcome in regenerative therapy. The focus of research in the Laboratory of Regenerative Medicine at the College of Veterinary Medicine is to understand this variation in large animals. Our research is focused on the study of equine mesenchymal stem cell biology prior to its use in the clinic. We have optimized *in vitro* molecular and cellular assays to isolate, characterize, and differentiate horse and goat adult mesenchymal stem cells; we can generate *ex vivo* and *in vivo* models of specific diseases; wounds, cartilage and tendon lesions, cortical and orthotropic bone defects to test their biological function in regeneration. Additionally, we are collaborating with the Nanotechnology Center (Arkansas) and a couple of private companies to assess the behavior of adult mesenchymal stem cells towards novel biomaterials or scaffolds generated for the treatment of musculoskeletal injuries. The goal of this three-step process is to improve clinical outcomes as well as increase our basic knowledge of stem cell function. With the progress made in the last 4 years, we are the only research laboratory in Tennessee to provide and use off-the-shelf equine allogenic mesenchymal stem cell stocks for immediate administration into clinical cases.