“Cell” Your Hurt Horse: Stem Cell Therapy in the Equine Industry

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It was the first day of the National Reining Horse Association Derby (NRHA) at the Oklahoma State Fairgrounds, and I was beyond excited. Although the horses and riders came from as far away as Europe and South America, the horse I wanted to see actually lived less than two miles away from my house. The owner and breeder of the horse, Sherm Lauder, is a retired agricultural education instructor who started breeding sound minded, quality reining horses as his second career. Getting to see his horse, Huggy Bear, at the show solidified my passion for horses and planted the dream of owning a reiner someday. However, about a month after the NRHA Derby, I learned Huggy Bear had bowed, or injured, a tendon, and possibly wouldn’t ever compete again. However, there was one way Huggy Bear could return to excelling at reining. Interestingly enough, the solution to Huggy Bear’s injury already existed in his body: the stem cell.

According to the National Institutes of Health (2016), a stem cell is an unspecialized cell with the ability to divide for an indefinite amount of time and “can give rise to specialized cells.” Stem cells can divide for several months to a few years, depending on the stem cell type. The stem cell is an unspecialized cell, meaning it doesn’t have any tissue-specific structures that help it do a certain job (2016). For example, a stem cell can’t function as a red blood cell because it lacks hemoglobin, a chemical in red blood cells that allows them to transport oxygen. Stem cells can, however, complete a process called differentiation in which the cell goes through several steps to become specialized. Internal and external factors affect what type of cell the stem cell will become (Pizzute, Lynch, & Pei, 2015). An internal factor is the stem cell’s DNA that codes for a specific cell type. External factors include chemicals secreted by surrounding cells or certain chemicals in the cell’s environment (NIH, 2016).

Although the use of stem cell therapy in people is increasing, the practice is still uncommon in the United States (J. M. Huser III, personal communication, April 6, 2017). However, stem cell therapy is readily available in the equine industry. Mesenchymal stem cells, or MSCs, are used for the therapy. MSCs help form bone, cartilage, tendon, muscle, skin, and adipose tissue, or fat (R&D Systems, 2017). Equine veterinarians collect the MSCs from three sources: umbilical cord tissue, adipose tissue, or bone marrow. Umbilical cord derived MSCs are used less than adipose and bone marrow derived MSCs. They can be safely collected from a foal without negative effects for the foal. Adipose derived MSCs are harvested from the fat on the horse’s hindquarters (Caudill, 2006). Bone marrow derived MSCs are collected from the horse’s sternum (Markoski, 2016).

Currently, the primary use of stem cells in the equine industry is as a regenerative medicine to treat joints, ligaments, and tendons (Broeckx et al., 2014; Smith, Werling, Dakin, Alam, Goodship, & Dudhia, 2013). To find out about the most current stem cell research, I interviewed Dr. David Frisbie, a professor at Colorado State University who has completed recent research on stem cells. I asked Dr. Frisbie how bone marrow derived MSCs compare to adipose derived MSCs when it comes to forming musculoskeletal tissue. He explained that the adipose derived MSCs are more concentrated in the original sample and divide faster in the lab (D. Frisbie, personal communication, January 13, 2017). However, he stressed that in his trials with the cells, the bone marrow derived MSCs differentiate into stronger musculoskeletal tissue, which makes them better in the long-term healing program (2017). Dr. Brent Hague (personal communication, January 13, 2017), a veterinarian who has also carried out clinical research over stem cells explained, “The main advantage of using regenerative therapies is to augment healing to produce repaired tissue that closely mimics the normal tissue function. Many times, the tissue

heals with an inferior scar that limits function. Stem cells can help restore function and more normal architecture to healed tissue.”

In a recent trial on the efficacy of bone marrow derived MSCs in healing musculoskeletal injuries in horses, the stem cells drastically improved the number of horses who not only become sound, but also competed at their previous workload. The multi-center trial included Oakridge Equine Hospital, Washington State University, Texas A&M, and Colorado State University. The injuries included torn menisci, subchondral bone cysts, and cartilage damage or loss. Sixty-seven percent of the horses became sound and returned to their previous workload in their discipline. All of the horses had a poor prognosis prior to the stem cell therapy, so the researchers agreed that the stem cell therapy yielded positive results (Equine Orthopaedic Research Center, 2012).

As researchers study stem cells, they strive to answer several questions. One of these questions involves autologous and allogeneic stem cells. Autologous stem cells are cells harvested from and injected back into the same horse. Allogeneic stem cells are harvested from one horse and injected into another (Pascoe, 2012). While there isn’t a great deal of research available in this area, here’s what experts do know: using allogeneic stem cells can be more convenient, as the cells can be harvested, cultured, and kept in a cell bank; thus, they can be pulled out whenever someone needed a treatment. Autologous cells aren’t as readily available, as the cells take time to be cultured before they can be injected back into the horse. However, when researchers compare the two cell types, there’s a better response to the autologous cells than to the allogeneic cells (D. Frisbie, personal communication, January 13, 2017). The allogenic cells still form quality tissue; however, the tissue formed by autologous cells is simply superior.

All of the ongoing stem cell research has clarified some other important aspects of stem cells, especially the process the stem cell goes through when forming tissue. Dr. Frisbie

(personal communication, January 13, 2017) explained, “When stem cells first started being used, people said that the stem cells regenerated the tissue…in the last few years we’ve realized that the stem cells only constitute a small part of the new tissue, less than ten percent of it and usually one to three percent. We’re realizing the ability of those stem cells to direct other cells. That’s how we’re viewing the stem cells now, which is a bit of a paradigm shift in the last decade.”

Thankfully, Sherm Lauder decided to try stem cell therapy on Huggy Bear. Much to his surprise, Huggy Bear returned to his reining career and still actively competes in the sport today. Horses just like Huggy Bear are returning to the same level of competition they were at before their injury because of stem cells. For such a new field, stem cells have already shown impressive results with the work scientists have done with them. Just think what researchers will be able to do with them once they better understand the mechanisms behind this small yet powerful cell.

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