



FOCUS 1

Promote the Repair and Optimal Health of Neuro-Musculoskeletal Tissues

- a. Orthobiologic therapies
- b. Pharmacologics
- c. Surgical techniques
- d. Physiotherapy, rehabilitation, and conditioning

Publications and Presentations

Textbook Chapters

Dow S, Pezzanite L, Chow L. Immunotherapy options for managing chronic infectious diseases. *Small Animal CVT*. In press.

Haussler K. Functional anatomy and biomechanics of the axial skeleton. *Essential Facts of Equine Physical Therapy, Rehabilitation and Sports Medicine*. In press.

Haussler K. Chiropractic. *Essential Facts of Equine Physical Therapy, Rehabilitation and Sports Medicine*. In press.

King M. Aquatic therapy. *Essential Facts of Equine Physical Therapy, Rehabilitation and Sports Medicine*. VBS GmbH.

King M, Clayton H. Active therapeutic exercises. *Essential Facts of Equine Physical Therapy, Rehabilitation and Sports Medicine*. In press.

King M. Proprioceptive exercises. *Essential Facts of Equine Physical Therapy, Rehabilitation and Sports Medicine*. In press.

Pezzanite L, Chow L, Dow S, Goodrich L, Schnabel L, Gilbertie J. Antimicrobial properties of equine platelets and stem cells and future horizons. *Veterinary Clinics of North America: Equine Practice*. 39: 565-578.

Pezzanite L, Hendrickson D. Wound healing. *Auer and Stick Equine Surgery*, 6th edition. In press.

Pezzanite L, Hendrickson D. Management of wound healing. *Auer and Stick Equine Surgery*, 6th edition. In press.

Spriet M, Vaughan B, Barrett M, Galuppo L. Advances in regional vascular injection techniques for the delivery of stem cells to musculoskeletal injury sites. *Veterinary Clinics: Equine Practice*. 39: 503-514.

Refereed Publications

Afzali M, Pannone S, Martinez R, Campbell M, Sanford J, Pezzanite L, Kurihara J, Johnson V, Dow S, Santangelo K. Intravenous injection of adipose-derived mesenchymal stromal cells benefits gait and inflammation in a spontaneous osteoarthritis model. *Journal of Orthopedic Research* 2023 April; 41(4):902-912. PMID: 36030381.

Alexander K, Simon E, Mama K, Rao S, Bass L. Intrathecal mepivacaine after general anesthesia is an effective method of equine euthanasia when compared to intravenous pentobarbital. *American Journal of Veterinary Research* 2023 March; 84(5). PMID: 36921025.

Barton C, Samol M, Nelson B, Piquini G, Smanik L, Goodrich L. Subchondral bone sequestrum formation in the proximal intra-articular and osteochondral region of the third metatarsal bone of an Appaloosa mare treated for septic arthritis. *Journal of American Veterinary Medicine Association* 2023 November; 1-4. PMID: 37948847.

Cooper B, DeMoya C, Sikes K, Frisbie D, Phillips N, Nelson B, McIlwraith CW, Kawcak C, Goodrich L, Snyder B, Grinstaff M. A polymer network architecture provides superior cushioning and lubrication of soft tissue compared to a linear architecture. *Biomaterial Science* 2023 November; 11(22):7339-7345. PMID: 37847186.

Johnson J, Gadomski B, Labus K, Stewart H, Nelson B, Seim H 3rd, Regan D, von Stade D, Kelly C, Horne P, Gall K, Easley J. Novel 3D printed lattice structure titanium cages evaluated in an ovine model of interbody fusion. *Journal of Orthopedic Research Spine* 2023 June; 6(3):e1268. PMID: 37780834.

Johnson S, Frisbie D, Griffenhagen G, King M. Equine blood flow restriction training: Safety validation. *Equine Veterinary Journal* 2023 September; 55(5):872-883. Epub January. PMID: 36516310.

Johnson S, Richards R, Frisbie D, Esselman A, McClure S. Equine shock wave therapy – where are we now? *Equine Veterinary Journal* 2023 July; 55(4):593-606. PMID: 36210719.

Joseph G, Duerr F, Zhou T, Elam L. Use of a novel shockwave trade results in better patient acceptance in awake canine patients treated for musculoskeletal disease. *Frontiers Veterinary Science* 2023 August; 10:1249592. PMID: 37621864.

Kim A, Duerr F, Phillips J, Samulski R, Grieger J, Goodrich L. Serotype-specific transduction of canine joint tissue explants and cultured monolayers by self-complementary adeno-associated viral vectors. *Gene Therapy* 2023 April; 30(3-4):398-404. PMID: 36261499.

O'Brien T, Hollinshead F, Goodrich L. Extracellular vesicles in the treatment and prevention of osteoarthritis: can horses help us translate this therapy to humans? *Extracell Vesicles and Circulating Nucleic Acids* 2023 June; 4(2):151-169. Epub April. PMID: 37829144.

Panizzi L, Dittmer K, Vignes M, Doucet J, Gedye K, Waterland M, Rogers C, Sano H, McIlwraith CW, Riley C. Plasma and Synovial Fluid Cell-Free DNA Concentrations Following Induction of Osteoarthritis in Horses. *Animals (Basel)* 2023 March; 13(6):1053. PMID: 36978592.

Pezzanite L, Timkovich A, Sikes K, Chow L, Hendrickson D, Becker J, Webster A, Santangelo K, Dow S. Erythrocyte removal from bone marrow aspirate concentrate improves efficacy as intra-articular cellular therapy in a rodent osteoarthritis model. *Annals of Translational Medicine* 2023 June; 11(9):311. Epub May. PMID: 37404993.

Pezzanite L, Griffenhagen G, Bass L, Okudaira M, Larson B, Hendrickson D. Liposomal bupivacaine is both safe and effective when administered via local infiltration at surgical site and mesovarium for laparoscopic ovariectomy in mares. *Equine Veterinary Journal* 2023 September; 55(5):755-764. Epub January. PMID: 36572902.

Rockow M, Griffenhagen G, Landolt G, Hendrickson D, Pezzanite L. Current Antimicrobial Use in Horses Undergoing Exploratory Celiotomy: A Survey of Board-Certified Equine Specialists. *Animals (Basel)* 2023 April; 13(9):1433. PMID: 37174470.

Smanik L, Selberg K, Mason G, Brock M, Stewart H, Goodrich L, Kawcak C. Evaluation of a modified subchondroplasty technique in an equine full-thickness cartilage defect model: a pilot study. *American Journal of Veterinary Research* 2023 February; 84(4). PMID: 36812091.

Stewart K, Brodin E, Gadomski B, Nelson B, Easley J. Mechanical comparison of application of locking intramedullary nail to locking compression plate in the ovine metatarsus. *Annals of Translational Medicine* 2023 March; 11(5):191. Epub February. PMID: 37007576.

Thampi P, Seabaugh K, Pezzanite L, Chu C, Phillips J, Grieger J, McIlwraith CW, Samulski R, Goodrich L. A pilot study to determine the optimal dose of scAAVIL-1ra in a large animal model of post-traumatic osteoarthritis. *Gene Therapy* 2023 September. PMID: 37696981

Thampi P, Samulski R, Grieger J, Phillips JN, McIlwraith CW, Goodrich L. Gene therapy approaches for equine osteoarthritis. *Frontiers Veterinary Science* 2023 January; 9:1117776. PMID: 36686173.

Thampi P, Seabaugh K, Pezzanite L, Chu C, Phillips J, Grieger J, McIlwraith CW, Samulski R, Goodrich L. A pilot study to determine the optimal dose of scAAVIL-1ra in a large animal model of post-traumatic osteoarthritis. *Gene Therapy* 2023 December; 30(12):792-800. Epub September. PMID: 37696981.

Yocom A, Contino E, Kawcak C. Review of the Mechanism of Action and Use of Bisphosphonates in Horses. *Journal of Equine Veterinary Science* 2023 August; 127:104503. Epub April. PMID: 37120118.

Research Abstracts, Presentations, Proceedings

Ammons D, Chow L, Larson B, Goodrich L, Dow S, Pezzanite L. Transcriptomic response in osteoarthritis using single-cell RNA sequencing approaches in an equine model. University of Colorado 5th Annual Orthopedic Research Symposium & D'Ambrosia Diversity Lectureship. Denver, CO. Poster.

Boxleitner T, Pezzanite L, Thampi P, Dow S, Chow L, Goodrich L, Johnstone B. Immunomodulatory effects of articular chondroprogenitor cells. AAVMC Veterinary Scholars Symposium. Puerto Rico. Poster.

Boxleitner T, Pezzanite L, Thampi P, Dow S, Chow L, Goodrich L, Johnstone B. Immunomodulatory effects of articular chondroprogenitor cells. University of Colorado 5th Annual Orthopedic Research Symposium & D'Ambrosia Diversity Lectureship. Denver, CO. Poster.

Colla S, Johnson J, McGilvray K, Zanotto G, Seabaugh K. Biomechanical Assessment of the Collateral Ligament of the Distal Interphalangeal Joint of the Horse following Alterations to the Palmar Angle. American College of Veterinary Sports Medicine and Rehabilitation Annual Conference, Charleston, SC.

Goodrich L. a. Fetlock Internal Fixation and Distal Interphalangeal Joints Laboratory; b. Carpal Slab Fracture, Internal Fixation, and Carpal Sheath Wet Laboratory; c. Navicular Bursoscopy. Colorado State University, Continuing Education Advanced Short Course. Fort Collins, CO.

Goodrich L. a. Arthroscopic Surgery of the Carpus Laboratory; b. Arthroscopic Surgery of the Tarsocrural Joint Laboratory; c. Arthroscopic Surgery of the Fetlock Joint Laboratory; d. Proximal Hind Limb– Stifle and Hock Wet Laboratory; e. Distal Limb Wet Laboratory; f. Basic Arthroscopic Techniques and Diagnostic Arthroscopy. Colorado State University, Continuing Education Short Course. Fort Collins, CO.

Goodrich L. a. Postoperative Management of Osteochondral Repair; b. Subchondral Bone Cyst Management; c. SBC Screw Placement Laboratory; d. Third Carpal Bone Laboratory; e. PSB Fracture Repair Laboratory; f. MC Condylar Fracture Repair Laboratory. Colorado State University, AO North America Advanced Course. Fort Collins, CO.

Goodrich L. a. Management of Orthopedic Infection; b. Surgical Approach and Plate Application of Simple Olecranon Fractures, AO North America Principles in Equine Fracture Course. Columbus, OH.

Haussler K. a. Biomechanical effects of HVLA thrusts: Literature review; b. Neurological effects of HVLA thrusts: Literature review; c. Practical training– Manipulation vs. Mobilization vs. Activator; d. Equine chiropractic research: Literature review; e. Treatment of neck pain and dysfunction. The Art & Science of Spinal Manipulation Therapy for The Advanced Practitioner, Applied Biomechanics and Rehabilitation Academy (ABnR), Lüsche, Germany.

Haussler K. Athletic conditioning: From A to Z in less than 30 seconds. Healing Oasis Wellness Center's Annual Conference. National University of Health Sciences, Lombard, IL.

Haussler K. Cervical articular process morphology: Clinical effects in horses. First Annual Conference of the American College of Veterinary Sports Medicine and Rehabilitation, Charleston, SC.

Kim L, Kreitner K, Scott D, Seabaugh K, Duncan C, Magzamen S. BREATHE: Understanding the relationship between air pollution and horse racing performance in California. COHA CCTSI, Washington, D.C. Poster.

King M. EMF, PEMF, Bio-electromagnetic energy regulation: Does it work? American College of Veterinary Sports Medicine and Rehabilitation Symposium. Charlotte, NC.

King M. Rehabilitation Approaches for Equine Stifle Dysfunction. The International Society of Equine Locomotion. Glendale, AZ.

King M. a. Equine Aquatic Therapy – Scientific review and clinical applications; b. Equine Axial Skeleton Dysfunction and Rehabilitation. Centaur Biomechanics. Virtual Lecture.

King M. Scientific Review of PEMF Therapies. Online Pet Health. Virtual Lecture.

Larson B, Ammons D, Chow L, Goodrich L, Dow S, Pezzanite L. Synovial transcriptomic response in osteoarthritis progression determined by single cell sequencing in an equine model. CSU CVMBS Day, Fort Collins, CO. Poster.

Luque R, Koch T, Goodrich LR, Giraldo A, Valverde A, Zur Linden A, Beehler Marfisi J, Koenig J. Mesenchymal stromal cells for the treatment of surgically induced equine fetlock osteoarthritis. ECVS. Krakow, Poland.

Luque R, Koch T, Goodrich LR, Giraldo A, Valverde A, Zur Linden A, Beehler Marfisi J, Koenig J. Mesenchymal stromal cells for the treatment of surgically induced equine fetlock osteoarthritis. American College Veterinary Sports Medicine and Rehabilitation Symposium. Charleston, NC.

Marshall-Gibson M, Durham M, Seabaugh K, Moorman V, Ferris D. Survey of equine veterinarians regarding primary equine back pain in the United States. American College of Veterinary Sports Medicine and Rehabilitation Annual Conference, Charleston, SC.
Maldonado M, Parkinson S, Story, M, Haussler K. Chiropractic treatment of lameness and concurrent axial skeleton pain and dysfunction in horses. International Conference on Equine Locomotion 9 (ICEL9), Utrecht, The Netherlands. Comparative Exercise Physiology; 19 (Suppl 1): S35.

Montoya T, Buntun B, D'Amato M, Graham K, Williams S, Ward T, Bisazza K, Easley J, Sikes K. Design and Implementation of A Static Weight Bearing Device For Use In Ovine (Sheep) Preclinical Studies. Rocky Mountain Bioengineering Symposium. Fort Collins, CO. [Mentee Award: Second Place, Oral Presentation]

Moorman V, Piquini G, Bass L, Pezzanite L. Initiation of training on lameness and hoof morphology and symmetry in two and three-year-old Quarter Horses. ACVMSR Symposium, Charleston, SC. Poster.

Nelson B. Arthroscopy & Arthroscopic Assisted Fracture Repair. American College of Veterinary Surgeons Large Animal Residents Workshop Webinar Orthopedics. Virtual.

Nelson B. Pedicle screw and rod fixation as a technique for ventral cervical stabilization in horses. Equine Spine Initiative, Lexington, KY.

Nelson B. Navicular Bursoscopy: A Review and Current Evidence. American College of Veterinary Surgeons Surgical Summit. Louisville, KY.

Nout-Lomas Y. Management of seizures. Panel. IVECCS, Aurora CO.

Patel A, Piquini G, Chow L, Impastato R, Hendrickson D, Dow S, Pezzanite L. Transcriptomic responses in horses with progressive osteoarthritis. AAVMC Veterinary Scholars Symposium. Puerto Rico. Poster.

Patterson H, Yocom A, Seabaugh K, Kawcak C and Contino E. The effect of various perineural analgesia techniques of interleukin-1b-induced synovitis of the equine metacarpophalangeal joint. Proceedings 69th Annual Convention American Association of Equine Practitioners.

Patterson H, Yocom A, Seabaugh K, Kawcak C and Contino E. The effect of various perineural analgesia techniques of interleukin-1b-induced synovitis of the equine metacarpophalangeal joint. Poster: 1st annual ACVMSR Symposium.

Pezzanite L, Chow L, Griffenhagen G, Bass L, Goodrich L, Impastato R, Dow A. Distinct differences in immunological properties of equine orthobiologics revealed by functional and transcriptomic analysis using an activated macrophage readout system. ACVMSR Symposium, Charleston, SC. Poster.

Pezzanite L. Joint therapies: Updates on mesenchymal stromal cells and extracellular vesicles. American College of Veterinary Surgeons (ACVS), Louisville, KY.

Pezzanite L, Chow L, Griffenhagen G, Bass L, Goodrich L, Impastato R, Dow S. Functional differences in orthobiologics. American College of Veterinary Surgeons (ACVS), Louisville, KY.

Pezzanite L, Hendrickson D. Updates on wound care – biofilms and wound dressings. Northeast Association of Equine Practitioners (NAEP), Saratoga, NY.

Pezzanite L, Schnabel L. Updates on orthobiologic therapies in equine practice. Northeast Association of Equine Practitioners (NAEP), Saratoga, NY.

Plaisance C, Chow L, Engiles J, Goodrich L, Dow S, Pezzanite L. Transcriptomic response of equine synovial tissues following immune conditioned cellular therapy to treat septic arthritis. Annual Biomedical Research Conference for Minoritized Scientists (ABRCMS), Phoenix, AZ. Poster.

Pezzanite L. Navicular bursoscopy: indications and outcomes. Northeast Association of Equine Practitioners (NAEP), Saratoga, NY.

Pezzanite L, Dow S. Updates on intra-articular antibiotic and local anaesthetic use in equine practice. Northeast Association of Equine Practitioners (NAEP), Saratoga, NY.

Pezzanite L, Ammons D, Chow L, Goodrich L, Dow S. Transcriptomic response to osteoarthritis. American College of Veterinary Surgeons (ACVS), Louisville, KY. Poster.

Pezzanite L, Timkovich A, Sikes KJ, Chow L, Hendrickson D, Becker J, Webster M, Santangelo K, Dow S. Erythrocyte removal from bone marrow aspirate concentrate improves efficacy as intra-articular cellular therapy in a rodent osteoarthritis model. Orthopedic Research Society, Dallas, TX. Poster.

Pezzanite L, Chow L, Phillips J, Griffenhagen G, Moore AR, Schær T, Engiles J, Werpy N, Gilbertie J, Schnabel L, Antczak D, Miller D, Dow S, Goodrich L. TLR-activated mesenchymal stromal cell therapy and antibiotics to treat multi-drug resistant Staphylococcal septic arthritis in an equine model. University of Colorado 5th Annual Orthopedic Research Symposium & D'Ambrosia Diversity Lectureship. Denver, CO. Poster.

Rockow M, Chow L, Impastato R, Webster A, Hendrickson D, Santangelo K, Dow S, Pezzanite L. Immune activated MSC for treatment of osteoarthritis in mouse models. AAVMC Veterinary Scholars Symposium. Puerto Rico. Poster.

Rockow M, Chow L, Impastato R, Hendrickson D, Santangelo K, Dow S, Pezzanite L. Immune activated cellular therapy for treatment of osteoarthritis. University of Colorado 5th Annual Orthopedic Research Symposium & D'Ambrosia Diversity Lectureship. Denver, CO. Poster.

Rockow M, Chow L, Impastato R, Webster M, Hendrickson D, Santangelo K, Dow S, Pezzanite L. TLR-3 priming of mesenchymal stromal cells (MSC) improved cellular treatment of osteoarthritis in a murine model. CSU CVMBS Day, Fort Collins, CO. Poster.

Schnabel L, Pezzanite L. Antimicrobial properties of equine stromal cells and platelets. American College of Veterinary Surgeons (ACVS), Louisville, KY.

Silliman B, Montoya T, Batson S, Winston S, Pezzanite L, McGilvray K, Easley J, Sikes K. Development of a surgical model for rotator cuff tendon degeneration in the rat. AAVMC Veterinary Scholars Symposium. Puerto Rico. Poster.

Smanik L, Selberg K, Kawcak C, Stewart H, Goodrich L. Computed tomography and fluoroscopy versus radiographic guidance for internal fixation of simulated dorsomedial-plantarolateral central tarsal bone fractures in non-racehorses. Veterinary Orthopaedic Society Conference. Big Sky, Montana.

Story M. Medical and surgical treatments for cervical pain and dysfunction. American College of Veterinary Surgeons. Lexington, KY.

Thampi P, Seabaugh K, Pezzanite L, Phillips J, Grieger J, McIlwraith CW, Chu C, Samulski R, Goodrich L. Optimization of scAAVIL-1ra dose in a large animal model of post-traumatic osteoarthritis. Orthopedic Research Society, Dallas, TX. Poster.

Thampi P, Samulski J, Grieger J, Phillips J, McIlwraith CW, Goodrich L. Characterization of scaavil-1ra/igf-1 combination gene therapy in equine chondrocytes and synoviocytes. Orthopedic Research Society Annual Meeting, Dallas, TX. Poster.

Winston S, Pezzanite L, Impastato R, Sikes K, Santangelo K, Dow S, McGilvray K. Immune instructive printed scaffolds to stimulate healing in rotator cuff tendon injury. University of Colorado 5th Annual Orthopedic Research Symposium & D'Ambrosia Diversity Lectureship. Denver, CO.





The Orthopaedic Research Center at Colorado State University is known worldwide for joint problem prevention and healing research in horses, with complementary work in human athletes. We are at the forefront of developing novel therapies, including stem cells that offer exciting treatment options for neuromusculoskeletal disease and injury.

Your gift to the ORC will advance our research program, support innovation in clinical treatments and regenerative therapies, and advance translational research. If you have more questions about giving opportunities at the ORC, please contact Sarah Schmidt, Assistant Vice President of Advancement, at s.schmidt@colostate.edu.

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