Stanford

Robert Lane Smith

Professor (Research) of Orthopedic Surgery, Emeritus

Orthopaedic Surgery

Bio

ACADEMIC APPOINTMENTS

- Professor Emeritus, Orthopaedic Surgery
- Member, Bio-X

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our group is interested in the molecular and cell biology underlying bone and cartilage metabolism in health and disease. Normal daily activities are linked to the ability of the articular cartilage to withstand normal joint forces that may reach 5-7 times body weight and bone homeostasis depends on daily mechanical loading histories. The phenotypic stability of cartilage and bone depends on a complex interplay between stimuli influencing cell metabolism, physical forces, cytokines, hormones and growth factors, and the genetic expression determining the material properties of the tissue. Our lab applies modern biochemical techniques to analyze:

1. Mechanisms of cartilage degradation in inflammation and sepsis;
2. Stimulation of cartilage growth and repair by growth factors and hormones in serum-free culture;
3. Effects of adherence and deposition of glycocalyx on bacterial resistance to antibiotic treatment;
4. Effects of mechanical stresses and strains on cartilage and bone cell gene expression and matrix syntheses;
5. Analysis of metal particles on bone resorption and prosthetic loosening in total joint arthroplasty.

The experimental techniques include development of primary cultures of human chondrocytes, quantification of proteoglycan and collagen synthesis and degradation, zymogen and kinetic analysis of neutral metalloproteinases, western analysis of protein expression, northern and slot blot analysis of mRNA levels and cloning of connective tissue and bacterial genes.

Publications

PUBLICATIONS

- **Local versus distal transplantation of human neural stem cells following chronic spinal cord injury** *SPINE JOURNAL*
  Cheng, I., Githens, M., Smith, R. L., Johnston, T. R., Park, D. Y., Stauff, M. P., Salari, N., Tileston, K. R., Kharazi, A. I.
  2016; 16 (6): 764-769
- **Identification of Human Juvenile Chondrocyte-Specific Factors that Stimulate Stem Cell Growth** *TISSUE ENGINEERING PART A*
  Taylor, S. E., Lee, J., Smeriglio, P., Razzaque, A., Smith, R. L., Dragoo, J. L., Maloney, W. J., Bhutani, N.

2016; 22 (7-8): 645-653

- **Biochemical and Cellular Assessment of Acetabular Chondral Flaps Identified During Hip Arthroscopy** *ARTHROSCOPY-THE JOURNAL OF ARTHROSCOPIC AND RELATED SURGERY*
  Hariri, S., Truntzer, J., Smith, R. L., Safran, M. R.
  2015; 31 (6): 1077-1083
- **T1 rho Dispersion in Articular Cartilage: Relationship to Material Properties and Macromolecular Content** *CARTILAGE*
  Keenan, K. E., Besier, T. F., Pauly, J. M., Smith, R. L., Delp, S. L., Beaupre, G. S., Gold, G. E.
  2015; 6 (2): 113-122
- **Interaction Between Osteoarthritic Chondrocytes and Adipose-Derived Stem Cells Is Dependent on Cell Distribution in Three-Dimension and Transforming Growth Factor-ß3 Induction.** *Tissue engineering. Part A*
  Lai, J. H., Rogan, H., Kajiyama, G., Goodman, S. B., Smith, R. L., Maloney, W., Yang, F.
  2015; 21 (5-6): 992-1002
- **Collagen VI Enhances Cartilage Tissue Generation by Stimulating Chondrocyte Proliferation.** *Tissue engineering. Part A*
  Smeriglio, P., Dhulipala, L., Lai, J. H., Goodman, S. B., Dragoo, J. L., Smith, R. L., Maloney, W. J., Yang, F., Bhutani, N.
  2015; 21 (3-4): 840-849
- **Comparative potential of juvenile and adult human articular chondrocytes for cartilage tissue formation in three-dimensional biomimetic hydrogels.** *Tissue engineering. Part A*
  Smeriglio, P., Lai, J. H., Dhulipala, L., Behn, A. W., Goodman, S. B., Smith, R. L., Maloney, W. J., Yang, F., Bhutani, N.
  2015; 21 (1-2): 147-155
- **Inhibition of Chondrocyte and Synovial Cell Death After Exposure to Commonly Used Anesthetics Chondrocyte Apoptosis After Anesthetics** *AMERICAN JOURNAL OF SPORTS MEDICINE*
  Rao, A. J., Johnston, T. R., Harris, A. H., Smith, R. L., Costouros, J. G.
  2014; 42 (1): 50-58
- **Stem cells catalyze cartilage formation by neonatal articular chondrocytes in 3D biomimetic hydrogels** *SCIENTIFIC REPORTS*
  Lai, J. H., Kajiyama, G., Smith, R. L., Maloney, W., Yang, F.
  2013; 3
- **Effects of Heme Oxygenase-1 on Bacterial Antigen-Induced Articular Chondrocyte Catabolism In Vitro** *JOURNAL OF ORTHOPAEDIC RESEARCH*
  Mawatari, T., Nakamichi, I., Suenaga, E., Maloney, W. J., Smith, R. L.
  2013; 31 (12): 1943-1949
- **Local effect of IL-4 delivery on polyethylene particle induced osteolysis in the murine calvarium.** *Journal of biomedical materials research. Part A*
  Rao, A. J., Nich, C., Dhulipala, L. S., Gibon, E., Valladares, R., Zwingenberger, S., Smith, R. L., Goodman, S. B.
  2013; 101 (7): 1926-1934
- **Direct subcutaneous injection of polyethylene particles over the murine calvaria results in dramatic osteolysis.** *International orthopaedics*
  Rao, A. J., Zwingenberger, S., Valladares, R., Li, C., Lane Smith, R., Goodman, S. B., Nich, C.
  2013; 37 (7): 1393-1398
- **Local effect of IL-4 delivery on polyethylene particle induced osteolysis in the murine calvarium** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A*
  Rao, A. J., Nich, C., Dhulipala, L. S., Gibon, E., Valladares, R., Zwingenberger, S., Smith, R. L., Goodman, S. B.
  2013; 101A (7): 1925-1934
- **Combined Transplantation of Human Neuronal and Mesenchymal Stem Cells following Spinal Cord Injury.** *Global spine journal*
  Park, D. Y., Mayle, R. E., Smith, R. L., Corcoran-Schwartz, I., Kharazi, A. I., Cheng, I.
  2013; 3 (1): 1-6
- **Functional assessment of the acute local and distal transplantation of human neural stem cells after spinal cord injury** *SPINE JOURNAL*
  Cheng, I., Mayle, R. E., Cox, C. A., Park, D. Y., Smith, R. L., Corcoran-Schwartz, I., Ponnusamy, K. E., Oshtory, R., Smuck, M. W., Mitra, R., Kharazi, A. I., Carragee, E. J.
  2012; 12 (11): 1040-1044
- **A relationship between mechanically-induced changes in serum cartilage oligomeric matrix protein (COMP) and changes in cartilage thickness after 5 years** *OSTEOARTHRITIS AND CARTILAGE*

Erhart-Hledik, J. C., Favre, J., Asay, J. L., Smith, R. L., Giori, N. J., Muendermann, A., Andriacchi, T. P.
2012; 20 (11): 1309-1315

- **The effect of suture coated with mesenchymal stem cells and bioactive substrate on tendon repair strength in a rat model.** *journal of hand surgery*
  Yao, J., Woon, C. Y., Behn, A., Korotkova, T., Park, D., Gajendran, V., Smith, R. L.
  2012; 37 (8): 1639-1645
- **The Effect of Suture Coated With Mesenchymal Stem Cells and Bioactive Substrate on Tendon Repair Strength in a Rat Model** *JOURNAL OF HAND SURGERY-AMERICAN VOLUME*
  Yao, J., Woon, C. Y., Behn, A., Korotkova, T., Park, D., Gajendran, V., Smith, R. L.
  2012; 37A (8): 1639-1645
- **Revision joint replacement, wear particles, and macrophage polarization** *ACTA BIOMATERIALIA*
  Rao, A. J., Gibon, E., Ma, T., Yao, Z., Smith, R. L., Goodman, S. B.
  2012; 8 (7): 2815-2823
- **Effect of a CCR1 receptor antagonist on systemic trafficking of MSCs and polyethylene particle-associated bone loss** *BIOMATERIALS*
  Gibon, E., Yao, Z., Rao, A. J., Zwingenberger, S., Batke, B., Valladares, R., Smith, R. L., Biswal, S., Gambhir, S. S., Goodman, S. B.
  2012; 33 (14): 3632-3638
- **Molecular profile of osteoprogenitor cells seeded on allograft bone** *JOURNAL OF TISSUE ENGINEERING AND REGENERATIVE MEDICINE*
  Smith, K. E., Huang, Z., Ma, T., Irani, A., Smith, R. L., Goodman, S. B.
  2011; 5 (9): 704-711
- **Cross-relaxation Imaging of Human Articular Cartilage** *MAGNETIC RESONANCE IN MEDICINE*
  Stikov, N., Keenan, K. E., Pauly, J. M., Smith, R. L., Dougherty, R. F., Gold, G. E.
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- **Role of the Toll-like receptor pathway in the recognition of orthopedic implant wear-debris particles** *BIOMATERIALS*
  Pearl, J. I., Ma, T., Irani, A. R., Huang, Z., Robinson, W. H., Smith, R. L., Goodman, S. B.
  2011; 32 (24): 5535-5542
- **Effects of Intermittent Hydrostatic Pressure and BMP-2 on Osteoarthritic Human Chondrocyte Metabolism In Vitro** *JOURNAL OF ORTHOPAEDIC RESEARCH*
  Smith, R. L., Lindsey, D. P., Dhulipala, L., Harris, A. H., Goodman, S. B., Maloney, W. J.
  2011; 29 (3): 361-368
- **Prediction of glycosaminoglycan content in human cartilage by age, T1 rho and T2 MRI** *OSTEOARTHRITIS AND CARTILAGE*
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- **Viability and Proliferation of Pluripotential Cells Delivered to Tendon Repair Sites Using Bioactive Sutures-An In Vitro Study** *JOURNAL OF HAND SURGERY-AMERICAN VOLUME*
  Yao, J., Korotkova, T., Smith, R. L.
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- **Viability and proliferation of pluripotential cells delivered to tendon repair sites using bioactive sutures--an in vitro study.** *journal of hand surgery*
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  Huang, Z., Ma, T., Ren, P., Smith, R. L., Goodman, S. B.
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- **Surveillance of systemic trafficking of macrophages induced by UHMWPE particles in nude mice by noninvasive imaging** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A*
  Ren, P., Huang, Z., Ma, T., Biswal, S., Smith, R. L., Goodman, S. B.
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- **Effects of Tensile Strain and Fluid Flow on Osteoarthritic Human Chondrocyte Metabolism In Vitro** *JOURNAL OF ORTHOPAEDIC RESEARCH*
  Mawatari, T., Lindsey, D. P., Harris, A. H., Goodman, S. B., Maloney, W. J., Smith, R. L.
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- **Polymethylmethacrylate particle exposure causes changes in p38 MAPK and TGF-beta signaling in differentiating MC3T3-E1 cells** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A*
  Ma, G. K., Chiu, R., Huang, Z., Pearl, J., Ma, T., Smith, R. L., Goodman, S. B.
  2010; 94A (1): 234-240

- **Polymethylmethacrylate particle exposure causes changes in p38 MAPK and TGF-beta signaling in differentiating MC3T3-E1 cells.** *Journal of biomedical materials research. Part A*
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- **Flexor Tendon Tissue Engineering: Bioreactor Cyclic Strain Increases Construct Strength** *TISSUE ENGINEERING PART A*
  Saber, S., Zhang, A. Y., Ki, S. H., Lindsey, D. P., Smith, R. L., Riboh, J., Pham, H., Chang, J.
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- **POLYMETHYLMETHACRYLATE PARTICLES INHIBIT HUMAN MESENCHYMAL STEM CELL DIFFERENTIATION INTO OSTEOBLASTS** *Western Regional Meeting of the American-Federation-for-Medical-Research*
  Chiu, R., Smith, R. L., Goodman, S.
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- **POLYMETHYLMETHACRYLATE PARTICLES INHIBIT HUMAN MESENCHYMAL STEM CELL DIFFERENTIATION INTO OSTEOBLASTS** *Western Regional Meeting of the American-Federation-for-Medical-Research*
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- **Biocompatibility of poly(ethylene glycol)/poly(acrylic acid) interpenetrating polymer network hydrogel particles in RAW 264.7 macrophage and MG-63 osteoblast cell lines.** *Journal of biomedical materials research. Part A*
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2009; 90B (1): 362-367

- **Flexor Tendon Tissue Engineering: Acellularized and Reseeded Tendon Constructs** *PLASTIC AND RECONSTRUCTIVE SURGERY*
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  Chiu, R., Ma, T., Smith, R. L., Goodman, S. B.
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  Ma, T., Ren, P., Larsen, D. M., Suenaga, E., Zilber, S., Genovese, M., Smith, R. L., Goodman, S. B.
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- **In vivo murine model of continuous intramedullary infusion of particles--a preliminary study.** *Journal of biomedical materials research. Part B, Applied biomaterials*
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- **In Vivo Murine Model of Continuous Intramedullary Infusion of Particles-A Preliminary Study** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART B-APPLIED BIOMATERIALS*
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  Chiu, R., Smith, R. L., Goodman, S.
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- **POLYMETHYLMETHACRYLATE PARTICLE-INDUCED SUPPRESSION OF OSTEOPROGENITOR DIFFERENTIATION INVOLVES INHIBITION OF RUNX2, OSTERIX, DLX5, AND beta-CATENIN EXPRESSION** *Western Regional Meeting of the American-Federation-for-Medical-Research*
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- **Continuous Intramedullary Polymer Particle Infusion Using a Murine Femoral Explant Model** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART B-APPLIED BIOMATERIALS*
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- **Polymethylmethacrylate particles inhibit osteoblastic differentiation of MC3T3-E1 osteoprogenitor cells** *JOURNAL OF ORTHOPAEDIC RESEARCH*
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- **Hydrostatic pressure enhances chondrogenic differentiation of human bone marrow stromal cells in osteochondrogenic medium** *ANNALS OF BIOMEDICAL ENGINEERING*
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  2008; 36 (5): 813-820

- **Quantitation of bone area in undecalcified frozen sections with fluorescent microscopy** *JOURNAL OF HISTOTECHNOLOGY*
  Ren, P., Ma, T., Huang, Z., Smith, R. L., Goodman, S. B.
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- **Histomorphometric Analysis of the intramedullary bone response to titanium particles in wild-type and IL-1R1 knowk-out mice: A preliminary study** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART B-APPLIED BIOMATERIALS*
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  Goodman, S. B., Ma, T., Spanogle, J., Chiu, R., Miyanishi, K., Oh, K., Plouhar, P., Wadsworth, S., Smith, R. L.
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