



## RESEARCH INTERESTS

My research interests in bioengineering lie within biomechanics, biotribology, and biochemistry. My long term research interests include mechanistic based, multidisciplinary study of articular cartilage boundary lubrication through clinical, biochemical and engineering collaborations. Relevant areas include the study of normal, injured, and diseased cartilage and synovial fluid, where composition and interactions of mechanically relevant biomolecules can be altered, as well as other tissues in the joint affected by injury and disease. This work could ultimately lead to the development of new cell or tissue based treatments that may halt or reverse the progressive loss of cartilage after sports injury or with aging and arthritis.

## HONORS AND AWARDS

### *AS RECIPIENT – NATIONAL*

Summer Research Scholarship (declined), Natural Sciences & Engineering Research Council of Canada, 1999.

### *AS RECIPIENT – LOCAL*

U California Wide Tissue Engineering Teaching Assistant, developing education material, 2003.

U Toronto Faculty of Applied Science & Engineering Dean's Honor List, 1997-2000.

3<sup>rd</sup> place in U Toronto 2<sup>nd</sup> year Engineering Design Tag Playing Robot Competition, 1997.

U Toronto Department of Engineering Science admission scholarship, 1996.

### *AS MENTOR – LOCAL*

Daniel Aguilar, Minority High School Student Summer Program, Department of Biochemistry, Rush University Medical Center, 2007.

Nicholas S. Gastelum, California Alliance for Minority Participation in Science, Engineering and Mathematics Program Scholar, 2003.

Eun Hee Han, McNair Program Scholar, 2001.

## PUBLICATIONS

### *REFEREED JOURNAL PAPERS*

1. **Schmidt TA**, Plaas AH, Sandy JD. Disulfide-bonded multimers of proteoglycan 4 (PRG4) are present in normal synovial fluids. *Biochim Biophys Acta* (in press), 2009.
2. **Schmidt TA**, Gastelum NS, Han EH, Nugent-Derfus GE, Schumacher BL, Sah RL. Differential regulation of proteoglycan 4 metabolism by IL-1 $\alpha$ , IGF-I, and TGF- $\beta$ 1. *Osteoarthritis Cartilage* 16:90-7, 2008.
3. Blewis ME, Nugent-Derfus GE, **Schmidt TA**, Schumacher BL, Sah RL. A model of synovial fluid lubricant composition in normal and injured joints. *Eur Cell Mater* 13:26-39, 2007.
4. Blewis ME, Schumacher BL, Klein TJ, **Schmidt TA**, Voegtline MS, Sah RL. Microenvironment regulation of PRG4 phenotype of chondrocytes. *J Orthop Res* 25:685-95, 2007.

5. **Schmidt TA**, Gastelum NS, Nguyen QT, Schumacher BL, Sah RL. Boundary lubrication of articular cartilage: role of synovial fluid constituents. *Arthritis Rheum* 56:882-91, 2007.
6. **Schmidt TA**, Sah RL. Effect of synovial fluid on boundary lubrication of articular cartilage. *Osteoarthritis Cartilage* 15:35-47, 2007.
7. Chawla K, Klein TJ, Schumacher BL, **Schmidt TA**, Voegtline MS, Thonar EJ-MA, Masuda K, Sah RL. Tracking chondrocytes and assessing their proliferation with PKH26: effects on secretion of proteoglycan 4 (PRG4). *J Orthop Res* 24:1499-1508, 2006.
8. Klein TJ, Schumacher BL, Blewis ME, **Schmidt TA**, Voegtline MS, Thonar EJ-MA, Masuda K, Sah RL. Tailoring secretion of proteoglycan 4 (PRG4) in tissue-engineered cartilage. *Tissue Eng* 12:1429-39, 2006.
9. Nugent GE, Aneloski NA, **Schmidt TA**, Schumacher BL, Voegtline MS, Sah RL. Dynamic shear stimulates cartilage biosynthesis of proteoglycan 4 (PRG4). *Arthritis Rheum* 54:1888-96, 2006.
10. Nugent GE, **Schmidt TA**, Schumacher BL, Voegtline MS, Bae WC, Jadin KD, Sah RL. Static and dynamic compression regulate cartilage metabolism of proteoglycan 4 (PRG4). *Biorheology* 43:191-200, 2006.
11. Schumacher BL, **Schmidt TA**, Voegtline MS, Chen AC, Sah RL. Proteoglycan 4 (PRG4) synthesis and immunolocalization in bovine meniscus. *J Orthop Res* 23:562-568, 2005.
12. **Schmidt TA**, Schumacher BL, Klein TJ, Voegtline MS, Sah RL. Synthesis of proteoglycan 4 by chondrocyte subpopulations in cartilage explants, monolayer cultures, and resurfaced cartilage cultures. *Arthritis Rheum* 50:2849-57, 2004.
13. Klein TJ, Schumacher BL, **Schmidt TA**, Li KW, Voegtline MS, Masuda K, Thonar EJ-MA, Sah RL. Tissue engineering of articular cartilage with stratification using chondrocyte subpopulations. *Osteoarthritis Cartilage* 11:595-602, 2003.
14. Kurtis MS, **Schmidt TA**, Bugbee WD, Loeser RF, Sah RL. Integrin-mediated adhesion of human chondrocytes to cartilage. *Arthritis Rheum* 48:110-8, 2003.

### **BOOK CHAPTERS**

1. Sah RL, Klein TJ, **Schmidt TA**, Albrecht DR, Bae WC, Nugent GE, McGowan KB, Temple MM, Jadin KD, Schumacher BL, Chen AC, Sandy JD: Articular cartilage repair, regeneration, and replacement. In: *Arthritis and Allied Conditions: A Textbook of Rheumatology*, ed by WJ Koopman, Lippincott Williams & Wilkins, Philadelphia, PA, 2005, pp 2277-2301.
2. **Schmidt TA**, Schumacher BL, Han EH, Klein TJ, Voegtline MS, Sah RL: Chemo-mechanical coupling in articular cartilage: IL-1a and TGF-B1 regulate chondrocyte synthesis and secretion of proteoglycan 4. In: *Physical Regulation of Skeletal Repair*, ed by RK Aaron and ME Bolander, American Academy of Orthopaedic Surgeons, Chicago, IL, 2005, pp 151-162.

### **OTHER WORKS**

1. **Schmidt TA**. *Proteoglycan 4 Metabolism and the Boundary Lubrication of Articular Cartilage*. Ph.D. Thesis supervised by Professor Robert L. Sah, University of California – San Diego, La Jolla, CA, USA, 2006.
2. **Schmidt TA**. *Recombinant Human Elastin Like Peptide Incorporation into Acellularized Porcine Tissue*. B.A.Sc. Thesis supervised by Professor Kim A. Woodhouse, University of Toronto, Toronto, ON, Canada, 2000.

**REFEREED CONFERENCE ABSTRACTS**

1. **Schmidt TA**, Sandy JD, Plaas AH. Proteoglycan 4 (PRG4) disulfide-bonded multimers in normal synovial fluid. *Trans Orthop Res Soc* 33:461, 2008.
2. Antonacci JM, **Schmidt TA**, Serventi LA, Shu YL, Gastelum NS, Schumacher BL, McIlwraith CW, Sah RL. Effects of joint injury on synovial fluid and boundary lubrication of cartilage. *Trans Orthop Res Soc* 32:156, 2007.
3. Blewis ME, Lao BJ, **Schmidt TA**, Nugent GE, Antonacci JM, Schumacher BL, Sah RL. Bioengineering joints: the synovial fluid. *Trans Orthop Res Soc* 32:1506, 2007.
4. Plaas A, Chekerov I, Zheng Y, **Schmidt TA**, Sah R, Carter J, Sandy J. Disulfide-bonded multimers of lubricin (LGP-1, PRG4) glycovariants in cartilage, synovium and synovial fluid. *Trans Orthop Res Soc* 31:1422, 2006.
5. Sah RL, McIlwraith CW, Bae WC, Gratz KR, Wong BL, Antonacci JM, **Schmidt TA**, Schumacher BL, Temple-Wong MM. Cartilage lubrication and diarthroidal joint MechanoBiology. *Int Cart Repair Soc* 7:B46-47, 2007.
6. Sullivan BD, Richards SM, Talbot D, **Schmidt TA**, Sullivan DA. Proteoglycan 4 mRNA expression in human corneal and conjunctival epithelial cells. *Invest Ophthalmol Vis Sci* 48:E795, 2007.
7. **Schmidt TA**, Nguyen QT, Gastelum NS, Schumacher BL, Sah RL. Cartilage boundary lubrication: dose-dependent effects of PRG4 and synovial fluid. *Int Cart Repair Soc* 6:7c-7, 2006.
8. **Schmidt TA**, Schumacher BL, Gastelum NS, Plaas AHK, Sah RL. PRG4 boundary lubrication of articular cartilage: role of disulfide bonding and chondroitin sulfate. *Trans Orthop Res Soc* 31:84, 2006.
9. Blewis ME, Schumacher BL, Klein TJ, **Schmidt TA**, Voegtline MS, Sah RL. Microenvironment regulation of superficial zone phenotype of chondrocytes. *Trans Orthop Res Soc* 30:1, 2005.
10. Chawla K, Klein TJ, Schumacher BL, Jadin KD, **Schmidt TA**, Chen AC, Wong V, Nakagawa K, Thonar EJ-MA, Masuda K, Sah RL. Enhanced formation of stratified tissue-engineered porcine cartilage from chondrocyte subpopulations with bone morphogenetic protein-7 (BMP-7). *Trans Orthop Res Soc* 30:294, 2005.
11. Nugent GE, **Schmidt TA**, Schumacher BL, Voegtline MS, Bae WC, Jadin KD, Sah RL. Biomechanical regulation of chondrocyte synthesis of PRG4. *Trans Orthop Res Soc* 30:81, 2005.
12. **Schmidt TA**, Schumacher BL, Nugent GE, Gastelum NS, Sah RL. PRG4 contributes to a "sacrificial layer" mechanism of boundary lubrication of articular cartilage. *Trans Orthop Res Soc* 30:900, 2005.
13. Chawla K, Klein TJ, Schumacher BL, Jadin KD, **Schmidt TA**, Voegtline MS, Thonar EJ-MA, Masuda K, Sah RL. Tracking donor chondrocytes stratified tissue-engineered cartilage after implantation *in vivo*. *Trans Orthop Res Soc* 29:306, 2004.
14. **Schmidt TA**, Schumacher BL, Han EH, Klein TJ, Voegtline MS, Sah RL. Synthesis and secretion of lubricin/superficial zone protein by chondrocytes in cartilage explants: modulation by TGF-B1 and IL-1a. *Trans Orthop Res Soc* 29:577, 2004.
15. **Schmidt TA**, Schumacher BL, Nugent GE, Bae WC, Klein TK, Voegtline MS, Bugbee WD, Sah RL. Functional localization and chemo-mechanical regulation of lubricin /

- superficial zone protein in normal and osteoarthritic articular cartilage. *Int Cart Repair Soc* 5, 2004.
16. Schumacher BL, **Schmidt TA**, Bae WC, Wong VW, Temple MM, Kim TW, Voegtline MS, Chawla K, Chen AC, Bugbee WD, Sah RL. Localization and expression of lubricin/superficial zone protein in human articular cartilage: alterations in osteoarthritis. *Trans Orthop Res Soc* 29:281, 2004.
  17. Klein TJ, Schumacher BL, **Schmidt TA**, Voegtline MS, Masuda K, Thonar EJ-MA, Sah RL. Tailoring secretion of superficial zone protein (SZP) in tissue engineered cartilage. *Trans Orthop Res Soc* 28:601, 2003.
  18. Sah RL, Lottman LM, **Schmidt TA**, Mankarious S. Effects of fibrin glue components on chondrocyte growth and matrix formation. *Trans Orthop Res Soc* 28:721, 2003.
  19. **Schmidt TA**, Schumacher BL, Klein TJ, Voegtline MS, Sah RL. Resurfacing articular cartilage with chondrocytes expressing superficial zone protein. *Trans Orthop Res Soc* 28:137, 2003.
  20. Schumacher BL, Voegtline MS, **Schmidt TA**, Klein TJ, Chen AC, Sah RL. Immunolocalization and synthesis of superficial zone protein (SZP) in meniscus. *Trans Orthop Res Soc* 28:613, 2003.

## ACADEMIC EXPERIENCES

***Assistant Professor, University of Calgary, Faculty of Kinesiology, Department of Mechanical and Manufacturing Engineering, Center for Bioengineering Research and Education, McCaig Institute of Bone and Joint Health, Calgary, AB, Canada, 2008 - .***

Examination and elucidation of the structure-function relationship governing the multiple biological properties of PRG4 that contribute to the overall maintenance and integrity of the knee.

Development of biomechanical-biotribological (boundary lubrication), biophysical, and biochemical methods.

***Instructor / Post-Doctoral Scholar, Rush University Medical Center, Departments of Internal Medicine & Biochemistry, Chicago, IL, 2006 - 2008.***

Developed methods for purification and characterization of PRG4 multimers and monomers.

Aided in development biological assays for use in conjunction with in vivo murine studies.

Contributed to tissue harvest, cell culture, and lab safety/maintenance procedures.

***Graduate Student Researcher, University of California San Diego, Cartilage Tissue Engineering Lab, La Jolla, CA, 2000-2006.***

Specified requirements for a customized multi-axial biomechanical tester, designed custom scaffolding for testing, and developed test protocols.

Aided in developing enzyme linked immunosorbent assays for PRG4.

Contributed to standardization of tissue harvest and cell culture procedures.

***Summer Student Researcher, St. Michael's Hospital, Toronto, ON, Cardiovascular Research, Toronto, ON, Canada, 2000.***

Developed a protocol for smooth muscle cell migration studies through acellularized vessel tissue within a Rotating Cell Culture System.

Designed an apparatus for cell contractility studies.

Aided in animal angioplasty surgery.

***Summer Student, Cancer Care Manitoba, Winnipeg, MB, Canada, 1999.***

Created software which scheduled and recorded electron therapy for cancer patients.

Calibrated a film scanner for a film dosimetry study and established a protocol for scanning and reading films.

Aided in daily quality assurance of therapy machines and created software for other smaller projects.

**INDUSTRY EXPERIENCES*****Summer Intern Engineering Assistant, Krebs Engineers, Tucson, AZ, 1998.***

Established a procedure for testing material wear due to particle impingement within hydro cyclones.

Summarized data in technical reports from daily experiments using several different types of materials.

**PRESENTATIONS*****PODIUM - INTERNATIONAL & NATIONAL***

1. *International Cartilage Repair Society*, San Diego, CA, 2006.
2. *Orthopaedic Research Society*, Chicago, IL, 2006.
3. *Contact Phenomena in Materials and Biological Systems*, Ringberg Castle, Germany, 2005.
4. *International Cartilage Repair Society*, Gent, Belgium, 2004.
5. *Gordon Research Conference on Musculoskeletal Biology & Bioengineering*, Andover, NH, 2004.
6. *Orthopaedic Research Society*, New Orleans, LA, USA, 2003.

***POSTER - INTERNATIONAL & NATIONAL***

1. *Gordon Research Conference on Proteoglycans*, Andover, NH, 2008.
2. *Orthopaedic Research Society*, San Francisco, CA, 2008.
3. *Gordon Research Conference on Musculoskeletal Biology & Bioengineering*, Andover, NH, 2006.
4. *Orthopaedic Research Society*, Washington, DC, 2005.
5. *Gordon Research Conference on Musculoskeletal Biology & Bioengineering*, Andover, NH, 2004.
6. *Orthopaedic Research Society*, San Francisco, CA, 2004.

***PODIUM – REGIONAL & LOCAL***

1. *Midwest Connective Tissue Workshop*, Chicago, IL, 2007.
2. *UCSD Bioengineering Graduate Students Meeting*, La Jolla, CA, 2004.
3. *UCSD Orthopaedics Research Conference*, La Jolla, CA, 2004.

***POSTER - REGIONAL & LOCAL***

1. *Midwest Connective Tissue Workshop*, Chicago, IL, 2006.
2. *UCSD Jacobs School of Engineering Research Expo*, La Jolla, CA, 2002-2006.
3. *UCSD Bioengineering Graduate Students Meeting*, La Jolla, CA, 2002-2005.

**TRAINEES**

***UNDERGRADUATE STUDENTS***

1. Nicholas S. Gastelum, Department of Bioengineering, California Alliance for Minority Participation in Science, Engineering and Mathematics, “Boundary Lubrication of Articular Cartilage” September, 2003-June, 2006.
2. Eun Hee Han, Department of Bioengineering, McNair Program, “Cytokine Regulation of PRG4 synthesis and secretion by chondrocytes” Jan, 2001-Jan, 2003. Subsequent position, Ph.D. Program, University of California - San Diego, 2005.

**CONTRIBUTIONS TO SCIENTIFIC MEETINGS**

***MEETING ORGANIZATION - INTERNATIONAL***

1. *International Cartilage Repair Society*, Staff, San Diego, CA, 2006.
2. *Gordon Research Conference on Musculoskeletal Biology & Bioengineering*, Activity Co-Coordinator, Andover, NH, 2004.

***MEETING ORGANIZATION - REGIONAL***

1. *Midwest Connective Tissue Workshop*, Audio-Visual Support, Chicago, IL, 2007.
2. *UCSD Biomedical Imaging Conference*, Audio-Visual Support, La Jolla, CA, 2005.

**CONTRIBUTIONS TO JOURNALS AND BOOKS**

***REVIEWER***

Journals

Scandinavian Journal of Rheumatology, 2008-

(reviews of papers done internally at the Cartilage Tissue Engineering Laboratory)

American Society for Artificial Internal Organs, 2003-2007.

Annals of Biomedical Engineering, 2004-2007.

Arthritis and Rheumatism, 2004-2007.

Journal of Clinical Investigation, 2005-2007.

Journal of Orthopaedic Research, 2003-2007.

Osteoarthritis and Cartilage, 2003-2007.

Proceedings of the National Academy of Sciences, 2006-2007.

Tissue Engineering, 2005-2007.

## **PROFESSIONAL SOCIETIES**

Orthopaedic Research Society.

Osteoarthritis Research Society International.

## **INSTITUTIONAL SERVICE**

### ***CAMPUS***

University of Calgary, Schulich School of Engineering Faculty Council: Faculty of Kinesiology Representative, 2008-.

University of Calgary, Biomedical Engineering Graduate Program Steering Committee: Member 2008-

Rush University Medical Center Faculty Council: Instructor Representative, 2007 – 2008.

California Alliance for Minority Participation in Science, Engineering and Mathematics: Graduate Student Panel Member, 2005.

## **EXTRACURRICULAR ACTIVITIES & INTERESTS**

### ***Long Distance Athlete***

Triathlons: Ironman Canada Triathlon, 2005; California Vine Man Half Ironman Triathlon, 2003.  
Marathons: Chicago Marathon, 2007; Suzuki Rock & Roll Marathon, 2002; Manitoba Marathon, 1999; Tucson Marathon, 1998.

Half marathons: Manitoba Half Marathon, 2007; Wild Miles 126 Mile Relay, 2004; San Diego Half Marathon, 2001; Toronto International Half Marathon, 1997.

Cycling: El Tour de Tucson 112 Miles, 2004; Solvang 100 Mile Ride, 2003.