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### **EDUCATION AND PROFESSIONAL HISTORY**

December, 1994      Ph.D. Biomedical Engineering, The University of Iowa, Iowa City, IA  
December, 1988      M.S. Mechanical Engineering, The University of Pittsburgh, Pittsburgh, PA  
August, 1982        B.S. Mechanical Engineering, The University of Pittsburgh, Pittsburgh, PA  
December, 1974      B.S. Science, The Pennsylvania State University, University Park, PA

### **Professional and Academic Positions**

03/1975–08/1980    Process Control Engineer  
Combustion Engineering Incorporated, Gibsonia, PA

03/1984–07/1985    Design Engineer  
Medrad (Medical Research and Development) Incorporated, Pittsburgh, PA

12/1982–03/1984    Research Engineer  
07/1985–12/1989    The Orthopaedic Research Laboratory, University of Pittsburgh, Pittsburgh, PA

01/1990–12/1995    Staff Engineer/Research Assistant  
The Orthopaedic Biomechanics Laboratory, University of Iowa, Iowa City, IA

02/1996–06/1997    Research Assistant Professor of Orthopaedic Surgery  
Allegheny University of the Health Sciences, Pittsburgh, PA

07/1997–06/1998    Visiting Professor of Electrical and Mechanical Engineering  
Technikon Northern Transvaal, Pretoria, South Africa

08/1998–05/2000    Visiting Associate Professor of Mechanical Engineering  
The University of Pittsburgh, Pittsburgh, PA

01/2001–Present    Adjunct Assistant Professor of Mechanical Engineering  
Biomedical Engineering, The University of Iowa, Iowa City, IA

09/2000– Present    Associate Research Engineer  
Orthopaedics & Rehabilitation, University of Iowa, Iowa City, IA

### **Other Professional Activities**

Member              The American Society of Mechanical Engineers (ASME)  
Member              The American Society of Biomechanics (ASB)

## SCHOLARSHIP

### Full Length Articles

1. Baratz ME, Rehak DC, Fu FH, Rudert MJ. Peripheral tears of the meniscus. The effect of open versus arthroscopic repair on intraarticular contact stresses in the human knee. *Am. J. Sports Med.* 1988 Jan-Feb;16(1):1–6.
2. McKernan DJ, Mutschler TA, Rudert MJ, Klein AH, Victorino G, Harner CD, Fu FH. The characterization of rotator cuff muscle forces and their effect on glenohumeral joint stability: A biomechanical study. *Am. J. Sports Med.* 1989;17(2). (Winner of the Excellence in Research Award from the American Orthopaedic Society for Sports Medicine.)
3. Flynn J, Rudert MJ, Olson E, Baratz M, Hanley E. The effects of freezing or freeze-drying on the biomechanical properties of the canine intervertebral disc. *Spine.* 1990 Jun;15(6):567–570.
4. Olson EJ, Hanley EN Jr, Rudert MJ, Baratz ME. Vertebral column allografts for the treatment of segmental spine defects. An experimental investigation in dogs. *Spine.* 1991 Sep;16(9):1081–1088.
5. Greis PE, Ward WT, Rodosky M, Rudert MJ, Stanitski C. A clinical and comparative biomechanical evaluation of proximal femoral osteotomy fixation in children. *Orthopedics.* 1993 Mar;16(3):273–279.
6. Caldwell NJ, Hale JE, Rudert MJ, Brown TD. An algorithm for approximate crinkle artifact compensation in pressure-sensitive film recordings. *J. Biomech.* 1993 Aug;26(8):1001–1009.
7. Hale JE, Rudert MJ, Brown TD. Indentation assessment of biphasic mechanical property deficits in size-dependent osteochondral defect repair. *J. Biomech.* 1993 Nov;26(11):1319–1325.
8. McKinley TO, Rudert MJ, Koos DC, Brown TD. Incongruity versus instability in the etiology of posttraumatic arthritis. *Clin. Orthop. Relat. Res.* 2004 Jun;(423):44–51.
9. Brown TD, Rudert MJ, Grosland NM. New methods for assessing cartilage contact stress after articular fracture. *Clin. Orthop. Relat. Res.* 2004 Jun;(423):52–8.
10. Saltzman CL, Tochigi Y, Rudert MJ, McIff TE, Brown TD. The effect of agility ankle prosthesis misalignment on the peri-ankle ligaments. *Clin. Orthop. Relat. Res.* 2004 Jul;(424):137–42.
11. Tochigi Y, Amendola A, Rudert MJ, Baer TE, Brown TD, Hillis SL, Saltzman CL. The role of the interosseous talocalcaneal ligament in subtalar joint stability. *Foot Ankle Int.* 2004 Aug;25(8):588–596.
12. McKinley TO, Rudert MJ, Koos DC, Tochigi Y, Baer TE, Brown TD. Pathomechanical determinants of posttraumatic arthritis. *Clin. Orthop. Relat. Res.* 2004 Oct;(427 Suppl):S78–88.
13. El-Khoury GY, Alliman KJ, Lundberg HJ, Rudert MJ, Brown TD, Saltzman CL. Cartilage thickness in cadaveric ankles: Measurement with double-contrast multi-detector row CT arthrography versus MR imaging. *Radiology.* 2004 Dec;233(3):768–773.
14. Tochigi Y, Rudert MJ, Brown TD, McIff TE, Saltzman CL. The effect of accuracy of implantation on range of movement of the Scandinavian Total Ankle Replacement. *J. Bone Joint Surg. Br.* 2005 May;87(5):736–740.
15. Tochigi Y, Rudert MJ, Amendola A, Brown TD, Saltzman CL. Tensile engagement of the peri-ankle ligaments in stance phase. *Foot Ankle Int.* 2005;26(12):1067–73.
16. McKinley TO, Rudert MJ, Koos DC, Pedersen DR, Baer TE, Tochigi Y, Brown TD. Contact stress transients during functional loading of ankle stepoff incongruities. *J. Biomech.* 2006;39:617–626.
17. McKinley TO, Rudert MJ, Koos DC, Pedersen DR, Baer TE, Tochigi Y, Brown TD. Stance-phase aggregate contact stress and contact stress gradient changes resulting from articular surface stepoffs in human cadaveric ankles. *Osteoarthritis Cartilage.* 2006 Feb;14(2):131–8.
18. McKinley TO, Rudert MJ, Tochigi Y, Pedersen DR, Koos DC, Baer TE, Brown TD. Incongruity-dependent changes of contact stress rates in human cadaveric ankles. *J. Orthop. Trauma.* 2006 Nov-Dec;20(10):732–8.
19. McKinley TO, Rudert MJ, Tochigi Y, Pedersen DR, Koos DC, Baer TE, Brown TD. Cambios dependientes de incongruencia de grados de estres de contacto en tobillos cadavericos humanos. *J. Orthop. Trauma.* 2006 Nov–Dec;20(10):747.

20. Tochigi Y, Rudert MJ, Saltzman CL, Amendola A, Brown TD. Contribution of articular surface geometry to ankle stabilization. *J. Bone Joint Surg. Am.* 2006;88:2704–2713.
21. Anderson DD, Goldsworthy JK, Li W, Rudert MJ, Tochigi Y, Brown TD. Physical validation of a patient-specific contact finite element model of the ankle. *J. Biomech.* 2007;40(8):1662–9. PMID1945165.
22. McKinley TO, Rudert MJ, Tochigi Y, Brown TD. Instability-associated changes in contact stress and contact stress rates in human cadaveric ankles. *J. Bone Joint Surg. Am.* 2008;90(2):375–383. PMC2587164.
23. Heiner AD, Rudert MJ, McKinley TO, Fredericks DC, Bobst JA, Tochigi Y. In vivo measurement of translational stiffness of rabbit knees. *J. Biomech.* 2007;40(10):2313–2317. PMID2080615.
24. Tochigi Y, Rudert MJ, McKinley TO, Pedersen DR, Brown TD. Correlation of dynamic cartilage contact stress aberrations with severity of instability in ankle incongruity. *J. Orthop. Res.* 2008;26(9):1186–1193. PMC Journal – In Process.
25. McKinley TO, Rudert MJ, Brown TD. The effect of incongruity and instability on contact stress directional gradients in human cadaveric ankles. *Osteoarthritis Cartilage* 2008 Nov;16(11):1363–9. PMC Journal – In Process.

### **Abstracts/Symposia/Conference Presentations**

1. Baratz ME, Rehak DC, Fu FH, Rudert MJ. Peripheral tears of the meniscus: The effect of open versus arthroscopic repair on intraarticular contact stresses in the human knee. The 13<sup>th</sup> Interim Meeting of The American Orthopaedic Society for Sports Medicine, January 1987, San Francisco, California.
2. Hanley E, Baratz M, Harvell J, Cain P, Mason G, Boniface R, Olson E, Rudert M, Ferguson G, Baum J. The use of tricalcium phosphate as a treatment for segmental vertebral body defects in the canine spine. The International Society for the Study of the Lumbar Spine, June 1987, Rome, Italy.
3. Vrahas MS, Veenis B, Rudert MJ, Fu FH. In vitro contact pressures at the human ankle. The 11<sup>th</sup> Annual Meeting of The American Society of Biomechanics, September 1987, Davis, California.
4. Baratz ME, Rehak DC, Rudert MJ, Fu FH. The biomechanical consequences of operative treatments for lesions of the meniscus. Winner of the North American Arthroscopy Association Resident's Paper Award, 1987.
5. Rudert MJ, Baratz ME, Rehak DC, Fu FH. Loading characteristics of pressensor: A pressure sensitive film. The 11<sup>th</sup> Annual Meeting of The American Society of Biomechanics, September 1987, Davis, California.
6. Rudert MJ, Baratz ME, Rehak DC, Fu FH. Loading characteristics of pressensor: A pressure sensitive film. The 34<sup>th</sup> Annual Meeting of The Orthopaedic Research Society, February 1988, Atlanta, Georgia.
7. Olson EJ, Rudert MJ, Hanley EN. Biomechanical analysis of canine thoracic vertebral body allografts for the treatment of segmental spine defects. The 34<sup>th</sup> Annual Meeting of The Orthopaedic Research Society, February 1988, Atlanta, Georgia. Olson EJ, Rudert MJ, Hanley EN. Biomechanical analysis of canine thoracic vertebral body allografts for the treatment of segmental spine defects. The International Society for the Study of the Lumbar Spine, April 1988, Miami, Florida.
8. McKernan DJ, Imbriglia JE, Rudert MJ, Hagberg WC. A biomechanical study of phalangeal fracture fixation. The American Fracture Association Meeting, April 1988, Birmingham, AL. Winner of The Meyerding Essay Award.
9. Flynn J, Rudert M, Olson E, Baratz M, Hanley E. The effects of freezing or freeze-drying on the biomechanical properties of the canine intervertebral disk. The International Society for the Study of the Lumbar Spine, April 1988, Miami, Florida.
10. Vrahas M, Veenis B, Rudert J, Fu F. Intra-articular contact stresses with simulated ankle malunions. The 5<sup>th</sup> Annual Meeting of the Orthopaedic Trauma Association, October 1989, Philadelphia, Pennsylvania.
11. McKernan DJ, Mutschler TA, Rudert MJ, Luo L, Harner CH, Fu FH. Significance of a partial and full Bankart lesion: A biomechanical comparison. The 35<sup>th</sup> Annual Meeting of The Orthopaedic Research Society, February 1989, Las Vegas, Nevada.
12. Olson EJ, Rudert MJ, Mutschler TA, Baratz ME, Flynn J, Hanley EN. Vertebral body allografts can

- successfully treat segmental spine defects in dogs. The 35<sup>th</sup> Annual Meeting of The Orthopaedic Research Society, February 1989, Las Vegas, Nevada.
13. Vrahas M, Veenis B, Rudert MJ, Fu FH. Articular contact stresses following simulated ankle malunions. The 36<sup>th</sup> Annual Meeting of The Orthopaedic Research Society, February 1990, New Orleans, Louisiana.
  14. Rudert J, Wood K, D'Antonio JA, Haines T, Rubash H. A radiographic analysis of femoral stem centralization in total hip arthroplasty. The 57<sup>th</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, February 1990, New Orleans, Louisiana.
  15. Greis P, Ward T, Rudert MJ, Rodosky M, Stanitski C. A comparative biomechanical and clinical evaluation of femoral osteotomy fixation in children. The Pediatric Orthopaedic Society of North America and European Pediatric Orthopaedic Society Combined Meeting, September 1990, Montreal, Quebec, Canada.
  16. Rodosky MW, Harner CD, Rudert MJ, Luo L, Fu F. The role of the biceps-superior glenoid labrum complex in anterior stability of the shoulder. The 21<sup>st</sup> Annual Meeting of the Eastern Orthopaedic Association, October 1990, Southampton, Bermuda.
  17. Guyton JL, Sumner DR, Rudert MJ, Turner TM, Brand RA. The effect of corticosteroids on bone ingrowth in a canine model. The 37<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, March, 1991 Anaheim, California.
  18. Mohler CG, Hale JE, Rudert MJ, Brand RA, Brown TD, Buckwalter JA. Size-dependent relations between contact stresses, histomorphometry, and repair tissue properties in healing Osteochondral Defects. Transactions of the 38<sup>th</sup> Annual Meeting of the Orthopaedic Research Society 17(1):208, 1992.
  19. Hale JE, Rudert MJ, Mohler CG, Brown TD. Biphasic constitutive characterization of osteochondral repair. Transactions of the 38<sup>th</sup> Annual Meeting of the Orthopaedic Research Society 17(2):616, 1992.
  20. Hale JE, Brown TD, Rudert MJ, Mohler CG, Brand RA, Buckwalter JA. Alterations of contact stress and tissue histomorphometry in size-dependent osteochondral defect repair. American Society of Biomechanics Young Scientist Pre-Doctoral Award, J. Biomech. 25(6):653, 1992.
  21. Brown TD, Hale JE, Rudert MJ, Anderson DD, Pope DF, Huber-Betzer H, Caldwell NJ, Brand RA. Biomechanics of local articular incongruities. 1992 International Symposium: Biomedical Engineering in the 21st Century, September 1992, Taipei, Taiwan.
  22. Rudert MJ, Brown TD. A hydrostatic compression technique for measuring structural compliance distributions in the femoral head. Proceedings of the American Society of Mechanical Engineers 1993 Bioengineering Conference, ASME, BED-Vol. 24:521–524, 1993.
  23. Caldwell NJ, Rudert MJ, Brown TD. An algorithm for approximate crinkle artifact compensation in pressure-sensitive film recordings. Proceedings of the American Society of Mechanical Engineers 1993 Bioengineering Conference, ASME, BED-Vol. 24:355–358, 1993.
  24. Adams DJ, Pedersen DR, Rudert MJ, Brand RA, Rubin CT, Brown TD. Geometric symmetry of the turkey ulna. 17<sup>th</sup> Annual Meeting of the American Society of Biomechanics, October 1993, Iowa City, Iowa.
  25. Rudert MJ, Brown TD. A hydrostatic compression technique to measure femoral head structural compliance. Proceedings of the 17<sup>th</sup> Annual Meeting of the American Society of Biomechanics, October 1993, pp 41–42, Iowa City, Iowa.
  26. Caldwell NJ, Hale JE, Rudert MJ, Brown TD. Crinkle artifact compensation in pressure-sensitive film recordings. Proceedings of the 17th Annual Meeting of the American Society of Biomechanics, October 1993, pp 131–132, Iowa City, Iowa.
  27. Rudert MJ, Brown TD. Radial compliance distributions of normal vs necrotic femoral heads. Transactions of the 40<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, February 1994, 19(1):211, New Orleans, Louisiana.
  28. Rudert MJ, Brown TD. Toward automation of patient-specific finite element models for bone grafting of femoral head osteonecrosis. ASME 1994 Advances in Bioengineering, November 1994;BED-Vol. 28:145–146, Chicago, Illinois.
  29. Rudert MJ, Brown TD. Tract-based FEA zonings for surgical planning of cortical grafting in femoral head osteonecrosis. The First International Symposium on Medical Robotics and Computer Assisted

- Surgery, August 1994, Pittsburgh, Pennsylvania.
30. Steffensmeier SJ, Rudert MJ, Cheng Y-J, Callaghan JJ, Brown TD. Relationship of mid/distal femoral stem geometry to torsional failure in cement. The 42<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, February 1996;21(2):407, Atlanta, Georgia.
  31. Ahn PB, Rudert MJ, Brown TD. Experimental determination of periosteum-dependent cortico-cancellous interfacial friction. The 42<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, February 1996, 21(2):603, Atlanta, Georgia.
  32. Brown TD, Rudert MJ, Pedersen DR, Baker KJ, Sakamoto J, Brand RA. Considerations for computer assisted planning of head-preserving surgery in femoral head osteonecrosis. Corporate Affiliates Workshop Computer-Guided Surgery in Orthopaedics presented at the 42<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, Atlanta, GA, February, 1996.
  33. Campbell PG, Hube RF, Loebig TG, Rudert MJ. Biomaterial modification of bone growth enhancement: Covalent bonding of insulin-like growth factor-I to metal surfaces. The 81<sup>st</sup> Annual Meeting of the Endocrine Society, June 1999, San Diego, California.
  34. Rudert MJ, Alliman K, Lundberg HJ, El-Khoury GY, Brown TD, Saltzman CL. Ankle articular cartilage thickness is accurately characterized with air-injection contrast-enhanced MDCT. American Orthopaedic Foot and Ankle Society's Annual 2002 Summer Meeting, July 11–14, 2002, Traverse City, Michigan.
  35. Tochigi Y, Saltzman CL, Amendola A, Rudert MJ, Baer TE, Brown TD. Direction of subtalar joint laxity with interosseous talocalcaneal ligament sectioning. American Orthopaedic Foot and Ankle Society's Annual 2002 Summer Meeting, July 11–14, 2002, Traverse City, Michigan.
  36. Rudert MJ, Alliman K, Lundberg HJ, El-Khoury GY, Brown TD, Saltzman CL. Ankle articular cartilage thickness is accurately measured with multi-detector computed tomography (MDCT). Proceedings of the IV World Congress of Biomechanics, August 4–9, 2002, Calgary, Alberta, Canada, p. 1092.
  37. Tochigi Y, Saltzman CL, Amendola A, Rudert MJ, Baer TE, Brown TD. Preferential direction of subtalar joint laxity with interosseous talocalcaneal ligament sectioning. Proceedings of the IV World Congress of Biomechanics, August 4–9, 2002, Calgary, Alberta, Canada, p. 460.
  38. Rudert MJ, Alliman K, Lundberg HJ, El-Khoury GY, Brown TD, Saltzman CL. Double contrast multi-detector CT (MD-CT) is superior to MR for assessing ankle cartilage thickness. International Federation of Foot & Ankle Societies 1<sup>st</sup> Triennial Scientific Meeting, September 12–14 2002, San Francisco, California.
  39. Tochigi Y, Saltzman CL, Amendola A, Rudert MJ, Baer TE, Brown TD. Preferential direction of subtalar joint laxity with interosseous talocalcaneal ligament injury. International Federation of Foot & Ankle Societies 1<sup>st</sup> Triennial Scientific Meeting, September 12–14 2002, San Francisco, California.
  40. McKinley TO, Rudert MJ, Lundberg HJ, Tochigi Y, Heiner AD, Brown TD. Dynamic contact pressure changes in pilon fractures with articular surface stepoff. Transactions of the 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, February 2–5, 2003, New Orleans, Louisiana, p. 0108.
  41. Rudert MJ, Alliman KJ, Lundberg HJ, El-Khoury GY, Brown TD, Saltzman CL. Articular cartilage thickness measurement with MRI and multi-detector computed tomography (MDCT). Transactions of the 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, February 2–5, 2003, New Orleans, Louisiana, p. 0571.
  42. Tochigi Y, Amendola A, Rudert MJ, Baer TE, Brown TD, Hillis SL, Saltzman CL. The role of the interosseous talocalcaneal ligament in subtalar joint stability. Transactions of the 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, February 2–5, 2003, New Orleans, Louisiana, p. 1302.
  43. Tochigi Y, Amendola A, Rudert MJ, Baer TE, Brown TD, Saltzman CL. Biomechanical effect of interosseous talocalcaneal ligament insufficiency on subtalar joint stability. American Academy of Orthopaedic Surgeons 70<sup>th</sup> Annual Meeting, February 5–9, 2003, New Orleans, Louisiana, p. 188.
  44. Tochigi Y, Rudert MJ, Brown TD, Saltzman CL. The role of the peri-ankle ligaments in stance phase. Final Program of the 19<sup>th</sup> Annual Summer Meeting of The American Orthopaedic Foot and Ankle Society, June 27–29, 2003, Hilton Head, South Carolina, p. 52.
  45. El-Khoury GH, Alliman K, Lundberg HJ, Rudert MJ, Brown TD, Saltzman CL. Double contrast MD-CT arthrography is superior to MRI in assessing cartilage thickness in the ankle. 89<sup>th</sup> Scientific Assembly & Annual Meeting of the Radiological Society of North America, November 30–December

- 5, 2003, Chicago, Illinois.
46. El-Khoury GY, Alliman K, Lundberg HJ, Rudert MJ, Brown TD, Saltzman CL. Double contrast MD-CT arthrography is superior to MRI in assessing cartilage thickness in the ankle. 89<sup>th</sup> Scientific Assembly and Annual Meeting of the Radiological Society of North America, December 1, 2003, Chicago, Illinois. Abstract C22-401 and Podium Presentation.
  47. Tochigi Y, Rudert MJ, Brown TD, McIff TE, Saltzman CL. Functional range of ankle motion of the S.T.A.R. prosthesis depends on accuracy of surgical implantation. 50<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, March 7–10, 2004, San Francisco, California. Abstract and Poster Presentation #1315.
  48. Tochigi Y, Rudert MJ, Amendola A, Brown TD, Saltzman CL. Tensile engagement of the peri-ankle ligaments in stance phase. 50<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, March 7–10, 2004, San Francisco, California. Abstract and Poster Presentation #1322.
  49. Tochigi Y, Rudert MJ, Brown TD, McIff TE, Saltzman CL. Effect of implantation accuracy on functional range of motion of the S.T.A.R. prosthesis. American Orthopaedic Foot and Ankle Society 20<sup>th</sup> Annual Summer Meeting, July 29–31, 2004, Seattle, Washington
  50. Baer TE, Pedersen DR, Rudert JM, Kallemeyn (Vos) NA, Grosland NM, Brown TD. A novel device for calibrating sheet array pressure sensors and for monitoring their performance. Proceedings of the 28<sup>th</sup> Annual Meeting of the American Society of Biomechanics, September 8–11, 2004, Portland, Oregon. Abstract #239.
  51. El-Khoury GY, Alliman KJ, Lundberg HJ, Rudert MJ, Brown TB, Saltzman CL. Accuracy of MD-CT arthrography in measuring articular thickness. The International Skeletal Society 31<sup>st</sup> Annual Refresher Course, St. Julians, Malta, October 10, 2004.
  52. McKinley TO, Rudert MJ, Koos DK, Pedersen DR, Baer TE, Tochigi Y, Marsh JL, Brown, TD. Real-time transient and whole-stance phase contact stress and contact stress gradient changes in an ankle incongruity model. OTA 20<sup>th</sup> Annual Meeting, October 8, 2004, Ft. Lauderdale/Hollywood, Florida. Paper Presentation #5, Abstract #101–102.
  53. McKinley TO, Rudert MJ, Koos DK, Pedersen DR, Baer TE, Tochigi Y, Marsh JL, Brown TD. Whole-cycle contact stress, contact stress directional gradient, and loading rate changes in an ankle incongruity model. 5<sup>th</sup> Combined Meeting of the Orthopaedic Research Societies of the U.S.A., Canada, Japan and Europe, October 11, 2004, Banff, Alberta, Canada. Session: Joint Biomechanics, Paper Presentation #064.
  54. McKinley TO, Rudert MJ, Koos DK, Pedersen DR, Baer TE, Tochigi Y, Marsh JL, Brown TD. Time-variant contact stress, contact stress directional gradient, and loading rate changes in an ankle incongruity model. 5<sup>th</sup> Combined Meeting of the Orthopaedic Research Societies of the U.S.A., Canada, Japan and Europe, October 10–13, 2004, Banff, Alberta, Canada. Poster Presentation #276.
  55. McKinley TO, Rudert MJ, Koos DK, Pedersen DR, Baer TE, Tochigi Y, Marsh JL, Brown TD. Time-variant contact stress, contact stress directional gradient, and loading rate changes in an ankle incongruity model. 5<sup>th</sup> Combined Meeting of the Orthopaedic Research Societies of the U.S.A., Canada, Japan and Europe, October 10–13, 2004, Banff, Alberta, Canada. Poster Presentation #276.
  56. Baer TE, Pedersen DR, Rudert MJ, Vos NA, Grosland NM, Brown TD. Calibrating and monitoring sheet array pressure sensors for intra-articular loading measurement. 5<sup>th</sup> Combined Meeting of the Orthopaedic Research Societies of the U.S.A., Canada, Japan and Europe, October 13, 2004, Banff, Alberta, Canada. Session: Arthroplasty II, Paper Presentation #115.
  57. McKinley TO, Rudert MJ, Koos DK, Pedersen DR, Baer TE, Tochigi Y, Marsh JL, Brown TD. Time-variant contact stress, contact stress directional gradient, and loading rate changes in an ankle incongruity model. 9<sup>th</sup> International Society for Fracture Repair, November 2–11, 2004, Bologna, Italy. Podium Presentation, Poster #47, Abstract #S23.
  58. Baer TE, Pedersen DR, Rudert MJ, Kallemeyn (Vos) NA, Grosland NM, Brown TD. Traveling-wave calibration of intra-articular sheet array pressure sensors. 9<sup>th</sup> World Congress of the Osteoarthritis Research Society International, December 2–5, 2004, Chicago, Illinois. Poster #306, Abstract #S125.
  59. Baer TE, Pedersen DR, Rudert MJ, Kallemeyn (Vos) NA, Grosland NM, Brown TD. Traveling-wave calibration of sheet array sensors for intra-articular pressure measurements. 51<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, February 20–23, 2005, Washington DC. Poster Presentation.
  60. Baer TE, Pedersen DR, Rudert MJ, Kallemeyn NA, Grosland NM, Brown TD. Calibration and

- monitoring of piezoresistive contact stress arrays using a traveling pressure wave protocol. XX<sup>th</sup> Congress of the International Society of Biomechanics and 29<sup>th</sup> Annual Meeting of the American Society of Biomechanics, July 31–August 5, 2005, Cleveland, Ohio. Instrumentation: Abstract #1165, Podium Presentation.
61. Heiner AD, Rudert MJ, McKinley TO. A device to measure in vivo translational and rotational laxity of rabbit knees. XX<sup>th</sup> Congress of the International Society of Biomechanics and 29<sup>th</sup> Annual Meeting of the American Society of Biomechanics, July 31–August 5, 2005, Cleveland, Ohio. Abstract #1004, Knee Mechanics 2, Podium Presentation.
  62. Tochigi Y, Rudert MJ, Amendola A, Brown TD, Saltzman CL. The contribution of articular geometry to ankle stabilization. American Orthopaedic Foot and Ankle Society 21<sup>st</sup> Annual Summer Meeting, July 14–17, 2005, Boston, Massachusetts.
  63. Tochigi Y, Rudert MJ, Saltzman CL, Amendola A, Brown TD. The contribution of articular surface geometry on ankle stabilization. XX<sup>th</sup> Congress of the International Society of Biomechanics and 29<sup>th</sup> Annual Meeting of the American Society of Biomechanics, July 31–August 5, 2005, Cleveland, Ohio. Ankle: Abstract #591, Podium Presentation.
  64. Heiner AD, Rudert MJ, McKinley TO, Fredericks DC, Bobst JA, Tochigi Y. In vivo measurement of translational and rotational laxity of rabbit knees. 10<sup>th</sup> World Congress on Osteoarthritis, December 8–11, 2005, Boston, Massachusetts. pp. S47, Poster Presentation #P75.
  65. Tochigi Y, Rudert MJ, Saltzman CL, Amendola A, Brown TD. The mechanisms of ankle stabilization: The role of articular surface geometry as the primary restraint. 10<sup>th</sup> World Congress on Osteoarthritis, December 8–11, 2005, Boston, Massachusetts. pp. S73, Poster Presentation #P138.
  66. Goldsworthy JK, Anderson DD, Rudert MJ, Tochigi Y, Pedersen DR, Brown TD. Validation of a patient-specific finite element model of the ankle. 14<sup>th</sup> Annual Symposium on Computational Methods in Orthopaedic Biomechanics, March 18, 2006, Chicago, Illinois. Abstract and Podium Presentation.
  67. Goreham-Voss CM, Rudert MJ, Brown TD. Poroelastic finite element analysis of a step-off articular incongruity. 14<sup>th</sup> Annual Symposium on Computational Methods in Orthopaedic Biomechanics, March 18, 2006, Chicago, Illinois. Abstract and Podium Presentation.
  68. Goldsworthy JK, Anderson DD, Rudert MJ, Tochigi Y, Pedersen DR, Brown TD. Validation of a patient-specific finite element model of the ankle. 2006 Midwest Graduate Student Biomechanics Symposium, March 31–April 1, 2006, Milwaukee, Wisconsin. Podium Presentation, Session 2: Locomotion 1.
  69. Goreham-Voss CM, Rudert MJ, Brown TD. Poroelastic finite element analysis of a step-off articular incongruity. 2006 Midwest Graduate Student Biomechanics Symposium, March 31–April 1, 2006, Milwaukee, Wisconsin. Poster Presentation.
  70. Goreham-Voss CM, Rudert MJ, Brown TD. Poroelastic finite element analysis of a step-off articular incongruity. The University of Iowa College of Engineering 4<sup>th</sup> Annual College of Engineering Research Open House, April 20, 2006, Iowa City, Iowa.
  71. Heiner AD, Rudert MJ, McKinley TO, Fredericks DC, Bobst JA, Tochigi Y. In vivo measurement of translational and rotational laxity of rabbit knees. 52<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, March 19–22, 2006, Chicago, Illinois. Poster Presentation #547.
  72. McKinley TO, Rudert MJ, Tochigi Y, Pedersen DR, Brown TD. Cartilage contact pressure elevations associated with articular surface incongruity and unstable joint motion. 52<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, March 19–22, 2006, Chicago, Illinois. Poster Presentation #1523.
  73. Tochigi Y, Rudert MJ, Saltzman CL, Amendola A, Brown TD. The effect of articular surface topographic variability on ankle stabilization. 52<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society, March 19–22, 2006, Chicago, Illinois. Poster Presentation #1892.
  74. Tochigi Y, Rudert MJ, Saltzman CL, Amendola A, Brown TD. The contribution of articular surface geometry to ankle stabilization. 73<sup>rd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, March 22–26, 2006, Chicago, Illinois. Poster Presentation #P223.
  75. Goldsworthy JK, Anderson DD, Rudert MJ, Tochigi Y, Pedersen DR, Brown TD. Validation of a patient-specific finite element model of the ankle. 30<sup>th</sup> Annual Meeting of the American Society of

- Biomechanics, September 6–9, 2006, Blacksburg, Virginia. Abstract ID #212, Session: Finite Element Analysis, Podium Presentation. MicroStrain Award Winner.
76. Goreham-Voss CM, Rudert MJ, Brown TD. Poroelastic finite element analysis of unstable motion of an incongruously reduced intra-articular fracture. 30<sup>th</sup> Annual Meeting of the American Society of Biomechanics, September 6–9, 2006, Blacksburg, Virginia. Abstract ID #198, Session: Modeling, Poster Presentation.
  77. Tochigi Y, Rudert MJ, McKinley TO, Pedersen DR, Brown TD. Cartilage contact stress aberration during unstable joint motion. 30<sup>th</sup> Annual Meeting of the American Society of Biomechanics, September 6–9, 2006, Blacksburg, Virginia. Abstract ID #206, Session: Bone/Cartilage, Poster Presentation.
  78. Ko C, Rudert MJ, Brown TD. Determination of the transverse compressive properties of human flexor digitorum tendons. 53<sup>rd</sup> Annual Meeting of the Orthopaedic Research Society, February 11–14, 2007, San Diego, California. Abstract Submission 3804A20794, Podium Presentation #51. Session 8: Tendon and Ligament Repair.
  79. McKinley TO, Heiner AD, Bobst JA, Rudert MJ, Brown TD. In vivo measurement of instability in rabbit knees. 53<sup>rd</sup> Annual Meeting of the Orthopaedic Research Society, February 11–14, 2007, San Diego, California. Abstract Submission 2250A5118. Poster Presentation #817.
  80. McKinley TO, Tochigi Y, Rudert MJ, Pedersen DR, Brown TD. Instability-associated changes in contact stress and contact stress rates in human ankles. 74<sup>th</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, February 14–18, 2007, San Diego, California. Poster # P466.
  81. Tochigi Y, Rudert MJ, McKinley TO, Pedersen DR, Brown TD. An experimental model of joint instability for study of dynamic cartilage contact mechanics. 53<sup>rd</sup> Annual Meeting of the Orthopaedic Research Society, February 11–14, 2007, San Diego, California. Abstract Submission 1140A14915, Poster Presentation #614.
  82. Ko C, Rudert MJ, Brown TD. A technique for determination of transverse material properties of human flexor digitorum tendons. 31<sup>st</sup> Annual Meeting of the American Society of Biomechanics, August 22–25, 2007, Stanford, California. Abstract and Podium 12: Tendon and Ligament.
  83. Tochigi Y, Rudert MJ, McKinley TO, Pedersen DR, Brown TD. Correlation of dynamic cartilage contact stress aberration with severity of joint instability. 31<sup>st</sup> Annual Meeting of the American Society of Biomechanics, August 22–25, 2007, Stanford, California. Abstract ID #213, Poster Presentation P4-15.
  84. Goreham-Voss CM, Tochigi Y, Rudert MJ, Brown TD. Contact face geometry as a determinant of cartilage stress during impaction testing. 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, March 2-5, 2008, San Francisco, California. Abstract ID: 395240, Poster Presentation #634, Session 7: Cartilage Mechanics.
  85. Goreham-Voss CM, McCabe DJ, Rudert MJ, Martin JA, Pedersen DR, Brown TD. Spatial correlations between local impact stress and cell death distributions. OARSI World Congress on Osteoarthritis 2008, September 18–21, 2008, Rome, Italy. Abstract 07-A-292-OARSI, Poster Presentation #121.
  86. Tochigi Y, McKinley TO, Heiner AD, Fredericks DC, Bobst JA, Martin JA, Rudert MJ, Brown TD. A rabbit knee model of controlled instability. OARSI World Congress on Osteoarthritis 2008, September 18–20, 2008, Rome, Italy. Abstract 07-A-490-OARSI, Poster Presentation #80.
  87. Tochigi Y, McCabe D, Martin JA, Rudert MJ, Buckwalter JA, Brown TD. Acute chondrocyte damage in human ankle intraarticular fracture. OARSI World Congress on Osteoarthritis 2008, September 18–21, 2008, Rome, Italy. Abstract 07-A-496-OARSI, Poster Presentation #208.
  88. Tochigi Y, Rudert MJ, Anderson DD, Brown TD, Annunziato A. Contact stresses in the human ankle with a focal resurfacing implant. OARSI World Congress on Osteoarthritis 2008, September 18–21, 2008, Rome, Italy. Abstract 07-A-500-OARSI, Poster Presentation #558.
  89. Tochigi Y, McKinley TO, Martin JA, Rudert MJ, Brown TD. An organ-level animal model of human intraarticular fracture. 24<sup>th</sup> Annual Meeting of the Orthopaedic Trauma Association, Denver, Colorado, October 15–18, 2008. Submitted Abstract #632.
  90. Tochigi Y, Anderson DD, Rudert MJ, Vaseenon T, Brown TD, Amendola A. Effect of implantation height upon contact stresses in the human ankle with a focal resurfacing implant. 55<sup>th</sup> Annual Meeting

of the Orthopaedic Research Society, February 22–25, 2009, Las Vegas, Nevada. Abstract ID: ORS2009-2175. Podium Presentation, Paper #109, Session 20: Foot and Ankle.

91. Tochigi Y, Martin JA, Rudert MJ, McCabe D, Goreham-Voss CM, Buckwalter JA, Brown TD. Acute phase pathology of cartilage injury in human ankle intraarticular fractures. 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, February 22–25, 2009, Las Vegas, Nevada. Abstract ID: ORS2009-2661. Poster Presentation #1078, Poster Session 25: Cartilage Impact Models.
92. Tochigi Y, McKinley TO, Vaseenon T, Fredericks DC, Heiner AD, Martin JA, Rudert MJ, Brown TD. Degree of joint instability determines severity of cartilage degeneration in rabbit knees. 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, February 22–25, 2009, Las Vegas, Nevada. Abstract ID: ORS2009-3220. Poster Presentation #1115, Poster Session 28: Osteoarthritis Animal Models.

### **Grant Support / Research Funding / Contracts**

#### **Pathogenesis–Prevention of Post-Traumatic OA—NIH 5 P50 AR048939**

09/16/02–08/31/08, \$4,647,276 Total Costs

Joseph A. Buckwalter, M.D., SCOR Director

Thomas D. Brown, Ph.D., SCOR Associate Director

#### **Project 2: Effects of Distraction and Motion on Osteoarthritis**

09/16/02–08/31/08, \$1,045,190 Total Costs

Annunziato Amendola, M.D., Principal Investigator

Thomas D. Brown, Ph.D., George El-Khoury, M.D., Steven L. Hillis, Ph.D.,

James A. Martin, Ph.D., M. James Rudert, Ph.D., Alan L. Stolpen, M.D., Ph.D.,

Daniel T. Thedens, Ph.D., Investigators

#### **Biomechanics Core**

09/16/02–08/31/08, \$1,261,464 Total Costs

Thomas D. Brown, Ph.D., Principal Investigator

Donald D. Anderson, Ph.D., Douglas R. Pedersen, Ph.D.,

M. James Rudert, Ph.D., Investigators

#### **Unstable Joints: Stress Anomaly and OA—Center for Disease Control & Prevention**

##### **R49 CCR721745-03**

09/30/02–09/29/05, \$859,942 Total Costs

09/30/04–09/29/05, \$298,153 Annual Total Costs

Todd O. McKinley, M.D., Principal Investigator

Thomas D. Brown, Ph.D., Nicole M. Grosland, Ph.D., James A. Martin, Ph.D.,

M. James Rudert, Ph.D., Investigators

Stephen L. Hillis, Ph.D., Consultant

#### **The Role of the Articular Surfaces in Ankle Stability—Chiba University Orthopaedic Alumni**

04/01/2005–03/31/2006, \$2,857 Total Costs

Yuki Tochigi, M.D., Ph.D., Principal Investigator

M. James Rudert, Ph.D., Annunziato Amendola, M.D., Thomas D. Brown, Ph.D.,

Charles L. Saltzman, M.D., Co-Investigators

**Investigation of Dislocation Kinematics of Oxinium THA Components—Smith & Nephew, Inc.**

06/15/06–08/15/06, \$14,154 Total Costs

M. James Rudert, Ph.D., Principal Investigator

Anneliese D. Heiner, Ph.D., Yuki Tochigi, M.D., Ph.D., Investigators

Thomas D. Brown, Ph.D., Consultant

**Implant/Construct Interactions in the Biomechanics of Total Hip Dislocation—**

**NIH 5 R01 AR53553**

09/25/06–08/31/10, \$1,220,144 Total Costs

Thomas D. Brown, Ph.D., Principal Investigator

John J. Callaghan, M.D., Jeffrey A. Weiss, Ph.D., Co-Investigators

Douglas R. Pedersen, Ph.D., M. James Rudert, Ph.D., Yuki Tochigi, M.D., Ph.D., Investigators

**The Effects of Osteochondral Defects and Focal Resurfacing on Joint Contact Mechanics—ArthroSurface, Inc.**

01/01/07–12/31/08 \$60,738 Total Costs

Annunziato Amendola, M.D., Principal Investigator

Donald D. Anderson, Ph.D., Yuki Tochigi, M.D., Ph.D., Co-Principal Investigators

M. James Rudert, Ph.D., Douglas R. Pedersen, Ph.D., Thomas D. Brown, Ph.D., Co-Investigators

Thomas E. Baer, B.A., Research Associate

**Development of an Animal Model of Human Intra-Articular Fracture—University of Iowa OVPR Biological Sciences Funding Program**

02/01/07–12/31/08, \$29,867 Total Costs

Yuki Tochigi, M.D., Ph.D., Principal Investigator

James A. Martin, Ph.D., M. James Rudert, Ph.D., Investigators

Thomas D. Brown, Ph.D., Michael G. Conzemius, D.V.M., Ph.D., Diplomate.A.C.V.S.,

Todd O. McKinley, M.D., Consultants

**Biomechanics of the Dysplastic Hip—NIH 5 R01 AR053344**

07/01/07–06/30/12

Jeffrey A. Weiss, Ph.D., Principal Investigator

Christopher L. Peters, M.D., Co-Principal Investigator

Gerard Ateshian, Ph.D., Consultant

University of Iowa Subcontract

07/01/07–06/30/12 \$296,407 Total Costs

07/01/08–06/30/09 \$70,998 Annual Total Costs

Thomas D. Brown, Ph.D., Subcontract Principal Investigator

M. James Rudert, Ph.D., Thomas E. Baer, B.A., Investigators

**Local Biomechanics of Median Nerve Insult in Carpal Tunnel—NIH 5 R01 AR053899**

09/07/07–08/31/11, \$1,034,322 Total Costs

Thomas D. Brown, Ph.D., Principal Investigator

Ericka A. Lawler, M.D., M. James Rudert, Ph.D., Daniel R. Thedens, Ph.D.,

Yuki Tochigi, M.D., Ph.D., Co-Investigators

**New Approaches to Assess and Forestall Osteoarthritis in Injured Joints—NIH 5 P50 AR055533**

09/10/07–08/31/12, \$7,435,286 Total Costs

Joseph A. Buckwalter, M.D., SORT Director  
Thomas D. Brown, Ph.D., SORT Associate-Director

**Project 2: Acute Versus Chronic Mechanical Damage in the Etiology of Post-Traumatic OA**

09/10/07–08/31/12, \$694,171 Total Direct Costs  
09/10/07–08/31/08, \$118,042 Annual Total Direct Costs  
Todd O. McKinley, M.D., Principal Investigator  
James A. Martin, Ph.D., M. James Rudert, Ph.D., Yuki Tochigi, M.D., Ph.D., Investigators

**Biomechanics & Imaging Core**

09/10/07–08/31/12, \$1,298,787 Total Direct Costs  
Thomas D. Brown, Ph.D., Principal Investigator  
Thomas E. Baer, B.A., George Y. El-Khoury, M.D., Anneliese D. Heiner, Ph.D.,  
M. James Rudert, Ph.D., Andrew R. Willis, Ph.D., Investigators

**Tissue and Experimental Modeling Core**

09/10/07–08/31/12, \$527,749 Total Direct Costs  
Yuki Tochigi, M.D., Ph.D., Principal Investigator  
Douglas C. Fredericks, B.S., James A. Martin, Ph.D., M. James Rudert, Ph.D., Investigators  
Annunziato Amendola, M.D., Thomas D. Brown, Ph.D.,  
Michael G. Conzemius, D.V.M, Ph.D., Diplomate, A.C.V.S., Consultants

**Acute Cartilage Damage Associated with Intraarticular Fractures— Orthopaedic Trauma Association**

01/01/09–12/31/09, \$25,000 Total Direct Costs  
Yuki Tochigi, M.D., Ph.D., Principal Investigator  
Todd O. McKinley, M.D., Co-Principal Investigator  
James A. Martin, Ph.D., M. James Rudert, Ph.D., Investigators