

# Christian M. Puttlitz, Ph.D.

*Curriculum Vitae*

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## CONTACT INFORMATION

Professor, Department of Mechanical Engineering  
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## PERSONAL INFORMATION

Date of Birth: July 28, 1970

Place of Birth: Lansing, Michigan

Citizenship: United States of America

Marital Status: Married (Tonya Puttlitz)

Children: 1 (Hayden Sierra)

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## FORMAL EDUCATION

Bachelor of Science (B.S.) Department of Materials Science Engineering and Mechanics Michigan State University East Lansing, Michigan	5/1992
Master of Science (M.S.) Department of Bioengineering Clemson University Clemson, South Carolina	12/1993
Doctor of Philosophy (Ph.D.) Department of Biomedical Engineering University of Iowa Iowa City, Iowa	5/1999
Postdoctoral Research Fellow University of California, San Francisco Orthopaedic Bioengineering Laboratory	1999-2001

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## PROFESSIONAL AND ACADEMIC EXPERIENCE

Erskine Fellow Department of Mechanical Engineering University of Canterbury Christchurch, New Zealand	2015-2016
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<p>Professor  Department of Mechanical Engineering (primary appointment)  School of Biomedical Engineering (secondary appointment)  Department of Clinical Sciences (courtesy appointment)  Colorado State University  Fort Collins, CO</p>	2014-present
<p>Associate Department Head for Graduate Studies  Department of Mechanical Engineering  Colorado State University  Fort Collins, CO</p>	2013-2016
<p>Associate Professor (courtesy appointment)  Department of Clinical Sciences  College of Veterinary Medicine and Biomedical Sciences  Colorado State University.  Fort Collins, CO</p>	2010-2014
<p>Associate Professor  School of Biomedical Engineering  Colorado State University  Fort Collins, CO</p>	2008-2014
<p>Interim Director  School of Biomedical Engineering  Colorado State University  Fort Collins, CO</p>	2007-2008
<p>Assistant Professor and Director  Orthopaedic Biomechanics Laboratory  San Francisco General Hospital  Department of Orthopaedic Surgery  University of California, San Francisco (UCSF)</p>	2001-2005
<p>Director  Orthopaedic Bioengineering Research Laboratory  Associate Professor, Department of Mechanical Engineering  Colorado State University  Fort Collins, CO</p>	2005-present
<p>Full Group Faculty Member  UCSF/UC Berkeley Joint Graduate Group in Bioengineering</p>	2001-2005
<p>Graduate Research Assistant  Departments of Biomedical Engineering and Orthopaedic Surgery  University of Iowa</p>	1994 - 1999
<p>Graduate Teaching Assistant  Department of Biomedical Engineering  University of Iowa</p>	1997 - 1998
<p>Pre-Professional Internship  International Business Machines (IBM)  Thermal Cooling Technology Group</p>	1991

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**VISITING PROFESSORSHIPS AND INVITED LECTURES**

- Visiting Professor, Department of Orthopaedic Surgery, and the Florida Orthopaedic Institute, University of South Florida, Tampa, FL, March 31, 2017.
  - Grand Rounds Lecture: “Sensor-based fracture healing prediction.”
- Invited Lecture, Rush University, Chicago, IL, September 19, 2016.
  - Grand Rounds Seminar: “Fracture healing prediction using implantable wireless sensors.” Department of Orthopaedic Surgery.
- Invited Lecture, Department of Orthopaedic Surgery, University of Otago, Christchurch, New Zealand, May 17, 2016.
  - Seminar: “Wireless sensors for fracture healing monitoring.”
- Invited Lecture, Christchurch General Hospital, Christchurch, New Zealand, March 21, 2016
  - Grand Rounds Seminar: “Sheep in space: bone fracture healing in microgravity.”
- Erskine Fellow, University of Canterbury, Department of Mechanical Engineering Christchurch, New Zealand, March 10, 2016
  - Seminar: “Bone fracture healing: how it is altered in outer space and development for detecting aberrant healing.”
- Invited Lecture, University of California, San Francisco, San Francisco, CA; April, 30, 2014.
  - Grand Rounds Seminar: “Bone fracture technology development for prediction of aberrant healing and issues associated with microgravity.” Department of Orthopaedic Surgery.
- Invited Lecturer, Texas A&M, College Station, TX; February 14, 2014
  - Department of Exercise Physiology Seminar: “Evaluation of bone fracture healing in simulated microgravity: gearing up to send man/woman to Mars.”
  - Mentored Research Program in Space Life Sciences Seminar: “Experimental and computational development of a Haversian bone model of simulated microgravity.”
- Visiting Professor, Universidad del Valle, Cali, Columbia; April 2013.
  - Keynote lecture: “BioMEMs sensors for predicting fracture healing y modeling microgravity using an ovine model.” Jornada Academica de Biomechanica, Universidad del Valle, Cali, Columbia; April 24, 2013.
  - Seminar: “Cervical Spine Finite Element Modeling and Non-Linear Viscoelasticity Implementation” Facultad de Ingenierias, Universidad del Valle, Cali, Columbia; April 24, 2013.
- Distinguished Visiting Research Scholar, International Collaboration On Repair Discoveries, Vancouver General Hospital, University of British Columbia, Vancouver, Canada; June 2012.
  - "Alterations in Cervical Spine Mechanics due to Ligamentous Damage and Intubation Protocol" presented to ICORD (International Collaboration On Repair Discoveries), University of British Columbia, Vancouver, BC Canada; June 7, 2012.
  - "In Vivo Sensing of Fracture Healing" presented to the Centre for Hip Health and Mobility, University of British Columbia, Vancouver, BC Canada; June 21, 2012.
  - "Viscoelastic Characterization and Modeling of Musculoskeletal Soft Tissues" presented to the Department of Mechanical Engineering, University of British Columbia, Vancouver, BC Canada; June 26, 2012.

- Invited Lecturer, University of Maryland, College Park, March 5, 2012
  - Department of Biomedical Engineering seminar series: "Adventures in Orthopaedic Biomechanics: Ligament Viscoelasticity and *In Vivo* Sensing of Fracture Healing".
- Invited Lecturer, Bilkent University, Ankara, Turkey; October 4, 2011
  - Departments of Electrical Engineering and Physics: "*In vivo* sensing of fracture healing".
- Invited Lecturer, Swiss Federal Institute of Technology, Zurich, Switzerland; September 28, 2011
  - Department of Biomedical Engineering seminar series: "Ligament Viscoelasticity and *in vivo* sensing of fracture healing".
- Invited Lecturer, University of Notre Dame, South Bend, Indiana; September 19, 2011.
  - Departments of Biomedical and Mechanical Engineering: "Modeling spinal degeneration, ligament viscoelasticity and *in vivo* sensing of fracture healing".
- Invited Lecturer: Special session at the Canadian Congress of Applied Mechanics on the campus of the University of British Columbia, Vancouver, Canada; June 7, 2011.
  - "A continuum mechanics approach for modeling the annulus fibrosus using experimental data."
- Invited Lecture: Northern Colorado Chapter of the American Society of Mechanical Engineering (ASME), Windsor, CO; March 23, 2011.
  - "Orthopaedic Biomechanics: Mechanical Engineering Applied to the Human Condition"
- Keynote Lecturer: PreMedica (pre-medical society) Professional Symposium, Colorado State University, Fort Collins, CO; February 19, 2011.
  - "Orthopaedic Biomechanics"
- Invited Lecturer: University of Maryland Medical School, Baltimore, MD; October 13, 2010.
  - Cardiovascular Service Grand Rounds "Biaxial Material Characterization of DVT Veins".
- Invited Lecturer: University of Colorado, Boulder, CO; February 10, 2010.
  - Mechanical Engineering Research Seminar: "Adventures in Finite Element Modeling of the Spine".
- Invited Lecturer: Medtronic Spinal and Biologics, Inc., Memphis, TN; August 8, 2008.
  - "Spinopelvic Mechanics and Fixation",
- Invited Lecturer: University of Canterbury, Christchurch, New Zealand; January 14, 2008.
  - Bioengineering seminar: "Basic Science and Clinically-Relevant Investigations in Orthopaedic Biomechanics".
- Invited Lecturer: Colorado State University.
  - Department of Health and Exercise Science: "Orthopaedic Biomechanics Research".
- Invited Lecturer: Clemson University, Clemson, SC; June 8, 2007
  - NSF REU seminar series: "Research Experiences for Undergraduates".
- Invited Lecturer: Hacettepe University, Ankara, Turkey; June 5, 2007.
  - Orthopaedic Grand Rounds seminar: "Translational Biomechanics Research".
- Invited Lecturer: Bilkent University, Ankara, Turkey; June 4, 2007.
  - Engineering seminar series: "Miniature Pressure Sensor Development for Orthopaedic Applications".

- Invited Lecturer: Bogazici University, Istanbul, Turkey; June 1, 2007.
  - Mechanical Engineering seminar: "Orthopaedic Finite Element Models".
- Invited Lecturer: CSU Animal Cancer Center, Fort Collins, CO; March 19, 2007.
  - "Clinically Relevant Investigations in Orthopaedic Biomechanics".
- Invited Lecturer: University of British Columbia, Vancouver, Canada; February 6, 2007.
  - Department of Orthopaedic Surgery seminar: "Spinal Biomechanics."
- Invited Lecturer: "University of Colorado Health Sciences Center, Aurora, CO; October 28, 2006.
  - Department of Orthopaedic Surgery Grand Rounds: "CSU Orthopaedic Bioengineering Research Laboratory Project Review".
- Invited Lecturer: University of Colorado Health Sciences Center, Department of Orthopaedic Surgery, Aurora, CO; July 12, 2006.
  - Resident Basic Science Series: "Basic Spinal Mechanics".
- Invited Lecturer: Colorado School of Mines, Department of Mechanical Engineering seminar, Golden, CO; March 16, 2006.
  - Mechanical Engineering seminar series: "Advances in Orthopaedic Biomechanics."

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#### INVITED BOOK CHAPTERS AND REVIEW ARTICLES

1. **CM Puttlitz**, VK Goel, MH Pope. "Biomechanical testing sequelae relevant to spinal fusion and instrumentation." *Orthopedic Clinics of North America* 29:571-589, 1998.
2. **CM Puttlitz**, VK Goel, RF McLain. "Biomechanics of spinal instrumentation." in Chapman's Operative Orthopaedics, Lippincott Raven Publishers, Philadelphia, 3619-32, 2001.
3. **CM Puttlitz** and D DiAngelo. Cervical spine arthroplasty biomechanics. *Neurosurgery Clinics of North America* 16:589-94, 2005.
4. DJ DiAngelo and **CM Puttlitz**. "Biomechanical aspects associated with cervical disc arthroplasty." in Dynamic Reconstruction of the Spine, DH Kim, FP Cammisa, RG Fessler (eds.), Thieme Medical Publishers, 2006.
5. T Miclau, K Bozic, B Tay, H Kim, C Colnot, **C Puttlitz**, J Gan, B Boyan, B Eames, L De La Fuente, J Helms. "Bone injury, repair and regeneration." in Orthopaedic Basic Science: Foundations of Clinical Practice (3<sup>rd</sup> Edition), TA Einhorn, RJ O'Keefe, JA Buckwalter (eds), American Academy of Orthopaedic Surgeons, p. 331-48, 2007.
6. BG Santoni and **CM Puttlitz**. "Biomechanical aspects associated with cervical spine instrumentation and arthroplasty." *Minerva Ortopedica e Traumatologica* 57:303-22, 2007.
7. Santoni BG, Lyons AS, McGilvray KC, Turner AS, Patel VV, **Puttlitz CM**. "Biomechanical and kinetic testing of two-level cervical disc replacement." *Minerva Ortopedica e Traumatologica* 61:1-9, 2010.
8. **CM Puttlitz**, S Shetye, KL Troyer. "Orthopaedic Soft Tissue Viscoelastic Material Modeling: Constitutive Formulation, Numerical Integration, and Computational Implementation" in Computational Bioengineering, G Zhang (ed), CRC/Taylor & Francis, p. 96-115, 2015.

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**PEER-REVIEWED JOURNAL PUBLICATIONS**

1. **CM Puttlitz.** “Optimal concentrations of thermal grease constituents for thermal pastes in flip-chip applications.” *Flip-Chip Technology and TAB/Advanced Packaging*, February, 1994.
2. **CM Puttlitz, BD Adams, TD Brown.** “Bioabsorbable pin fixation of intercarpal joints: an evaluation of fixation stiffness.” *Clinical Biomechanics* 12:149-153, 1997.
3. **CM Puttlitz, VK Goel, CR Clark, VC Traynelis, JL Scifert, NM Grosland.** “Biomechanical rationale for the pathology of rheumatoid arthritis in the craniovertebral junction.” *Spine* 25:1607-1616, 2000.
4. **CM Puttlitz, VK Goel, CR Clark, VC Traynelis.** “Pathomechanisms of failures of the odontoid.” *Spine* 25:2868-2876, 2000.
5. **CM Puttlitz, VK Goel, VC Traynelis, CR Clark.** “A finite element investigation of upper cervical fixation.” *Spine* 26:2449-2455, 2001.
6. FS Kleinstueck, CJ Diederich, WH Nau, JA Smith, **CM Puttlitz**, DS Bradford, JC Lotz: “Acute biomechanical and histological effects of intradiscal electrothermal therapy on human lumbar discs.” *Spine* 26:2198-2207, 2001.
7. RP Melcher; **CM Puttlitz**, FS Kleinstueck, JC Lotz, J Harms, DS Bradford. “Biomechanical testing of posterior atlanto-axial fixation techniques.” *Spine* 27:2435-2430, 2002.
8. C Byl, **C Puttlitz**, N Byl, J Lotz, K Topp. “Strain in the median and ulnar nerves during upper extremity positioning.” *Journal of Hand Surgery* 27:1032-1040, 2002.
9. T Ishiko, **CM Puttlitz**, JC Lotz, E Diao. “Scaphoid kinematic behavior after division of the transverse carpal ligament.” *Journal of Hand Surgery* 28:267-71, 2003.
10. FS Kleinstueck, CJ Diederich, WH Nau, **CM Puttlitz**, JA Smith, DS Bradford, JC Lotz: “Temperature and thermal dose distributions during intradiscal electrothermal therapy in the cadaveric lumbar spine.” *Spine* 28:1700-9, 2003.
11. **CM Puttlitz**, RP Melcher, FS Kleinstueck, J Harms, DS Bradford, JC Lotz. “Stability analysis of craniovertebral fixation techniques.” *Journal of Bone and Joint Surgery* 86A:561-8, 2004.
12. **CM Puttlitz**, V Deviren, JA Smith, FS Kleinstueck, QNH Tran, RT Hopkins, P Eisele, JC. Lotz: “Biomechanics of cervical laminoplasty: kinetic studies comparing different surgical techniques, temporal effects and the degree of level involvement.” *European Spine Journal* 13:213-21, 2004.
13. **CM Puttlitz**, BK Tay, MA Rousseau, Z Xu, DS Bradford, JC Lotz. “Intervertebral disc replacement maintains cervical spine kinetics.” *Spine* 29:2809-14, 2004.
14. D Ananthkrishnan, S Berven, K Chang, JC Lotz, Z Xu, **CM Puttlitz**. “The effect on anterior column loading due to different vertebral augmentation techniques.” *Clinical Biomechanics* 20:25-31, 2005.
15. BS Boyd, **C Puttlitz**, J Gan, KS Topp. “Strain and excursion in the rat sciatic nerve during a modified straight leg raise are altered after traumatic nerve injury.” *Journal of Orthopaedic Research* 23:764-70, 2005.
16. J Gorek, E Acaroglu, S Berven, A Yousef, **CM Puttlitz**. “Constructs incorporating intra-laminar C2 screws provide rigid stability for atlanto-axial fixation.” *Spine* 30:1513-8, 2005.

17. S Gupta, F Carrillo, M Balooch, L Pruitt, **C Puttlitz**. “Simulated soft tissue nanoindentation – a finite element study.” *Journal of Materials Research* 20:1979-94, 2005.
18. C Ames, F Acosta, J Chi, J Iyengar, W Muiru, E Acaroglu, **C Puttlitz**. “Biomechanical comparison of PLIF and TLIF performed at one and two levels.” *Spine* 30:E562-66, 2005.
19. C Lu, T Miclau, D Hu, E Hansen, K Tsui, **C Puttlitz**, R Marcucio. “Cellular basis for age-related changes in fracture repair.” *Journal of Orthopaedic Research* 23:1300-7, 2005.
20. F Carrillo, S Gupta, M Balooch, S Marshall, G Marshall, L Pruitt, **C Puttlitz**. “Nanoindentation of polydimethylsiloxane elastomers: effect of cross-linking, work of adhesion and fluid environment on elastic modulus.” *Journal of Materials Research* 20:2820-30, 2005.
21. V Deviren, E Acaroglu, J Lee, S Hu, L Lenke, D Polly, T Kuklo, M O’Brien, D Brumfield, **CM Puttlitz**. “Pedicle screw fixation of the thoracic spine: an *in vitro* biomechanical study on different configurations.” *Spine* 30:2530-7, 2005.
22. L Comerford, B Ma, J Wilson, **CM Puttlitz**. “Biomechanical analysis of arthroscopic rotator cuff repairs – double vs. single row fixation.” *Journal of Bone and Joint Surgery* 88:403-10, 2006.
23. C Lindsey, V Deviren, Z Xu, RF Yeh, **CM Puttlitz**. “The effects of rod contouring on spinal construct fatigue strength.” *Spine* 31:1680-7, 2006.
24. M Fujita, M Diab, Z Xu, **C Puttlitz**. “A biomechanical analysis of sublaminar and subtransverse process fixation using metal wires and polyethylene cables.” *Spine* 31:2202-8, 2006.
25. S Gupta, F Carrillo, C Li, L Pruitt, **C Puttlitz**. “Adhesive forces significantly affect elastic modulus determination of soft polymeric materials in nanoindentation.” *Materials Letters* 61:448-51, 2007.
26. **CM Puttlitz**, J Harms, Z Xu, V Deviren, RP Melcher. “Acute stability afforded by C2 replacement constructs.” *Spine Journal* 7:210-215, 2007.
27. T Kim, U Ayturk, A Haskell, T Miclau, **C Puttlitz**. “Fixation of osteoporotic distal fibula fractures: a biomechanical comparison of locking versus conventional plates.” *Journal of Foot and Ankle Surgery* 46:2-6, 2007.
28. **CM Puttlitz**, F Masaru, A Barkley, M Diab, E Acaroglu. “A biomechanical assessment of thoracic spine stapling.” *Spine* 32:766-771, 2007.
29. KK Haussler, AE Hill, **CM Puttlitz**, CW McIlwraith. “Effects vertebral mobilization and manipulation on kinematics of the thoracolumbar region.” *American Journal of Veterinary Research* 68:508-16, 2007.
30. B Boyd, **C Puttlitz**, LJ Noble-Hausslein, CM John, A Trivedi, KS Topp. “Deviations in gait pattern in experimental models of hindlimb paresis shown by a novel pressure mapping system.” *Journal of Neuroscience Research* 85:2272-83, 2007.
31. T Miclau, C Lu, Z Thompson, P Choi, **C Puttlitz**, R Marcucio, J Helms. “Effects of delayed stabilization on fracture healing.” *Journal of Orthopaedic Research* 25:1552-8, 2007.
32. BG Santoni, W Womack, DL Wheeler, **CM Puttlitz**. “A mechanical and computational investigation of conduit orientation on the strength of massive bone allografts.” *Bone* 41:769-74, 2007.
33. WJ Womack, BG Santoni, **CM Puttlitz**. “Diametral compression of non-circular diaphyseal bone sections.” *Journal of Biomechanics* 41:194-9, 2008.

34. W Womack, D Woldtved, **CM Puttlitz**, “Lower cervical spine facet cartilage thickness mapping.” *Osteoarthritis and Cartilage* 16:1018-23, 2008.
35. U Kandemir, A Matityahu, R Desai, **C Puttlitz**. “Does a volar locking plate provide equivalent stability as a dorsal nonlocking plate in a dorsally comminuted distal radius fracture? A biomechanical study.” *Journal of Orthopaedic Trauma* 22:605-10, 2008.
36. R Melik, N Perkgoz, E Unal, Z Dilli, **C Puttlitz**, H Demir. “Bio-implantable passive on-chip RF-MEMS strain sensing resonators sensors for orthopaedic applications.” *Journal of Micromechanics and Microengineering* 18; article number: 115017, 2008.
37. C Goh, B Santoni, **C Puttlitz**, R Palmer. “Comparison of the mechanical behaviors of semicontoured, locking plate-rod fixation and anatomically contoured, conventional plate-rod fixation applied to experimentally induced gap fractures in canine femora.” *American Journal of Veterinary Research* 70:23-9, 2009.
38. BG Santoni, BJ Hindman, **CM Puttlitz**, JB Weeks, N Johnson, M Maktabi, MM Todd. “Manual in-line stabilization increases pressures applied by the laryngoscope blade during direct laryngoscopy and orotracheal intubation.” *Anesthesiology* 110:24-31, 2009.
39. KK Hausler, KC McGilvray, UM Ayturk, **CM Puttlitz**, AE Hill, CW McIlwraith. “Deformation of the equine pelvis in response to in vitro 3D sacroiliac joint loading.” *Equine Veterinary Journal* 41:207-12, 2009.
40. R Melik, E Unal, N Perkgoz, **C Puttlitz** and HV Demir. “Flexible metamaterials for wireless strain sensing.” *Applied Physics Letters* 95; article number: 181105, 2009.
41. HE Aryan, CB Newman, DC Lu, SS Hu, BK Tay, DS Bradford, **CM Puttlitz**, Ames CP. “Relaxation of forces needed to distract cervical vertebrae after discectomy: a biomechanical study.” *Journal of Spinal Disorders & Techniques* 22:100-4, 2009.
42. BG Santoni, R Hynes, KC McGilvray, WP Didelot, J Bellflower, G Rodriguez-Canessa, AS Lyons, MAW Henson, WJ Womack, **CM Puttlitz**. “Cortical bone trajectory for lumbar pedicle screws.” *Spine Journal* 9:366-73, 2009.
43. R Melik, E Unal, N Perkgoz, **C Puttlitz**, HV Demir. “Metamaterial-based wireless strain sensors.” *Applied Physics Letters* 95; article number: 011106, 2009.
44. S Sheyte, K Malholtra, S Ryan, **C Puttlitz**. “Determination of mechanical properties of canine carpal ligaments.” *American Journal of Veterinary Research* 70:1026-30, 2009.
45. R Melik, E Unal, N Perkgoz, **C Puttlitz**, HV Demir. “Circular high-q resonating isotropic strain sensors with large shift of resonance frequency under stress.” *IEEE Sensors* 9:9444-51, 2009.
46. T Gall, B Santoni, E Egger, **C Puttlitz**, M Rooney “*In vitro* biomechanical comparison of polypropylene mesh, modified three-loop pulley suture pattern, and a combination for repair of distal canine achilles’ tendon.” *Veterinary Surgery* 38:845-851, 2009.
47. BG Santoni, KC McGilvray, AS Lyons, M Bansal, AS Turner, JD MacGilvray, SH Coleman, **CM Puttlitz**. “Biomechanical analyses of an ovine rotator cuff repair via porous patch augmentation in a chronic rupture model.” *American Journal of Sports Medicine* 38:679-86, 2010.
48. R Melik, E Unal, N Perkgoz, **C Puttlitz** and HV Demir. “Metamaterial-based telemetric strain sensing in different materials.” *Optic Express* 18:5000-7, 2010.



49. PD Leahy, BS Smith, KL Easton, CE Kawcak, SS Shetye, **CM Puttlitz**. “Correlation of mechanical properties within the equine third metacarpus with trabecular bending and multi-density computed tomography data.” *Bone* 46:1108-13, 2010.
50. R Melik, E Unal, N Perkgoz, B Santoni, D Kamstock, **C Puttlitz** and HV Demir. “Nested metamaterials for wireless strain sensing.” *IEEE Journal of Selected Topics in Quantum Electronics* 16:450-8, 2010.
51. U Ayturk, J Garcia, **CM Puttlitz**. “The micromechanical role of the annulus fibrosis components under physiological loading of the lumbar spine.” *Journal of Biomechanical Engineering* 132; article number:061007, 2010.
52. KC McGilvray, R Sarkar, K Nguyen, **CM Puttlitz**. “A biomechanical analysis of venous tissue in its normal and post-phlebotic conditions.” *Journal of Biomechanics* 43:2941-7, 2010.
53. S Botolin, **C Puttlitz**, T Baldini, A Petrella, E Burger, C Abjornson, V Patel. “Facet joint biomechanics at the treated and adjacent levels after total disc replacement.” *Spine* 36:E27-32, 2011.
54. W Womack, U Ayturk, **CM Puttlitz**. “Cartilage thickness distribution affects computational model predictions of facet contact parameters.” *Journal of Biomechanical Engineering* 133; article number:011009, 2011.
55. K Troyer and **CM Puttlitz**. “Human cervical spine ligaments exhibit fully nonlinear viscoelastic behavior.” *Acta Biomaterialia* 7:700-09, 2011.
56. NR Cabano, KL Troyer, RH Palmer, **CM Puttlitz**, BG Santoni. “Mechanical comparison of two suture constructs for extra-capsular stifle stabilization.” *Veterinary Surgery* 40: 334-9, 2011.
57. V Zoppa, BG Santoni, **CM Puttlitz**, DA Hendrickson. “Arthrodesis of the equine proximal interphalangeal joint: A biomechanical comparison of 3-hole 4.5 mm locking compression plate and 3-hole 4.5 mm narrow dynamic compression plate with two oblique 5.5 mm cortex screws.” *Veterinary Surgery* 40: 253-9, 2011.
58. KC McGilvray, BG Santoni, AS Turner, S Bogdansky, DL Wheeler, **CM Puttlitz**. “Effects of <sup>60</sup>Co gamma irradiation dose on initial structural biomechanical properties of ovine bone – patellar tendon – bone allografts.” *Cell and Tissue Banking* 12: 89-98, 2011.
59. D Woldtvedt, W Womack, B Gadomski, D Schuldt, **CM Puttlitz**. “Finite element lumbar spine facet contact parameter predictions are affected by the cartilage thickness distribution and initial joint gap size.” *Journal of Biomechanical Engineering* 133; article number 061009, 2011.
60. W Womack, PD Leahy, VV Patel, **CM Puttlitz**. “Finite element modeling of kinematic and load transmission alterations due to cervical disc replacement.” *Spine* 36: E1126-33, 2011.
61. UM Ayturk and **CM Puttlitz**. “Parametric convergence sensitivity and validation of a finite element model of the human lumbar spine.” *Computer Methods in Biomechanics and Biomedical Engineering* 14:695-705, 2011.
62. CK Hee, LA Wisner-Lynch, CM Roden, DJ Aguiar, JS Dines, DM Dines, AS Turner, DL Ruehlman, HK Kestler, SE Lynch, KC McGilvray, AS Lyons, **CM Puttlitz**, BG Santoni. “Augmentation of a rotator cuff repair in an ovine model using rhPDGF-BB and a type I bovine collagen matrix in an ovine.” *American Journal of Sports Medicine* 39:1630-9, 2011.
63. AS Lyons, BP Sherman, **CM Puttlitz**, VV Patel, C Abjornson, AS Turner, HB Seim, EL Burger, EM Lindley. “Failure of resorbable plates and screws in an ovine model of anterior cervical discectomy and fusion.” *Spine* 11:876-83, 2011.

64. K Troyer, DJ Estep, **CM Puttlitz**. “Viscoelastic effects during loading play an integral role in soft tissue mechanics.” *Acta Biomaterialia* 8:234-43, 2012.
65. K Troyer, **CM Puttlitz**. “Nonlinear viscoelasticity plays an essential role in the functional behavior of spinal ligaments.” *Journal of Biomechanics* 45: 684-91, 2012.
66. PD Leahy, **CM Puttlitz**. “The effects of ligamentous injury in the human lower cervical spine.” *Journal of Biomechanics* 45: 2668-72, 2012.
67. UM Ayturk, B Gadomski, D Schuldt, V Patel, **CM Puttlitz**. “Modeling degenerative disk disease in the lumbar spine: a combined experimental, constitutive, and computational approach.” *Journal of Biomechanical Engineering* 134; article number 101003, 2012.
68. KL Troyer, SS Shetye, **CM Puttlitz**. “Experimental characterization and finite element implementation of soft tissue nonlinear viscoelasticity.” *Journal of Biomechanical Engineering* 134, article number 114501, 2012.
69. BC Gadomski, KC McGilvray, JT Easley, EJ Ehrhart, RH Palmer, B Santoni, **CM Puttlitz**. “An in vivo ovine model of bone tissue alterations in simulated microgravity conditions.” *Journal of Biomechanical Engineering* 136: 021020, 2014.
70. DL Wheeler, JM Lane, HB Seim III, **C Puttlitz**, S Itescu, AS Turner, “Allogeneic mesenchymal progenitor cells for posterolateral lumbar spine fusion in sheep, *The Spine Journal*, doi: 10.1016/j.spinee.2013.09.048, 2013
71. S Shetye, K Troyer, F Streijer, JHT Lee, BK Kwon, P Cripton, **CM Puttlitz**. “Nonlinear viscoelastic characterization of the porcine spinal cord. “ *Acta Biomaterialia* 10:792-7, 2014.
72. B Ozbey, E Unal, H Ertugrul, VB Erturk, O Kurc, **CM Puttlitz**, A Altintas, HV Demir. “Wireless displacement sensing enabled by metamaterial probes for remote structural health monitoring.” *Sensors* 14: 1691-704, 2014.
73. VC Traynelis, J Sherman, E Nottmeier, V Singh, K McGilvray, **CM Puttlitz**, PD Leahy. “Kinetic analysis of anterior cervical discectomy and fusion supplemented with transarticular screws.” *Journal of Neurosurgery: Spine* 20:485-61, 2014.
74. SS Shetye, M Deault, **CM Puttlitz**. “Biaxial response of ovine spinal cord dura mater.” *Journal of the Mechanical behavior of Biomedical Materials* 34:146-53, 2014.
75. KM Labus, SK Han, AH Hsieh, **CM Puttlitz**. “A computational model to describe the regional interlamellar shear of the annulus fibrosis.” *Journal of Biomechanical Engineering* 136:051009, 2014.
76. BJ Hindman, BG Santoni, **CM Puttlitz**, RP From, MM Todd. “Intubation biomechanics: laryngoscope force and cervical spine motion during intubation with Macintosh and Airtraq laryngoscopes.” *Anesthesiology* 121:260-71, 2014.
77. M Dreischarf, T Zander, A Shirazi-Adl, **CM Puttlitz**, CJ Adam, CS Chen, VK Goel, A Kiapour, YH Kim, KM Labus, JP Little, WM Park, YH Wang, HJ Wilke, A Rohlmann, H Schmidt. “Comparison of eight published static finite element models of the intact lumbar spine: predictive power of models improves when combined together.” *Journal of Biomechanics* 47:1757-66, 2014.
78. BC Gadomski, KC McGilvray, JT Easley, RH Palmer, BG Santoni, **CM Puttlitz**. “Partial gravity unloading inhibits bone healing responses in a large animal model.” *Journal of Biomechanics* 47:2836-42, 2014.

79. KP Nguyen, KC McGilvray, **CM Puttlitz**, S Mukhopadhyay, C Chabasse, R Sarkar. "Matrix Metalloproteinase 9 (MMP-9) regulates vein wall biomechanics in murine thrombus resolution." *PLoS One* 10: e0139145, 2015.
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85. CM Maulucci, CA Sansur, V Singh, A Cholewczynski, SS Shetye, K McGilvray, **CM Puttlitz**. "Cortical bone facet spacers for cervical spine decompression: effects on intervertebral kinetics and foraminal area." *Journal of Neurosurgery: Spine* 24, 69-76, 2016.
86. PD Leahy PD, **CM Puttlitz**. "Addition of lateral bending range of motion measurement to standard sagittal measurement to improve diagnosis sensitivity of ligamentous injury in the human lower cervical spine." *European Spine Journal* 25:122-6, 2016.
87. HE Jaramillo, **CM Puttlitz**, K McGilvray, JJ Garcia. "Characterization of the L4-L5-S1 motion segment using the stepwise reduction method." *Journal of Biomechanics* 47:1248-54, 2016.
88. BC Gadomski, ZF Lerner, RC Browning, JT Easley, RH Palmer, BG Santoni, **CM Puttlitz**. "Computational characterization of fracture healing under reduced gravity loading conditions." *Journal of Orthopaedic Research* 34:1206-15, 2016.
89. SK Han, CW Chen, KM Labus, CM Puttlitz, Y Chen, AH Hsieh. "Optical coherence tomographic elastography reveals mesoscale shear strain inhomogeneities in the annulus fibrosis." *Spine* 41:E770-7, 2016.
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91. KM Labus, **CM Puttlitz**. "An anisotropic hyperelastic constitutive model of brain white matter in biaxial tension and structural-mechanical relationships." *Journal of the Mechanical Behavior of Biomedical Materials* 62:195-208, 2016.
92. PB Suh, **C Puttlitz**, C Lewis, S Bal, K McGilvray. "The effect of cervical interbody cage morphology, material composition, and bone density on subsidence risk." *Journal of the American Academy of Orthopaedic Surgeons* 25:160-168, 2017.

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95. KC McGilvray, EI Waldorff, J Easley, HB Seim, N Zhang, RJ Linovitz, **CM Puttlitz**. “Evaluation of a PEEK titanium composite interbody spacer in an ovine lumbar interbody fusion model: A biomechanical, micro-computed tomography, and histologic analyses.” *The Spine Journal* 17:1907-1916, 2017.
96. <sup>1</sup>BC Gadomski, SS Shetye, BJ Hindman, F Dexter, BG Santoni, MM Todd, VC Traynelis, RP From, RB Fontes, **CM Puttlitz**. “Intubation biomechanics: validation of a finite element model of cervical spine motion during endotracheal intubation in intact and injured conditions.” *Journal of Neurosurgery: Spine* 28:10-22, 2017.
97. NL Ramo, SS Shetye, F Streijger, JHT Lee, KL Troyer, BK Kwon, P Crompton, **CM Puttlitz**. “Comparison of in-vivo and ex-vivo viscoelastic behavior of the spinal cord.” *Acta Biomaterialia* 68:78-89, 2018.
98. N Ramo, SS Shetye, **CM Puttlitz**. “Damage accumulation modeling and rate dependency of spinal dura mater.” *Journal of Engineering and Science in Medical Diagnostics and Therapy* 1:011006, 2018.
99. NL Ramo, **CM Puttlitz**, KL Troyer. “The development and validation of a numerical integration method for non-linear viscoelastic modeling.” *PLoS One* 13:e0190137, 2018.

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## CITATION HISTORY OF PEER-REVIEWED PUBLICATIONS

Citation data obtained from a Google Scholar search on February 12, 2018

	All	Since 2013
Citations <sup>2</sup>	4540	2389
h-index <sup>3</sup>	35	27
i10-index <sup>4</sup>	70	59

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## ABSTRACTS AND CONFERENCE PROCEEDINGS

1. **C Puttlitz**, B Adams, V Goel. “A protocol for automated generation of a CT-based finite element model of the distal radius.” 20<sup>th</sup> Annual Meeting of the American Society of Biomechanics, Atlanta, GA, October 17-19, 1996.

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<sup>1</sup> Cover article.

<sup>2</sup> Total number of citations to all publications.

<sup>3</sup> h-index: h publications having at least h citations.

<sup>4</sup> i10-index: number of publications with at least 10 citations.

2. BD Adams, **CM Puttlitz**. “Bioabsorbable pin fixation of the scapholunate and lunotriquetral joints.” Combined Meeting of the American and Japanese Societies for Surgery of the Hand, Hilton Head, SC, 1997.
3. **CM Puttlitz**, BD Adams. “An alternative method of fixation of the scapholunate and lunotriquetral interosseous ligaments.” American Society for Surgery of the Hand, Boca Raton, FL, 1997.
4. **CM Puttlitz**, VK Goel, CR Clark, VC Traynelis, JL Scifert, NM Grosland. “Biomechanical rationale for the pathology of rheumatoid arthritis in the craniovertebral junction.” 26<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Atlanta, GA, 1998.
5. **CM Puttlitz**, VK Goel, CR Clark, VC Traynelis, JL Scifert, NM Grosland. “Relationship of upper cervical rheumatoid arthritis diagnostic criteria to ligament involvement.” 45<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Anaheim, CA, February 1-4, 1999.
6. JL Scifert, VK Goel, NM Grosland, **CM Puttlitz**, K Totoribe, VC Traynelis. “Finite element investigation of anterior plate and bone graft load sharing in the cervical spine.” 45<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Anaheim, CA, February 1-4, 1999.
7. **CM Puttlitz**, VK Goel, NM Grosland, JL Scifert, CR Clark, VC Traynelis. “Biomechanical aspects of early rheumatoid arthritis involvement of the upper cervical spine: a finite element investigation.” American Society of Mechanical Engineers Summer Bioengineering Conference, Big Sky, MT, June 16-20, 1999.
8. JL Scifert, VK Goel, NM Grosland, **CM Puttlitz**, K Totoribe, VC Traynelis. “Anterior plate and bone graft load sharing in the cervical spine: a finite element investigation.” 23<sup>rd</sup> Annual Meeting of the American Society of Biomechanics, Pittsburgh, PA, October 21-23, 1999.
9. **CM Puttlitz**, VK Goel, CR Clark. “Biomechanical aspects of odontoid fracture etiology: a finite element investigation.” 1999 Winter American Society of Mechanical Engineers IMECE, Nashville, TN, November 14-17, 1999.
10. **CM Puttlitz**, VK Goel, CR Clark, VC Traynelis. “Fracture etiology of the odontoid process.” 27<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Seattle WA, December 16-18, 1999.
11. **CM Puttlitz**, VK Goel, CR Clark, VC Traynelis. “An investigation of cervical anchor type and unilateral vs. bilateral implementation of an upper cervical fusion device.” 27<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Seattle, WA, December 16-18, 1999.
12. JL Scifert, VK Goel, NM Grosland, **CM Puttlitz**, K Totoribe, VC Traynelis. “Load sharing in the cervical spine following anterior bone graft and plating.” 27<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Seattle, WA, December 16-18, 1999.
13. **CM Puttlitz**, JC Lotz, A Green, J Helms. “Distraction callus osteogenic response may be mediated by fluid pressure.” 45 Annual Meeting of the Orthopaedic Research Society, Orlando, FL, March 12-15, 2000.
14. **CM Puttlitz**, V Goel, CR Clark, V Traynelis. “Fracture etiology of the odontoid process.” 16<sup>th</sup> Annual Meeting of the European Section of the Cervical Spine Research Society, London, June 21-24, 2000.
15. F Kleinstueck, C Diederich, W Nau, J Smith, **C Puttlitz**, D Bradford, J Lotz, “IDET thermal dosimetry in human lumbar discs.” 35<sup>th</sup> Annual Meeting of the Scoliosis Research Society, Cairns, Australia, October 18-21, 2000.

16. F Kleinstueck, C Diederich, W Nau, J Smith, **C Puttlitz**, D Bradford, J Lotz, “The IDET procedure. Biomechanical and histological effects on human lumbar discs.” 35<sup>th</sup> Annual Meeting of the Scoliosis Research Society, Cairns, Australia, October 18-21, 2000.
17. FS Kleinstueck, C Diederich, W Nau, J Smith; **C Puttlitz** , J Lotz, D Bradford. “The IDET procedure: temperature distributions and biomechanical effects on human lumbar disk.” 15<sup>th</sup> Annual Meeting of the North American Spine Society, New Orleans, LA, October 25-28, 2000.
18. **CM Puttlitz**, VK Goel, VC Traynelis, CR Clark: “A stress analysis of upper cervical hardware.” 28<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Charleston, SC, November 30-December 2, 2000.
19. FS Kleinstueck, C Diederich, W Nau, J Smith; **C Puttlitz** , J Lotz, D Bradford. “The IDET procedure: biomechanical and histological effects on human lumbar discs.” 68<sup>th</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Francisco, CA, February 28-March 4, 2001.
20. FS Kleinstueck, C Diederich, W Nau, J Smith; **C Puttlitz** , J Lotz, D Bradford. “IDET thermal dosimetry in human lumbar discs.” 68<sup>th</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Francisco, CA, February 28-March 4, 2001.
21. **CM Puttlitz**, QNH Tran, JA Smith, FS Kleinstueck, V Deviren, DS Bradford JC Lotz, RT Hopkins. “Lower cervical spine motion as a function of the degree of laminoplasty involvement.” 17<sup>th</sup> Annual Meeting of the European Section of the Cervical Spine Research Society, Torino, Italy, July 5-7, 2001.
22. RP Melcher, **CM Puttlitz**, J Harms, JC Lotz, DS Bradford. “Biomechanical testing of posterior atlanto-axial fixation techniques.” 17<sup>th</sup> Annual Meeting of the European Section of the Cervical Spine Research Society, Torino, Italy, July 5-7, 2001.
23. **CM Puttlitz**, QNH Tran, JA Smith, FS Kleinstueck, V Deviren, DS Bradford JC Lotz, RT Hopkins. “Scar tissue formation affects cervical spine kinematics after en-bloc laminoplasty.” 16<sup>th</sup> Annual Meeting of the North American Spine Society, Seattle, October 31–November 3, 2001.
24. **CM Puttlitz**, QNH Tran, JA Smith, FS Kleinstueck, V Deviren, JC Lotz, RT Hopkins. “Cervical spine kinematics are affected by formation of scar tissue after laminoplasty.” 29<sup>th</sup> Annual Meeting of the Cervical Spine Research Society Meeting, Monterey, CA, November 29-December 2, 2001.
25. R.P. Melcher, **C.M. Puttlitz**, F.S. Kleinstueck, J.C. Lotz, J. Harms, D.S. Bradford. “Biomechanical comparison of contemporary and novel posterior atlanto-axial fixation techniques.” 29<sup>th</sup> Annual Meeting of the Cervical Spine Research Society Meeting, Monterey, CA, November 29-December 2, 2001.
26. **C.M. Puttlitz**, R.P. Melcher; F.S. Kleinstueck, J.C. Lotz, J. Harms, D.S. Bradford “Comparative stability analysis of craniovertebral fixation with special reference to cervical anchor type.” 29<sup>th</sup> Annual Meeting of the Cervical Spine Research Society Meeting, Monterey, CA, November 29-December 2, 2001.
27. E Diao, **C Puttlitz**, T Ishiko, J Lotz. “Transection of the transverse carpal ligament affects scaphoid motion.” 48<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Dallas, TX, February 10-13, 2001.
28. **C Puttlitz**, R Melcher, J Harms, F Kleinstueck, D Bardford, J Lotz. “A biomechanical investigation of acute stability afforded by craniovertebral screw constructs.” 29<sup>th</sup> 48<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Dallas, TX, February 10-13, 2001.

29. **C Puttlitz**, V Deviren, F Kleinstueck, J Smith, J Lotz, R Hopkins. "Temporal iatrogenic biomechanical effects of cervical laminoplasty." 48<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Dallas, TX, February 10-13, 2001.
30. CB Dolan, **CM Puttlitz**, I Chamkasem, F VitoCruz, H Lu, B Lee, K Tsuye, J Lotz, KS Topp. "Effects of a mild crush injury on the biomechanics, morphology, and function of the sciatic nerve in the rat." Annual Meeting of the American Academy of Anatomists – Experimental Biology, New Orleans, LA, April 20-24, 2002.
31. DM Ebenstein, **CM Puttlitz**, L Pruitt. "A novel technique for measuring murine fracture callus material properties using nanoindentation." 28<sup>th</sup> Annual Meeting of the Society for Biomaterials, Tampa Bay, FL, April 24-27, 2002.
32. RP Melcher, **CM Puttlitz**, V Deviren, D Jeszensky, J Harms. "Stability analysis of C2 replacement constructs." 30<sup>th</sup> Annual Meeting of the Cervical Spine Research Society Meeting, Miami, FL, December 5-7, 2002.
33. **CM Puttlitz**, RP Melcher, J Harms, V Deviren, D Jeszensky. "Biomechanical analysis of C2 replacement constructs." 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, LA, February 2-5, 2003.
34. D Ananthkrishnan, S Berven, V Deviren, J Lotz, **C Puttlitz**. "Changes in spinal loading due to vertebral augmentation: Vertebroplasty versus kyphoplasty." International Meeting of Advanced Spine Technologies (IMAST), Rome, July 11-14, 2003.
35. S Gupta, **CM Puttlitz**, L Pruitt. "Nanoscale indentation of simulated soft tissues." 12<sup>th</sup> Annual Symposium on Computational Methods In Orthopaedic Biomechanics, San Francisco, CA, March 6, 2004.
36. B Tay, S Hu, M-A Rousseau, Z Xu, **C Puttlitz**. "Physiologic motion is replicated by disc arthroplasty." 50<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, March 7-10, 2004.
37. **C Puttlitz**, B Tay, V Deviren, S Hu, M-A Rousseau, J Lotz. "Kinetic analysis of prodisc-c: a cadaveric study." 4<sup>th</sup> Annual Meeting of the Spine Arthroplasty Society, Vienna, May 4-7, 2004.
38. DM Ebenstein, J Fischer, C Li, **C Puttlitz**, L Pruitt. "Nano-DMA for characterization of viscoelastic polymers and biomaterials." 7<sup>th</sup> World Biomaterials Congress, Sydney, May 17-21, 2004.
39. **CM Puttlitz**, J Gorek, E Acaroglu, S Berven. "C2 translaminar screws provide good stability for atlanto-axial fixation." 20<sup>th</sup> Annual Meeting of the Cervical Spine Research Society – European Section, Porto, May 30-June 5, 2004.
40. **CM Puttlitz**, V Deviren, S Hu, M-A Rousseau, B Tay, J Lotz. "A ball-and-socket cervical disk prosthesis replicates physiologic motion." 20<sup>th</sup> Annual Meeting of the Cervical Spine Research Society – European Section, Porto, May 30-June 5, 2004.
41. V Deviren, E Acaroglu, J Lee, T Kuklo, L Lenke, M O'Brien, D Polly, **C Puttlitz**. "Thoracic spine construct stability is dependent upon the number and configuration of pedicle screws." 39<sup>th</sup> Annual Meeting of the Scoliosis Research Society, Buenos Aires, September 6-9, 2004.
42. S Gupta, L Pruitt, **CM Puttlitz**. "Nanoscale indentation of simulated soft tissues." ASME International Mechanical Engineering Congress, Anaheim, November 13-19, 2004.
43. **CM Puttlitz**, J Gorek, S Berven, E Acaroglu. "Atlanto-axial stability is achieved using intralaminar screws in C2." 32<sup>nd</sup> Annual Meeting of the Cervical Spine Research Society, Boston, December 9-12, 2004.

44. CT Lindsey, Z Xu, V Deviren, **CM Puttlitz**. “The effects of rod contouring on spinal construct fatigue strength.” 51<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, Washington, D.C., February 20-23, 2005.
45. F Carrillo, S Gupta, L Pruitt, M Balloch, **CM Puttlitz**. “Nanoindentation validation of soft biomaterials.” 51<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, Washington, D.C., February 20-23, 2005.
46. CB Ma, L Comerford, J Wilson, **CM Puttlitz**. “Biomechanical analysis of arthroscopic rotator cuff repairs – double row versus single row fixation.” 51<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, Washington, D.C., February 20-23, 2005.
47. V Deviren, E Acaroglu, J Lee, S Hu, L Lenke, D Polly, T Kuklo, M O’Brien, D Brumfield, **C Puttlitz**. “The number of pedicle screws and degree of intrinsic stability determine construct stiffness in the thoracic spine.” 51<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, Washington, D.C., February 20-23, 2005.
48. E Acaroglu, C Ames, J Chi, J Iyengar, W Muir, B Sadikovic, **C Puttlitz**. “Posterior instrumentation reduces inherent stability differences in immediate post-operative range of motion between one and two level TLIF and PLIF procedures.” 51<sup>st</sup> Annual Meeting of the Orthopaedic Research Society, Washington, D.C., February 20-23, 2005.
49. CB Ma, L Comerford, J Wilson, **C Puttlitz**. “Biomechanical analysis of arthroscopic rotator cuff repair suture configurations- double row vs. single row fixation.” 5<sup>th</sup> Biennial Congress of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine, Hollywood, FL, April 3-7, 2005.
50. C Li, S Gupta, F Carrillo, **C Puttlitz**, L Pruitt. “Nanoindentation and unconfined compression characterization of poly dimethyl siloxane.” 30<sup>th</sup> Annual Meeting of the Society for Biomaterials, Memphis, TN, April 27-30, 2005.
51. **CM Puttlitz**, V Deviren, C Lindsey. “Spinal rod contouring significantly reduces fatigue resistance.” 12<sup>th</sup> International Meeting on Advanced Spine Technologies, Banff, Alberta, Canada, July 7-9, 2005.
52. C Ames, L Comerford, S Hu, B Tay, **C Puttlitz**. “Intra-operative force relaxation is significant across the cervical intervertebral disc space.” 33<sup>rd</sup> Annual Meeting of the Cervical Spine Research Society, San Diego, December 1-3, 2005.
53. U Kandemir, A Matityahu, R Desai, **C Puttlitz**. “Distal radius fixation using dorsal non-locking plate vs. volar locking plate.” Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 5-7, 2006.
54. M Diab, J Howlett, **C Puttlitz**. “Clinical and biomechanical effect of eyelet screws on Ender nails for fixation of femoral shaft fractures in children.” Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 5-7, 2006.
55. **C Puttlitz**, N Johnson, B Hindman, J Weeks, M Maktabi, M Todd. “Effects of manual in-line stabilization on the magnitude and distribution of pressures exerted by a laryngoscope blade during direct laryngoscopy and intubation.” 34<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Palm Beach, FL, November 29-December 2, 2006.
56. **CM Puttlitz**, W Womack, C Ames. “A modified quasi-linear viscoelastic parametric study of the cervical disc.” 7<sup>th</sup> Annual Meeting of the Spine Arthroplasty Society, Berlin, May 1-4, 2007.



57. **CM Puttlitz**, K McGilvray, A Lyons, U Ayturk, AS Turner, V Patel. "Acute biomechanical implications of two-level cervical disc replacement and associated salvage procedure." 7<sup>th</sup> Annual Meeting of the Spine Arthroplasty Society, Berlin, May 1-4, 2007.
58. B Santoni, W Womack, D Wheeler, **C Puttlitz**. "A mechanical and computational investigation on the effects of conduit orientation on the strength of massive bone allografts" 2007 ASME Summer Bioengineering Conference, Keystone, CO, June 20-24, 2007.
59. K McGilvray, A Lyons, AS Turner, J MacGillivray, S Coleman, **C Puttlitz**. "Shoulder tendon repair biomechanics using a polyurethane patch in a chronic ovine defect model." 2007 ASME Summer Bioengineering Conference, Keystone, CO, June 20-24, 2007.
60. McGilvray, Amy Lyons, AS Turner, V Patel, **C Puttlitz**. "Kinetic and biomechanical testing of two-level cervical disc replacement." 2007 ASME Summer Bioengineering Conference, Keystone, CO, June 20-24, 2007.
61. W Womack, **C Puttlitz**. "Diametral compression of hollow non-circular bone sections." 2007 ASME Summer Bioengineering Conference, Keystone, CO, June 20-24, 2007.
62. **CM Puttlitz**, K McGilvray, A Lyons, U Ayturk, AS Turner, V Patel. "Biomechanical implications of adjacent level cervical disc replacement and associated salvage procedures." 14<sup>th</sup> International Meeting on Advanced Spine Techniques (IMAST), Paradise Island, Bahamas, July 11-14, 2007.
63. WJ Womack, DJ Woldtvedt, **CM Puttlitz**. "Three-dimensional cartilage thickness and geometry mapping of cervical facet joints." 35<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, San Francisco, CA, November 28 – December 1, 2007.
64. R Hynes, BG Santoni, MAW Henson, **CP Puttlitz**. "Dense bone engagement in osteoporotic vertebra using a novel pedicle screw trajectory results in enhanced fixation." 2008 Annual Meeting of the AANS/CNS Section on Disorders of the Spine and Peripheral Nerves, Orlando, FL, February 27 – March 1, 2008.
65. BG Santoni, TT Gall, EL Egger, **CM Puttlitz**. "In vitro biomechanical comparison of polypropylene mesh, a three-loop pulley suture pattern and a combination of these treatments for the reconstruction of ruptured canine Achilles tendons." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
66. WJ Womack, D Woldtvedt, **CM Puttlitz**. "Diametral compression: computational and experimental investigation of a new bone strength test." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
67. WJ Womack, D Woldtvedt, **CM Puttlitz**. "An analytical description of cartilage thickness mapping and shape of the cervical spine facet joints." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
68. A Lyons, K Foley, H Bonin, E Lange, AS Turner, M Beck, H Seim, **CM Puttlitz**. "Hydroxyapatite surface augmentation improves pedicle screw osseointegration for posterior dynamic fixation systems." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
69. BG Santoni, RA Hynes, KC McGilvray, G Rodriguez-Canessa, AS Lyons, MA Henson, WJ Womack, **CM Puttlitz**. "Lumbar pedicle screw design and trajectory affects bone quality available for purchase and fixation mechanics." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.

70. K McGilvray, A Lyons, M Bansal, AS Turner, J MacGillivray, S Coleman, **C Puttlitz**. "Biomechanical and histological analysis of a chronic nonacute ovine rotator cuff repair using a polyurethane patch." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
71. **CM Puttlitz**, K McGilvray, AS Lyons, BG Santoni, V Patel, AS Turner. "Kinetic implications of replacement of a cervical intervertebral disc at adjacent levels and associated salvage procedure." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
72. BG Santoni, R Hynes, MAW Henson, K McGilvray, G Rodriguez-Cannessa, A Lyons, M Henson, WJ Womack, **CP Puttlitz**. "Lumbar pedicle screw design and trajectory affects bone quality available for purchase and fixation mechanics." 54<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
73. TT Gall, BG Santoni, EL Egger, MB Rooney, **CM Puttlitz**. "In vitro biomechanical comparison of polypropylene mesh, a three-loop pulley suture pattern and a combination of the two in the repair of avulsed canine Achilles tendons." Veterinary Orthopaedic Society Conference, Big Sky, Montana, March 8 – 15, 2008.
74. SS Shetye, K Malholtra, G Rodriguez-Cannessa, S Ryan, **CM Puttlitz**. "Mechanical behavior of canine antebrachial ligaments and its relation to collagen content." Veterinary Orthopaedic Society Conference, Big Sky, Montana, March 8 – 15, 2008.
75. B Santoni, CS Goh, RH Palmer, **CM Puttlitz**. "Biomechanical evaluation of semi-contoured, locking plate/rod versus anatomically-contoured, conventional plate/rod fixation in a canine femoral defect model." British Veterinary Orthopaedic Association Spring Meeting, Birmingham, United Kingdom, April 2, 2008.
76. V Patel, A Lyons, C Abjornson, AS Turner, **C Puttlitz**. "Histological evaluation of bioresorbable plates in a sheep model." European Cervical Spine Research Society, Geneva, May 26-31, 2008.
77. **C Puttlitz**, D Woldtvedt, W Womack. "Cervical facet joint cartilage thickness distributions." European Cervical Spine Research Society, Geneva, May 26-31, 2008.
78. **C Puttlitz**, V Patel, B Santoni. "A biomechanical investigation of two-level cervical disc replacement and associated salvage procedure." European Cervical Spine Research Society, Geneva, May 26-31, 2008.
79. U Ayturk, **C Puttlitz**. "Nucleotomy has a minimal impact on kinetics/kinematics and a significant influence on load transfer in the lumbar spine." International Society for the Study of the Lumbar Spine, Geneva, May 26-31, 2008.
80. U Ayturk, **C Puttlitz**. "Sensitivity of finite element predictions of kinetic and mechanical parameters to changes in mesh refinement." International Society for the Study of the Lumbar Spine, Geneva, May 26-31, 2008.
81. V Patel, C Abjornson, S Turner, H Seim, A Lyons, **C Puttlitz**. "Failure analysis of absorbable cervical plates." 23<sup>rd</sup> Annual Meeting of the North American Spine Society, Toronto, October 14-18, 2008.
82. BG Santoni, CJ Ronholdt, S Bogdansky, AS Turner, **CM Puttlitz**. "A biomechanical, histological and TEM analysis on the effect of a novel cleaning process on ovine patellar tendon grafts." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.
83. R Tichota, **C Puttlitz**, V Patel, V Deviren. "The effect of upper end vertebra selection on adjacent segment stability in selective lumbar instrumentation." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.

84. UM Ayturk, **CM Puttlitz**. "Determination of the *in situ* properties of the annulus fibrosus using available *in vitro* experimentation data." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.
85. AS Lyons, HB Seim, S Turner, C Abjornson, E Lindley, VV Patel, **C Puttlitz**. "Evaluation of a bioresorbable anterior cervical plate: a pilot study in sheep." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.
86. K McGilvray, B Santoni, D Moynihan, M Getelman, **C Puttlitz**. "Acute Mechanical Evaluation of Three Shoulder Tendon Repair Suture Techniques." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.
87. R Tichota, **C Puttlitz**, A Lyons, K Troyer, S Shetye, W Womack, R Arslanoglu, B Santoni. "A biomechanical study of a limited motion device for lumbar posterior stabilization in an ovine model." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.
88. AS Lyons, H Bonin, HB Seim, S Turner, **C Puttlitz**. "Intermediate term effects of HA-coated pedicle screws with and without BMP-2 used in conjunction with rigid instrumentation in an ovine model." 55<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Las Vegas, February 22-25, 2009.
89. NR Cabano, BG Santoni, RH Palmer, KT Troyer, **CM Puttlitz**. "Mechanical comparison of two suture materials for extra-capsular stifle stabilization." Veterinary Orthopaedic Society Conference, Steamboat Springs, February 28- March 7, 2009.
90. KC McGilvray, **CM Puttlitz**. "Mechanical characterization of deep vein thrombosis in a murine model using nanoindentation." Eighth International Conference on Modeling in Medicine and Biology, Crete, Greece, May 26-29, 2009.
91. JJ Garcia, **CM Puttlitz**. "A simplified strain energy function to represent the mechanical behavior of the annulus fibrosus." 2009 ASME Summer Bioengineering Conference, Lake Tahoe, CA, June 17-21, 2009.
92. UM Ayturk, **CM Puttlitz**. "The effect of mesh refinement on the predictions of finite element models of the spine." 2009 ASME Summer Bioengineering Conference, Lake Tahoe, CA, June 17-21, 2009.
93. BG Santoni, **CM Puttlitz**. "Development and biocompatibility characterization of a BioMEMS sensor for monitoring the progression of fracture healing." 2009 ASME Summer Bioengineering Conference, Lake Tahoe, CA, June 17-21, 2009.
94. Santoni BG, Joslyn AG, Ronhodt CJ, Bogdanský S, Klein RJ, Turner AS, **Puttlitz CM**. The effects of a novel cleaning process on the structural architecture and biomechanical properties of ovine patellar tendon grafts. 33rd Annual Meeting of the American Association of Tissue Banks, Las Vegas, September 13-16, 2009.
95. Ayturk FO, Santoni BG, Woldtvedt D, **Puttlitz CM**. "Modeling of the transverse post-yield behavior of bovine cortical bone." 4<sup>th</sup> International Conference on Computational Bioengineering, Bertinoro (Forli), Italy, September 16-18 2009.
96. DM Wilson, Bhattacharjee AG, Santoni BG, **Puttlitz CM**, Ehrhart N. "Mechanical evaluation of the 3.5mm broad limited contact dynamic compression plate and the 3.5 mm broad locking compression plate." Veterinary Orthopaedic Society (VOS) Conference, Breckenridge, CO, February 20-27, 2010.

97. UM Ayturk, **CM Puttlitz**. "The annulus fibrosis stabilizes lumbar motion segments treated with artificial disc replacement." 9<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering, Valencia, Spain, February 24-27, 2010.
98. W Womack, **CM Puttlitz**. "Nonlinear structural finite element modeling of the human annulus fibrosis." 9<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering, Valencia, Spain, February 24-27, 2010.
99. S Shetye, **CM Puttlitz**. "Evaluation of a distal radius endoprosthesis using a validated finite element model of the canine antebrachium." 9<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering, Valencia, Spain, February 24-27, 2010.
100. SS Shetye, **CM Puttlitz**. "The use of a locking vs. non-locking plate in distal radius endoprosthesis for canine limb sparing." 18th Annual Symposium on Computational Methods in Orthopaedic Biomechanics, New Orleans, March 5, 2010.
101. U Ayturk, V Patel, **C Puttlitz**. "A finite element evaluation of two-level disc replacement in the lumbar spine." 18th Annual Symposium on Computational Methods in Orthopaedic Biomechanics, New Orleans, March 5, 2010.
102. SS Shetye, AS Lyons, AG Bhattacharjee, C Abjornson, **CM Puttlitz**. "Radiographic and histological evaluation of a surface demineralized flexible allograft chain in an ovine vertebra body model." 56<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, March 6-9, 2010.
103. K Troyer, **C Puttlitz**. "Nonlinear viscoelastic behavior of human cervical spine ligaments." 56<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, March 6-9, 2010.
104. BG Santoni, AS Lyons, KC McGilvray, HB Seim III, AS Turner, C Abjornson, **CM Puttlitz**. "Biomechanical and histological evaluation of an allograft anchor for pedicle screw augmentation in an ovine model." 56<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, March 6-9, 2010.
105. CK Hee, CM Roden, LA Wisner-Lynch, DJ Aguiar, JS Dines, AS Turner, DL Ruehlman, HK Kestler, SE Lynch, KC McGilvray, AS Lyons, **CM Puttlitz**, BG Santoni. "Evaluation of rhPDGF-BB in combination with a flowable collagen matrix for the treatment of acute achilles tendon injury." 56<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, March 6-9, 2010.
106. CK Hee, LA Wisner-Lynch, CM Roden, DJ Aguiar, JS Dines, AS Turner, DL Ruehlman, HK Kestler, SE Lynch, KC McGilvray, AS Lyons, **CM Puttlitz**, BG Santoni. "Rotator cuff repair in an ovine model using a combination product comprised of a type I bovine collagen matrix and rhPDGF-BB." 56<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, March 6-9, 2010.
107. C Hart, EJ Ehrhart, A Lyons, D Duval, **C Puttlitz**, A Turner. "Evaluation of dermagraft to accelerate the healing of rotator cuff injuries in a sheep model." 56<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, March 6-9, 2010.
108. U Ayturk, V Patel, **C Puttlitz**. "Partial annulus fibrosis preservation facilitates restoration of biomechanics in lumbar spine segments treated with artificial disc replacement." 10<sup>th</sup> Annual Spine Arthroplasty Society (SAS), New Orleans, LA, April 27-30, 2010.
109. SS Shetye, AS Lyons, AG Bhattacharjee, BG Santoni, C Abjornson, **CM Puttlitz**. "Evaluation of a surface demineralized flexible allograft chain in an ovine vertebra body model." 10<sup>th</sup> Annual Spine Arthroplasty Society (SAS), New Orleans, LA, April 27-30, 2010.
110. K Troyer, **CM Puttlitz**. "Human cervical ligaments exhibit non-linear viscoelastic behavior." ASME Summer Bioengineering Conference, Naples, FL, June 16-19, 2010.

111. K Troyer, **CM Puttlitz**. "Development and validation of an iterative computational algorithm to characterize the viscoelastic behavior of biological tissue." 19th Annual Symposium on Computational Methods in Orthopaedic Biomechanics, Long Beach, January 12, 2011.
112. B Gadomski, J Rasmussen, **CM Puttlitz**. "Implementation of physiological muscle loading in a finite element model of the human lumbar spine." 57<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Long Beach, CA, January 13-16, 2011.
113. UM Ayturk, D Schuldt, V Patel, **CM Puttlitz**. "Orthotropic continuum model development for healthy and degenerated annulus fibrosis based on a biaxial testing protocol." 57<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Long Beach, CA, January 13-16, 2011.
114. UM Ayturk, V Patel, **CM Puttlitz**. "Finite element modeling of degenerated-related biomechanical changes of the lumbar spine." 57<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Long Beach, CA, January 13-16, 2011.
115. KK Hausler, A Swedberg, KC McGilvray, SS Shetye, AS Turner, **CM Puttlitz**. Effects of botox on spinal kinematics in an intervertebral disc annulotomy sheep model." 57<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, Long Beach, CA, January 13-16, 2011.
116. BC Gadomski, J Rasmussen, **CM Puttlitz**. "The effect of muscle loading on internal mechanical parameters of the lumbar spine: a finite element study." ASME Summer Bioengineering Conference, Farmington, PA, June 22-25, 2011.
117. PD Leahy, **CM Puttlitz**. "Mechanical properties of injured human cervical spine ligaments and corresponding effect on spinal kinematics." ASME Summer Bioengineering Conference, Farmington, PA, June 22-25, 2011.
118. S Shetye, S Ryan, N Ehrhart, **CM Puttlitz**. "Novel endoprosthesis for canine limb sparing of canine distal radius osteosarcoma patients - a modular approach." ASME Summer Bioengineering Conference, Farmington, PA, June 22-25, 2011.
119. K Troyer, **CM Puttlitz**. "Comparison of A novel nonlinear viscoelastic finite ramp time correction method to a heaviside step assumption." ASME Summer Bioengineering Conference, Farmington, PA, June 22-25, 2011.
120. BC Gadomski, J Rasmussen, P Galibarov, **CM Puttlitz**. "The effect of coupled motions and lifting tasks on human lumbar nucleus pressures and annulus fibrosis stresses in a muscle-loaded finite element model." International Society for Biomechanics, Brussels, Belgium, July 3-7, 2011.
121. KL Troyer, **CM Puttlitz**. "Nonlinear viscoelasticity is requisite to simultaneously describe static and dynamic ligament mechanics." 58th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, February 4-7, 2012.
122. KC McGilvray, HV Demir, E Unal, KL Troyer, R Melik, **CM Puttlitz**. "*In vivo* fracture healing assessment using a novel bio-microelectromechanical system." 58th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, February 4-7, 2012.
123. PD Leahy, KC McGilvray, J Sherman, V Traynelis, E Nottmeier, V Singh, B Murrell, V Patel, **CM Puttlitz**. "Analysis of anterior cervical discectomy and fusion kinematics when supplemented with facet screw instrumentation." 58th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, February 4-7, 2012.

124. BC Gadomski, **CM Puttlitz**. “Experimental evaluations of intervertebral disc mechanics following posterolateral fusion are dependent on testing protocol.” 58th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, February 4-7, 2012.
125. BC Gadomski, KC McGilvray, JT Easley, RH Palmer, **CM Puttlitz**. “An ovine model of simulated microgravity.” NASA Human Research Program Investigators’ Workshop, Houston, TX, February 14-16, 2012.
126. PD Leahy, KC McGilvray, J Sherman, V Traynelis, E Nottmeier, V Singh, B Murrell, V Patel, **CM Puttlitz**. “Kinematic assay of multi-level anterior cervical discectomy and fusion with supplementary facet screw instrumentation. Annual Meeting of the AANS/CNS Section on Disorders of the Spine and Peripheral Nerves. Orlando, FL, March 7-10, 2012.
127. PD Leahy, KC McGilvray, J Sherman, V Traynelis, E Nottmeier, V Singh, B Murrell, V Patel, **CM Puttlitz**. “Analysis of anterior cervical discectomy and fusion kinematics when supplemented with facet screw instrumentation.” 80th Annual Scientific Meeting of the American Association of Neurological Surgeons, Miami, FL, April 14-18, 2012.
128. RH Palmer, J Easley, K McGilvray, **C Puttlitz**. “Development of SMART plate technology: pilot data in the ovine.” 16<sup>th</sup> Congress of the European Society of Veterinary Orthopaedics and Traumatology, Bologna, Italy, September 12-15, 2012.
129. C Maulucci, C Sansur, **C Puttlitz**, V Singh, K McGilvray. “Kinematic response of cortical bone facet spacers for cervical spine decompression.” 40<sup>th</sup> Annual Meeting of the Cervical Spine Research Society, Chicago, December 6-8, 2012.
130. K McGilvray, R Palmer, JT Easley, E Unal, HV Demir, **C Puttlitz**. “A novel bio-microelectrical (BioMEMs) sensor to assess the in vivo fracture healing cascade.” 59th Annual Meeting of the Orthopaedic Research Society, San Antonio, TX, January 25-30, 2013.
131. K McGilvray, C Sansur, C Maulucci, V Singh, **C Puttlitz**. “A kinematic evaluation of cervical allograft facet spacers which can be used to provide indirect decompression through distraction.” 59th Annual Meeting of the Orthopaedic Research Society, San Antonio, TX, January 25-30, 2013.
132. BC Gadomski, KC McGilvray, JT Easley, RH Palmer, **CM Puttlitz**. “Evaluation of a ground-based ovine model of simulated microgravity.” NASA Human Research Program Investigators’ Workshop, Galveston, TX, February 12-14, 2013.
133. BC Gadomski, **CM Puttlitz**. “Design of a dynamic stabilization device for the correction of the center of rotation in the lumbar spine.” 13<sup>th</sup> Annual Conference of the International Society for the Advancement of Spine Surgery, Vancouver, BC Canada, April 3-5, 2013.
134. K McGilvray, HV Demir, E Unal, **C Puttlitz**. “A novel bio-microelectrical system for in vivo diagnostic monitoring of fracture healing.” American Society of Mechanical Engineers 2013 Summer Bioengineering Conference, Sunriver, OR, June 26-29, 2013.
135. S Shetye, **CM Puttlitz**. “Biaxial response of ovine spinal cord dura mater.” American Society of Mechanical Engineers 2013 Summer Bioengineering Conference, Sunriver, OR, June 26-29, 2013.
136. B Gadomski, K McGilvray, J Easley, R Palmer, **C Puttlitz**. “Simulating microgravity in a large animal model.” American Society of Mechanical Engineers 2013 Summer Bioengineering Conference, Sunriver, OR, June 26-29, 2013.
137. KM Labus, AH Hsieh, **C Puttlitz**. “Lamellar and interlamellar shear compared across regions of the annulus fibrosus.” American Society of Mechanical Engineers 2013 Summer Bioengineering Conference, Sunriver, OR, June 26-29, 2013.

138. S Shetye, KL Troyer, F Streijger, J Lee, BK Kwon, P Cripton, **C Puttlitz**. “*In vitro* nonlinear viscoelastic characterization of the porcine spinal cord.” American Society of Mechanical Engineers 2013 Summer Bioengineering Conference, Sunriver, OR, June 26-29, 2013.
139. BC Gadowski, KC McGilvray, JT Easley, RH Palmer, **CM Puttlitz**. “Evaluation of Haversian bone fracture healing in simulated microgravity.” NASA Human Research Program Investigators’ Workshop, Galveston, TX, February 12-13, 2014.
140. KM Labus, GA Orozco, JJ García, **CM Puttlitz**. “An anisotropic model of the biaxial mechanics of brain white matter.” 7<sup>th</sup> World Congress of Biomechanics, Boston, July 6-11, 2014.
141. M Dreischarf, T Zander, A Shirazi-Adl, **CM Puttlitz**, CJ Adam, J Clayton, CS Chen, VK Goel, A Kiapour, YH Kim, KM Labus, JP Little, WM Park, YH Wang, HJ Wilke, A Rohlmann, H Schmidt. “Comparison of eight published lumbar spine finite element models.” 7<sup>th</sup> World Congress of Biomechanics, Boston, July 6-11, 2014.
142. BC Gadowski, ZF Lerner, RC Browning, **CM Puttlitz**. “Development and validation of a finite element model of the ovine hindlimb for the investigation of microgravity loading on skeletal tissue healing.” 7<sup>th</sup> World Congress of Biomechanics, Boston, July 6-11, 2014.
143. BC Gadowski, KC McGilvray, JT Easley, RH Palmer, D Ruehlman, M Roberts, **CM Puttlitz**. “Shock wave therapy does not enhance acute fracture strength but may accelerate formation rates under simulated microgravity conditions.” NASA Human Research Program Investigators’ Workshop; Galveston, TX, January 13-15, 2015.
144. BC Gadowski, ZF Lerner, RC Browning, **CM Puttlitz**. “Finite element modeling of the ovine hindlimb for the investigation of microgravity-related mechanobiological alterations.” 60th Annual Meeting of the Orthopedic Research Society; Las Vegas, NV, March 28-31, 2015.
145. KM Labus, JJ Garcia, **CM Puttlitz**. “Modeling the biaxial mechanics of brain white matter.” 60th Annual Meeting of the Orthopedic Research Society; Las Vegas, NV, March 28-31, 2015.
146. BC Gadowski, ZF Lerner, RC Browning, **CM Puttlitz**. “A finite element investigation of fracture healing under simulated microgravity loading conditions.” Summer Biomechanics, Bioengineering and Biotransport Conference; Snowbird, UT, June 17-20, 2015.
147. N Ramo, SS Shetye, **CM Puttlitz**. “Damage accumulation modeling and rate dependency of spinal dura mater.” Summer Biomechanics, Bioengineering and Biotransport Conference; Snowbird, UT, June 17-20, 2015.
148. K McGilvray, S Telfer, J Rafferty, A Cox, L Farr, M Mendoza, S Shetye, **C Puttlitz**. “Comparative analysis of human lumbar and thoracic vertebrae using micro-computed tomography (micro-CT) and the fine structure analysis (fineSA®) MRI Technique.” American Society of Bone and Mineral Research Annual Meeting, Seattle, October 9-12, 2015.
149. BC Gadowski, Y-X. Qin, J. Jiao, KC McGilvray, JT Easley, RH Palmer, **CM Puttlitz**. “Shock wave therapy and low-intensity pulsed ultrasound accelerate bone formation rates under simulated microgravity conditions.” NASA Human Research Program Investigators’ Workshop; Galveston, TX, February 8-11, 2016.
150. BC Gadowski, SS Shetye, BJ Hindman, BG Santoni, MM Todd, VC Traynelis, RB Fontes, **CM Puttlitz**. “Computational modeling of direct laryngoscopy and the effect of cervical spine injury on intervertebral kinetics.” International Anesthesiology Research Society; San Francisco, CA, May 21-24, 2016.

151. K McGilvray, **C Puttlitz**, S Berven, W Hsu, T Mroz, J Rhee. "Biomechanical and Histologic Comparison of a Novel 3-D Printed Porous Titanium Interbody Cage to PEEK." North American Spine Society Annual Meeting, Boston, October 26-29, 2016.
152. KA Baer, BS Schon, TB Woodfield, KC McGilvray, **CM Puttlitz**. "Biaxial mechanics of 3D plotted constructs for annulus fibrosis repair." Annual Meeting of the International Society for Biofabrication, Winston-Salem, North Carolina, October 29-31, 2016.
153. JT Easley, ES Hackett, M Hawes, P St. Pierre, M Frackle, R Tashjian, K Nason, **CM Puttlitz**, K McGilvray. "Tendon-to-bone interface augmentation using a marrow wicking system for primary rotator cuff repair in a sheep model." Annual Meeting of the Orthopaedic Research Society, San Diego, March 19-22, 2017.
154. K McGilvray, HB Seim, SH Berven, WK Hsu, TE Mroz, JM Rhee, **CM Puttlitz**, JT Easley. "Biomechanical and histological comparison of a novel 3D printed titanium interbody cage to standard PEEK cages." Annual Meeting of the Orthopaedic Research Society, San Diego, March 19-22, 2017.
155. KA Baer, JT Easley, R Palmer, L Nakamura, **C Puttlitz**, K McGilvray. "Evaluation of an orthopaedic screw retention device using an in vivo ovine metatarsal fracture model." Annual Meeting of the Orthopaedic Research Society, San Diego, March 19-22, 2017.
156. P Suh, C Lewis, **C Puttlitz**, B. Bal, K McGilvray. "Determining the weighted impact of factors leading to intervertebral cage subsidence." International Society for the Advancement of Spine Surgery, Las Vegas, April 6 – April 8, 2017.
157. NL Ramo, KL Troyer, **CM Puttlitz**. "Viscoelastic Behavior of Isolated Cervical Spinal Cord and Pia Mater Tissues." 2017 Summer Biomechanics, Bioengineering, and Biotransport Conference, Tucson, Arizona, June 21-24, 2017.
158. NL Ramo, KL Troyer, **CM Puttlitz**. "An Efficient Numerical Integration Method for Non-linear Viscoelastic Modeling." 2017 Summer Biomechanics, Bioengineering, and Biotransport Conference, Tucson, Arizona, June 21-24, 2017.
159. K McGilvray, H Silcox, J Rawlinson, **C Puttlitz**. "A biomechanical study of OLIF with unilateral and bilateral fixation." 2017 Annual Meeting of the Congress of Neurological Surgeons, Boston, Massachusetts, October 7-11, 2017.
160. K McGilvray, H Silcox, J Rawlinson, **C Puttlitz**. "An acute biomechanical study of plate-cage fixation for OLIF." 2017 Annual Meeting of the Congress of Neurological Surgeons, Boston, Massachusetts, October 7-11, 2017.
161. NL Ramo, SS Shetye, **CM Puttlitz**. "Damage accumulation modeling and rate dependency of spinal dura mater." American Society for Mechanical Engineering 2017 International Mechanical Engineering Congress and Exposition, Tampa, Florida, November 3-9, 2017.
162. M Page, T Woodfield, **CM Puttlitz**. "Interlamellar bonding is critical for achieving the requisite mechanical properties of regenerative scaffolds." Biofabrication 2017, Beijing, China, October 15-18, 2017.
163. KM Labus, KC McGilvray, **CM Puttlitz**. "Monitoring fracture healing via non-invasive electromagnetic sensing of mechanical stability." Orthopaedic Research Society 2018 Annual Meeting, New Orleans, LA, March 10-13, 2018.



164. M Nguyen-Trong, KL Labus, W Liu, K McGilvray, CM Puttlitz, Z Wang. "Distinct biaxial mechanical properties between right and left ventricles in healthy sheep." Experimental Biology 2018, San Diego, CA, April 21-25, 2018.

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## FEDERAL RESEARCH SUPPORT

### Current Funding

Puttlitz (role: Co-I); McGilvray (PI)

NIH-NIAMS Total Direct Costs: \$ 2,499,365 Effort: 2.0 calendar months/yr

Early Detection and Prediction of Complex Bone Healing (R01AR069734)

This project seeks to use a flexible substrate bioMEMs sensor to predict the fracture healing outcomes associated with a wide spectrum of difficult fracture patterns.

### Completed Funding

Puttlitz (role: PI)

NIH-NIBIB and NIAMS Total Direct Costs: \$ 1,211,321 Effort: 2.0 calendar months/yr

4/01/2011-03/31/15

Intubation Mechanics of the Stable and Unstable Cervical Spine (R01EB013241)

This project seeks to determine the relationship between peri-airway loading and resultant cervical spine kinetics during intubation in the presence of cervical spine instability.

Puttlitz (role: PI)

NASA Total Direct Costs: \$ 865,064 Effort: 1.0 calendar months/yr

7/01/2011-6/30/15

A Large Animal Model of Fracture Healing in Simulated Microgravity Environments (10-10NASA2-0020)

This project seeks to establish an isolated ovine metatarsus as a ground-based model of simulated microgravity. We propose to use this model to study fracture healing in the presence of simulated microgravity and determine optimal interventions to mitigate the deleterious effects of microgravity on bony healing.

Puttlitz (role: PI)

NIH-NIAMS Total Direct Costs: \$9,700 Effort: 0 calendar months/yr

12/20/09-11/30/10

The Annual Symposium on Computational Methods in Orthopaedic Biomechanics (2R13AR057262-02)

This application seeks to partially fund a computational meeting (commonly known as the "pre-ORS") that provides a forum for trainees and junior researchers to present their work in computational orthopaedic biomechanics.

Puttlitz (role: PI)

NIH-NIAMS Total Direct Costs: \$9,500 Effort: 0 calendar months/yr

2/20/09-8/31/09

The Annual Symposium on Computational Methods in Orthopaedic Biomechanics (1R13AR057262-01)

This application seeks to partially fund a computational meeting (commonly known as the "pre-ORS") that provides a forum for trainees and junior researchers to present their work in computational orthopaedic biomechanics.

Puttlitz (role: PI)

NIH-NIBIB and NIAMS Total Direct Costs: \$9,900 Effort: 0 calendar months/yr

8/01/2010-07/31/11

19th Annual Symposium on Computational Methods in Orthopaedic Biomechanics (9R13EB012930-03)

This application seeks to partially fund a computational meeting (commonly known as the "pre-ORS") that provides a forum for trainees and junior researchers to present their work in computational orthopaedic biomechanics.

Puttlitz (role: Co-I); Sarkar (PI)

NIH- NHLBI

Total Direct Costs: \$200,000

Effort: 0 calendar months/yr

5/12/06-3/31/10

Fibrotic Effects and Regulation of MMP Proteins in Thrombus Resolution (1R01HL083917-01)

Our role in this subcontract was to develop and implement a biaxial testing system to determine the inherent mechanical changes in the venous tissue due to the development of thrombi.

Puttlitz (role: PI)

NIH-NIBIB

Total Direct Costs: \$750,000

Effort: 2.0 calendar months/yr

9/10/09 – 8/31/12

BioMEMs Sensor for Fracture Healing (R01EB010035-01)

This project seeks to develop an implantable sensor that can determine whether fracture healing is following a normal or aberrant course during the critically important early healing period.

Puttlitz (role: Co-I); Hsieh (PI)

NIH - NIAMS

Total Direct Costs: \$40,000

Effort: 0 calendar months/yr

1/1/11-12/31/12 (no cost extension granted until 12/ 2013)

Role of Matrix Shear Stresses in Annulus Fibrosis Mechanobiology (1R21AR059325-01)

Our role in this subcontract is to develop and implement a finite element model of the interlamellar space of the annulus fibrosis.

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## PATENTS

- CM Puttlitz and BC Gadomski. “Pedicule Screw Assembly and Dynamic Spinal Stabilization Devices Incorporating The Pedicle Screw Assembly” Patent number: 201210601; Publication date: August 10, 2012.
- CM Puttlitz and BG Gadomski. “Interspinous Spacer Devices for Dynamic Stabilization of Degraded Spinal Segments.” Patent number: 2012106014; Publication date: August 8, 2012.
- HV Demir and CM Puttlitz. “BioMEMs sensor and apparatuses and methods thereof.” Patent number: 2010028077; Publication date: March 12, 2010.

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## HONORS AND AWARDS

- Editor’s Choice: one of the 9 highest impact papers in *Journal of Biomechanical Engineering* in 2014.
- Distinguishing Visiting Research Scholar, University of British Columbia, June 2012.
- Monfort Professor, Colorado State University, April 2011
- Whitecloud Basic Science Award, International Meeting on Advanced Spine Techniques, June 2010.
- Editor’s Choice: one of the 10 highest impact papers in *Anesthesiology* in 2009, January 2010.
- Outstanding Abstract Award, American Association of Tissue Banks, September 2009.
- Abell Outstanding Early-Career Faculty Award, Colorado State University, April 2008.
- Bloomberg Memorial Award for Outstanding Research, Veterinary Orthopaedic Society, March 2008.
- Elastikon Equine Research Award, Grayson-Jockey Club Research Foundation, May 2007.
- Best Basic Science Award, Inman-Abbott Society, San Francisco, May 2005.

- Finalist, Basic Science Award at the Cervical Spine Research Society, December 2004.
- Finalist, Basic Science Award at the Cervical Spine Research Society, December 2003.
- Best Poster Award at the International Society for the Study of the Lumbar Spine, June 2001.
- Sigma Xi, National Research Honorary Society, January 2001.
- Best Paper Award, North American Spine Society Meeting, October 2000.
- Finalist, Doctoral Paper Competition, American Society of Mechanical Engineers, November 1999.
- Tau Beta Pi, National Engineering Honor Society, Fall 1995.
- Academic All-American Society, Spring 1993.
- Alpha Sigma Mu, National Materials Science and Engineering Honor Society, Spring 1992.

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#### **PROFESSIONAL AFFILIATIONS**

- Orthopaedic Research Society
- Cervical Spine Research Society
- American Society of Biomechanics
- American Society of Mechanical Engineers
- International Society of Biomechanics
- The International Society for the Advancement of Spine Surgery
- North American Spine Society

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#### **AD HOC MANUSCRIPT REVIEWER**

- Acta Biomaterialia
- Advances in Orthopaedics
- American Journal of Veterinary Medicine
- American Journal of Veterinary Research
- Annals of Biomedical Engineering
- Biomechanics and Modeling in Mechanobiology
- Biomedical Engineering Online
- Clinical Anatomy
- Computer Methods and Programming in Biomedicine
- International Journal of Numerical Modeling in Electronic Networks, Devices and Fields
- Journal of Applied Physics
- Journal of Biomaterials Research
- Journal of Biomaterials Research – Part B – Applied Biomaterials
- Journal of Biomechanical Engineering
- Journal of Biomechanics
- Journal of Bone and Joint Surgery
- Journal of Cosmology
- Journal of Engineering in Medicine
- Journal of Mechanical Behavior of Biomedical Materials
- Journal of Mechanical Engineering and Science
- Journal of Nanostructured Polymers and Composites
- Journal of Neurosurgery

- Journal of Orthopaedic Research
- Journal of Shoulder and Elbow Surgery
- Materials Science and Engineering A
- Materials Science and Engineering B
- Medical Engineering and Physics
- Proceedings of the Institution of Mechanical Engineers, Part H, Journal of Engineering in Medicine
- Spine

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## PROFESSIONAL SERVICE

### *Intramural*

Education Committee	Department of Orthopaedic Surgery, UCSF	2002
Resident Int. Committee	Department of Orthopaedic Surgery, UCSF	2002-2004
Research Committee	Department of Orthopaedic Surgery, UCSF	2002-2004
Admissions Committee	Joint Bioengineering Program, UCSF/UCB	2002-2004
Executive Committee	Biomedical Engineering Program, CSU	2005-2008
Graduate Committee	Department of Mechanical Engineering	2010-present
Policy and Procedure Comm.	College of Engineering, CSU	2006-2008
Graduate Affairs Comm. (Chair)	Biomedical Engineering Program, CSU	2007-2008
Comm. on Intercollegiate Athletics	Faculty Council, CSU	2007-2010
Graduate Committee	School of Biomedical Engineering	2010-present

### *Extramural*

Program Chair	Computational Methods in Ortho Biomechanics	2001
Study Section	National Science Foundation CAREER Award	2003
Program Co-Chair	Computational Methods in Ortho Biomechanics	2004
Local Org. Com.	Int. Symposium on Ligament and Tendon	2004
Section Reviewer	Orthopaedic Research Society	2005
Research Committee	Cervical Spine Research Society	2006 - 2009
Program Co-Chair	Computational Methods in Ortho Biomechanics	2007- 2014
Editorial Board	Journal of Histotechnology	2013-present

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## GRADUATE STUDENT AND POST-DOCTORAL FELLOW MENTORING

### *Pre-Doctoral*

Quy Tran	Med School, UCSF	2001
Joe Lee	Med School, UCSF	2003
Ahad Yousef	Biology, UC Irvine (Undergrad.)	2003
Bahar Fata	Bioengineering, UCB <sup>5</sup>	2003
Jonathan Fischer	Mech. Eng., UCB (MS)	2003 - 2004
Colleen Lindsey	Mech. Eng., UCB (MS)	2003 - 2004
Lyn Comerford	Mech. Eng., UCB (MS)	2003 - 2004
Shikha Gupta	Mech. Eng., UCB (PhD)	2003 - 2008
Antonia Barkley	Bioengineering, UCSF/UCB <sup>6</sup> (MS)	2004 - 2005
Jaicharan Iyengar	Medical School, UCSF (MD thesis)	2004
William Muir	Bioengineering, UC Davis (BS)	2004
Rohan Desai	Bioengineering, UCB (BS)	2004 - 2005
Timothy Ruckh	Mech. Eng., CSU (MS)	2005 - 2007

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<sup>5</sup> UCB denotes University of California, Berkeley

<sup>6</sup> UCSF/UCB denotes University of California. San Francisco and University of California, Berkeley Joint Program in Bioengineering.

Wesley Womack	Mech. Eng., CSU (PhD)	2005 - 2009
Gliceria Rodriguez-Canessa	Chem. Eng., CSU (BS)	2006 - 2007
Ugur Ayturk	Mech. Eng., CSU (PhD)	2006 - 2010
Kirk McGilvray	Mech. Eng., CSU (PhD)	2006 - 2009
Carrie Gowan	Mech. Eng., CSU (MS)	2006 - 2008
Kevin Troyer	Mech. Eng., CSU (MS)	2007 - 2008
Snehal Shetye	Mech. Eng., CSU (PhD)	2007 - 2010
Kevin Troyer	Mech. Eng., CSU (PhD)	2008 - 2012
Ross Tichota	Mech. Eng., CSU (MS)	2007 - 2009
Dan Woldtvedt	Mech. Eng., CSU (BS Honors thesis)	2007 - 2009
Patrick Leahy	Mech. Eng., CSU (PhD)	2008 - 2012
Ben Gadmoski	Biomed Eng., CSU (PhD)	2009 - 2015
Kevin Labus	Biomed Eng., CSU (PhD)	2011- 2016
Nicole Ramo	Biomed Eng., CSU (PhD Candidate)	2013- present
Mitchell Page	Mech. Eng., CSU (PhD Candidate)	2016-present
Conor Sutherland	Mech. Eng., CSU (PhD Candidate)	2017-present
Jacob Wolynski	Bioengineering, CSU (PhD Candidate)	2017- present

*Post-Doctoral Fellows*

Robert Melcher, MD	Orthopaedic Research Fellow	2000 - 2001
Dheera Anathkrishnan, MD	Orthopaedic Research Fellow	2001 - 2002
Christopher Grimsrud, MD	Orthopaedic Resident	2003 - 2004
Todd Kim, MD	Orthopaedic Resident	2004 - 2005
Fernando Carrillo, PhD	Postdoctoral Fellow	2004 - 2005
Fujita Masaru, MD	Visiting Orthopaedic Researcher	2004 - 2005
Brandon Santoni, PhD	Postdoctoral Fellow	2006 - 2008
Kirk McGilvray, PhD	Postdoctoral Fellow	2009 - 2010
Snehal Shetye, PhD	Postdoctoral Fellow	2011- 2015
Kevin Labus, PhD	Postdoctoral Fellow	2016-present

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**TEACHING**

<b>Year</b>	<b>Semester</b>	<b>Course</b>	<b>Hours</b>	<b>Enrollment</b>
2017	Spring	MECH 498B – Research Practicum	4	19
2017	Spring	MECH 325 – Machine Design	3	160
2016	Fall	MECH 498A – Research Practicum	4	19
2016	Fall	MECH/BIOM 580A7 - Musculoskeletal Biomechanics	3	7
2015	Spring	MECH 480B – Perspectives on Mechanical Engineering Graduate Education	1	13
2015	Spring	MECH 325 – Machine Design	3	138
2015	Spring	MECH 498B – Research Practicum	4	9
2014	Spring	MECH 325 – Machine Design	3	110
2014	Spring	MECH 480A – Perspectives on Mechanical Engineering Graduate Education	1	9
2014	Fall	MECH 325 – Machine Design	3	59
2014	Fall	MECH 498A – Research Practicum	4	9
2014	Fall	MECH 480A – Perspectives on Mechanical Engineering Graduate Education	1	8

2013	Spring	MECH 325 – Machine Design	3	158
2013	Fall	MECH 325 - Machine Design	3	57
2012	Spring	MECH 325 - Machine Design	3	129
2012	Fall	MECH/BIOM470 - Biomedical Engineering	3	12
2011	Spring	MECH 325 - Machine Design	3	122
2011	Fall	MECH/BIOM 470 - Introduction to Biomedical Engineering	3	67
2010	Spring	MECH 325 - Machine Design	3	104
2010	Fall	MECH470 - Biomedical Engineering	3	50
2009	Spring	MECH/BIOM 671 - Biomechanics	3	5
2009	Fall	MECH/BIOM 470 - Introduction to Bioengineering	3	47
2009	Spring	MECH325 - Machine Design	3	71
2008	Fall	MECH/BIOM 470 - Introduction to Bioengineering	3	33
2008	Spring	MECH/BIOM 671 - Biomechanics	3	4
2007	Fall	MECH/BIOM 470 - Introduction to Bioengineering	3	26
2006	Spring	MECH/BIOM 671 - Biomechanics	3	8
2006	Fall	MECH/BIOM 470 - Introduction to Bioengineering	3	23
2005	Fall	MECH/BIOM 470 - Introduction to Bioengineering	3	29