

**B. SONNY BAL, MD JD MBA**

**CURRICULUM VITAE**

Professor  
Department of Orthopaedic Surgery  
University of Missouri Health Care  
1100 Virginia Avenue  
Columbia, Missouri 65212

Phone: (573) 882-6762  
Fax: (573) 882-8200  
Email: BalB@health.missouri.edu

**EDUCATION**

**Orthopaedic Fellowships:**

Research Assistant 8/1/1994 to 7/31/1995  
Orthopaedic Biomechanics Laboratory  
William H. Harris, M.D.  
Massachusetts General Hospital  
Boston, Massachusetts

Hip and Implant Surgery, Post-graduate year 7 8/1/1993 to 7/31/1994  
William H. Harris, M.D.  
Massachusetts General Hospital  
Harvard Medical School  
Boston, Massachusetts

**Surgery Internships & Residency:**

Orthopaedic Surgery, Post-graduate years 3-6 7/1/1989 to 6/30/1993  
Department of Orthopaedic Surgery  
University of Missouri School of Medicine  
Kansas City, Missouri

General Surgery, Post-graduate years 1-2 7/1/1987 to 6/30/1989  
Department of General Surgery  
University of California Hospitals and Clinics  
San Francisco, California

**Law:**

University of Missouri School of Law (JD) 8/27/2002 to 5/16/2009  
Columbia, Missouri

**Business Management:**

Kellogg Graduate School of Management (MBA) 09/1/1997 to 6/30/1999  
Northwestern University  
Evanston, IL

**Medical School:**

September 12, 2013

Cornell University Medical College (MD)  
New York, New York

8/1/1983 to 5/27/1987

**Undergraduate/Graduate:**

University of California (MS-Genetics)  
Davis, California

7/1/1982 to 6/30/1983

University of California (BS-Genetics)  
Davis, California

3/1/1981 to 6/30/1982

San Joaquin Delta College (AA-Biology)  
Stockton, California

1/16/1979 to 2/28/1981

**ACADEMIC APPOINTMENTS**

Professor  
Department of Orthopaedic Surgery  
University of Missouri Health System-Columbia

9/1/2013 to Present

Adjunct Faculty  
Executive MBA Medicine Program  
University Malaysia

8/2012 to Present

Interim Chairman  
Department of Orthopaedic Surgery  
University of Missouri Health System-Columbia

12/15/2008 to 8/30/2009

Chief of Adult Reconstruction  
Department of Orthopaedic Surgery  
University of Missouri Health System-Columbia

9/1/2007 to 7/31/2013

Associate Professor  
Department of Orthopaedic Surgery  
University of Missouri Health System-Columbia

9/1/2007 to 8/31/2013

Adjunct Professor  
Department of Materials Science and Engineering  
University of Missouri - Rolla

2005 to Present

Assistant Professor  
Department of Orthopaedic Surgery  
University of Missouri Health System-Columbia

9/1/1999 to 8/31/2007

Attending Physician and Shareholder/Partner  
Jackson County Orthopaedics, Inc.  
Blue Springs, Missouri

1995 to 1999

Assistant in Orthopaedic Surgery  
Cambridge Hospital/Harvard Medical School  
Cambridge, Massachusetts

1993 to 1995

**BOARD CERTIFICATION**

American Board of Orthopaedic Surgery, July 1997.  
American Board of Orthopaedic Surgery, recertified, January 2008.  
Missouri Bar Examination, September 2009.

**PROFESSIONAL MEMBERSHIPS**

Honorary, Lifetime full member of International Society for Technology in Arthroplasty; January 1, 2013 to present.  
Professional Liability and Compliance Committee; March 1, 2012.  
American Bar Association; 2009 to present.  
The Missouri Bar; 2009 to present.  
University of Missouri Graduate Faculty; 2009.  
University Physicians Professional Liability Committee; 2006 to 2008.  
Clinical Orthopaedic Society; 2005 to present.  
Jefferson Club, University of Missouri-Columbia; 2005 to present.  
The Library Society, University of Missouri-Columbia; 2005 to present.  
The McAlester Society, University of Missouri-Columbia; 2005 to present.  
McMaster University Evidence-Based Journal Reviewing System; 2003 to 2006.  
Missouri State Orthopaedic Association; 2003 to present.  
American Association of Hip and Knee Surgeons; 2001 to present.  
Mid-America Orthopaedic Association; 2000 to present.  
Orthopaedic Research Society; 2000 to present.  
Society for Biomaterials; 2000 to present.  
American Academy of Orthopaedic Surgeons.

**HOSPITAL AFFILIATIONS**

University of Missouri Hospital and Clinics; 6/21/1999 to present. (Active)  
Columbia Regional Hospital; 8/16/2000 to present. (Active)  
Boone Hospital Center; 6/2000 to present. (Courtesy)  
Capital Region Medical Center; 11/15/2005 to present. (Active)  
Harry S. Truman Veterans' Memorial Hospital; 12/12/1999 to present. (WOC)  
St. Mary's Hospital, Blue Springs, MO; 7/1995 to 8/1999.  
Centerpoint Medical Center of Independence (Medical Center of Independence), Independence, MO; 1995 to 1999.  
Cambridge Hospital, Cambridge, MA; 1994 to 1995.

**OUTPATIENT CENTER AFFILIATIONS**

The Institute for Outpatient Surgery; 7/1/2002 to present.  
HealthSouth Rusk Rehabilitation Center; 6/8/2006 to present.

**HONORS AND AWARDS**

Certificate of Editorial Achievement in recognition of contribution as Guest Editor for Composite Materials in Skeletal Engineering for Open Access Journal. December 2012.  
AAOS Achievement Award for Volunteer Service. January 27, 2012.  
American Board of Orthopaedic Surgeons: Invited examiner for oral examination of candidates taking Part II of ABOS Certification Examination. July 18-21, 2011.  
Missouri Life Sciences Research Award. The Evaluation of a Synthetic Bioactive Biomaterial Scaffold for the Tissue Engineering of Cartilage. P Jayabalan, MN Rahaman, BS Bal, HJ Sims, JL Cook. July 18 – 21, 2011.  
2nd Place Phi Zeta Research Day Poster Presentation, University of Missouri. July 18 – 21, September 12, 2013

2011.

President's Intercampus Collaboration Award. March 4, 2011.

University of Missouri, Research and Creativities Forum 2010: 1<sup>st</sup> Place Award Bioactive Glass 13-93 as a subchondral substrate for tissue engineered osteochondral constructs *P Jayabalan, AR Tan, MN Rahaman, BS Bal, CT Hung, JL Cook*.

Appointed to Elwood L. Thomas Inn of Court, MU School of Law; 2008 to 2009.

American Board of Orthopaedic Surgeons: Invited examiner for oral examination of candidates taking Part II of ABOS Certification Examination, July 14-17, 2008.

COL Making A Difference Award, 2008.

Paul "HAP" Award for Outstanding Scientific Paper, International Society of Technology in Arthroplasty (ISTA), August 2007.

American Academy of Orthopaedic Surgeons, Clinician-Scientist Travel Fellowship Award, December 2006.

American Academy of Orthopaedic Surgeons, Leadership Fellows Program, Class of 2007 (elected 2006).

University of Missouri Health Care Service Quality Award for July 2005.

Department of Radiology-Chair Search Committee, University of Missouri Health Care, 2001.

St. Luke's Hospital House Staff Research Award, University of Missouri School of Medicine 1991.

Rex L. Diveley Orthopaedic Research Award, University of Missouri-Kansas City School of Medicine 1990, 1992, and 1993.

Department of Orthopaedic Surgery Prize, University of Missouri - Kansas City School of Medicine 1990, 1991, 1992, and 1993.

Richard H. Kiene Orthopaedic Award, University of Missouri - Kansas City School of Medicine 1990, 1991, and 1992.

Honors in Research with M.D. degree, Cornell University Medical College 1987.

Dept. of Physiology Basic Science Research Prize, Cornell University Medical College 1987.

Teaching Assistantships, Genetics and Biochemistry, University of California-Davis 1982 to 1983.

Alpha Zeta Honor Society, University of California-Davis 1982.

B.S. degree with High Honors, University of California-Davis 1982.

A.A. degree with High Honors, San Joaquin Delta College 1981.

Teaching Assistantships, Chemistry and Physics, San Joaquin Delta College 1980 to 1981.

Alpha Gamma Sigma Honor Society, San Joaquin Delta College 1980.

### **RESEARCH ADVISOR, SPONSORSHIP, MENTORSHIP**

"Design of a Cable Tensioning Tool For Reattachment of the Greater Trochanter."

Undergraduate thesis, Mechanical & Aerospace Engineering, MU MAE 350 Honors Research, December 2002, Jonathan T. Brown. Sherif El-Gizawy, PhD, Honors Advisor and **B. Sonny Bal, MD**, Research Advisor.

"Finite Element Analysis of Proximal Femoral Loading In Minimally Invasive Total Hip Replacement." MS Thesis, October 2005, Aaron Xavier Molina Martell. Sherif El-Gizawy, PhD, Thesis Supervisor and **B. Sonny Bal, MD**, Thesis Co-Supervisor.

"Alternative Avenues for MedicoLegal Dispute Resolution." Program mentor and graduate advisor, 2005-2006, Sukhsimranjit Singh, LLM degree, University of Missouri Law School.

"Fabrication of Functional Gradient Composite Ceramic Materials for Orthopaedic Bearings." Hrishikesh Keshavan, 2002-2003. MS thesis, MU Aerospace and Mechanical Engineering.

September 12, 2013

Graduate student advisors: Khaled Morsi, PhD, and **B. Sonny Bal, MD.**

“Response of primary human blood monocytes and the U937 human monocytic cell line to alumina ceramic particles.” Efrat Yagil, MS thesis, MU School of Veterinary Immunobiology. Graduate Advisors: D. Mark Estes, PhD, and **B. Sonny Bal, MD.**

“Tissue-engineered osteochondral constructs.” Post Graduate fellowship advisor: Dr. Wenhai Huang, PhD. January 1, 2005 to June 30, 2006. Mohamed Rahaman, PhD, and **B. Sonny Bal, MD.**

“Alumina/polyethylene acetabular cups and alumina-niobium bearings for total hip arthroplasty.” Post Graduate fellowship advisor: Yadong Li, PhD, April 1, 2005 to July 31, 2006. Co-Advisors: Mohamed Rahaman, PhD, and **B. Sonny Bal, MD.**

“Interaction of cells with bioactive glasses.” Undergraduate fellowship; Second Prize in the UM-Rolla annual undergraduate research competition, Agatha Dwilewicz, April 2006. Advisors: Mohamed Rahaman, PhD, and **B. Sonny Bal, MD.**

“Fabrication of hydroxyapatite and bioactive glass scaffolds for bone repair and regeneration.” Qiang Fu, PhD, August 2005. Advisor: Mohamed Rahaman, PhD, and **B. Sonny Bal, MD.**

“Composite Ceramic THA Bearings.” Post Graduate fellowship Dr. Aihua Yao, Visiting Scientist, July 15, 2006 to present. Advisors: Mohamed Rahaman, PhD, and **B. Sonny Bal, MD.**

“Nanomechanical Property Characterization of Femoral Heads.” Masters of Science thesis presented to the Faculty of the Graduate School, University of Missouri-Columbia, Prashanthi Tirunagari 2006. Sanjeev Khanna, PhD, Thesis Supervisor and **B. Sonny Bal, MD**, Research Advisor.

“Freeze casting of bioactive ceramics and glass scaffolds for engineering bone tissue.” PhD/DE Advisory and Thesis Defense Committee. Qiang Fu August 15, 2005 to May 28, 2009. Mohamed Rahaman, PhD, Faith Dogan, PhD, Roger Brown, PhD, Delbert Day, PhD and **B. Sonny Bal, MD.**

“Serum Amyloid Factor and Osteophyte Formation in Degenerative Joint Disease.” Srijita Dhar, student May 2008 to present. Master’s thesis committee.

Doctoral Dissertation and Advisory Committee member, PhD degree, Graduate Student Xin Liu, January 2010-August 2012, Missouri S&T University, Rolla, MO. Dissertation: Bioactive Glass Scaffolds for the Regeneration of Load-Bearing Bone.

“Bioactive Glass (13-93) as a subchondral substrate for tissue-engineered osteochondral constructs.” Prakash Jayabalan, Andrea Tan, Mohammed N Rahaman, **B Sonny Bal**, Hannah J Sims, Clark T Hung and James L Cook. Prakash won 2010 MU Post-Doctoral Association Travel Award Grant.

Faculty Mentor: MU Discovery Fellow Research Student (Darby Provance); 2011 to 2012.

“A New Standard for Measuring Professional Conduct of the Physician in Training.” *Publication in preparation* Faculty Advisor: Haden Ross Compton, 2<sup>nd</sup> year law student, University of

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Missouri-Columbia.

Advisor to Missouri Law Review Associate Member, fall 2011 academic semester, University of Missouri, Columbia.

Advisor to Clint Mathews. A class ran by Jake Holliday of the Missouri Innovation Center - Starting a High Growth Venture - The Business Plan.

Supported seven (7) post-graduate fellows at Comparative Orthopaedic Laboratory, 2003 to present.

**COMMITTEE SERVICE**

**National/International:**

At-Large Legal Advisor for Health Policy Committee, American Association of Hip and Knee Surgeons, January 2010 to present.

Contributing Author to the Interactive Educational Program (IEP) for Total Joint, 2010 to present.

Orthopaedic Research & Education Foundation (OREF), Orthopaedic Partners Committee. Appointment, June 2010 to present.

Medical Liability Committee, American Academy of Orthopaedic Surgeons, March 2008 to March 2010.

Honorary One Health Initiative Website Advisory Board, July 2009 to present.

Hip, Knee, and Adult Reconstruction Evaluation Subcommittee, American Academy of Orthopaedic Surgeons, 2007 to 2013.

American Academy of Orthopaedic Surgeons, Leadership Fellows Program, 2007 to 2008.

Legal Advisory Committee, American Association of Hip and Knee Surgeons, July 2005 to present; Vice-Chairman, November, 2005, Chairman elect 2007 to 2010.

American Legal Forum and Orthopaedic Medical Legal Advisor Bulletin, Founding Member, and Board of Directors, Chapel Hill, NC, 2005 to present.

Medical Liability Committee, American Academy of Orthopaedic Surgeons, Academic Business and Practice Management Committee, American Academy of Orthopaedic Surgeons, 2002 to 2005.

Foundation for the Advancement of Research in Medicine, Board of Directors, California, 2002 to present.

ECRI-Health Technology Forecast Advisory Board, 2003 to 2005.

Orthopaedic Research & Education Foundation (OREF), Finance Committee. Appointment, August 2012 to present.

American Bar Association Advisory Panel, appointed March 2012 to present.

**Industry:**

Board of Directors, Amedica US Spine Inc., Salt Lake City, UT. Appointed January 2012.

Board of Directors, OrthoMind Inc. Social Media website for Orthopaedic Surgeons. Appointed August 2011.

Designer Surgeon Panel, Zimmer Inc., Warsaw, Indiana, 2002 to present.

Total Joint Reconstruction Clinical Advisory Panel, Amedica Inc., Salt Lake City, UT, 2005 to present.

Board of Directors, BoneSmart.org and FARMortho LLC.

Scientific Advisory Board for the ConforMIS iTotal Hip Implant, May 2013 to present.

**University:**

MU Discovery Fellows Program for the 2011 to 2012 academic year.

MU Orthopaedic Transitional Leadership Advisory Committee, 2008 to 2009.

Member; Board of Directors and Executive Committee, Missouri Orthopaedic Institute, University of Missouri.

Promotion & Tenure Committee of the Department of Orthopaedic Surgery, University of Missouri, Columbia.

UP Malpractice Committee.

Service Line Chief, 9/1/2007 to 8/31/2013

**EDITORIAL BOARDS/PEER REVIEWER**

Peer reviewer for the Hip, Knee & Adult Reconstruction questions for the new Self-Assessment Examination based on the AAOS Orthopaedic Knowledge Online, April 27, 2012 to present.

Editorial Manager, Adult Reconstruction OKO Self-Assessment Exam: Adult Reconstruction, April 2011.

Editorial Board, *World Journal of Orthopedics* (WJO), March 2011 to present.

Peer reviewer, *Journal of Knee Surgery*, April 2010 to present.

Editorial Board member of *Orthopedics Today*, April 2010 to present.

Editorial Board of *Global Journal of Surgery*, February 2010 to June 30, 2012.

Dove Medical Press, Honorary Editorial Board, 2008 to present.

Editorial Board, *Journal of Orthopaedic Surgical Advances*, October 2007 to present.

September 12, 2013

Peer reviewer for *Journal of the American Academy of Orthopaedic Surgeons*.

**SCIENTIFIC PRESENTATIONS (peer reviewed)**

1. **Bal BS.** "Alpha-adrenergic blockade alters regional perfusion during E. coli bacteremia." First International Shock Congress and Tenth Annual Conference on Shock, Montreal, Canada, June 7-11, 1987.
2. **Bal BS.** "Concentration- and calcium- dependent binding of acidic phosphoproteins to type-I collagen." American Society for Bone and Mineral Research, San Diego, California, August 24-28, 1991.
3. **Bal BS.** "The oblique trochanteric osteotomy." 23rd Annual Hip Course, Harvard Medical School, Boston, Massachusetts, 1993.
4. **Bal BS.** "Factors in trochanteric union." 24th Annual Hip Course, Harvard Medical School, Boston, Massachusetts, 1994.
5. **Bal BS.** "Wear in monoblock versus modular femoral stems." 25th Annual Hip Course, Harvard Medical School, Boston, Massachusetts, 1995.
6. **Bal BS.** "Fate of trochanters in revision total hip arthroplasty." 25th Annual Hip Course, Harvard Medical School, Boston, Massachusetts, 1995.
7. **Bal BS.** "Trochanteric escape in revision total hip arthroplasty." 25th Annual Hip Course, Harvard Medical School, Boston, Massachusetts, 1995.
8. **Bal BS,** Vandellune D, Gurba DM and Harris WH. "A comparison of polyethylene wear between femoral stems of different modularity, porous-coating, and metal composition." Annual Meeting of the American Academy of Orthopaedic Surgeons, Atlanta, Georgia, February 22-26, 1995.
9. **Bal BS.** "Cementless cups into prior allografts." 29th Annual Hip Course, Harvard Medical School, Boston, Massachusetts, 1999.
10. **Bal BS.** "Ceramic femoral components in total knee replacement." Mid-Central States Orthopaedic Society/Missouri State Orthopaedic Association Annual Meeting, Branson, Missouri, June 2000.
11. **Bal BS.** "Ceramic femoral head fractures." 4th Annual Symposium on Alternate Bearings in Total Joint Arthroplasty, Maui, Hawaii, September 24-26, 2001.
12. **Bal BS.** "Zirconia ceramic femoral component in total knee replacement." 4th Annual Symposium on Alternative Bearings in Total Joint Arthroplasty, Maui, Hawaii, September 24-26, 2001.
13. Cook JL, Ray A, Ray BK, Kuroki K, Kenter K, **Bal BS.** "Transcription factor SAF-1 regulates matrix metalloproteinase-1 gene expression in osteoarthritis" Aust G. Orthop Res Soc, New Orleans, LA, February 2-5, 2003. *\*\*Orthopaedic Research Society's 2003 New Investigator Recognition Award Winner\*\**



14. **Bal BS.** “Ceramic-on-ceramic bearings in total hip replacement.” 33<sup>rd</sup> Annual Course, Advances in Arthroplasty, Harvard Medical School, Cambridge, MA, September 17-20, 2003.
15. **Bal BS.** “Ceramic total knee replacement.” The 6<sup>th</sup> Annual Symposium on Alternative Bearing Surfaces in Total Joint Replacement, San Francisco, California, September 22-24, 2003.
16. **Bal BS.** “Characterization of surface damage to alumina bearings in total hip arthroplasty.” 17<sup>th</sup> Annual Symposium of the International Society for Technology in Arthroplasty, Rome, Italy, September 23-25, 2004.
17. **Bal BS.** “Ceramics dislocation.” 34<sup>th</sup> Annual Course, Advances in Arthroplasty, Harvard Medical School, Cambridge, MA, September 29-October 2, 2004.
18. **Bal BS.** “My first 50 cases.” 34<sup>th</sup> Annual Course, Advances in Arthroplasty, Harvard Medical School, Cambridge, MA, September 29-October 2, 2004.
19. **Bal BS.** “Encore ceramic-ceramic and status of PDP.” The 7<sup>th</sup> Annual Symposium on Alternative Bearing Surfaces in Total Joint Replacement, Philadelphia, PA, October 14-15, 2004.
20. **Bal BS.** “Ceramic total knee replacement.” The 7<sup>th</sup> Annual Symposium on Alternative Bearing Surfaces in Total Joint Replacement, Philadelphia, PA, October 14-15, 2004.
21. **Bal BS.** “MIS THR: not an easy road.” The 7<sup>th</sup> Annual Symposium on Alternative Bearing Surfaces in Total Joint Replacement, Philadelphia, PA, October 14-15, 2004.
22. **Bal BS.** “Early clinical results of primary hip replacement surgery using two incisions.” The 14<sup>th</sup> Annual American Association of Hip and Knee Surgeons, November 5-7, 2004, Dallas, Texas.
23. **Bal BS,** Haltom D, Aleto T, Barrett MO. “Clinical results in eighty-nine primary total hip replacements performed with a two-incision minimally invasive technique.” Minimally Invasive Surgery meets Computer Assisted Orthopaedic Surgical Technology (MIS meets CAOS) Indianapolis, IN, May 19-21, 2005.
24. **Bal BS,** Garino JP. “Ceramic-on-ceramic versus ceramic-on-polyethylene bearings in total hip arthroplasty: results of a multicenter prospective randomized study and update of modern ceramic total hip trials in the USA.” BioloX Symposium, Washington, DC, June 1-11, 2005.
25. **Bal BS.** “Surface changes to alumina femoral heads after metal staining during implantation, and after recurrent dislocations of the prosthetic hip.” BioloX Symposium, Washington, DC, June 1-11, 2005.
26. **Bal BS.** “Primary total knee replacement with a zirconia ceramic femoral component.” BioloX Symposium, Washington, DC, June 1-11, 2005.

27. **Bal BS**. “MIS sub-vastus approach to total knee replacement.” 35<sup>th</sup> Annual Course, Advances in Arthroplasty, Harvard Medical School, Cambridge, MA, September 28-October 1, 2005.
28. **Bal BS**. “Ceramics for the orthopaedic surgeon.” 35<sup>th</sup> Annual Course, Advances in Arthroplasty, Harvard Medical School, Cambridge, MA, September 28-October 1, 2005.
29. **Bal BS**. “High incidence of fractures of the polyethylene tibial post in a posterior cruciate-substituting total knee system.” The 15<sup>th</sup> Annual American Association of Hip and Knee Surgeons, Dallas, Texas November 4-6, 2005.
30. **Bal BS**. “A few concepts, regards, medical defense, action and liability reform.” An educational presentation by the AAHKS Legal Advisory Committee. The 15<sup>th</sup> Annual American Association of Hip and Knee Surgeons, Dallas, Texas, November 4-6, 2005.
31. **Bal BS**, Khandkar A. “Alternative bearing in total hip replacement.” The 50<sup>th</sup> Annual Conference of Indian Orthopaedic Association, Mumbai, India, December 28, 2005.
32. **Bal BS**. “Alternative bearing – ceramics.” The 50<sup>th</sup> Annual Conference of Indian Orthopaedic Association, Mumbai, India, December 28, 2005.
33. **Bal BS**, Greenberg DD, Li S, Cherry KL, Aletto TJ. “Failure of the polyethylene tibial post in a posterior cruciate-substituting total knee arthroplasty.” Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, Ill., March 24, 2006.
34. **Bal BS**, Lowe J, Burlingame N, Serafin L. “Relationship between diameter and load to failure in ceramic femoral heads.” 23<sup>rd</sup> Annual Southern Orthopaedic Association Meeting, Paradise Island, Bahamas, July 20, 2006.
35. **Bal BS**, Lowe J, Burlingame N, Serafin L. “MIS sub-vastus approach to total knee replacement.” Twenty-third Annual Southern Orthopaedic Association Meeting, Paradise Island, Bahamas, July 20, 2006.
36. **Bal BS**, Barrett MO, Lowe J. “Early outcomes of primary total hip replacements with a modified two incision approach.” 23<sup>rd</sup> Annual Southern Orthopaedic Association Meeting, Paradise Island, Bahamas, July 20, 2006.
37. **Bal BS**. “Zimmer MIS 2-incision THA improvement—M/L taper hip.” Zimmer Arthroplasty Course, Nashville, Tennessee, November 10, 2006.
38. **Bal BS**. “Avoiding leg length discrepancy with *VerSys* hip/longevity poly.” Zimmer Arthroplasty Course, Nashville, Tennessee, November 10, 2006.
39. **Bal BS**, Ries M, Atwood S, Anderson M, Penenberg B, Halley D, Greenwald A, Pruitt L, Penenberg, B. “Fracture of highly cross-linked UHMWPE acetabular Liners.” Presented at the 75<sup>th</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Francisco, CA, March 5-9, 2008.

40. Khandkar AC, Bernero J, **Bal BS**, Lakshminarayanan R, Clarke I, Hoffman AA. "Silicon nitride: a new material for spinal implants." 10<sup>th</sup> Annual Update in Hip and Knee Arthroplasty and Bearings Surfaces, held in Racho Mirage, CA, September 17-19, 2008.
41. Cook JL, Lima EG, Ng KW, Kuroki K, Stoker AM, **Bal BS**, Ateshian GA, Hung CT. "Towards biologic osteochondral resurfacing of the canine patella using tissue engineered anatomic constructs." Orthopaedic Research Society, New Orleans, LA, March 6-9, 2009.
42. Lima EG, Chao PH, Ateshian GA, Cook JL, **Bal BS**, Vunjak-Novakovic G, Hung CT. "Porous tantalum metal outperforms devitalized bone as a substrate for osteochondral tissue engineering." Orthopaedic Research Society, New Orleans, LA, March 6-9, 2009.
43. Tan AR, Barsi JM, Jayabalan PS, Rahaman MN, **Bal BS**, Ateshian GA, Cook JL, Hung, CT. "The potential for 13-93 bioglass as a medium supplement for culturing tissue engineered cartilage." Orthopaedic Research Society, New Orleans, LA, March 6-9, 2009.
44. Jayabalan P, Tan AR, Rahaman MN, **Bal BS**, Sims HJ, Hung CT, Cook JL. "Bioactive glass (13-93) as a subchondral substrate for tissue-engineered osteochondral constructs." Orthopaedic Research Society, New Orleans, March 6-9, 2009
45. Invited speaker: "2010 Anterior approach total hip arthroplasty" for the round table discussion tip and tricks Q&A and "Learning the anterior approach my experience with technique (from 2-incision to anterior approach)" in Las Vegas, NV, October 22, 2010.
46. "The anterior approach optimizes THA outcome" and "Ceramic-ceramic use in THA: comforts and caveats." 12<sup>th</sup> Annual Current Concepts in Joint Replacement Las Vegas, NV May 22 – 25, 2011.
47. Accepted presentation for the 63<sup>rd</sup> Annual Meeting of The Association of Bone and Joint Surgeons in Dublin, Ireland, June 8-12, 2011.
48. Symposium: "Contemporary medico-legal issues in orthopaedic surgery" in San Francisco, CA, February 6 - 10, 2012.
49. "Medico-legal issues in arthroplasty surgery," "Metal cones in TKR," "Fundamentals of revision TKA basic principles – case presentations and rapid fire discussions," "Bioactive glasses in skeletal reconstruction," "Infected TKR - case presentations and rapid fire discussions." 11th Anniversary of the Annual Advances in Arthritis, Arthroplasty and Trauma Course in St. Louis, MO, April 26-28, 2012.
50. "Current status of ceramic total hip bearings" and "Discussion panel: metal-on-metal total hips." 2012 Annual Missouri State Orthopaedic Association Meeting May 18 – 19, 2012.
51. The 42nd Annual Advances in Arthroplasty Course, Harvard Medical School, Cambridge, MA, October 2–5, 2012.
52. 2013 Annual Meeting American Academy of Orthopaedic Surgeons, Instructional Course: "Contemporary medico-legal issues in orthopaedic surgery" in Chicago, IL, March 19-23, 2013.

53. 2013 Annual Meeting American Academy of Orthopaedic Surgeons, Symposium: “Medical-legal considerations in managing patients with musculoskeletal tumors” in Chicago, IL, March 19-23, 2013.
54. The Stevens Conference: The 2nd Conference on Bacteria – Material Interactions: “Silicon nitride – A unique antibacterial bioceramic” in Hoboken, NJ, June 6, 2013.
55. ISTA 26<sup>th</sup> Annual Congress: “Patient-specific implants and instruments improved outcomes of total knee replacement” in Palm Beach, Florida, October 18, 2013.

**SCIENTIFIC PRESENTATIONS (not peer reviewed)**

1. **Bal BS.** “Dorsal Capsulodesis of the Scaphoid for Scapholunate Dissociation.” American Orthopaedic Association Residents’ Conference, Kansas City, Missouri, 1991.
2. **Bal BS.** “Experience with Ceramic Knee Femur.” Orthopedic Review Symposium, Vail Colorado, January 2002.
3. **Bal BS.** “Minimally Invasive Total Knee Technique & Results.” Contemporary Topics in Orthopedics, Vail Colorado, January 2-3, 2003.
4. **Bal BS.** “Minimally Invasive Total Hip Replacement.” Contemporary Topics in Orthopedics, Vail Colorado, January 2-3, 2003.
5. **Bal BS.** “Minimally Invasive Hip and Knee Replacement Surgery: Fact, Fiction, Reality and Myth. What the Patient Should Know.” Columbia, MO, March 12, 2005.
6. **Bal BS.** “Ceramic Bearings in Prosthetic Hip and Knee Joints.” University of Missouri-Rolla, Department of Materials Science and Engineering, December 1, 2005.
7. **Bal BS.** “Modified Two Incision Technique.” 20<sup>th</sup> Annual Vail Orthopaedic Symposium, Total Hip & Knee Arthroplasty, Vail, Colorado, January 22-27, 2006.
8. **Bal BS, Rahaman MN.** “Tissue-Engineering of Cartilage on Bioactive Glass Scaffolds.” 6<sup>th</sup> Annual Comparative Orthopaedics Day, Columbia, Missouri, April 14, 2006.
9. **Bal BS, Aleto TJ.** “Advances in Hip and Knee Replacement.” Columbia Activity Recreation Center, September 15, 2006.
10. **Bal BS.** “The Outcomes of Two-Incision Total Hip Arthroplasty Performed Without Intraoperative Fluoroscopy.” Minimally Invasive Surgery meets Computer Assisted Orthopaedic Surgical Technology (MIS meets CAOS) in Scottsdale, AZ, October 26-28, 2006.
11. **Bal BS.** “Subvastus Total Knee Arthroplasty Without Cement or Tourniquet.” Minimally Invasive Surgery meets Computer Assisted Orthopaedic Surgical Technology (MIS meets CAOS) in Scottsdale, AZ. MIS-CAOS, October 26-28, 2006.
12. **Bal BS.** “Acetabular Reaming and Positioning.” Anterior Approach Total Hip Arthroplasty, San Francisco, CA, March 1, 2013.

13. Tolia P, Marlow M, **Bal BS**, Phillips S. Panel Discussion: "How Can We More Quickly Bring New Materials-Based Infection-Control Strategies to Clinical Practice?" Matthew Libera, moderator. The Stevens Conference: The 2<sup>nd</sup> Conference on Bacteria – Material Interactions, Hoboken, NJ, June 6, 2013.

**ABSTRACTS/POSTERS (peer reviewed)**

1. **Bal BS**, Cherry K, Edelstein D. "Prospective Randomized Study Comparing Ceramic/Ceramic and Ceramic/PE Bearing Surfaces in Total Hip Arthroplasty." The American Academy of Orthopaedic Surgeons 69th Annual Meeting in Dallas, Texas, February 2002.
2. Cook JL, Kuroki K, **Bal BS**. "Effects of Bipolar Radiofrequency Energy on Articular Cartilage Extracellular Matrix." Orthop Res Soc in Dallas, TX, February 10-14, 2002.
3. Kazmier P, Burd T, **Bal BS**. "Nonunion of the Greater Trochanter Following the Anterior Trochanteric Slide Osteotomy." The 35<sup>th</sup> Annual Residents Conference in Memphis, Tennessee, April 12-14, 2002.
4. Marberry KM, Cook JL, Kuroki K, Brawner T, Geiger T, Jayalaban P, Kenter K, **Bal BS**. "Effects of Radiofrequency Generated Heat on Human Degenerative Articular Cartilage." American Orthopaedic Association - 35th Annual Residents Conference in Memphis, TN, April 13-15, 2002.
5. Kazmier P, Burd T, **Bal BS**. "Nonunion of the Greater Trochanter Following the Anterior Trochanteric Slide Osteotomy." 12<sup>th</sup> Annual Meeting of the Mid-America Orthopaedic Association in Tucson, Arizona, April 24-28, 2002.
6. Marberry KM, Cook JL, Kuroki K, Kenter K, **Bal BS**. "In Vitro Assessment of Articular Cartilage Stiffness Following Treatment with Radiofrequency Generated Heat." 20<sup>th</sup> Annual Mid-America Orthopaedic Association Meeting in Tucson, AZ, April 25-28, 2002.
7. Kazmier P, **Bal BS**, Patil SK, Rahaman MN. "Microscopic Characterization of Alumina Bearing Surfaces in Total Hip Arthroplasty." The 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society in New Orleans, Louisiana, February 2-5, 2003.
8. Kazmier P, Gornowicz B, Crow B, Christensen G, **Bal BS**. "Bacterial Adhesion to Alumina Ceramic Versus Cobalt-Chrome Femoral Heads." The 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society, New Orleans, Louisiana, February 2-5, 2003.
9. Kuroki K, Ray A, Aust G, Cook JL, **Bal BS**, Ray B. "SAF-1 Regulates Matrix Metalloproteinase-1 in Osteoarthritis." Missouri Life Sciences Week in Columbia, MO, March 3-7, 2003.
10. Roller BL, Cook JL, **Bal BS**, Stoker AM. "Correlation of Clinical Assessment of Meniscal Pathology to Biochemical and Molecular Analyses." University of Missouri Health Sciences Research Day in Columbia, MO, November 11, 2004.
11. Kumar D, Shakya A, Kuroki K, Cook JL, **Bal BS**, Ray A, Ray BK. "Induction of Matrix Metalloproteinases in Chondrocyte Cells of Osteoarthritic Cartilage is Mediated by

- Inflammation-Responsive Transcription Factors.” The American Society For Biochemistry and Molecular Biology Meeting, 2004.
12. Hendricks KJ, Aleto TJ, **Bal BS**. “Early results of Modern Ceramic on Ceramic Total Hip Arthroplasty, A Prospective Randomized Study.” 22<sup>nd</sup> Annual Mid-America Orthopaedic Association Meeting, 2004.
  13. Roller BL, Cook JL, **Bal BS**, Stoker AM. “Correlation of Clinical Assessment of Meniscal Pathology to Biochemical and Molecular Analyses.” 3<sup>rd</sup> Biology of the Meniscus Meeting in Washington, DC, February 23, 2005.
  14. **Bal BS**, Kazmier P, Burd T, Aleto TJ. “Anterior Trochanteric Slide Osteotomy for Primary Total Hip Replacement. Review of Nonunion and Complications.” American Academy of Orthopaedic Surgeons Annual Meeting in Washington, D.C. February 23-27, 2005.
  15. **Bal BS**, Ray BK, Shakya A, Ray A. “Overexpression of MMP-14 in Human Osteoarthritic Joint Is Mediated by SAF-1.” 52<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society in Chicago, IL, March 19-22, 2006.
  16. **Bal BS**, Evans R, Rahaman M, Ellingsen MD, Khanna, SK. “Comparison of Surface Characteristics and Prediction of Wear Properties between Alumina and Oxinium Femoral Heads.” 52<sup>nd</sup> Annual Meeting of the Orthopaedic Research Society in Chicago, IL, March 19-22, 2006.
  17. **Bal BS**, Rahaman M, Kuroki K, Cook JL. “In Vivo Comparison of Tissue Engineered Osteochondral Plugs Using Allograft Bone, Trabecular Metal and Bioactive Glass Substrates.” Orthop Res Soc in San Diego, CA, February 11-14, 2007.
  18. Roller BL, Stoker AM, Fox DB, **Bal BS**, Cook JL. “Characterization of Pathology of Knee Menisci: Correlation of Radiographic, Gross, Histologic, Biochemical and Molecular Measures of Disease.” Orthop Res Soc in San Diego, CA, February 11-14, 2007.
  19. **Bal BS**, Hillard A, Lowe J, Aleto TJ, Greenberg D. “Muscle Damage after Total Hip Arthroplasty with the Two-incision Technique.” 24<sup>th</sup> Annual Mid-America Orthopaedic Association Meeting in Boca Raton, Florida, April 11-15, 2007.
  20. **Bal BS**, Hughes M, Li S, Aleto TJ, Rahaman MN. “The Effect of Metal Staining on Alumina-Alumina Hip Simulation Wear.” 24<sup>th</sup> Annual Mid-America Orthopaedic Association Meeting in Boca Raton, Florida, April 11-15, 2007.
  21. **Bal BS**, Barrett MO, Greenberg DD, Lowe J, Aleto TJ. “Incidence of Heterotopic Ossification Following Primary Two-incision Total Hip Arthroplasty.” 24<sup>th</sup> Annual Mid-America Orthopaedic Association Meeting in Boca Raton, Florida, April 11-15, 2007.
  22. **Bal BS**, Aleto TJ, Lakshminarayanan RR, Khandkar A, Clarke I, Hoffman A. “The Wear of Silicon Nitride Ceramic Bearings in a Hip Simulator.” 24<sup>th</sup> Annual Mid-America Orthopaedic Association Meeting in Boca Raton, Florida, April 11-15, 2007.

23. Rahaman MN, Li Y, Aleto TJ, **Bal BS**. "Alumina Ceramic Femoral Heads with a Metal Taper." 24<sup>th</sup> Annual Mid-America Orthopaedic Association Meeting in Boca Raton, Florida, April 11-15, 2007.
24. Cook JL, Lima EG, Ng KW, Kuroki K, Stoker AM, **Bal BS**, Ateshian GA, Hung CT. "Towards Biologic Osteochondral Resurfacing of the Canine Patella Using Tissue Engineered Anatomic Constructs." Orthop Res Soc in Las Vegas, NV, February 22-25, 2009.
25. Lima EG, Chao PH, Ateshian GA, Cook JL, **Bal BS**, Vunjak-Novakovic G, Hung CT. "Porous Tantalum Metal Outperforms Devitalized Bone as a Substrate for Osteochondral Tissue Engineering." Orthop Res Soc in Las Vegas, NV, February 22-25, 2009.
26. Tan AR, Barsi JM, Jayabalan P, Rahaman MN, **Bal BS**, Ateshian GA, Cook JL, Hung CT. "The Potential for 13-93 Bioglass as a Medium Supplement for Culturing Tissue Engineered Cartilage." 55<sup>th</sup> Annual Orthopaedic Research Society Conference in Las Vegas, NV, February 22 – 25, 2009.
27. Jayabalan P, Tan AR, Barsi JM, Rahaman MN, Ateshian GA, Hung CT, Cook JL, **Bal BS**. "In Vitro Optimization of Tissue Engineered Osteochondral Grafts." 9<sup>th</sup> Annual Comparative Orthopaedics Day in Columbia, MO, April 2009
28. Jayabalan P, Tan AR, Barsi JM, Rahaman MN, **Bal BS**, Ateshian AG, Hung CT, Cook JL. "Bioactive Glass (13-93) as a Subchondral Substrate and Culture Media Supplement for Tissue Engineered Cartilage." International Cartilage Repair Society conference in Miami, Florida, May 2009.
29. Franklin SP, Hung C, Lima E, Ng K, Kuroki K, Stoker A, **Bal BS**, Ateshian G, Pfeiffer F, Cook JL. "Progression toward Biologic Joint Resurfacing in Dogs." Veterinary Orthopedic Society Conference in Breckenridge, CO, February 20-27, 2010.
30. Roller BL, Stoker AM, Marberry KM, White RA, **Bal BS**, Cook JL. "Characterization of Meniscal Pathology with Molecular and Proteomic Analyses." Orthop Res Soc in New Orleans, LA, March 6-9, 2010.
31. Roller BL, Stoker AM, Garner BC, **Bal BS**, Raghu DR, Cook JL. "Analysis of Synovial Fluid Biomarkers and Correlation with Radiography." Orthop Res Soc in New Orleans, LA, March 6-9, 2010.
32. Jayabalan P, Tan AR, Rahaman MN, **Bal BS**, Sims HJ, Hung CT, Cook JL. "Bioactive Glass (13-93) as a Subchondral Substrate for Tissue-engineered Osteochondral Constructs." Orthop Res Soc in New Orleans, LA, March 6-9, 2010.
33. **B.S. Bal**, Aleto TJ, Aggarwal A, Wegman B. "Primary Uncemented Total Knee Replacement with a Monoblock Tibial Component." American Academy of Orthopaedic Surgeons Annual Meeting in San Diego, CA, February 15-19, 2011.
34. **Bal BS**. "Informed Consent Law: How Much to Disclose?" 64<sup>th</sup> Annual Meeting of the Association of Bone and Joint Surgeons in Charleston, South Carolina, May 2–6, 2012.

35. Pfeiffer FM, **Bal BS**. “P51; Fabrication and Evaluation of Tissue Engineered Femoral Head Implants for Resurfacing of Osteoarthritic Joints.” International Cartilage Repair Society conference in Montreal, Canada, May 12-15, 2012.
36. McEntire BJ, Lakshminarayanan A, **Bal BS**, Webster TJ. “An Overview of Silicon Nitride as a Novel Biomaterial.” 2012 Innovations in Biomaterials Conference, American Ceramic Society in Raleigh, NC, September 11-13, 2012.
37. Franklin S, Pfeiffer FM, Cockrell M, Stoker A, **Bal BS**, Cook JL. “Effects of Low Temperature Hydrogen Peroxide Gas Plasma Sterilization on In Vitro Cytotoxicity of Poly-L-Caprolactone (PCL).”
38. Ivie C, **Bal BS**. “Concerns and Limitations of Ceramic Total Hip Bearings.” The Association of Bone and Joint Surgeons 65<sup>th</sup> Annual Meeting at Çırağan Palace Kempinski in Istanbul, Turkey, April 24-28, 2013.
39. Rahaman MN, **Bal BS**, Huang T. “Porous titanium implants fabricated by a salt bath sintering process for bone repair applications.” Materials Science & Technology 2013, Next Generation Biomaterials; Montreal, Quebec Canada, October 27-31, 2013.

**INVITED MODERATOR, KEYNOTE SPEAKER**

Moderator. “Alternative Bearings and Minimally Invasive Surgery Techniques” at the University of Pennsylvania for The 7<sup>th</sup> Annual Symposium on Alternative Bearing Surfaces in Total Joint Replacement, Philadelphia, PA, October 14-15, 2004.

“Advances in Arthroplasty, An Emphasis on Treatment Options for the Young/Active Patient.” Harvard University, Cambridge, MA, October 3-7, 2006.

Meeting Co-Chairman and Presenter. “Minimally Invasive Total Hip Surgery.” Minimally Invasive Surgery meets Computer Assisted Orthopaedic Surgical Technology (MIS meets CAOS) in Scottsdale, AZ, October 26-28, 2006.

“MIS Total Joint Arthroplasty and other Factors Effecting Recovery.” American Association of Hip & Knee Surgeons Meeting in Dallas, TX, November 3-5, 2006.

Keynote Speaker. “Hard-on-hard Bearings in THA.” Moderator: “Mini-Smith Peterson and Head Damage: Hard on Hard.” Hip and Knee Arthroplasty Continuing Education Course at Harvard University in Cambridge, MA, September 25-27, 2007.

Moderator. “Soft Tissue and Tachnology.” Tissue Engineering of Articular Cartilage. Musculoskeletal Transplant Foundation in Vancouver, British Columbia, October 11-13, 2007.

Meeting Chairmen and Presenter. “Anterior Total Hip Arthroplasty Mini-Symposium.” American Association of Hip & Knee Surgeons, November 2, 2007.

Orthopaedic Research Society in Las Vegas, NV, Feb 2009.

Regional Life Sciences Summit in Kansas City, MO, March 9, 2010.

The Anterior Approach Total Hip Arthroplasty Lab in Henderson, NV, October 21-22, 2010.

September 12, 2013



The Anterior Approach THA Cadaver Lab in Houston, TX, January 13-14, 2011.

Anterior Approach Total Hip Arthroplasty. "Anatomic Consideration and Patient Selection for the Anterior Approach" and "Learning the Anterior Approach – My Experience with the Technique (From 2-Incision to Anterior Approach)." Las Vegas, NV April 8, 2011.

"Filling the Gaps: Bone Deficiency and Treatment Options." Missouri Musculoskeletal Conference in Kansas City, MO, July 28, 2011.

Moderator and speaker for the 11th Anniversary of the Annual Advances in Arthritis, Arthroplasty and Trauma Course in St. Louis, Missouri, April 26-28, 2012.

"Custom Implants in Joint Replacement." Meeting of the Morgan-Stanley Investment Banking Group, Boston, MA, March 28, 2013.

"Closed Medical Negligence Claims Can Drive and Reduce Litigation." The 4<sup>th</sup> Annual Pegalis and Erickson Lectureship, New York, New York, April 9, 2013.

"Reducing Liability Risk and Improving Quality: Role of the Orthopaedic Executive." 2013 Annual American Association of Orthopaedic Executives, San Diego, CA, April 28-30, 2013.

Faculty Panel Presenter. "Perioperative Management THA. AAOS/AAHKS Challenges and Controversies in Total Joint Arthroplasty, Rosemont, IL. May 3, 2013.

Lab Faculty. "Primary THA (Direct THA/Mini Posterior)." AAOS/AAHKS Challenges and Controversies in Total Joint Arthroplasty, Rosemont, IL. May 3, 2013.

Lab Faculty. "Revision THA (Trochanteric Osteotomy, Augment, Cage)." AAOS/AAHKS Challenges and Controversies in Total Joint Arthroplasty, Rosemont, IL. May 3, 2013.

Lab Faculty. "Primary TKA." AAOS/AAHKS Challenges and Controversies in Total Joint Arthroplasty, Rosemont, IL. May 4, 2013.

Lab Faculty. "Revision TKA." AAOS/AAHKS Challenges and Controversies in Total Joint Arthroplasty, Rosemont, IL. May 4, 2013.

Moderator: "Contemporary Medico-Legal Issues in Orthopaedic Surgery." 2014 AAOS Annual Meeting, in New Orleans, Louisiana, March 11-15, 2014.

### **MAJOR LECTURES AND VISITING PROFESSORSHIPS**

Grand Rounds Lecture: Legal Liability During Residency Training. University of Southern California, Los Angeles, CA. June 8, 2012.

Grand Rounds Lecture: Anterior Total Hip Replacement –Affirmative. Louisiana State University, Shreveport, LA. September 23, 2011.

Dinner Lecture: Medical Liability of Physicians in Training. Louisiana State University, Shreveport, LA. September 22, 2011.

**RESEARCH GRANTS AWARDED**

**Principal Investigator:**

Arthritis Foundation: "Comparison of tissue-engineered osteochondral grafts fabricated with mesenchymal stem cells and trabecular metal or allograft bone." \$199,997.00. 6/1/2005 to 5/31/2007.

Pfizer Inc.: "Comparison of tissue-engineered osteochondral grafts fabricated with mesenchymal stem cells and trabecular metal or allograft bone." \$199,999.00. 7/1/2005 to 7/1/2007.

N/A: "Comparison of tissue-engineered osteochondral grafts fabricated with mesenchymal stem cells and trabecular metal or allograft bone." \$100,000.00. 7/1/2005 to 6/30/2007.

Aircast Foundation: "Development of osteoarthritis in transgenic mice with increased SAF-1 expression in articular cartilage." \$99,998.00. 8/1/2005 to 7/31/2007.

National Health Institute: "Development of osteoarthritis in transgenic mice with increased SAF-1 expression in articular cartilage." \$404,248.00. 10/1/2005 to 9/30/2007.

Research Point: "Potential site for knee or hip arthroplasty surgery clinical trial." \$0.00. 1/4/2006 to 1/3/2007.

Zimmer Holdings, Inc.: "Comparison of tissue-engineered osteochondral grafts fabricated with mesenchymal stem cells and trabecular metal or allograft bone." \$125,406.00. 5/25/2006 to 5/24/2007.

Orthopaedic Research and Education Foundation: "Comparison of tissue-engineered patellar osteochondral grafts fabricated from mesenchymal stem cells and bioactive glass or trabecular tantalum metal." \$150,625.00. 7/1/2007 to 6/30/2010.

National Institute of Health: "Novel freeze-cast bioactive glass scaffolds for bone repair." \$108,472.00. 1/1/2009 to 12/31/2010.

Missouri Life Science Research Board: "Missouri consortium for biomaterials research and commercialization." \$292,287.00. 1/1/2009 to 12/31/2011.

Missouri Life Science Research Board: "Tissue engineered resurfacing of the hip joint." \$198,459.00. 1/1/2009 to 12/31/2011.

Missouri Life Science Research Board: "Research on freeform fabrication of objects with graded bio-materials." \$105,283.00. 1/1/2009 to 12/31/2011.

Orthopaedic Research and Education Foundation: "Bioactive glass scaffolds for bone repair." \$131,328.00. 7/1/2009 to 6/30/2012.

Department of Health and Human Services: "Novel freeze-cast bioactive glass scaffolds." \$108,482.00. 8/19/09 to 7/31/12.

National Institute of Health: "Functional tissue-engineered osteochondral composite constructs." \$254,701.00. 10/15/2009 to 10/14/2011.

Missouri Life Science Research Board: "Research of freeform fabrication of objects."  
\$105,284.00. 1/1/2010 to 12/31/2012.

Missouri Life Science Research Board: "Missouri consortium for biomaterials research and commercialization." \$400,001.00. 1/1/2010 to 12/31/2012.

Missouri Life Science Research Board: "Ceramic-metal composite femoral head for total hip arthroplasty." \$125,826.00. 2/1/2010 to 1/31/2012.

Missouri Life Science Research Board: "Development of a hybrid metal-bioactive glass material for skeletal repair." \$123,955.00. 1/1/2011 to 12/31/2012.

Zimmer Holdings, Inc.: "Design and testing of a canine biological femoral head replacement."  
\$342,837.00. 7/1/2011 to 6/30/2014.

National Institute of Health: "Bioengineering research partnership: bioactive glass in regenerative medicine." \$719,725.00. 8/1/2011 to 7/31/2016.

Orthopedic Research Society: "Faculty career development through the orthopaedic research society's collaborative exchange award." \$7,501.00. 10/1/2011 to 9/30/2012.

Musculoskeletal Transplant Foundation: "Fabrication and testing of a canine biological femoral head arthroplasty." \$301,106.00. 1/1/2012 to 12/31/2014.

National Institute of Health: "Bioactive glass in osteochondral tissue engineering." \$138,969.00. 1/1/2012 to 12/31/2013.

Musculoskeletal Transplant Foundation: "Bioactive glass in skeletal regeneration." \$0.00. 1/1/2012 to 12/31/2014.

National Institute of Health: "Bioactive glass in regenerative medicine." \$114,638.00. 5/1/2012 to 4/30/2017.

Orthopaedic Research and Education Foundation: "Fabrication and testing of a canine biological femoral head arthroplasty." \$223,932.00. 7/1/2012 to 6/30/2015.

Department of Defense: "Bicompatible device for repairing segmental bone defects."  
\$292,335.00. 7/1/2012 to 6/30/2014.

Consultant for a NIH SBIR research project "Silorane based bone cements" proposal by Nanova and UMKC. Grant pending.

**Co-Investigator:**

National Science Foundation: "MRSEC interactions & transformation at membrane interfaces."  
\$22,774,108.00. 9/1/2005 to 8/30/2011.

Musculoskeletal Transplant Foundation: "Characterization of pathology of the knee menisci for optimizing diagnosis and treatment of meniscal disorders." \$56,252.00. 1/1/2007 to 12/31/2007.

Orthopaedic Research and Education Foundation: "Characterization of pathology of the knee

menisci for optimizing diagnosis and treatment of meniscal disorders.” 7/1/2007 to 6/30/2008.

Arthritis Foundation: “Analysis of regional chondrocyte metabolism in canine and human OA patients.” \$200,000.00. 7/1/2007 to 6/30/2009.

National Institute of Health: “Synovial fluid molecules pertaining to toll-like receptors as biomarkers of osteoarthritis followed by acute knee injury.” \$ 789,738.00. 10/1/2009 to 9/30/2011.

National Football League: “Characterization of pathology of the knee menisci for optimizing diagnosis and treatment of meniscal disorders.” \$119,252.00. 1/1/2010 to 6/30/2012.

Arthritis Foundation: “Synovial fluid derived biomarkers in osteoarthritis.” \$74,800.00. 6/1/2011 to 5/31/2012.

National Institute of Health: “Center of research translation.” \$7,233,877.00. 7/1/2012 to 6/30/2017.

Coulter Foundation: “Nano-Radiosynovectomy for Osteoarthritis Treatment” \$41,976.00 09/01/2012 to 08/31/2013.

#### **Key Personnel:**

AO Research Fund: “Characterizing knee menisci pathology for optimal diagnosis and treatment of meniscal disorders.” \$51,380.00. 8/1/2009 to 7/31/2009.

National Institute of Health: “Creation of new musculoskeletal engineering faculty position.” \$1,365,092.00. 10/1/2009 to 9/30/2011.

National Institute of Health: “Characterization of pathology of the knee menisci for optimizing diagnosis and treatment of meniscal disorders.” \$227,250.00. 4/1/2010 to 3/31/2013.

National Institute of Health: “Fabrication and testing of a canine biological femoral head arthroplasty.” \$218,495.00. 7/1/2012 to 6/30/2015.

#### **PUBLICATIONS**

##### **Peer-reviewed journal articles:**

1. Fantini GA, Shiono S, **Bal BS**, Shires GT. Adrenergic mechanism contribute to alterations in regional perfusion during normotensive E. coli bacteremia. *J Trauma*. 1989 Sep;29(9):1252-7.
2. **Bal BS**, Gurba DM. Coumadin-induced necrosis of the skin after total knee replacement. A case report. *J Bone Joint Surg Am*. 1991 Jan;73(1):129-30.
3. Chen Y, **Bal BS**, Gorski JP. Calcium and collagen binding properties of osteopontin, bone sialoprotein, and bone acidic glycoprotein-75 from bone. *J Biol Chem*. 1992 Dec 5;267(34):24871-8.
4. **Bal BS**, Jones L Jr. Arthroscopic resection of a chondroblastoma in the knee. *Arthroscopy*. 1995 Apr;11(2):216-9.

5. **Bal BS**, Sampath SAC, Burke DW. A technique for cementing the patella component in total knee arthroplasty. *Am J Orthop*. 1995 Apr;24(4):358.
6. **Bal BS**. A technique for comparison of leg lengths during total hip arthroplasty. *Am J Orthop*. 1996 Jan;25(1):61-2.
7. McGrory BJ, **Bal BS**, Harris WH. Current concepts of six trochanteric osteotomies for total hip arthroplasty. *J Am Acad Orthop Surgeons*. 1996;4:258-67.
8. **Bal BS**, Sandow T. Bilateral femoral neck fractures with negative bone scans. A case report. *Orthopaedics*. 1996 Nov;19(11):974-6.
9. **Bal BS**, Jiranek W, Harris WH. Periprosthetic osteolysis around an uncemented endoprosthesis. A Case Report. *J Arthroplasty*. 1997;12(3):346-9.
10. **Bal BS**, Maurer B, Harris W. Trochanteric union following revision total hip arthroplasty. *J Arthroplasty*. 1998 Jan;13(1):29-33.
11. **Bal BS**, Vandellune D, Gurba DM, Jasty M, Harris WH. Polyethylene wear in cases using femoral stems of similar geometry, but different metals, porous layer, and modularity. *J Arthroplasty*. 1998 Aug;13(5):492-9.
12. **Bal BS**, Maurer T, Harris W. Revision of the acetabular component without cement after a previous acetabular reconstruction with use of a bulk femoral head graft in patients who had congenital dislocation or dysplasia. *J Bone Joint Surg Am*. 1999 Dec;81(12):1703-6.
13. Ray A, Kuroki K, Cook JL, **Bal BS**, Kenter K, Aust G, Ray BK. Induction of matrix metalloproteinase 1 gene expression is regulated by inflammation-responsive transcription factor SAF-1 in osteoarthritis. *Arthritis Rheum*. 2003 Jan;48(1):134-45.
14. Oonishi H, Kim SC, Clarke I, Asano T, **Bal BS**, Kyomoto M, Masuda S. Retrieved ceramic total knee prosthesis in clinical use for 23 years. *Key Eng Mater* Vols. 240-242, pp. 797-800, 2003.
15. Keshavan H, **Bal BS**, Morsi K. Preliminary investigation into the production of grain-size functionally gradient materials for artificial hip implant applications, TMS Annual Meeting, Symposium: Surface Engineering: In *Materials Science II*, Mar 2-6 2003, San Diego, CA, United States, 2003, p 233-41.
16. Morsi K, Keshavan H, **Bal BS**. Processing of grain-size functionally gradient bioceramics for implant applications. *J Mater Sci Mater Med*. 2004 Feb;15(2):191-7.
17. Cook JL, Kuroki K, Kenter K, Marberry K, Brawner T, Geiger T, Jayabalan P, **Bal BS**. Bipolar and monopolar radiofrequency treatment of osteoarthritic knee articular cartilage: acute and temporal effects on cartilage compressive stiffness, permeability, cell synthesis, and extracellular matrix composition. *J Knee Surg*. 2004 Apr;17(2):99-108.
18. Yagil-Kelmer E, Kazmier P, Rahaman MN, **Bal BS**, Tessman RK, Estes DM. Comparison of the response of primary human blood monocytes and the U937 human monocytic cell line to two different sizes of alumina ceramic particles. *J Orthop Res*.

2004 Jul;22(4):832-8.

19. Morsi K, Keshavan H, **Bal BS**: Hot Pressing of Graded Ultrafine-Grained Alumina Bioceramics. *Mater Sci Eng A386*: 384-389, September 2004.
20. Ray A, **Bal BS**, Ray BK. Transcriptional induction of matrix metalloproteinase-9 in the chondrocyte and synoviocyte cells is regulated via a novel mechanism: evidence for functional cooperation between serum amyloid A-activating factor-1 and AP-1. *J Immunol*. 2005 Sep 15;175(6):4039-48.
21. **Bal BS**, Aleto TJ, Garino JP, Toni A, Hendricks K. Ceramic-on-ceramic versus ceramic-on-polyethylene bearings in total hip arthroplasty: results of a multicenter prospective randomized study and update of modern ceramic total hip trials in the U.S. *Hip Int*. 2005 July-September;15:129-35.
22. Aleto T, Garino JP, Hendricks KJ, **Bal BS**. A comparison of ceramic-on-ceramic with ceramic-on-polyethylene bearings in total hip arthroplasty: early results of a prospective randomized trial. *U Penn Orthop J*. 2005;17:1-5.
23. **Bal BS**, Haltom D, Aleto TJ, Barrett MO. Early complications in eighty-nine primary total hip replacements performed with a two-incision minimally invasive technique. *J Bone Joint Surg Am*. 2005 Nov;87(11):2432-8.
24. **Bal BS**, Barrett MO. Acute sepsis complicating degenerative arthritis of the hip joint: a report of three cases. *J Surg Orthop Adv*. 2005 Winter;14(4):190-2.
25. **Bal BS**, Barrett MO, Lowe J. A modified two-incision technique for primary total hip replacement. *Seminars in Arthroplasty*. September 2005;16(3):198-207.
26. **Bal BS**, Kazmier P, Burd T, Aleto TJ. Anterior trochanteric slide osteotomy for primary total hip replacement. Review of nonunion and complications. *J Arthroplasty*. 2006 Jan;21(1):59-63.
27. **Bal BS**, Greenberg D, Buhrmester L, Aleto TJ. Primary total knee replacement with a zirconia ceramic femoral component. *J Knee Surg*. 2006 Apr;19(2):89-93.
28. **Bal BS**, Aleto TJ. A method to remove the polyethylene liner during hip revision surgery. *Am J Orthop*. 2006 May;35(5):242.
29. **Bal BS**, Haltom D, Aleto T, Barrett M. Early complications of primary total hip replacement performed with a two-incision minimally invasive technique. *Surgical Technique. J Bone Joint Surg Am*. 2006 Sep;88 Suppl 1 Pt 2:221-33.
30. **Bal BS**, Garino J, Ries M, Rahaman MN. Ceramic materials in total joint arthroplasty. *Seminars in Arthroplasty*. September/December 2006;17(3/4):94-101.
31. Rahaman MN, Brown RF, **Bal BS**, Day DE. Bioactive glasses for nonbearing applications in total joint arthroplasty. *Seminars in Arthroplasty*. September/December 2006;17(3/4):102-12.

32. Garino J, Rahaman MN, **Bal BS**. The reliability of modern alumina bearings in total hip arthroplasty. *Seminars in Arthroplasty*. September/December 2006;17(3/4):113-9.
33. **Bal BS**, Rahaman MN, Aleto TJ, Miller FS, Traina F, Toni A. The significance of metal staining on alumina femoral heads in total hip arthroplasty. *J Arthroplasty*. 2007 Jan;22(1):14-9.
34. **Bal BS**, Greenberg DD, Lowe J, Aleto TJ. Primary total knee arthroplasty performed with a MIS subvastus approach. *Tech Knee Surg*. 2007 March;6(1):60-7.
35. **Bal BS**, Greenberg D. Failure of a metal-reinforced tibial post in TKA. A case report. *J Arthroplasty*. 2007 Apr;22(3):464-7.
36. **Bal BS**, Garino J, Ries M, Rahaman MN. A review of ceramic bearing materials in total joint arthroplasty. *Hip Int*. 2007 Jan-Mar;17(1):21-30.
37. Barrett MO, **Bal BS**. Septic arthritis of the hip joint in an immune competent adult: the significance of the differential diagnosis. *J Am Board Fam Med*. 2007 May-Jun;20(3):307-9.
38. Fu Q, Rahaman MN, Bal BS, Huang W, Day DE. Preparation and bioactive characteristics of a porous 13-93 glass, and fabrication in the articulating surface of a proximal tibia. *J Biomed Mater Res A*. 2007 Jul;82(1):222-9.
39. Rahaman MN, **Bal BS**, Garino J, Ries M, Yao J. Ceramics for prosthetic hip and knee joint replacement. *J Am Ceram Soc*. 2007;90(7):1965-88.
40. Yoon RS, Lloyd EW, McGrory B, **Bal BS**, Macaulay W. Studies presented in poster format at the annual Meetings of the American Association of Hip & Knee Surgeons: how do they fare in the peer review process? *J Arthroplasty*. 2007 Sept;22(6 Suppl 2):17-20.
41. Upadhyay A, York S, Macaulay M, McGrory B, Robbennolt J, **Bal BS**. Medical malpractice in hip and knee arthroplasty. *J Arthroplasty*. 2007 Sept;22(6 Suppl 2):2-7.
42. **Bal BS**, Garino J, Ries M, Oonishi H. Ceramic bearings in total knee arthroplasty. *J Knee Surg*. 2007 Oct;20(4):261-70.
43. Fu Q, Rahaman MN, Dogan F, **Bal BS**. Freeze casting of porous hydroxyapatite scaffolds. I. Processing and general microstructure. *J Biomed Mater Res B Appl Biomater*. 2008 Jul;86(1):125-35.
44. Fu Q, Rahaman MN, Dogan F, **Bal BS**. Freeze casting of porous hydroxyapatite scaffolds. II. Sintering, microstructure, and mechanical behavior. *J Biomed Mater Res B Appl Biomater*. 2008 Aug;86(2):514-22.
45. **Bal BS**, Lowe J, Hillard A. Muscle damage in minimally invasive total hip replacement: MRI evidence that it is not significant. *Instr Course Lect*. 2008 Jan 15;57:223-29.
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**Bal BS**. Managing Editor, Hip and Knee section, eMedicine Clinical Knowledge Base (<http://www.edmedicine.com>).

**Bal BS.** Editor-in-Chief, American Legal Forum, Orthopaedic Medical Legal Advisor Bulletin since November 2005.

**Bal BS.** Elite reviewer on the Editorial Board, *Journal of Arthroplasty*, September 2006 to present.

**Bal BS.** ABJS Member Associate Editors Board, *Clinical Orthopaedics and Related Research*, 2006 to present.

**Bal BS.** Guest Editor, *Journal of Bone and Joint Surgery*, May 2007 to present.

**Bal BS.** International Editorial Board, *The Knee*, May 2007 to present.

**Bal BS.** Musculoskeletal Transplant Foundation, Peer-Reviewed Research Grants, 2006 & 2007.

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#### **PHILANTHROPY**

Founder, The Sonny and Dana Bal Orthopaedic Endowment. Award funds for orthopaedic educational and scientific endeavors at the University of Missouri-Columbia.

“Substrates for Osteochondal Tissue Engineering.” Research grant and work in progress with Columbia University, New York and The Comparative Orthopaedic Laboratory, University of Missouri, Columbia. Total budget is \$15,764.27.

Very Distinguished Fellows- Diplomats, Jefferson Club 2006-2007. Members support translates into student scholarships, nationally recognized faculty, groundbreaking research and state-of-the-art facilities that enhance the University's reputation and stature.

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