

CURRICULUM VITAE

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Professor

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Personal Data: United States Citizen

Education:

1986 B.Sc., Tufts University
Medford, MA (Biology)

For three years, I was enrolled in a five-year, double-degree (Bachelor of Music, Bachelor of Science) program at Tufts University and New England Conservatory of Music, in which I attended both schools simultaneously. In September 1985, I elected to withdraw from my studies as a clarinet performance major at NEC to concentrate on and complete my Tufts studies.

1991 M.D., McGill University Faculty of Medicine (Medicine)
Montreal, QC, Canada

Postgraduate Training:

Internship and Residencies:

1991—1992 Intern in General Surgery, St. Luke's/Roosevelt Hospital Center,
New York, NY
1992—1993 Resident in General Surgery, St. Luke's/Roosevelt Hospital Center,
New York, NY
1993—1996 Resident in Orthopaedic Surgery, McGill University, Montreal, QC

Fellowships:

- 1996—1997 Shriners Fellow, Orthopaedic Research, Joint Diseases Laboratory, Shriners Hospital for Children, Montreal Unit
- 1997—1998 Fellowship - Adult Reconstruction and Joint Replacement, University of Pittsburgh Medical Center, Pittsburgh, PA

Faculty Positions:

- 1996—1997 Shriners Fellow, Orthopaedic Research, Joint Diseases Laboratory, Shriners Hospital for Children, Montreal Unit
- 1997—1998 Clinical Instructor, Department of Orthopaedic Surgery
University Of Pittsburgh Medical Center. Pittsburgh, PA
- 2001—2006 Assistant Professor of Orthopaedic Surgery,
The George Washington University, Washington, DC
- 2001—2006 Visiting Faculty/Adjunct Investigator, Cartilage Biology and Orthopaedics
Branch, National Institute of Arthritis, Musculoskeletal and Skin Diseases
(NIAMS) National Institutes of Health, Bethesda, MD
- 2006—2010 Assistant Professor of Orthopaedics and Sports Medicine,
University of Washington, Seattle, WA
- 2010—2015 Associate Professor of Orthopaedics and Sports Medicine,
University of Washington, Seattle, WA
- 2015 Professor of Orthopaedics and Sports Medicine,
University of Washington, Seattle, WA

Hospital Positions:

- 1998—2000 Holy Cross Hospital, Silver Spring, MD
- 1998—2000 Washington Hospital Center, Washington, DC
- 2000—2001 Overlook Hospital, Summit, NJ
- 2000—2001 Rahway Hospital, Rahway, NJ

- 2001—2006 The George Washington University Hospital, Washington, DC
- 2006—present University of Washington Medical Center, Seattle, WA
- 2006—present Harborview Medical Center, Seattle, WA
- 2012 – present UW Northwest Hospital, Seattle, WA

Honors:

- 1997 Winner, Sherwood Davis & Geck Award for Excellence in Basic Science Research at McGill University
- 2002—2003 Resident Teaching Award
Department of Orthopaedic Surgery, The George Washington University
Washington, DC
- 2005—2006 Fellow, Leadership Fellows Program
American Academy of Orthopaedic Surgeons
- 2013 Achievement Award, American Academy of Orthopaedic Surgeons
- 2013 Election to the Association of Bone and Joint Surgeons
- 2013 America’s Top Doctors; U.S. News & World Report
- 2013 UW Start-up Launch Celebration (Jointmetrixmedical.com)
- 2013 UW C4C (Center for Commercialization) Innovator Recognition Award

Board Certification:

- 1991 FLEX (New York State) National Board of Medical Examiners
- 1991 LMCC (Licensure of the Medical Council of Canada)
- 1994 Principles of Surgery Examination -
Royal College of Surgeons - Canada
- 1996 Specialty Examination in Orthopaedic Surgery -
Royal College of Physicians and Surgeons – Canada

- 1998 American Board of Orthopaedic Surgery
Part I Examination (written), July 14, 1998
Part II Examination (oral), July 10, 2000
- 2009 American Board of Orthopaedic Surgery: Maintenance of Certification
- 2022 American Board of Orthopaedic Surgery: Maintenance of Certification
(most recent)

Current Licenses to Practice:

- 2006 Licensure in Washington State (MD 00045972)

Professional Organizations:

National and International:

- 1996—present Fellow of the Royal College of Surgeons – Canada
- 1996—present Canadian Orthopaedic Association
- 1998—2000 Candidate Member, American Academy of Orthopaedic Surgeons
- 2000—present Fellow, American Academy of Orthopaedic Surgeons
- 2002—present Orthopaedic Research Society
- 2012—present Active Member, Association of Bone and Joint Surgeons
- 2013—present Active Member, American Association of Hip and Knee Surgeons

Regional:

- 2000—2001 New Jersey Orthopaedic Society
- 2001—2006 Washington Orthopaedic Society
- 2006—present Washington State Orthopaedic Association
- 2006—2011 Board Member, Arthritis Foundation
Pacific Northwest Chapter Seattle, WA

Teaching Responsibilities:

1. Local contributions

Medical School

- 2001—2006 "Introduction to Orthopaedics"
"Common Orthopaedic Problems"
"Examination of the Hip and Knee"
Medical Student Surgical Clinical Core Teaching Program
The George Washington University
- 2004—2006 "Introduction to Physical Examination of the Hip and Knee"
Medical Student Introduction to Clinical Medicine
The George Washington University
- 2008—2011 HuBio 553 Musculoskeletal System
University of Washington

Graduate Medical Education

- 2001—2006 Developed Adult Reconstruction and Arthroplasty Core Curriculum
GWU Orthopaedic Residency Program
- 2001—2006 Developed Basic Science Core Curriculum
GWU Orthopaedic Residency Program
- 2003—2006 Established research program for PGY-3 residents in Orthopaedic Surgery
at Cartilage Biology and Orthopaedics Branch
National Institute of Arthritis, Musculoskeletal and Skin Diseases,
NIH, Bethesda, MD
- 2002—2006 Orthopaedic Resident Selection Committee
The George Washington University
- 2006—present Faculty Lecture Series
Department of Orthopaedics and Sports Medicine
University of Washington
- 2006—present Shared responsibility for orthopaedic trauma and arthroplasty education
and clinical supervision at the University of Washington, Seattle, WA

2008—present Orthopaedic Resident Selection Committee
Department of Orthopaedics and Sports Medicine
University of Washington

2008 - present Arthroscopy Boot Camp (Resident teaching)
Tracy, CA

Local Advisory and Supervisory Responsibilities

2001—2006 Responsible for clinical supervision and educational component of adult reconstruction and arthroplasty for orthopaedic residency program
The George Washington University, Washington, DC

2002—present Mentor for 2-3 medical students/year with interest in orthopaedics
Class of 2003: 2 students
Class of 2004: 3 students
Class of 2005: 2 students
Class of 2006: 2 students
Class of 2009: 2 students
Class of 2010: 1 student
Class of 2013: 1 student

2001—2006 Shared responsibility for orthopaedic trauma education and clinical supervision while at George Washington University, Washington, DC

2006—present Shared responsibility for orthopaedic trauma and arthroplasty education and clinical supervision at the University of Washington, Seattle, WA

2007--present Faculty Research Adviser, University of Washington
Jason King, MD
Jason Wilcox, MD
Sean Amman, MD
Christopher Wolf, MD
Sid Baucom, MD
Dan Holtzman, MD
Ted Sousa, MD
Paige Mallette, MD
Sara Shippee, MD

Local Invited Teaching presentations (selected)

P. A. Manner, MD FRCS(C)

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- 2002 Cartilage Biology and Orthopaedics Branch
NIAMS, NIH, Bethesda, MD

- 2002 Department of Rheumatology, The George Washington University,
Washington, DC

- 2004 Featured Speaker, Association of Surgical Technologists
Annual Meeting, Washington, DC

- 2004 Featured Speaker, Orthopaedic Surgery Department Grand Rounds
National Naval Medical Center, Bethesda, MD

- 2012 Faculty, UWEB21 Biomaterials Intensive Short Course,
University of Washington
"Orthopaedics and Biomaterials"

- 2012 Featured Speaker, Seattle Surgical Society
"Metal-on-Metal hips: a New Hope or the Dark Side?"

- 2012 University of Washington School of Pharmacy, Pharm 523: Survey of
Biomedical Regulatory Affairs

- 2014 - present Faculty, UWEB21 Biomaterials Intensive Short Course,
University of Washington
"Orthopaedics and Biomaterials – a Clinician's Perspective"

Continuing Medical Education

- 1997 Instructor, Revision Hip Surgery Course
American Academy of Orthopaedic Surgeons Orthopaedic Learning
Center, Rosemont, IL

- 1998 Instructor, Lower Limb Anatomy
University of Pittsburgh Medical School, Pittsburgh, PA

- 1998 Lecturer, Continuing Medical Education
Mid-Atlantic Permanente Medical Group, PC
Maryland and Washington, DC.

- 2006 Faculty, Western Sphere of Influence September Meeting
 "Embarking on the 2-incision MIS Total Hip Replacement"
 "Trabecular Metal in Total Knee Replacement"
 "The Mysteriously Painful Total Hip Arthroplasty"
 Las Vegas, NV
- 2006 "What's New in Hip Replacement"
 Department of Geriatrics, Harborview Medical Center
 University of Washington
- 2007 "What's New in Hip Replacement"
 Arthritis Foundation Pacific Northwest Chapter
 Rheumatology Conference, Seattle, WA
- 2007 Faculty, Western Sphere of Influence Spring Meeting
 "Trabecular Metal for Hips and Knees"
 "The Painful Total Knee - Assessment and Treatment"
 "Hip Resurfacing in 2007—Why Save the Neck?"
 "The Mysteriously Painful THA"
 Las Vegas, NV
- 2007 Faculty, Western Sphere of Influence September Meeting
 "What's so great about big heads: Large Diameter Heads Should NOT be
 Used Most of the Time in THA"
 "Two-Incision Minimally Invasive total Hip Arthroplasty in 2008"
 "Hip Resurfacing in 2007—Why has it returned?"
 Las Vegas, NV
- 2008 Faculty, The Hip and Pelvis in Function & Dysfunction: Biomechanical &
 Clinical Aspects of Hip & Pelvic Pain
 "Recent Advances in Hip Replacement"
 University of Washington, Seattle, WA
- 2009 Faculty, Idaho Orthopaedic Society Annual Meeting, Boise, Idaho
 "MIS THA/TKA: Pearls and Pitfalls"
 "Bearing Surfaces and Large Femoral heads"
 "Unicompartmental and Patellofemoral Arthroplasty: A New Hope?"
- 2009 Faculty and Moderator, Modern Trends in Joint Replacement
 "Diagnosis and Treatment of Infected Total Joint Arthroplasty"

"The AAOS Could Do a Lot Better!"
Indian Wells, CA

2010 Faculty and Moderator, Modern Trends in Joint Replacement
"New developments in Hard-Hard Bearings"
"Diagnosis and Treatment of Infected Total Joint Arthroplasty"
"The Middle Aged Arthritic Knee"
"Hip Impingement"
Indian Wells, CA

2011 Faculty and Moderator, Modern Trends in Joint Replacement
"Comparison of Surgical Approaches for Knee Arthroplasty"
"Modern Thinking in THA: Large heads or thick polys"
"Periprosthetic Joint Infection"
"PS versus CR – a question for the ages"
Indian Wells, CA

2012 Faculty and Moderator, Modern Trends in Joint Replacement
"Diagnosis and workup for revision TKA"
"Defect classification and preop planning for revision THA"
"DVT prophylaxis options in 2012"
Indian Wells, CA

2013 Faculty and Moderator, Modern Trends in Joint Replacement
"Nonoperative treatment options for the varus knee"
"Remote patient monitoring"
"Periprosthetic Joint Infection: Diagnosis"
Indian Wells, CA

2018 Grand Rounds Speaker
"Osteoarthritis: When hips and knees get rusty"
Northwest Hospital and Medical Center
Seattle, WA

2019 Faculty, "Hip and Knee Surgery for the Non-surgeon"
Wenatchee Valley Medical Conference
Wenatchee, WA

2. Regional, National, And International Contributions

- 2001—2006 Developed Adult Reconstruction and Arthroplasty Core Curriculum
GWU Orthopaedic Residency Program
- 2001—2006 Developed Basic Science Core Curriculum
GWU Orthopaedic Residency Program
- 2003—2006 Established research program for PGY-3 residents in Orthopaedic Surgery
at Cartilage Biology and Orthopaedics Branch
National Institute of Arthritis, Musculoskeletal and Skin Diseases,
NIH, Bethesda, MD
- 2002—2006 Orthopaedic Resident Selection Committee
The George Washington University
- 2002 Lecturer, George Washington University Hospital Community Education
Seminars – Replacing Worn Out Hips and Knees
Washington, DC
- 2002 Advisor on HIPAA regulations with respect to orthopaedic implant
company representatives to Kathleen Fyffe, Senior Advisor, Office of the
National Coordinator for Health Information Technology, Department of
Health and Human Services, Washington, DC
- 2003 “Basic Science of Cartilage—From the Machine Shop to the Greenhouse”
Visiting Faculty, Harvard Arthroplasty Course
Cambridge, MA
- 2003 “Two-incision Minimally Invasive Total Hip Arthroplasty”
Arthroplasty Instructional Course
Zimmer Institute; Warsaw, Indiana
- 2003 Lecturer, George Washington University Hospital Health Fair
Washington, DC
- 2004—2006 Lecturer, George Washington University Hospital Community, Education
Seminars – Minimally Invasive Knee Surgery, Minimally
Invasive Hip Surgery, Washington, DC
- 2004 “Two-incision Minimally Invasive Total Hip Arthroplasty”
Arthroplasty Instructional Course

PAWS (Practical Anatomy Workshop)
St. Louis, Missouri

- 2004 "Two-incision Minimally Invasive Total Hip Arthroplasty"
Arthroplasty Instructional Course
Johns Hopkins Bayview Medical Center, Baltimore, MD
- 2005 "Embarking on the *Zimmer MIS 2-Incision* Hip Procedure"
Emerging Technologies & Techniques in Minimally Invasive Arthroplasty
Johns Hopkins Bayview Medical Center, Baltimore, MD
- 2005 National Orthopaedic Leadership Conference
American Academy of Orthopaedic Surgeons
Washington, DC
- 2006 National Orthopaedic Leadership Conference
American Academy of Orthopaedic Surgeons
Washington, DC
- 2006 "Computer-Assisted Total Knee Replacement"
Arthroplasty Instructional Course
Zimmer Institute, Warsaw, Indiana
- 2007 Moderator
6th Combined Meeting of the Orthopaedic Research Societies
Honolulu, HI
- 2007 Featured Speaker, Journey for a Cure
Arthritis Foundation Pacific Northwest Chapter
Seattle, WA
- 2008 Moderator
54th Annual Meeting, Orthopaedic Research Society
San Francisco, CA
- 2008 Featured Speaker, Journey for a Cure
Arthritis Foundation Pacific Northwest Chapter
Seattle, WA

- 2008-2011 Arthritis Foundation Community Lecture Series
Arthritis Foundation Pacific Northwest Chapter
Lynnwood, WA
- 2013 Faculty, International Consensus Meeting, International Consensus on
Periprosthetic Joint Infection
Philadelphia, PA
- 2014 Co-Chair, Musculoskeletal Infection: Where are we in 2014?
Research Symposium
Orthopaedic Research Society/American Academy of Orthopaedic
Surgeons
Rosemont, IL
- 2016 Faculty and Moderator
American Academy of Orthopaedic Surgeons Annual Meeting
Orlando
- 2017 Faculty and Moderator
American Academy of Orthopaedic Surgeons Annual Meeting
San Diego, CA
- 2018 Invited Faculty
6th Annual Combined Meeting of Chinese Hip Society/American
Association of Hip and Knee Surgeons
Guiyang, Guizhou. China
- 2018 Faculty and Moderator
American Academy of Orthopaedic Surgeons Annual Meeting
New Orleans, LA
- 2018 Faculty, International Consensus Meeting, International Consensus on
Periprosthetic Joint Infection
Philadelphia, PA
- 2019 Faculty and Moderator
American Academy of Orthopaedic Surgeons Annual Meeting
Las Vegas, NV
- 2020 Clinical expert, stem-cell therapy for musculoskeletal conditions

Washington State Health Care Authority, Health Technology Clinical Committee

- 2021 Faculty and Moderator
American Academy of Orthopaedic Surgeons Annual Meeting
San Diego, CA
- 2022 Faculty and Moderator
American Academy of Orthopaedic Surgeons Annual Meeting
Chicago, IL
- 2023 Moderator
Annual Meeting, Orthopaedic Research Society
Dallas, TX
- 2023 – 2025 Committee on Evidence-Based Quality and Value
American Academy of Orthopaedic Surgeons
Chicago, IL
- 2023 – 2025 Topic Chair, Infection
Orthopaedic Research Society
- 2023 Faculty
American Academy of Orthopaedic Surgeons Annual Meeting
Las Vegas, NV

Editorial Board/Reviewer:

- 2004—2013 *Orthopedics* (Editorial Board)
- 2004—2014 *Tissue Engineering*
- 2006—2013 *Journal of Bone and Joint Surgery*
- 2005—2014 *Journal of Orthopaedic Research*
- 2007 Orthopaedic Research Society 53rd Annual Meeting Program
- 2007 Orthopaedic Research Society 6th Combined Meeting

- 2008 Orthopaedic Research Society 54th Annual Meeting Program
- 2009—present Canada Foundation for Innovation/Fondation canadienne pour l'innovation – Expert Committee on Musculoskeletal Research
- 2012—2013 Editor, Hip Newsletter, *Journal of Bone and Joint Surgery*
- 2012 - 2014 Reviewer, *Clinical Orthopaedics and Related Research*
- 2014 - present Senior Editor, *Clinical Orthopaedics and Related Research*
- 2015-present AAOS Annual Meeting Central Program Committee
- 2019 Program Director (PD) of the Hip and Knee Grant program, Orthopaedic Research and Education Foundation

Special National Responsibilities

- 2005—2008 Committee for Professional Liability
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2008—2013 Research Development Committee
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2009 - 2017 Consultant, Orthopaedic and Rehabilitation Panel
Center for Devices and Radiological Health
Food and Drug Administration
Silver Spring, MD
- 2009—2013 Evidence Based Guideline: Osteoarthritis of the Knee Work Group
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2010—2013 Advocacy Committee
Orthopaedic Research Society
Rosemont, IL
- 2011—2012 Metal on Metal Technology Overview Workgroup
American Academy of Orthopaedic Surgeons

Rosemont, IL

On June 27, 2012, along with Young-Min Kwon (Harvard) and Markus Wimmer (Rush), I testified on behalf of the AAOS, AAHKS, ORS, and Hip Society at the FDA Panel meeting on Metal on Metal Bearings.

- 2012—2013 Voting Panel, *Appropriate Use Criteria for Optimizing the Management of Full-Thickness Rotator Cuff Tears*
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2014—present Adult Reconstruction-Hip Program Committee
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2014 Writing Panel, *Appropriate Use Criteria for Management of Osteochondritis Dissecans of the Knee*
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2015 Writing panel, *Appropriate Use Criteria on the Surgical Management of Osteoarthritis of the Knee*
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2017 Voting panel, *Appropriate Use Criteria for Osteoarthritis of the Hip*
American Academy of Orthopaedic Surgeons
Rosemont, IL
- 2018 AAOS Representative
MEDCAC (Medicare Evidence Development & Coverage Advisory Committee), Center for Medicare and Medicaid Services
Baltimore, MD
- 2022 – present Innovation Network, Orthopaedic Research Society
- 2023 – present Chair of the Infection Topic, Annual Meeting, Orthopaedic Research Society

Special Local Responsibilities:

- 1998—2000 Clinical Leader, Arthroplasty Section, Centers of Excellence Strategy Planning Group, Mid-Atlantic Permanente Medical Group, PC
Rockville, MD
- 2000—2001 Total Joint Replacement Sub-Committee, Orthopedic Service Line, Atlantic Health System
Summit, NJ
- 2001—2006 Co-Director, The Total Joint Replacement Center
The George Washington University Medical Center
Washington, DC
- 2002—2006 Faculty Senate, The George Washington University, Washington, DC
- 2003—2006 Minimally Invasive Surgery Group
The George Washington University Medical Center
Washington, DC
- 2006—2011 Surgical Infections Committee, University of Washington Medical Center
- 2007—2011 Clinical Practice Committee, University of Washington Medical Center
- 2009—2011 Provider Satisfaction Committee, University of Washington Medical Center
- 2010—2012 Finance Committee, Department of Orthopaedics & Sports Medicine,
University of Washington Medical Center
- 2015-2016 NWH Hip and Knee Care Pathway Project
Northwest Hospital and Medical Center
- 2016 – present Faculty Senate, University of Washington
- 2016 – present Clinical Practice Innovator Program
University of Washington Medical Center
- 2018 – present Faculty Senate Adjudication Panel, University of Washington
- 2018 – present Orthopaedic Clinical Product Utilization Core Group, University of
Washington

Research Funding:

A. Previously Funded Projects:

Cartilage Biology and Orthopaedics Branch of the National Institute of Arthritis Musculoskeletal and Skin Diseases, and Zimmer Holdings, **Manner PA**, \$145,000/annum support of resident education, George Washington University, 2002-2006. Principal Investigator.

(This provided salary support to all PGY-3 residents at George Washington University, who spent 6 months engaged in basic research in the Cartilage Biology and Orthopaedics Branch.)

Wallace H. Coulter Foundation, \$20,000 Seed Grant, **Manner PA**, University of Washington, August 2007-October 2007. Principal Investigator.

Wallace H. Coulter Foundation Translational Research Partnership, **Manner PA**, \$100,000, University of Washington, April 2008 – March 2009. Principal Investigator.

Wallace H. Coulter Foundation Translational Research Partnership, **Manner PA**, \$96,000, University of Washington, April 2009 – March 2010. Principal Investigator.

Wallace H. Coulter Foundation Translational Research Partnership: Remote Monitoring of Function after Total Knee Arthroplasty. Cavanagh PR, **Manner PA**, Hanson AM. \$100,000, University of Washington, July 2011 – June 2012. Co-PI.

Department of Defense (DOD) Congressionally Directed Medical Research Programs Peer Reviewed Orthopaedic Research Program (PRORP) Translational Research Award: Development of novel Point-of-Care treatment for articular cartilage injury. Use of a novel adipose-derived mesenchymal stem cell/biopolymer construct for acute and definitive osteochondral injury. Tuan R, Paek J, **Manner PA**. \$279,000, University of Washington, September 2010 – August 2013. Co- PI.

Wallace H. Coulter Foundation Translational Research Partnership: Remote Monitoring of Function after Total Knee Arthroplasty. Cavanagh PR, **Manner PA**, Hanson AM. \$100,000, University of Washington, October 2012 – September 2013. Co-PI.

Washington Research Foundation: Remote Monitoring of Function after Total Knee Arthroplasty. Cavanagh PR, **Manner PA**, Marver D, Odell R, Hanson AM. \$46,000, University of Washington, October 2012 - September 2013. Co-PI.

NICHD SBIR (Small Business Innovation Research) Program, Remote Monitoring During Rehabilitation. \$150,000, JointMetrixMedical. Odell R, Marver D, **Manner PA**, Hanson AM, Cavanagh PR. Co-PI.

B. Applications

NIAMS R-21 (Exploratory/Developmental Research Grant Award), Remote Monitoring of Function after Total Knee Arthroplasty. Cavanagh PR, **Manner PA**, Hanson AM. Amount TBA (as of 5/2011), University of Washington. Co-PI.

Telemedicine and Advanced Technology Research Center (TATRC), Department of Defense. Bone Repair with Sphere-templated (6S) Polymers. Ratner B, **Manner, PA**. \$200,000, University of Washington. Co-PI.

Washington State Life Sciences Discovery Fund: Remote Monitoring of Function after Total Knee Arthroplasty. Cavanagh PR, **Manner PA**, Marver D, Odell R, Hanson AM. \$250,000, University of Washington, January 2013 – December 2013. Co-PI.

University of Washington Royalty Research Fund. A new concept in the mechanism leading to osteoarthritis. Roudier M, **Manner PA**, Simkin P. \$39,562. Co-PI.

NIAMS R-21 (Exploratory/Developmental Research Grant Award), Bone Repair with Pro-Regenerative STEPP Scaffolds. \$200,000, University of Washington. Ratner B, **Manner, PA**. Co-PI.

C. Patents

Provisional Patent Applications # 61/681,015 (Filed 8/8/2012 and renewed 8/8/2013), 61/864,131 (Filed 8/9/2013), and 61/942,507 (Filed 2/20/2014). Systems and Methods for Assessment, Analysis, and Reporting of a Patient's Use of Post-Surgical or Post-Injured Joint.; Inventors: Peter Cavanagh, Paul Manner, Andrea Hanson, Alexandre Bykov.

E. Entrepreneurship

Chief Medical Officer, JointMetrix Medical. (<http://jointmetrixmedical.com>).

JointMetrix Medical was created to commercialize technology developed in the Department of Orthopaedics and Sports Medicine at the University of Washington. This remote monitoring technology was developed over the last decade in connection with NASA-sponsored research to measure astronauts' activity aboard the international space station.

Specialized for orthopedics, the technology allows continuous and accurate measurement

of patients' joint motion and overall activity, and is designed enhance clinicians' ability to track and positively influence post-surgical outcomes.

In August 2014, 19% of JointMetrix Medical was acquired by Zimmer, a major orthopaedic implant company, for \$2 million. Zimmer subsequently relinquished this share, and we dissolved JointMetrix Medical in 2019.

Bibliography:

A) Manuscripts in Refereed Journals:

1. **Manner P**, Rubash HE, Herndon J. Prospectus: Future Trends in Blood Transfusion in Orthopaedic Surgery. *Clinical Orthopaedics and Related Research*. 1998 Dec; 357:101-115.
2. Dahlberg L, Billingham RC, **Manner P**, Nelson F, Webb G, Ionescu M, Reiner A, Tanzer M, Zukor D, Chen J, Van Wart HE, Poole AR. Selective enhancement of collagenase-mediated cleavage of resident type II collagen in cultured osteoarthritic cartilage and arrest with a synthetic inhibitor that spares collagenase 1 (matrix metalloproteinase 1). *Arthritis Rheum*. 2000 Mar;43(3):673-82.
3. Tuli R, Seghatoleslami M, Tuli S, Wang M, Hozack W, **Manner P**, Danielson K, Tuan R. A simple, high-yield method for obtaining multipotential mesenchymal progenitor cells from trabecular bone. *Mol Biotechnol*. 2003 Jan;23(1):37-49.
4. Wang M, Tuli R, **Manner P**, Sharkey P, Hall D, Tuan R. Direct and indirect induction of apoptosis in human mesenchymal stem cells in response to titanium particles. *J Orthop Res*. 2003 21:697-707.
5. Tuli, R., Tuli, S., Nandi, S., Wang, M.L., Alexander, P.G., Smith, H.H., Hozack, W.J., **Manner, P.A.**, Danielson, K.G., and Tuan, R.S. Characterization of Multipotential Mesenchymal Progenitor Cells Derived from Human Trabecular Bone. *Stem Cells*. 2003 21:681-693.
6. Tuli R, Tuli S, Nandi S, Huang X, **Manner PA**, Hozack WJ, Danielson KG, Hall DJ, Tuan RS. Transforming Growth Factor- β -mediated Chondrogenesis of Human Mesenchymal Progenitor Cells Involves N-cadherin and Mitogen-activated Protein Kinase and Wnt Signaling Cross-talk. *J Biol Chem*. 2003 Oct 17;278(42):41227-41236.
7. Tuli R, Nandi S, Li WJ, Tuli S, Huang X, **Manner PA**, Laquerriere P, Noth U, Hall DJ, Tuan RS. Human mesenchymal progenitor cell-based tissue engineering of a single-unit osteochondral construct. *Tissue Eng*. 2004 Jul-Aug;10(7-8):1169-79.
8. Wang X, **Manner P**, Horner A, Shum L, Tuan RS, Nuckolls G. Regulation of MMP-13 expression by Runx2 and FGF2 in osteoarthritic cartilage. *Osteoarthritis Cartilage*. 2004 Dec;12(12):963-73.

9. Okafor CC, Haleem-Smith H, Laqueriere P, **Manner PA**, Tuan RS. Particulate endocytosis mediates biological responses of human mesenchymal stem cells to titanium wear debris. *J Orthop Res.* 2006 Jan 31; 24(3):461-473.
10. Levine MJ, West K, Michelson JD, **Manner PA**. Retrospective comparison of two-incision total hip arthroplasty with a standard direct lateral approach: a single surgeon's experience. *Seminars in Arthroplasty.* 2007 Dec 18(4):18-22.
11. McCarron J, Baumbusch C, Michelson JD, **Manner PA**. Economic evaluation of peri-operative admissions for direct lateral versus 2-incision minimally invasive total hip arthroplasty. *Seminars in Arthroplasty.* 2008 Jun 19(2):180-185.
12. Williams SL, Bachison C, Michelson JD, **Manner PA**. Component position in 2-incision minimally invasive total hip arthroplasty compared to standard total hip arthroplasty. *Journal of Arthroplasty.* 2008 Feb;23(2):197-202.
13. Birmingham P, Helm JM, **Manner PA**, Tuan RS, Simulated Joint Infection Assessment by Rapid Detection of Live Bacteria via Real-Time Reverse Transcription Polymerase Chain Reaction. *J Bone Joint Surg Am.* 2008 Mar;90(3):602-8.
14. Standaert C, **Manner PA**, Herring SA. Expert Opinion and Controversies in Musculoskeletal and Sports Medicine: Femoroacetabular Impingement. *Archives of Physical Medicine and Rehabilitation.* 2008 May;89(5):890-893.
15. Gu NY, Wolf C, Leopold SS, **Manner PA**, Doctor JN. A Comparison of Physician and Patient Time Tradeoffs for Postoperative Hip Outcomes. *Value Health.* 2009 Jun;12(4):618-20.
16. Wang X, **Manner PA**, Song YJ, Tuan RS (2009) Histone deacetylase inhibitors antagonize FGF2 and IL-beta effects on MMP expression in human articular chondrocytes. *Growth Factors.* 2009 Jan 27: 40-49.
17. King JC, **Manner PA**, Stamper DL, Schaad DC, Leopold SS. Is minimally invasive total knee arthroplasty associated with lower costs than traditional TKA? *Clin Orthop Relat Res.* 2011 Jun;469(6):1716-20.
18. Wolf CF, Gu NY, Doctor JN, **Manner PA**, Leopold SS. Comparison of One versus Two-Stage Revision for the Infected Total Hip Arthroplasty: A Markov Expected-Utility Decision Analysis *J Bone Joint Surg Am.* 2011 Apr;93(7):631-9.

19. **Manner P.** Minimally invasive hip surgery. *Orthopedics*. 2012 Feb 1;35(2):123-4.
20. Amman S, Cizik A, Leopold SS, **Manner PA.** Two-incision minimally invasive vs standard total hip arthroplasty: comparison of component position and hospital costs. *J Arthroplasty*. 2012 Sep;27(8):1569-1574.
21. Bozic KJ, Browne J, Dangles CJ, **Manner PA,** Yates AJ Jr, Weber KL, Boyer KM, Zemaitis P, Woznica A, Turkelson CM, Wies JL. Modern Metal-on-Metal Hip Implants. *J Am Acad Orthop Surg*. 2012 Jun;20(6):402-6.
22. Alexander PG, McCarron JA, Levine MJ, Melvin GM, Murray PJ, **Manner PA,** Tuan RS. An *In Vivo* Lapine Model for Impact-Induced Injury and Osteoarthritic Degeneration of Articular Cartilage. *Cartilage* 2012 3(4):323–333.
23. Alexander PG, Song Y, Taboas JM, Chen FH, Melvin GM, **Manner PA,** Tuan RS. Development of a Spring-Loaded Impact Device to Deliver Injurious Mechanical Impacts to the Articular Cartilage Surface. *Cartilage* 2013 4(1):52-62.
24. Tsai TL, **Manner PA,** Li WJ. Regulation of Mesenchymal Stem Cell Chondrogenesis by Glucose through Protein Kinase C/Transforming Growth Factor Signaling. *Osteoarthritis and Cartilage*. 2013 21(2):368-76.
25. **Manner P.** CORR Insights(®): Outcome of One-stage Cementless Exchange for Acute Postoperative Periprosthetic Hip Infection. *Clin Orthop Relat Res*. 2013 Jul 19.
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33. **Manner PA.** Medicare Advantage – what will happen to arthroplasty? *pending publication*

34. **Manner PA.** Prosthetic Joint Infection: the Infectious Diseases Society update *pending publication*
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36. **Manner PA.** Appropriateness criteria - a Trojan horse for rationing? *JBJS Orthop Highlights: Hip Surg, 2013 Feb 6;3(2):e7*
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C. Videos

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4. *The Middle-aged arthritic knee*. OrthopaedicsOne, accessed at <http://www.orthopaedicsone.com>.
5. *Diagnosis and Treatment of Infected TJA*. OrthopaedicsOne, accessed at <http://www.orthopaedicsone.com>.
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D. Abstracts:

Local

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3. Hatakeyama Y, Horner A, **Manner P**, Tuan R, Nuckolls G, Shum L. Distinct Roles of BMP-4 and GDF-5 in the regulation of cartilage formation. *Presented at the NIAMS retreat, Airlie, VA, June 2002.*
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13. Long J, Murray PJ, Alexander PG, **Manner PA**, Tuan RS. Age-related differential responses of rabbit articular cartilage to blunt impact. *Presented at the Ruth Jackson Orthopaedic Society Annual Meeting, San Antonio, TX 2005.*
14. Amann S, Cizik A, Leopold SS, **Manner PA**. Two-incision minimally invasive vs. standard total hip arthroplasty: Comparison of component position and hospital costs. *Presented at the Western Orthopaedic Society Annual Meeting, Honolulu, HI, 2011.*
15. Hanson AM, Lee EW, Jacques CM, **Manner PA**, Cavanagh PR. Assessing the real-world impact of clinical interventions and outcomes: The science of ambulatory assessment. *Presented at the Society for Ambulatory Assessment, Ann Arbor, MI 2011*

International

16. **Manner P**, Billingham RC, Ionescu M, Reiner A, Zukor D, Huk O, Poole AR. Use of an antibody, specific to the collagenase cleavage site in type II collagen, to study degeneration in human articular cartilage in osteoarthritis. *Presented at the 44th Orthopaedic Research Society Annual Meeting, New Orleans, March, 1998 – Finalist, New Investigator Recognition Award.*
17. **Manner P**, Billingham RC, Ionescu M, Reiner A, Zukor D, Huk O, Poole AR. Different patterns of collagenase cleavage of type II collagen in normal articular cartilage from individuals undergoing autopsy vs. organ transplant donors, and osteoarthritic cartilage. *Presented at the 44th Orthopaedic Research Society Annual Meeting, New Orleans, March, 1998.*

18. Webb GR, **Manner PA**, Pidoux I, Poole AR. Type II collagen and proteoglycan breakdown in early focal degenerative lesions in human articular cartilage in aging. *Presented at the 45th Orthopaedic Research Society Annual Meeting, Anaheim, CA, 1999.*
19. Tuli R, Tuli S, Seghatoleslami MR, Wang ML, Hozack WJ, **Manner PA**, Danielson KG, Tuan RS. Long term culture expansion, growth kinetics, and multilineage differentiation potential of mesenchymal progenitor cells derived from trabecular bone. *Presented at the 49th Orthopaedic Research Society Annual Meeting, New Orleans, 2003.*
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23. Wang X, **Manner P**, Horner A, Shum L, Tuan R, Nuckolls G. FGF2 and RUNX2 synergistically up-regulate MMP-13 expression in articular chondrocytes. *Presented at the 50th Orthopaedic Research Society Annual Meeting, San Francisco, 2004.*
24. Tuli, R., Nandi, S., Li, W.J., Tuli, S., Huang, X., **Manner, P.A.**, Noth, U., Hall, D.J., and Tuan, R.S. Tissue engineering of a single-unit osteochondral construct using human mesenchymal progenitor cells. *Presented at the 50th Orthopaedic Research Society Annual Meeting, San Francisco, 2004.*
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28. McCarron JA, Alexander PG, Levine MJ, Melvin GM, **Manner PA**, Tuan RS. Analysis of supraphysiologic impact injury to articular cartilage using an in vivo rabbit model for osteoarthritis. *Presented at the 51st Orthopaedic Research Society Annual Meeting, Washington, DC, 2005.*
29. Alexander PG, Murray PJ, Long J, **Manner PA**, Tuan RS. Cell Death in a rabbit model for post-traumatic cartilage degeneration and osteoarthritis. *Presented at the OsteoArthritis Research Society International 10th World Congress, Boston, MA, 2005.*
30. Wang X, **Manner PA**, Tuan RS. Histone deacetylase inhibitors antagonized FGF-2 effects on chondrocyte proliferation and MMP expression. *Presented at the 52nd Orthopaedic Research Society Annual Meeting, Chicago, IL 2006.*
31. Levine MJ, West K, Michelson J, **Manner PA**. Comparison of minimally invasive two-incision total hip approach with the direct lateral approach. *Presented at the American Academy of Orthopaedic Surgeons Annual Meeting, San Diego, 2007.*
32. Williams SL, Bachison C, Michelson J, **Manner PA**. Component position in two-incision minimally invasive total hip arthroplasty compared to standard total hip arthroplasty. *Presented at the American Academy of Orthopaedic Surgeons Annual Meeting, San Diego, 2007.*
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36. Gu NY, Wolf C, Leopold SS, **Manner PA**, Doctor JN. A Comparison of Physician and Patient Time Tradeoffs for Postoperative Hip Outcomes. *Presented at the 55th Orthopaedic Research Society Annual Meeting, Las Vegas, 2009.*
37. Wolf C, Gu NY, Doctor JN, Leopold SS, **Manner PA**. Comparison of direct-exchange vs. two-stage revision for the infected THA: A Markov expected-value decision analysis. *Presented at the International Society for Technology in Arthroplasty Annual Congress, Waikoloa, HI, 2009.*
38. Ratner BD, **Manner PA**. Bone repair with sphere templated scaffolds. *Presented at the Annual Meeting of the Australian Orthopaedic Association. Cairns, Queensland, Australia, 2009.*
39. Tsai DT, **Manner PA**, Li WJ. High Glucose Up-regulates the TGF- β Signaling for Chondrogenesis of Human Mesenchymal Stem Cells. *Presented at the 56th Annual Meeting of the Orthopaedic Research Society, New Orleans, LA, 2010.*
40. Tsai DT, Palumbo SL, **Manner PA**, Li WJ. Temporal Induction of Diverse Extracellular Matrix Proteins for Effective Osteogenesis. *Presented at the 56th Annual Meeting of the Orthopaedic Research Society, New Orleans, LA, 2010.*
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42. Lee, A, Hagen J, Wahl CJ, **Manner PA**, Cavanagh PR. ACL length changes during robotic simulation of knee laxity tests. *Presented at the 34th annual meeting of the American Society of Biomechanics, Providence, RI, 2010.*
43. Leopold SS, Wolf CF, Gu NY, Doctor JN, **Manner PA**. Comparison of one versus two-stage revision for the infected total hip arthroplasty: A Markov expected-utility decision analysis. *Presented at the 63rd Annual Meeting of The Association of Bone and Joint Surgeons, Dublin, Ireland 2011.*

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45. Amann S, Cizik A, Leopold SS, **Manner PA**. Two-Incision Minimally Invasive vs. Standard Total Hip Arthroplasty: Comparison of Component Position and Hospital Costs. *Presented at the International Congress for Joint Reconstruction, San Diego, 2012.*
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48. Gottardi R, Hwang MP, Simson M, **Manner PA**, Tan J, Alexander PG, Little SR, Tuan RS. Autologous Stem Cell Recruitment for Articular Cartilage Regeneration. *Presented at the Biomedical Engineering Society (BMES) Annual Meeting, Seattle, WA, 2013.*
49. Roudier M, **Manner P**, Simkin P. Tidemark Duplication In Osteoarthritis: Evidence Of Incremental Progression? *Presented at the ACR/ARHP Annual Meeting, San Diego, 2013.*
50. **Manner P**. Can Academic Orthopaedics be Cost Effective in a Community Setting? *Presented at the 66th Annual Meeting of The Association of Bone and Joint Surgeons, New York, 2014.*
51. Roudier M, **Manner P**, Simkin P. Histological Evidence of Sequential Failed Osteochondral Repair: An Etiology for OA? *Submitted for presentation at ACR/ARHP Annual Meeting, Boston, MA, 2014.*

52. Cavanagh P, Fournier M, **Manner P**. Remote Patient Monitoring in Total Knee Arthroplasty. *Presented at the 27th Annual Congress, International Society for Technology in Arthroplasty, Kyoto, Japan, 2014.*
53. **Manner P**, Archdeacon M, Parvizi J. Scientific Exhibit: Musculoskeletal Infection (AAOS Research Development Committee). *Presented at the Annual Meeting of the American Academy of Orthopaedic Surgeons, Las Vegas, Nevada, 2015.*
54. Shippee S, Cizik A, **Manner P**. Budget Impact Analysis for Total Joint Arthroplasty in Patients with Hemophilia. *Presented at the 2nd Annual Pan Pacific Orthopaedic Congress, Kona, HI, 2015.*
55. Gottardi R, Piroso A, Alexander PG, **Manner PA**, Puppi D, Chiellini F, Tuan RS. An in vitro Chondro-Osteo-Vascular Triphasic Model of the Osteochondral Complex for Studying Osteochondral Biology and for Drug Screening. *Presented at the 62nd Annual Meeting of the Orthopaedic Research Society, Orlando, FL, March 2015.*
56. Gottardi R, Conoscenti G, Alexander PG, **Manner PA**, La Carrubba V, Brucato V, Tuan RS. A PLLA Scaffold with Continuous Gradient Pore Size for Osteochondral Regeneration Validated in a Microphysiological Tissue System Bioreactor. *Presented at the 62nd Annual Meeting of the Orthopaedic Research Society, Orlando, FL, March 2015.*
57. Gottardi R, Lin H, D'Urso G, Iannetti GL, Zunino P, Lozito TP, Alexander PG, **Manner PA**, Sefton EA, Woodruff TK, Tuan RS. Validation of an Osteochondral Microphysiological System Applied to Study the Protective Role of Sex Hormones. *Presented at the 62nd Annual Meeting of the Orthopaedic Research Society, Orlando, FL, March 2015.*
58. Gottardi R, Hwang MP, Simson M, **Manner PA**, Tan J, Alexander PG, Tuan RS, Little SR. Autologous Stem Cell Recruitment for Articular Cartilage Regeneration. *Presented at the 13th US-Japan Symposium on Drug Delivery Systems, Maui, HI, December 2015.*
59. Gottardi R, Bianconi PA, **Manner PA**, Alexander PG, Tuan RS, Little SR. Prevention of Cartilage Calcification by Controlled Release of Dorsomorphin, *Presented at the 13th US-Japan Symposium on Drug Delivery Systems, Maui, HI, December 2015.*
60. Gottardi R, Lin H, Iannetti L, D'Urso G, Zunino P, Lozito T, Alexander P, **Manner P**, Sefton E, Woodruff T, Tuan R. Validation Of An Osteochondral Bioreactor Applied

To Study The Protective Role Of Sex Hormones. *Presented at the Biomedical Engineering Society Annual Meeting, Minneapolis, October 2016.*

61. Gottardi R, Piroso A, Alexander P, **Manner P**, Puppi D, Chiellini F, Tuan R. An In Vitro Chondro-Osteo-Vascular Triphasic Model Of The Osteochondral Complex. *Presented at the Biomedical Engineering Society Annual Meeting, Minneapolis, October 2016.*
62. Gottardi R, Conoscenti G, Alexander P, **Manner P**, La Carrubba V, Brucato V, Tuan R. A Continuous Pore Size Gradient PLLA Scaffold For Osteochondral Regeneration. *Presented at the Biomedical Engineering Society Annual Meeting, Minneapolis, October 2016.*
63. Shippee-Wallace S, **Manner P**. Budget Impact Analysis for Total Joint Arthroplasty in Patients with Hemophilia. *Presented at the 69th Annual Meeting of The Association of Bone and Joint Surgeons, Austin, 2017.*
64. Fitz D, **Manner P**. Comparison Of Conventional Reference Axes For Femoral Component Rotation In Total Knee Arthroplasty To Custom, Patient Specific Surgical Plans: A CT-based Study. *Presented at the 73rd Annual Meeting of The Association of Bone and Joint Surgeons, Virtual. 2021*
65. Fernando N, **Manner P**. Custom-designed Total Knee Arthroplasty Is Cost-effective In Comparison To A Standard Implant. *Presented at the 73rd Annual Meeting of The Association of Bone and Joint Surgeons, Virtual. 2021.*