

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors. Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: **Ladd, Amy L.**

eRA COMMONS USER NAME (credential, e.g., agency login): LADD.AMY

POSITION TITLE: Vice-Chair and Professor of Orthopaedic Surgery, Chief, Robert A. Chase Hand Center at Stanford, Professor of Plastic Surgery (by courtesy), Professor of Rheumatology & Immunology (by courtesy)

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Start Date MM/YYYY	Completion Date MM/YYYY	FIELD OF STUDY
Dartmouth College, Hanover, New Hampshire	A.B.	1980		History
SUNY Upstate Medical Center, Syracuse, New York	M.D.	1984		Medicine
Swedish Hospital Medical Center, Seattle, WA	PGY1	1985		General Surgery
Pacific Medical Center, U. of Wash, Seattle, WA	PGY2	1986		GMO/Orthopaedic Surgery
University of Rochester, Rochester, New York	PGY5	1989		Orthopaedic Surgery
Brigham & Women’s, Harvard Univ., Boston, MA	PGY6	1990		Hand Surgery fellowship

**A. Personal Statement**

I am Professor and Vice-Chair of Orthopaedic Surgery, and my research team aims to diagnose, predict, treat, and prevent base of thumb (trapezium-metacarpal, also known as first carpometacarpal, or CMC1) osteoarthritis. The base of thumb orchestrates functional human hand activity: writing, buttoning, grasping, opening a jar - all require the stability, dexterity, and strength the thumb provides. Thumb CMC osteoarthritis afflicts the majority of post-menopausal women, and as aging progresses, afflicts essentially all women and men across the spectrum of race, ethnicity, and socioeconomic status. Treatment to date addresses end-stage disease with surgical techniques essentially unchanged in half a century. This arguably antiquated treatment stems from challenges in understanding and decoding a complex, small, and critically functioning joint, and challenges in identifying solutions that match current technology.

My collaborators and our team have established the shape and mechanics of this complex “saddle” CMC1 joint, and have identified the pattern of early arthritis progression in longitudinal studies. We are deciphering how its shape and functional demands contribute to its demise. We are determining why some people advance slowly with arthritis progression, and others advance quickly and require surgery. The typical surgery for pain relief removes the trapezium bone and destroys the joint completely. To date there are no “less invasive” or intermediary treatments that delay or prevent this progression. There are also no total joints like in the hip or knee that turn back the functional clock. Our lab is poised to answer these questions and create solutions for this common disease. With this application we aim to develop personalized precise bone cuts (osteotomy) that restore metacarpal joint coverage of the trapezium that is lost with disease progression. We therefore aim to demonstrate a measurable delay or arrest of arthritis progression, and consequently delay or prevent joint destructive, end-stage surgical procedures. My team’s investigative approaches include using imaging modalities (x-rays, CTs, 3D generated models with segmentation, and surgical simulation) to plan and execute metacarpal osteotomy on subjects with early disease, to measure joint coverage, and clinical improvement.

**Ongoing and recently completed projects that I would like to highlight include:**

American Foundation for Surgery of the Hand, 2020 Two-Year Clinical Grant 1/1/21-12/31/23  
Pain Relief after Trapeziectomy without Opioids: Ibuprofen & Acetaminophen vs. Oxycodone.  
PI: AL Ladd

American Foundation for Surgery of the Hand, 2019 Resident/Fellow Fast Track Grant 2/1/20-1/31/21  
Helping Surgeons' Hands: A Biomechanical Evaluation of Ergonomic Instruments.  
PI and Mentor to fellow J Putnam

NIH 1R01AR059185-01A2 4/15/16-9/15/21, NCX-3/15/21  
Thumb CMC Biomechanics and Early OA Progression  
PI: JJ Crisco. Role: Co-investigator; Subcontract PI at Stanford University site

Stanford Women's Health & Sex Differences in Medicine (WHSDM) Seed Grant 1/1/20-6/30/21  
Thumb CMC OA as an Early Marker for Low BMD in Postmenopausal Women  
PI: AL Ladd

NIH 1R01AR059185-01A1 07/01/11 – 03/31/16  
Thumb CMC Biomechanics and Early OA Progression  
PI: JJ Crisco. Role: Co-investigator; Subcontract PI at Stanford University site

NIH R13AR065906-01 09/13-8/14  
1st International Thumb Osteoarthritis Workshop (ITOW), Conference Grant  
PI: JJ Crisco. Role: Co-investigator; Subcontract PI at Stanford University site

NIH 1R13AR074278-01 09/13-8/14  
3rd International Thumb Osteoarthritis Workshop (ITOW), Conference Grant  
PI: JJ Crisco. Role: Co-investigator; Subcontract PI at Stanford University site

OREF/RJOS/DePuy Career Development Award  
7/1/10-12/31/11  
Thumb CMC Joint in Women: Anatomy and function in Symptomatic and Early Arthritis Subjects  
PI: AL Ladd

**Citations:**

1. Putnam JG, Kerkhof FD, Shah K, Richards AW, **Ladd A.** Helping Surgeons' Hands:A Biomechanical Evaluation of Ergonomic Instruments. J Hand Surg Am. 2023 Feb 4:S0363-5023(22)00767-5. doi: 10.1016/j.jhsa.2022.12.006. Epub ahead of print. PMID: 36746690.
2. **Ladd AL.** The Teleology of the Thumb: On Purpose and Design. J Hand Surg Am. 2018 Mar;43(3):248-259. PubMed PMID: 29502577.
3. Coughlan MJ, Bourdillon A, Crisco JJ, Kenney D, Weiss AP, **Ladd AL.** Reduction in Cylindrical Grasp Strength Is Associated With Early Thumb Carpometacarpal Osteoarthritis. Clin Orthop Relat Res. 2017 Feb;475(2):522-528. PubMed PMID: 27822895.
4. **Ladd AL,** Crisco JJ, Hagert E, Rose J, Weiss, APC: The Puzzle of the Thumb: Mobility, Stability, and Demands in Opposition. The 2014 ABJS Nicolas Andry Award. Clin Orthop Relat Res. 2014 Dec;472(12):3605-22. PubMed PMID: 25171934. PMCID: PMC4397810.

**B. Positions, Scientific Appointments and Honors**

**Positions and Employment**

2013-present	Vice-chair, Academic Affairs, Dept of Orthopaedic Surgery, Stanford Univ. School of Medicine
2012-2019	Asst. Dean of Medical Advising, Stanford University School of Medicine
2007-present	Professor and Chief, Robert A. Chase Hand & Upper Limb Center, Stanford University
2003-present	Professor, Dept of Orthopaedics; Div. Plastic Surgery, and Div. Immunology / Rheumatology (Dept. of Medicine), by courtesy, Stanford University, Stanford, CA
2001-2007	Head of Outreach, SUMMIT (Stanford University Medical Media Information Technologies)
1998-2003	Assoc. Professor, Div. of Hand Surgery, Dept. of Funct. Restoration, & Assoc. Professor by courtesy, Divs. of Immunology / Rheumatology (Dept. of Medicine), Stanford University,
1993-1998	Asst Prof, Div Rheumatology & Immunology, Dept. Medicine (by courtesy), Stanford Univ.
1991-present	Chief of the Children's Hand Clinic, Lucile Packard Children's Hospital at Stanford
1991 – 2020	Founder and Director, Hand Surgery Fellowship, Stanford University
1990-1998	Asst Professor, Div. of Hand Surgery, Dept Funct. Restoration, Stanford University
1990-1999	Chief, Hand & Upper Extremity Section, Dept Surgery, Palo Alto VA Med Ctr, Palo Alto, CA

### **Other Experience and Professional Memberships**

2022-2025	Executive Board, presidential line, Association of Bone and Joint Surgeons (ABJS)
2022-2023	Second vice-president, ABJS
2015-2018	Board of Directors, American Academy of Orthopaedic Surgeons (AAOS)
2015-2018	Leadership line, Board of Specialty Societies (BOS) of AAOS Secretary 2015-16, Chair-elect 2016-17, Chair 2017-18
2014-present	Orthopaedic Research Society
2010 - 2014	Presidential line, Ruth Jackson Orthopaedic Society Treasurer 2010-12, vice-president 2012-13, president 2013-14
2009 - present	Oral Examiner, American Board of Orthopaedic Surgery
2008 - present	American Association of Bone & Joint Surgeons inducted 2008
2008 - 2013	Board of Directors, California Orthopaedic Society
2003 - present	American Orthopaedic Association, inducted 2003
2002 - present	International Wrist Investigators Workshop, elected 2002
2002 - present	International Society for Fracture & Repair, elected 2002
1996 - present	Western Orthopaedic Association, elected August 1996
1995 - present	American Society for Surgery of the Hand, inducted 1995
1999 - 2004	Editor-in-Chief, Yearbook of Hand Surgery
1994 - present	American Academy of Orthopaedic Surgeons, inducted 1994
1987 - present	Ruth Jackson Orthopaedic Society elected 1987

### **Honors**

2023	Distinguished Clinician Educator Award, American Orthopaedic Association
2021	Arthur L Bloomfield Award in Recognition of Excellence in Teaching of Clinical Medicine, Stanford University School of Medicine
2020	Poster Award, "Outstanding quality and scientific achievement," Orthopaedic Implants Section, Orthopaedic Research Society
2017	Andrew J Weiland Medal, The Teleology of the Thumb: On Purpose and Design, ASSH
2014	Nicolas Andry Award, "significant contribution to musculoskeletal research," Association of Bone and Joint Surgeons
2012	Compere Award, Outstanding Scientific Paper, Twentieth Century Orthopaedic Assoc.
2012 – 2014	Guest Editor, Thumb CMC Arthritis Symposium, Clinical Orthopaedics & Related Research
2012	Emanuel B. Kaplan Excellence in Anatomy award, ASSH Annual Meeting
2010	Dean's Award for Distinguished Teaching, Stanford University
2010	OREF/RJOS/DePuy Career Development Award
2004	Iris Litt Fund research award, Institute for Women & Gender at Stanford
2003	AAOS Multimedia Award, Paget's Disease of Bone: AAOS 70 <sup>th</sup> Annual Mtg, New Orleans, LA
2002	Poster Exhibit Award, Best Scientific Honorable Mention, ASSH Annual Meeting, Seattle, WA
2000-2001	Sterling Bunnell Traveling Fellowship, American Society for Surgery of the Hand (ASSH)
1998	Outstanding Faculty Physician Award, Cowell Student Health Center, Stanford University
1997	Woman of Achievements award, Professions categ., San Jose Mercury News & Women's Fund

### **Teaching Responsibilities (selected examples)**

**Vice-Chair Academic Affairs**, Department of Orthopaedic Surgery 2014-present

**Fellowship Director**, Stanford Hand & Upper Limb ACGME-accredited (orthopaedics) 1991-2020

**Director of Education** for Medical Students, Residents, and Fellows, Stanford University Medical school Hand & Upper Extremity Rotation (combined orthopaedic and plastic surgery residents) 1990-present

**Dissertation Committee**, Doctoral Dissertation for Victoria Jew, Material Science and Engineering PhD candidate, "Subcritical Crack Propagation in Calcium Phosphate Cements," June 2003

**Dissertation Committee**, Doctoral Dissertation for Matthew Wright, Music PhD Candidate, "The Shape of an Instant: Measuring and Modeling Perceptual Attack Time with Probability Density Functions," February 2008

**Lead Instructor**: The Anatomy of Movement, 2004-10 Interdisciplinary course at Stanford University.

**Dissertation Committee**, Doctoral Dissertation for Eni Halilaj, Bioeng. Ph.D. Candidate, Brown University, "Image-Based Analysis of Mechanical Mediators of Osteoarthritis in 1st Carpometacarpal Joint," Sept 2014

**Dissertation Committee**, PhD Candidate Marco Schneider, University of Auckland, Auckland, NZ.

Dissertation 28 September 2017.

**Dissertation Committee**, Dissertation for Josephine Kalshoven, PhD Candidate, Brown University, examining Biomechanics of Thumb CMC Osteoarthritis, 2021-present

## C. Contributions to Science

1. **Thumb CMC Arthritis:** I have made significant contributions to advancing the understanding of the functional importance, biomechanics, pathology, and surgical treatment of the thumb CMC joint. The opposable thumb, unique to humans, is one of our defining anatomic features. I have investigated the morphology, forces, and motion of both normal and arthritic joints in an effort to provide quantitative evidence of disease progression, using tools from comparative anatomy, gross dissections, microscopic analysis, multimodal imaging, and live-subject kinematic studies. Over the past decade I have been a Co-Investigator and the Stanford site director for an NIH-funded study designed to elucidate the mechanics of the normal thumb carpometacarpal (CMC) joint and the potential role of altered mechanics in the progression of thumb CMC OA. Our findings have challenged the conventional wisdom about the role of causation due to sex-related differences in joint shape, though we have found sex-related differences in cartilage thinning. We have recently identified joint subluxation and morphology changes with disease progression, the focus of this application. I served as the primary investigator or co-investigator in all of these studies.
  - a. Crisco JJ, Halilaj E, Moore DC, Patel T, Weiss AP, **Ladd AL**. In Vivo kinematics of the trapeziometacarpal joint during thumb extension-flexion and abduction-adduction. *J Hand Surg Am*. 2015 Feb;40(2):289-96. PubMed PMID: 25542440.
  - b. Schneider MT, Zhang J, Crisco JJ, Weiss AP, **Ladd AL**, Nielsen P, Besier T. Men and women have similarly shaped carpometacarpal joint bones. *J Biomech*. 2015 Sep 18;48(12):3420-6. PubMed PMID: 26116042. PMCID: PMC4592789
  - c. Ludwig CA, Mobargha N, Okogbaa J, Hagert E, Ladd AL. Altered Innervation Pattern in Ligaments of Patients with Basal Thumb Arthritis. *J Wrist Surg*. 2015 Nov;4(4):284-91. doi: 10.1055/s-0035-1564982. PubMed PMID: 26649261; PubMed Central PMCID: PMC4626232.
  - d. Van Nortwick S, Berger A, Cheng R, Lee J, **Ladd AL**: Trapezial Topography in Thumb Carpometacarpal Arthritis. *J Wrist Surg* 2013;2:263–270, PubMed PMID: 24436826. PMCID: PMC3764251
  - e. McQuillan TJ, Kenney D, Crisco JJ, Weiss AP, **Ladd AL**. Weaker Functional Pinch Strength Is Associated With Early Thumb Carpometacarpal Osteoarthritis. *Clin Orthop Relat Res*. 2016 Feb;474(2):557-61. PubMed PMID: 26493987.
  - f. Rein S, Okogbaa J, Hagert E, Manthey S, **Ladd A**. Histopathological analysis of the synovium in trapeziometacarpal osteoarthritis. *J Hand Surg Eur Vol*. 2019 Dec;44(10):1079-1088. PubMed PMID: 31109229
  - g. Morton AM, Moore DC, Ladd AL, Weiss AC, Molino J, Crisco JJ. Dorsal Subluxation of the First Metacarpal During Thumb Flexion is an Indicator of Carpometacarpal Osteoarthritis Progression. *Clin Orthop Relat Res*. 2023 Jun1;481(6):1224-1237. Epub 2023 Mar 6. PMID:36877171.
2. I have made significant contributions to musculoskeletal science in examining the role of sex and gender in musculoskeletal disease, from the role structural anatomy differences, hormones, and genetics play in differential disease expression, to the historical biases in the subject populations of clinical and basic research projects, as well as the scientific reporting of musculoskeletal research and outcomes. The presentation of musculoskeletal disease differs in men and women, and recognition of the differences between men and women's burden of disease and response to treatment is critical to optimizing care. I also served as the section editor and wrote quarterly editorials on sex and gender issues in orthopaedics for *Clinical Orthopaedics and Related Research*.
  - a. Halilaj E, Moore DC, Patel TK, Laidlaw DH, **Ladd AL**, Weiss AP, Crisco JJ. Older asymptomatic women exhibit patterns of thumb carpometacarpal joint space narrowing that precede changes associated with early osteoarthritis. *J Biomech*.2015 Oct 15;48(13):3643-9. PMCID: PMC46000656
  - b. Wolf JM, Cannada L, Van Heest AE, O'Connor MI, **Ladd AL**. Male and female differences in musculoskeletal disease. *J Am Acad Orthop Surgeons* 2015 June;23(6):339-347. PMCID: Pending
  - c. Halilaj E, Moore DC, Laidlaw DH, Got CJ, Weiss AP, **Ladd AL**, Crisco JJ. The morphology of the thumb carpometacarpal joint does not differ between men and women, but changes with aging and early osteoarthritis. *J Biomech*. 2014 Aug 22;47(11):2709-14. PubMed PMID: 24909332. PMCID: PMC4130650
  - d. **Ladd AL**. Gendered Innovations in Orthopaedic Science: Civil Liberties, Darwin, and the Evolution of Science. *Clin Orthop Relat Res*. 2015 Feb 10. PubMed PMID: 25666144. PMCID: PMC4385341

- e. Chou LB, Johnson B, Shapiro LM, Pun S, Cannada LK, Chen AF, Valone LC, VanNortwick SS, **Ladd AL**, Finlay AK. Increased Prevalence of Breast and All-cause Cancer in Female Orthopaedic Surgeons. *J Am Acad Orthop Surg Glob Res Rev.* 2022 May 1;6(5):e22.00031. doi: 10.5435/JAAOSGlobal-D-22-00031. PMID: 3558782.
3. I have made significant contributions to general orthopaedic surgery, ranging from treatment of osteoporotic fractures and the need for bone health awareness, to improving clinical outcomes assessment in patient reported outcome measures (PROMs), to identifying the lack of musculoskeletal (MSK) education in medical school curriculum, to quantifying coordinated movement with motion analysis of the golf swing, to identifying environmental impact of orthopaedic surgery.
- a. Wolf JM, Cannada LK, Lane JM, Sawyer AJ, **Ladd AL**. A comprehensive overview of osteoporotic fracture treatment. *Instr Course Lect.* 2015;64:25-36. PubMed PMID:25745892. PMCID: 25745892
- b. Goldhahn J, Beaton D, **Ladd AL**, Macdermid J, Hoang-Kim A. Recommendation for measuring clinical outcome in distal radius fractures: A core set of domains for standardized reporting in clinical practice and research. *Arch Orthop Trauma Surg.* 2014 Feb;134(2):197-205. PubMed PMID: 23728832.
- c. Wang, T., Xiong, G., Lu, L., Bernstein, J., **Ladd, A**: Musculoskeletal Education in Medical Schools: A Survey in California and Review of Literature. *Medical Science Educator* 2021; 31 (1): 131–36. DOI 10.1007/s40670-020-01144-3
- d. Gire J, Koltsov J, Segovia N, Kenney D, Yao J, **Ladd AL**: Single Assessment Numeric Evaluation (SANE) in Hand Surgery - Does a One Question Instrument Compare Favorably? *J Hand Surg Am.* 2020 Jul;45(7):589-596, PMID: 32482496
- e. Steele KM, Roh EY, Mahtani G, Meister DW, **Ladd AL**, Rose J. Golf Swing Rotational Velocity: The Essential Follow-Through. *Ann Rehabil Med.* 2018 Oct;42(5):713-721. PubMed PMID: 30404420. \*Active member of the research team, data analysis, manuscript review.
- f. Saleh JR, Mitchell A, Kha ST, Outterson R, Choi A, Allen L, Chang T, **Ladd AL**, Goodman SB, Fox P, Chou L. The Environmental Impact of Orthopaedic Surgery. *JBone Joint Surg Am.* 2023 Jan 4;105(1):74-82. doi: 10.2106/JBJS.22.00548. Epub2022 Nov 7. PMID: 36574633.

#### Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/1PE7d7YPOREQy/bibliographay/48855619/public/?sort=date&direction=ascending>