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Senior Biomechanics Consultant
Augspurger Komm Engineering, Inc.
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EDUCATION

Ph.D. Pennsylvania State University (Biomechanics) 1982
M.A. University of Iowa (Biomechanics) 1978
B.A. Oberlin College (Physics) 1975

PRINCIPAL AREAS OF RESEARCH, TEACHING, OR CONSULTING

Biomechanics — Application of mechanical and anatomical principles to human movement. Mechanisms of injury; motion capture and analysis; forensic biomechanics; accident reconstruction; sports biomechanics (locomotion, swimming, throwing, jumping, kicking); human factors and ergonomics; functional anatomy; tissue mechanics; upper extremity cumulative trauma disorders and carpal tunnel syndrome (CTS); upper extremity function; body segment interactions during movement; human body inertial properties.

Classes taught: Biomechanics, Biomechanics of the Skeletal System, Qualitative Analysis in Sports Biomechanics, Advanced Topics in Biomechanics, Functional Anatomy and Kinesiology, Electromyographic Kinesiology.

Examples of consulting cases: Motor vehicle accidents and accident reconstruction, injury mechanisms, seat belt issues, patent infringement, police brutality claims, surveillance video analysis, human factors and ergonomics, suspected child abuse, wrongful death, murder cases, slip/trip/fall injuries, mining accidents, rock climbing accidents, sports injuries, swimming pool diving accidents, water slide accidents. Worked on more than 500 cases so far. Worked for both defendants and plaintiffs. Testified in numerous depositions and trials over last 42 years.

CONSULTING EXPERIENCE

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| 2016-present | Senior Biomechanics Consultant, Augspurgen Komm Engineering, Inc., Phoenix, AZ. See example cases above. |
| 2008-2015 | Senior Biomechanics Consultant, Augspurgen Komm Engineering, Inc. and BTI Consultants, Phoenix, AZ. See example cases above. |
| 1996-present | Ergonomics/Human Factors Consultant, Tempe/Phoenix, AZ. Evaluated individual or groups of computer workstations (including desks, chairs, keyboards, monitors, etc.) and made written recommendations for improving ergonomics and reducing the risk of repetitive strain injury. |
| 1994-2007 | Senior Biomechanics Consultant, BTI Consultants, Tempe, AZ. See example cases above. |
| 1992-1994 | Biomechanics Consultant, Biomechanics Research and Consulting, Inc., Tempe, AZ. Similar work as for Augspurgen Komm Engineering and BTI Consultants. |
| 1992 | Human Factors/System Safety Consultant, Salt River Project, Phoenix, AZ. Evaluated causes of carpal tunnel syndrome and other cumulative trauma disorders among SRP auto mechanics and machine shop workers. |
| 1991-1992 | Biomechanics Consultant, START Sports Medicine Clinic, Tempe, AZ. Evaluated their video motion analysis system and checked it for accuracy. Provided advice on the proper use of their system for the analysis of golf swings and other sports applications. |
| 1990-1992 | Aquatics Safety Consultant, Dobson Association, Mesa, AZ. Conducted a safety analysis of competitive pools and made recommendations concerning the minimum depth required for performing racing dives safely. Oversaw plans and construction of new pool. |
| 1990-1991 | Scientific Consultant to the Egyptian National Swim and Diving Teams, Egyptian Swimming Federation, Cairo, Egypt. |

- 1985-1989 Biomechanics and Computer Consultant, Orthopaedic Consultants, Dallas, TX and ATI Products, Inc., Denver, CO. In charge of hardware and software development for electrogoniometer research, gait analysis, and locomotion studies. Worked toward development of marketable products for clinical gait analysis.
- 1983-1985 Biomechanics Research Consultant for 1984 U.S. Olympic Swim Team, United States Swimming, Inc., Colorado Springs, CO.
- 1982-1984 Biomechanics Consultant, Columbia, SC. Served as expert witness in legal cases involving injury and liability ranging from slip-and-fall accidents to automobile and motorcycle accidents. Worked for plaintiffs.
- 1977-1981 Biomechanics Consulting Assistant, Iowa City, IA and State College, PA. As a graduate student, I assisted my professors with their forensic biomechanics cases. My professor at Iowa (James Hay) worked as an expert witness for the defense in two sports injury cases. My professor at Penn State (Peter Cavanagh) worked as an expert witness for the prosecution in a murder case.

SELECTED SCIENTIFIC/PROFESSIONAL PUBLICATIONS AND PRESENTATIONS

- “Neuromechanical responses to spinal mobilization and manipulation in an ovine model of cervical intervertebral disc degeneration,” with C.J. Colloca and others. To be presented at the 36th Annual Scientific Meeting of the Spine Society of Australia, Perth, Australia, April 2025.
- “Does disc injury lead to progression of cervical disc degeneration? Histopathological analysis in an ovine model,” with C.J. Colloca and others. To be presented at the 36th Annual Scientific Meeting of the Spine Society of Australia, Perth, Australia, April 2025.
- “Effects of cervical intervertebral disc injury and adjacent segment response: An in vivo ovine biomechanical model with histological validation,” with C.J. Colloca and others, presented at the 35th Annual Scientific Meeting of the Spine Society of Australia, Sydney, Australia, April 2024.
- “Measurement and analysis of biomechanical outcomes of chiropractic adjustment performance in chiropractic education and practice,” with C. Colloca and others. *Journal of Manipulative and Physiological Therapeutics*, 43, 212-224, 2020 (doi:10.1016/j.jmpt.2019.05.006).
- “Mechanical misconceptions: Have we lost the ‘mechanics’ in ‘sports biomechanics’?” with A.D. Vigotsky and others, *Journal of Biomechanics*, 93, 1-5, 2019 (doi:10.1016/j.jbiomech.2019.07.005).
- “A general model for estimating lower extremity inertial properties of individuals with transtibial amputation,” with A.E. Ferris and others, *Journal of Biomechanics*, 54, 44-48, 2017 (doi: 10.1016/j.jbiomech.2017.01.034).
- “Does disc injury lead to progression of cervical disc degeneration? Histological analysis in an ovine model,” with C.J. Colloca and others, presented at Spineweek – The North American Spine Society, Singapore, May 2016.
- “Biomechanical evaluation of a cervical intervertebral disc degeneration model: Part 1 – histological analysis,” with C.J. Colloca and others, presented at the 2016 Association of Chiropractic Colleges Educational Conference and Research Agenda Conference (ACCRAC), Orlando, FL, March 2016.
- “Biomechanical evaluation of a cervical intervertebral disc degeneration model: Part 2 – in vivo biomechanical testing,” with C.J. Colloca and others, presented at the 2016 Association of Chiropractic Colleges Educational Conference and Research Agenda Conference (ACCRAC), Orlando, FL, March 2016.
- “Biomechanical evaluation of a cervical intervertebral disc degeneration model: Part 3 – spinal manipulative therapy,” with C.J. Colloca and others, presented at the 2016 Association of Chiropractic Colleges Educational Conference and Research Agenda Conference (ACCRAC), Orlando, FL, March 2016.
- “Why do baseball players warm up with a weighted bat?” Paper presented at the Arizona SciTech Festival, Science of Baseball Symposium, Scottsdale, AZ, March 2015 (repeated March 2016).
- “How does a curveball curve?” presented at the Arizona SciTech Festival, Science of Baseball Symposium, Scottsdale, AZ, March 2015 (repeated March 2016).
- “The relationship of golf club handle twist velocity to pelvis and thorax rotation and side bend,” with P.J. Cheetham and others, presented at the 2014 World Scientific Congress of Golf, Gold Coast, Queensland, Australia, September 2014.

- “The relationship of golf club handle twist velocity to club head speed and driving accuracy,” with P.J. Cheetham and others, presented at the 2014 World Scientific Congress of Golf, Gold Coast, Queensland, Australia, September 2014.
- “Upper extremity function in sprint vs. distance running,” with A. Froidmont, presented at the Nigg International Calgary Running Symposium, Calgary, Alberta, Canada, August 2014.
- “Oscillation and reaction board techniques for estimating inertial properties of a below-knee prosthesis,” with J.D. Smith and others. *Journal of Visualized Experiments*, 87, e50977, 2014 (doi:10.3791/50977; jove.com/video/50977).
- “Forensic Biomechanics: You, too, can be an expert witness and solve real world problems.” Keynote address at the 2013 International Conference of Korean Society of Sport Biomechanics: The Role of Sports Biomechanics in Sport Sciences, Semyung University, Chungcheongbuk-do, South Korea, October 2013.
- “Effect of Fuerte y en Forma! on balance outcomes in Hispanics with arthritis,” with A.I. Miller and C.A. Der Ananian, presented at the Southwest American College of Sports Medicine Annual Regional Meeting, Los Angeles, CA, October 2013.
- “Direct measures of prosthesis inertia influence joint kinetics during swing,” with J.D. Smith and others, presented at the 37th Annual Meeting of the American Society of Biomechanics, Omaha, NE, September 2013.
- “Mechanical factors associated with the development of high ball velocity during an instep soccer kick.” With J.K. De Witt. *Sports Biomechanics*, 11, 382-90, 2012.
- “A mechanics comparison between landing from a countermovement jump and landing from stepping off a box,” with M. Afifi. *Journal of Applied Biomechanics*, 28, 1-9, 2012.
- “Why do baseball players warm up with a weighted bat?” with Y.K. Kim, presented at the Arizona SciTech Festival, Science of Baseball Symposium, Scottsdale, AZ, February 2012 (repeated in 2013, 2014, 2015, and 2016).
- “What causes Little League Elbow?” presented at the Arizona SciTech Festival, Science of Baseball Symposium, Scottsdale, AZ, February 2012.
- “Dynamic spinal stiffness changes in an in vivo model of spondylolysis,” with C.J. Colloca, presented at the 25th Annual Meeting of the North American Spine Society, Chicago, IL, November 2011.
- “Differences in ACL laxity between breaststroke and freestyle swimmers compared with non-swimmers,” with E. Von Hess, presented at the 58th annual meeting of the American College of Sports Medicine, Denver, CO, June 2011.
- “Physiological responses to high-velocity, low-amplitude toggle-recoil chiropractic thrusts,” with C. Colloca, presented at the 11th Biennial Congress of the World Federation of Chiropractic, Rio de Janeiro, Brazil, April 2011.
- “Variability of force magnitude and force duration in instrument-based manipulation techniques re-examined,” with C. Colloca and others, presented at the 11th Biennial Congress of the World Federation of Chiropractic, Rio de Janeiro, Brazil, April 2011.
- “Measurement and analysis of a biomechanical outcome of chiropractic adjustment performance in chiropractic education,” with C. Cunliffe and others, presented at the 2011 Association of Chiropractic Colleges Research Agenda Conference. Las Vegas, NV, March, 2011.
- “Predicting knee valgus during landing from a jump from a field test in a fatigued condition,” with M. Afifi, presented at the 34th annual meeting of the American Society of Biomechanics, Providence, RI, August 2010.
- “Effect of seat belt anchor placement on occupant protection in rollover with consideration given to frontal impact,” with A.M. Curzon and E. Cooper, SAE Technical Paper 2010-01-0524, Society of Automotive Engineers, Warrendale, PA, 2010 (also presented at the 2010 SAE World Congress, Detroit, MI, April 2010).
- “Multi-component control strategy underlying production of maximal hand velocity during horizontal arm swing,” with Y.K. Kim and N. Dounskaia, *Journal of Neurophysiology*, 102, 2889-2999, 2009.
- “Effects of handle and block configuration on swim start performance,” with P.F. Vint and others, presented at the XXVII International Society of Biomechanics in Sports Conference, Limerick, Ireland, August 2009.
- “The effects of different fatiguing protocols on landing mechanics and knee kinesthetic sense,” with M. Afifi, presented at the 33rd annual meeting of the American Society of Biomechanics, State College, PA, August 2009.
- “Force-time profile characterization of the McTimoney toggle-torque-recoil technique,” with C.J. Colloca and others. *Journal of Manipulative and Physiological Therapeutics*, 32, 372-378, 2009.

- “Comparison of swim starts using side handle and front handle grip techniques,” with P.F. Vint and others, presented at the 56th annual meeting of the American College of Sports Medicine, Seattle, WA, May 2009.
- “Front- or rear-weighted track start or grab start: Which is the best for female swimmers?” with R.L. Welcher and T.R. George, *Sports Biomechanics*, 7, 100-113, 2008.
- “Developing a field test to predict knee valgus during landing form a jump,” with M. Afifi and K. Heinrichs, presented at the World Congress of Performance Analysis of Sport VIII, Magdeburg, Germany, September 2008.
- “Kinematic analysis on influence of an extra weight in horizontal arm swing,” with Y.K. Kim, presented at the 4th North American Congress on Biomechanics, Ann Arbor, MI, August 2008.
- “The relationship between knee valgus when squatting and during vertical jump takeoff and landing,” with M. Afifi and K. Heinrichs, presented at the 4th North American Congress on Biomechanics, Ann Arbor, MI, August 2008.
- “Comparison of kinematic sequence parameters between amateur and professional golfers,” with P.J. Cheetham and others, presented at the World Scientific Congress of Golf V, Phoenix, AZ, March 2008 and published in D. Crews and R. Lutz (Eds.) *Science and Golf V: Proceedings of the Fifth World Scientific Congress of Golf* (pp. 30-36), Mesa, AZ: Energy In Motion, 2008.
- “The effects of stepping off vs. hopping off a box on calculated drop heights in two-legged landings,” with M. Afifi, presented at the 31st annual meeting of the American Society of Biomechanics, Stanford, CA, August 2007.
- “Stroke resumption following flip turns in swimming,” with B. Larsen, presented at the 31st annual meeting of the American Society of Biomechanics, Stanford, CA, August 2007.
- “Roles of leading and trailing arms in baseball bat swing,” with Y.K. Kim, presented at the 31st annual meeting of the American Society of Biomechanics, Stanford, CA, August 2007.
- “Lower extremity kinematics are different when landing from a box vs. landing from a counter-movement jump,” with M. Afifi, presented at the 54th Annual Meeting of the American College of Sports Medicine, New Orleans, LA, May 2007.
- “Accuracy and inter-examiner reliability of digital motion x-ray analysis of the cervical spine,” with C.J. Colloca and others, presented at the 9th Biennial Congress of the World Federation of Chiropractic, International Conference on Chiropractic Research, Vilamoura, Portugal, May 2007.
- “A GRF comparison between landing from a countermovement jump and landing from stepping off a box,” with M. Afifi, presented at the 30th Annual Meeting of the American Society of Biomechanics, Fairfax, VA, September 2006.
- “Asymmetrical force distribution in swimming starts,” with R.W. Welcher and others, presented at the American Swimming Coaches Association (ASCA) World Clinic, Washington, DC, September 2006.
- “Biomechanical classification of Taekwondo kicks,” with Y.K. Kim, presented at the 30th Annual Meeting of the American Society of Biomechanics, Fairfax, VA, September 2006.
- “The biomechanical and clinical significance of the lumbar erector spinae flexion-relaxation phenomenon: a review of the literature,” with C.J. Colloca, *Journal of Manipulative and Physiological Therapeutics*, 28, 623-631, 2005.
- “Manipulative treatment of Carpal Tunnel Syndrome: Biomechanical and osteopathic intervention to increase the length of the transverse carpal ligament—Part II: Effect of gender and manipulative ‘priming’,” with B. Sucher and others, *Journal of the American Osteopathic Association*, 105, 135-143, 2005.
- “Buoyant forces and center of buoyancy in five bodysuits compared to conventional swimsuits,” with B.J. Morrison and others, presented at the Center for Aquatics Research and Education (CARE), University of Edinburgh, Edinburgh, Scotland, November 2005.
- “The effects of quantitative feedback on the reduction of landing force,” with S. Novotny, presented at the combined 20th Congress of the International Society of Biomechanics and the 29th Annual Meeting of the American Society of Biomechanics, Cleveland, OH, August 2005.
- “The effect of aging on stroke parameters in swimming,” with B. Morrison, presented at the combined 20th Congress of the International Society of Biomechanics and the 29th Annual Meeting of the American Society of Biomechanics, Cleveland, OH, August 2005.
- “Does warming up with a weighted bat help or hurt bat speed in baseball?” with Y.K. Kim, presented at the combined 20th Congress of the International Society of Biomechanics and the 29th Annual Meeting of the American Society of Biomechanics, Cleveland, OH, August 2005.

- “The effect of a hurdle preflight approach on takeoff velocities in springboard diving,” with S. Sultvedt, presented at the 52nd Annual Meeting of the American College of Sports Medicine, Nashville, TN, June 2005.
- “Transition from the glide phase to free swimming following a freestyle flip turn: which arm pulls first?” with B. Larsen, presented at the 52nd Annual Meeting of the American College of Sports Medicine, Nashville, TN, June 2005.
- “Stretching the transverse carpal ligament as an alternative to surgery in the treatment of Carpal Tunnel Syndrome,” presented at the monthly meeting of Dr. Gladys T. McGarey Research Foundation’s Physician Discussion Group, Scottsdale, AZ, November 2004.
- “Factors in producing a ‘soft’ landing in terms of both force and sound,” with S. Novotny, presented at the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 2004.
- “3D computer simulation of roundhouse kick in Taekwondo,” with Y.K. Kim and G.T. Yamaguchi, presented at the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 2004.
- “Muscle function in the generation of propulsive and braking forces during running,” with A.R. Gaines and P.E. Martin, presented at the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 2004.
- “Predicting out-of-plane point locations using the 2D-DLT,” with B. Morrison and others, presented at the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 2004.
- “Factors affecting the accuracy of 2D-DLT calibration,” with S.P. McLean and others, presented at the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 2004.
- “Healthy bodies, healthy selves: Hands, wrists, and arms after 50,” presented twice at monthly meetings of OASIS (Older Adult Service and Information Systems), Phoenix and Scottsdale, AZ, November 2003.
- “Carpal tunnel syndrome & osteopathic manipulative medicine,” with B.M. Sucher, presented at the 2003 American Osteopathic Association Convention and Scientific Seminar, New Orleans, LA, October 2003.
- “Accuracy of using multiple zones for the DLT in swimming,” with B.J. Morrison, presented at the 27th Annual Meeting of the American Society of Biomechanics, Toledo, OH, September 2003.
- “Do bodysuits from different manufacturers aid a swimmer’s buoyancy?” with B.J. Morrison and others, presented at the 27th Annual Meeting of the American Society of Biomechanics, Toledo, OH, September 2003.
- “Hay’s deterministic models and their use in sport biomechanics,” presented at the 27th Annual Meeting of the American Society of Biomechanics, Toledo, OH, September 2003.
- “A perfectionist looks at sports techniques: A tribute to Jim Hay,” with B.D. Wilson and others, presented at the 27th Annual Meeting of the American Society of Biomechanics, Toledo, OH, September 2003.
- “A comparison of buoyant forces and center of buoyancy in competitive swimmers wearing conventional and full body swimsuits,” with B.J. Morrison and others, presented at the 2003 American Swimming Coaches Association World Clinic, San Diego, CA, September 2003.
- “Factors related to ball velocity during an instep soccer kick,” with J.K. DeWitt, presented at the IV World Congress of Biomechanics, Calgary, Canada, August 2002.
- “On the mechanisms of propulsion in swimming: Is it lift, drag, or something else?” presented as the Southwest District AAHPERD Scholar Lecture, San Diego, CA, April 2002.
- “Effect of gender and method of stretching the transverse carpal ligament in cadavers: Application to carpal tunnel syndrome,” with B.M. Sucher and others, presented at the 2001 Annual Meeting of the American Osteopathic Association, October 2001.
- “Carpal Tunnel in court reporting,” presented at the annual convention of the Arizona Court Reporters Association, Phoenix, AZ, September 2001.
- “Creep response of the transverse carpal ligament in cadavers: Application to carpal tunnel syndrome,” with B.M. Sucher and others, presented at the 25th Annual Meeting of the American Society of Biomechanics, San Diego, CA, August 2001.
- “Addition of an approach to a relay swimming start,” with S.P. McLean and others, *Journal of Applied Biomechanics*, 16, 343-356. 2000.
- “An analysis of the new ‘high tech’ swimming suits worn at the 2000 Olympic games,” with B. Morrison, presented at the Nevada AHPERD Convention, Las Vegas, NV, November 2000.
- “Buoyancy, gender, and swimming performance,” with S.P. McLean, *Journal of Applied Biomechanics*, 16, 248-263, 2000.

- “The influence of arm position, level of submersion, and level of inhalation on the buoyant force and center of buoyancy of competitive swimmers,” with S.P. McLean, *Research Quarterly for Exercise and Sport*, 71, 182-189, 2000 (doi: 10.1080/02701367.2000.10608896).
- “Kinematics of step-through swimming starts,” with S.P. McLean and others, presented at the 47th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN, June 2000.
- “Try stretching the transverse carpal ligament rather than cutting it as a means of treating or preventing carpal tunnel syndrome,” with B.M. Sucher and others, presented at the 47th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN, May 2000.
- “Manipulative treatment of Carpal Tunnel Syndrome: Biomechanical and osteopathic intervention to increase the length of the transverse carpal ligament-part II,” with B.M. Sucher and others, presented at the American Osteopathic College of Rehabilitation Medicine Mid-Year Meeting, Chicago, IL, May 2000.
- “Low impact collisions: Accident reconstruction and injury analysis,” presented at the Automobile Liability II Seminar, Phoenix, AZ, May 4, 2000.
- “Normalized jerk: A measure to capture developmental characteristics of young girls’ overarm throwing,” with J.H. Yan and others, *Journal of Applied Biomechanics*, 16, 196-203, 2000.
- “The use of close-range 3D photogrammetry to measure the elongation of the transverse carpal ligament in cadavers: application to carpal tunnel syndrome,” with B.M. Sucher and others, presented at the 17th Congress of the International Society of Biomechanics, Calgary, Alberta, Canada, August 1999.
- “An analysis of velocity and time characteristics of three starts in competitive swimming,” with R.L. Welcher, presented at the 17th Congress of the International Society of Biomechanics, Calgary, Alberta, Canada, August 1999.
- “Longer integration intervals reduce variability and improve reliability of EMG derived from maximal isometric exertions,” with P.F. Vint, *Journal of Applied Biomechanics*, 15, 210-220, 1999.
- “Manipulative treatment of carpal tunnel syndrome—biomechanical and osteopathic intervention to increase the length of the transverse carpal ligament,” with B.M. Sucher, *Journal of the American Osteopathic Association*, 98, 679-686, 1998 (doi:10.1515/jom-1998-0118).
- “Sex differences in the center of buoyancy location of competitive swimmers,” with S.P. McLean. *Journal of Sports Sciences*, 16, 373-383, 1998 (doi: 10.1080/02640419808559365).
- “Lengthening the transverse carpal ligament under static loads in cadavers,” with B.M. Sucher and others, presented at the 1998 North American Congress of Biomechanics, Waterloo, Ontario, Canada, August 1998.
- “Relationships between ball release velocity and 3D joint kinematics in baseball throwing,” with C.P. Sherwood and others, presented at the 21st Annual Meeting of the American Society of Biomechanics, Clemson, SC, September 1997.
- “3D angular velocities most related to ball release velocity in baseball throwing,” with C.P. Sherwood and others, presented at the 16th Congress of the International Society of Biomechanics, Tokyo, Japan, August 1997.
- “Accident reconstruction and biomechanics of low impact vehicular collisions,” presented to Arizona personal injury attorneys, BTI Consultants, Tempe, AZ, July 1996.
- “Biomechanical determinants of human performance: Application to vertical jumping,” presented at the Korean Sport Science Institute, Seoul, South Korea, June 1996.
- “On the mechanisms of propulsion in swimming: Is it lift, drag, or something else?” presented at the 1996 Seoul International Sport Science Congress, Seoul, South Korea, June 1996.
- “Endpoint problems in smoothing raw kinematic data: An evaluation of four popular methods,” with P.F. Vint, *Journal of Biomechanics*, 29, 1637-1642, 1996.
- “Differences between one-foot and two-foot vertical jump performances,” with P.F. Vint, *Journal of Applied Biomechanics*, 12, 341-361, 1996.
- “How elite swimmers swim faster: Mechanisms of propulsion in swimming,” presented at the Annual Meeting of the Southwest Chapter of the American College of Sports Medicine, San Diego, CA, November 1995.
- “Proper use of child safety restraints in motor vehicles,” presented at the Injury Analysis Seminar, BTI Consultants, Tempe, AZ, May 1995.
- “Effect of low impact vehicular collisions on the human body,” presented at the Injury Analysis Seminar, BTI Consultants, Tempe, AZ, May 1995.
- “NLT vs. extrapolated DLT: A comparison of methods for quantifying 3-D human motion in large activity volumes,” with S.P. McLean, *Journal of Biomechanics*, 28, 1219-1223, 1995.

- “A comparison of Sargent jump height and actual flight height in vertical jumping,” with P.F. Vint, presented at the 18th Annual Meeting of the American Society of Biomechanics, Columbus, OH, October 1994.
- “3-D analysis of throwing patterns of young boys and girls,” with J.R. Thomas and others, presented at the 17th Annual Meeting of the American Society of Biomechanics, Iowa City, IA, October 1993.
- “Gender differences in the biomechanics of throwing,” presented at the 11th Annual Injuries in Baseball Course, American Sports Medicine Institute, Birmingham, AL, January 1993.
- “Case studies of asymmetrical arm action in running,” *International Journal of Sport Biomechanics*, 8, 111-128, 1992.
- “Repetitive strain injuries (RSI): Quantifying contributing factors through research,” presented at the Advanced Ergonomics Systems RSI workshop, Phoenix, AZ, June 1992.
- “A mathematical model of competitive swimming in pools with currents,” with S.P. McLean, *International Journal of Sport Biomechanics*, 7, 163-174, 1991.
- “Whole body movement: Coordination of arms and legs in walking and running.” In J. Winters & S.L.Y. Woo (Eds.), *Multiple Muscle Systems: Biomechanics and Movement Organization* (pp. 694-705), New York: Springer-Verlag, 1990.
- “Adjustments to the segment center of mass proportions of Clauser et al. (1969),” *Journal of Biomechanics*, 23, 949-951, 1990.
- “Upper extremity function in distance running.” In P.R. Cavanagh (Ed.), *Biomechanics of Distance Running* (pp. 107-134), Champaign, IL: Human Kinetics, 1990.
- “Biomechanics of swimming,” *Eight* (8) papers presented to the Cairo Zone of the Egyptian Swimming Federation, Cairo, Egypt, March 1990.
- “Biomechanics of springboard and platform diving,” *Six* (6) papers presented to the Cairo Zone of the Egyptian Swimming Federation, Cairo, Egypt, March 1990.
- “An analysis of angular momentum during the run-up and takeoff in long jumping,” with B.A. Munkasy and S.A. Chinworth, presented at the XIIth International Congress of Biomechanics, Los Angeles, CA, June 1989.
- “Propulsive techniques: Front crawl stroke, butterfly, backstroke, breaststroke,” with R.E. Schleihauf and others, in B. Ungerechts et al. (Eds.), *Swimming Science V* (pp. 53-59), Champaign, IL: Human Kinetics, 1988.
- “A biomechanical analysis of the 1984 U.S. Olympic freestyle distance swimmers,” with E. Maglischo and others, in B. Ungerechts et al. (Eds.), *Swimming Science V* (pp. 351-360), Champaign, IL: Human Kinetics, 1988.
- “Upper extremity function in running. II: Angular momentum considerations,” *International Journal of Sport Biomechanics*, 3, 242-263, 1987 (doi: 10.1123/ijsb.3.3.242).
- “Upper extremity function in running. I: Center of mass and propulsion considerations,” with P.R. Cavanagh and K.R. Williams, *International Journal of Sport Biomechanics*, 3, 222-241, 1987 (doi: 10.1123/ijsb.3.3.222).
- “A biomechanical analysis of the 1984 U.S. Olympic Swimming Team: The distance freestylers,” with E. Maglischo and others, *Journal of Swimming Research*, 2(3), 12-16, 1986.
- “A kinetic analysis of U.S. Olympic butterfly swimmers,” presented at the Annual Meeting of the American College of Sports Medicine, Indianapolis, IN, May 1986.
- “A hydrodynamic analysis of breaststroke swimmers,” with A.L. Thayer and others, in J.G. Hay (Ed.), *Starting, Stroking, & Turning* (pp. 131-144), Iowa City, IA: University of Iowa, 1986.
- “Regression equations to predict segmental moments of inertia from anthropometric measurements: An extension of the data of Chandler et al. (1975),” *Journal of Biomechanics*, 18, 621-624, 1985.
- “A three-dimensional analysis of the net moments at the shoulder and elbow joints in running and their relationship to upper extremity EMG activity,” in D.A. Winter et al. (Eds.), *Biomechanics IX-B* (pp. 337-342), Champaign, IL: Human Kinetics, 1985.
- “Biomechanics of swimming propulsion,” with R.E. Schleihauf and others, in T.F. Welsh (Ed.), *The 1984 ASCA World Clinic Yearbook* (pp. 19-24), Ft. Lauderdale, FL: American Swimming Coaches Association, 1985.
- “Biomechanical analysis of U.S. Olympic freestylers,” with E.W. Maglischo and others, in T.F. Welsh (Ed.), *The 1984 ASCA World Clinic Yearbook* (pp. 212-217), Ft. Lauderdale, FL: American Swimming Coaches Association, 1985.
- “Impact forces upon landing from a height in children,” with P. Werner and others, presented at the 8th Annual Meeting of the American Society of Biomechanics, Tucson, AZ, October 1984.
- “Effects of intervention in the teaching process on jumping and landing abilities of second grade children,” with P.H. Werner and J.E. Rink, presented at the Olympic Scientific Congress, Eugene, OR, July 1984.

- “A three-dimensional analysis of the net moments at the shoulder and elbow joints in running their relationship to upper extremity EMG activity,” presented at the 9th International Congress of Biomechanics, Waterloo, Ontario, August 1983.
- “Upper extremity contributions to angular momentum in running,” with P.R. Cavanagh and K.R. Williams, in H. Matsui and K. Kobayashi (Eds.), *Biomechanics VIII-B* (pp. 641-647), Champaign, IL: Human Kinetics, 1983.
- “Segmental contributions to angular momentum in treadmill running at various speeds,” presented at the Annual Meeting of the American College of Sports Medicine, Minneapolis, MN, May 1982.
- “Biomechanics of sport: The state of the art,” with P.R. Cavanagh, in G.A. Brooks (Ed.), *Perspectives on the Academic Discipline of Physical Education* (pp. 137-157), Champaign, IL: Human Kinetics, 1981.
- “Upper extremity contributions to angular momentum and propulsion in running,” with P.R. Cavanagh and K.R. Williams, presented at the 8th International Congress of Biomechanics, Nagoya, Japan, July 1981.
- “Upper extremity function in treadmill walking,” with P.R. Cavanagh, presented at the Annual Meeting of the American College of Sports Medicine, Miami, FL, May 1981.
- “Human somersaulting stability: A key to understanding how airborne twists are initiated,” presented at the 4th Annual Meeting of the American Society of Biomechanics, Burlington, VT, October 1980.

SELECTED FUNDED RESEARCH GRANTS

- “Force production and performance in swimming starts with and without a rear-foot wedge,” with P.F. Vint, USA Swimming, Inc. and US Olympic Committee, \$20,000, 2007-09 (PI).
- “Dynamics of motor-respiratory coupling,” with P. Amazeen and others. National Science Foundation, \$349,988, 2005-08 (Co-PI)
- “Asymmetrical force production during swimming starts,” with S. Conci and others. USA Swimming, Inc., \$15,000, 2005-07 (PI).
- “Age effects on the stroke rate-stroke length relationship in sprint freestyle,” with B. Morrison. International Society of Biomechanics Matching Dissertation Grant, \$2,000, 2004-05 (Co-PI).
- “The effect of age on the stroke rate, stroke length relationship in freestyle swimming,” with B. Morrison. United States Masters Swimming Endowment Fund, \$4,750, 2004-05 (PI).
- “A comparison of body density and center of buoyancy in competitive swimmers wearing conventional and full-body swimsuits,” with others, USA Swimming, \$18,579, 2001-02 (PI).
- “Skill-driven optimization of construction operations” with A. Wiesel and others, National Science Foundation, \$149,970, 2000-02 (Co-PI).
- “Identification of factors related to the development of ball speed and one-legged landings in the volleyball attack,” with P.F. Vint, United States Olympic Committee, \$23,573, 1999-2000 (PI).
- “Non-surgical release of the transverse carpal ligament: A cadaver study using external devices and osteopathic manipulation,” with B.M. Sucher, American Osteopathic Association, \$25,616, 1998-2000 (PI).
- “Investigation of ergonomic keyboard design on typing kinematics,” Arizona State University Institutional Biomedical Research Grant, \$624, 1993 (PI).
- “Gender differences in the center of buoyancy location of competitive swimmers,” with S.P. McLean, National Collegiate Athletic Association, \$19,998, 1992-93 (PI).
- “Repetitive strain injuries in utility industry field employees,” with P.F. Vint, Salt River Project, \$5,697, 1992 (PI).
- “Kinematic, electromyographic, and osteopathic investigation of repetitive strain syndrome in computer keyboard operators,” with others, DeRoy Testamentary Foundation, \$16,986, 1991-92 (PI).
- “Gender differences in mechanics of children’s throwing: Growth and practice contributions,” with others, Arizona State University College of Liberal Arts and Sciences Summer Research Award, \$2,800, 1989 (Co-PI).
- “Upper extremity function in race walking,” The Athletics Congress of the U.S.A. Basic Research Grant, \$7,300, 1989-90 (PI).
- “Upper extremity function in sprint running,” United States Olympic Committee Basic Research Grant, \$12,950, 1988-89 (PI).
- “A hydrodynamic analysis of the hand propulsive forces used by U.S. Olympic swimmers,” North Texas State University Faculty Research Grant, \$4,500, 1984-85 (PI).

SCIENTIFIC AND PROFESSIONAL AFFILIATIONS

American College of Sports Medicine (ACSM)
American Society of Biomechanics (ASB)
International Society of Biomechanics (ISB)
USA Swimming Sports Medicine and Science Network
Society of Automotive Engineers (SAE)

PROFESSIONAL SOCIETY ACTIVITIES

Journal of Biomechanics, Editorial Board, 2005-present.
International Society of Biomechanics in Sports (ISBS), Board of Directors, 2004-06.
USA Swimming, Inc., Sports Medicine and Science Network, 2002-present.
ASB, Education Committee, 1999-2002.
ASB, Nominating Committee, 1997-98, 2001-02.
American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD), Biomechanics Review Panel Chair, 1993-94.
Medicine and Science in Sports and Exercise, Associate Editor, 1992-94.
ASB, Site Committee for the 15th Annual Meeting, 1990-91.
ASB, Program Committee for 14th Annual Meeting, 1990.
USA Swimming, Inc., Biomechanics Research Team, 1983-88.

HONORS AND AWARDS

American Alliance for Health, Physical Education, Recreation, and Dance: Southwest District Scholar of the Year, 2000-2001.

ACADEMIC EXPERIENCE

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| 2015-present | Arizona State University, Professor Emeritus, Kinesiology |
| 2010-2015 | Arizona State University, Graduate Faculty in Mechanical Engineering |
| 2007-2015 | Arizona State University, Affiliated Faculty in Arts, Media, and Engineering (AME) |
| 1993-2015 | Arizona State University, Associate Professor, Kinesiology |
| 1987-1993 | Arizona State University, Assistant Professor, Exercise Science |
| 1984-1987 | North Texas State University, Assistant Professor |
| 1981-1984 | University of South Carolina, Assistant Professor |
| 1978-1981 | Pennsylvania State University, Graduate Research Assistant |
| 1976-1978 | University of Iowa, Graduate Teaching and Research Assistant |

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