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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. Biomechanics of locomotion, swimming, throwing, and jumping; upper extremity function; body segment interactions during movement; human body inertial properties; human factors and ergonomics, especially upper extremity cumulative trauma disorders and Carpal Tunnel Syndrome; forensic biomechanics; accident reconstruction.

CONSULTING EXPERIENCE

1996-present Ergonomics 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-present Senior Biomechanics Consultant, BTI Consultants, Tempe/Phoenix, AZ. Served as expert witness in numerous legal cases involving injury and liability ranging from automobile accidents to murder cases. Worked for both defendants and plaintiffs.

1992-94 Senior Biomechanics Consultant, Biomechanics Research and Consulting, Inc., Tempe, AZ. Similar work as for 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.

1990-92 Aquatics Safety Consultant, Dobson Association, Mesa, AZ. Conducted a safety analysis of competitive pools and made recommendations concerning minimum depth required for performing racing dives safely. Oversaw plans and construction of new pool.

1991-92 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.

1990-91 Scientific Consultant to the Egyptian National Swim and Diving Teams, Egyptian Swimming Federation, Cairo, Egypt.

1985-89 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 product for clinical gait analysis.

1983-85 Biomechanics Research Consultant for 1984 U.S. Olympic Swim Team, United States Swimming, Inc., Colorado Springs, CO.

1977-84 Forensic Biomechanics Consultant, Iowa City, IA, State College, PA, and Columbia, SC. Served as expert witness in numerous legal cases involving injury and liability ranging from slip-and-fall accidents and sports accidents, to automobile and motorcycle accidents, to a murder case. Worked for both defendants and plaintiffs.

SELECTED PROFESSIONAL PUBLICATIONS AND PRESENTATIONS

“An analysis of velocity and temporal characteristics of three starts in competitive swimming,” with R.L. Welcher and T.R. George, *Sports Biomechanics*, in press.

“The effects of stepping off vs. hopping off a box on calculated drop heights in two-legged landings,” with M. Affi, 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. Affi, 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. Affi, presented at the 30th Annual Meeting of the American Society of Biomechanics, Fairfax, VA, 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. 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.
- "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 others, 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.
- "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 others, 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 others, 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 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 others, presented at the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 2004.
- "Accuracy of using multiple zones for the DLT in swimming," with B. 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 others, presented at the 27th Annual Meeting of the American Society of Biomechanics, Toledo, OH, September 2003.
- "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.
- "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.
- "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 others, presented at the 27th Annual Meeting of the American Society of Biomechanics, Toledo, OH, September 2003.
- "Carpal tunnel syndrome & osteopathic manipulative medicine," with B. Sucher, presented at the 2003 American Osteopathic Association Convention and Scientific Seminar, New Orleans, LA, October 2003.
- "A comparison of buoyant forces and center of buoyancy in competitive swimmers wearing conventional and full body swimsuits," with 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.
- "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.
- "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 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.
- "Gender differences in the center of buoyancy location of competitive swimmers," with S.P. McLean. *Journal of Sports Sciences*, 16, 373-383, 1998.
- "Lengthening the transverse carpal ligament under static loads in cadavers," with 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 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 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, 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, 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 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," with others, 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* papers presented to the Cairo Zone of the Egyptian Swimming Federation, Cairo, Egypt, March 1990.
- "Biomechanics of springboard and platform diving," *Six* 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 others, presented at the XII International Congress of Biomechanics, Los Angeles, CA, June 1989.
- "Propulsive techniques: Front crawl stroke, butterfly, backstroke, breaststroke," with 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 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.
- "Upper extremity function in running. I: Center of mass and propulsion considerations," with others, *International Journal of Sport Biomechanics*, 3, 222-241, 1987.
- "A biomechanical analysis of the 1984 U.S. Olympic Swimming Team: The distance freestylers," *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.
- "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.
- "Impact forces upon landing from a height in children," with others, presented at the 8th Annual Meeting of the American Society of Biomechanics, Tucson, AZ, October 1984.

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, 2007-08 (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).

MEMBERSHIPS IN SCIENTIFIC AND PROFESSIONAL SOCIETIES

- American College of Sports Medicine (ACSM, Member)
- American Society of Biomechanics (ASB, Member)
- International Society of Biomechanics (ISB, Member)
- International Society of Biomechanics in Sports (ISBS, Member)
- USA Swimming Sports Medicine and Science Network (Member)

PROFESSIONAL SOCIETY ACTIVITIES

- ASB, Education Committee, 1999-2002.
- ASB, Nominating Committee, 1997-98, 2001-02.
- 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, Sports Medicine and Science, 2002-06.
- ISBS, Board of Directors, 2004-06.
- Journal of Biomechanics*, Editorial Board, 2005-present.

HONORS AND AWARDS

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

ACADEMIC EXPERIENCE

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| 1993-Present | Arizona State University, Associate Professor, Department of Kinesiology |
| 1987-93 | Arizona State University, Assistant Professor |
| 1984-87 | North Texas State University, Assistant Professor |

1981-84 University of South Carolina, Assistant Professor

ACADEMIC EXPERIENCE (Continued)

1978-81 Pennsylvania State University, Graduate Research Assistant
1976-78 University of Iowa, Graduate Teaching and Research Assistant

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