

Biosketch

Lawrence E. Armstrong, Ph.D., FACSM

Professor, The University of Connecticut, Neag School of Education
Human Performance Laboratory, Department of Kinesiology
with Joint Appointments in
Department of Physiology & Neurobiology and
Department of Nutritional Sciences

Previous Positions

- Research Physiologist, U.S. Army Research Institute of Environmental Medicine, Heat Research Division [human research], Natick MA. 1983 - 1990
- President, New England Regional Chapter of the American College of Sports Medicine, 1991 - 1992, 500 members
- High School Biology & Chemistry Teacher, High School Principal & Athletic Director, Fayette OH. 1971-1980.

Selected Peer Reviewed Publications (141 total)

- Armstrong, L.E., Costill, D.L., Fink, W.J. Influence of Diuretic-Induced Dehydration on Competitive Running Performance. *Medicine and Science in Sport & Exercise*, 17(4): 456-461, 1985.
- Armstrong, L.E., Costill, D.L., Fink, W.J., Bassett, D., Hargreaves, J., Nishibata, I., King, D.S. Effects of Dietary Sodium on Body and Muscle Potassium Content During Heat Acclimation. *European Journal of Applied Physiology*, 54:391- 397, 1985.
- Armstrong, L.E., Hubbard, R.W., Szlyk, P.C., Matthew, W.T., Sils, I. V. Voluntary Dehydration and Electrolyte Losses During Exercise in the Heat. *Aviation, Space and Environmental Medicine*, 56:765-770, 1985.
- Armstrong, L.E., Costill D.L., Fink, W.J. Changes in body water and electrolytes during heat acclimation: effects of dietary sodium. *Aviation, Space and Environmental Medicine*, 58:143-148, 1987.
- Armstrong, L.E., Hubbard, R.W., DeLuca, J.P., Christensen, E.L. Heat acclimatization during summer running in Northeastern United States. *Medicine and Science in Sport & Exercise*, 19(2):131-136, 1987.
- Armstrong, L.E., Francesconi, R.P., Kraemer, W.J., Leva, N., De Luca, J.P., Hubbard, R.W. Plasma cortisol, renin, and aldosterone during a heat acclimation program. *International J Sports Medicine* 10(1):38-42, 1989.
- Armstrong L.E., Hubbard R.W., Askew E.W., De Luca J.P., O'Brien C., et al. Responses to moderate and low sodium diets during exercise-heat acclimation. *Int. J Sport Nutr.* 3(2):207-221, 1993.
- Armstrong L.E., Maresh C.M., Castellani J., Bergeron M., Kenefick, R. W., LaGasse, K.E., Riebe, D. Urinary indices of hydration status. *Int. J. Sport Nutrition* 4:265-279, 1994.
- Armstrong L.E., Maresh C.M., Riebe D., Kenefick R.W., Castellani J.W., Senk J.M. Local cooling in wheelchair athletes during heat stress. *Medicine & Science Sports & Exercise* 27:211-217, 1995.
- Bergeron M.F., Maresh C.M., Armstrong L.E., Signorile J.F., Castellani J.W, et al. Fluid-electrolyte balance associated with tennis match play in a hot environment. *Int. J. Sport Nutrition* 5:180-193, 1995.
- Armstrong L.E., Maresh C.M., Bergeron M.F., Hoffman J.R., Whittlesey M.J., Roy G. Exercise-Heat Tolerance of Collegiate Distance Runners at 38°C. *J. Strength & Conditioning Rsch.* 10:190-196, 1996.
- Armstrong L.E., Crago A.E., Adams R., Roberts W.O., Maresh C.M. Whole-body cooling of hyperthermic runners: comparison of two field therapies. *Am. J. Emergency Med.* 14:355-358, 1996.
- Whittlesey M.J., Maresh C.M., Armstrong L.E., Morocco T.S., Hannon D.R., Gabaree C.V., Hoffman J.R. Plasma volume responses to consecutive anaerobic exercise tests. *Int. J. Sports Med.* 17:268-271, 1996.
- Castellani J.W., Maresh C.M., Armstrong L.E., Kenefick R.W., Riebe D., Echegaray M., Casa D.J., Castracane D.V. Intravenous vs. oral rehydration: effects on exercise-heat stress. *J. Applied Physiology* 82:799-806, 1997.
- Armstrong L.E., Maresh C.M., Gabaree C.V., Hoffman J.R., Kavouras S.A. et al. Thermal & circulatory responses during exercise: effects of hypohydration, dehydration, and water intake. *J. Applied Physiol.* 82:2028-2035,1997.
- Armstrong L.E., Kenefick R.W., Castellani J.W., et al. Bioimpedance spectroscopy technique: intra-, extracellular, and total body water. *Med. & Sci. in Sports Exerc.* 29:1657-1663, 1997.
- Armstrong L.E., Herrera-Sotto J.A., Hacker F.T., Casa D.J., Kavouras S.A., Maresh C.M. Urinary indices during dehydration, exercise, and rehydration. *International J. Sport Nutrition* 8:345-355, 1998.
- Casa D.J., Maresh C.M., Armstrong L.E., Kavouras S.A., Herrera J.A., Hacker F.T., Keith N.R., Elliott T.A. Intravenous versus oral rehydration during a brief period: responses to subsequent exercise in heat. *Med. Sci. Sports & Exerc.* 32(1):124-133, 2000.
- Armstrong L.E., Stoppani J. Central nervous system control of heat acclimation adaptations: an emerging paradigm. *Reviews in the Neurosciences* 13(3):271-285, 2002.
- Armstrong L.E. Caffeine: Body Fluid-Electrolyte Balance and Exercise Performance. *International Journal of Sport Nutrition & Exercise Metabolism* 12(2):189-206, 2002.
- Armstrong L.E., VanHeest J.L. The unknown mechanism of the overtraining syndrome: clues from depression and psychoneuroimmunology. *Sports Medicine* 32(3):185-209, 2002.

- Ormerod J.K., Elliott T.A., Scheett T.P., VanHeest J.L., Armstrong L.E., Maresh C.M. Drinking behavior and perception of thirst in untrained women during 6 weeks of heat acclimation and outdoor training. *International Journal of Sport Nutrition and Exercise Metabolism* 13(1):15-28, 2003.
- Kraemer W.J., Armstrong L.E., Watson G. The effects of exertional heatstroke and exercise-heat acclimation on plasma β -endorphin concentrations. *Aviation Space Environmental Medicine* 74:758-762, 2003.
- Armstrong L.E. Exertional hyponatremia. *Journal of Sports Sciences (UK)* 22(1):144-145, 2004
- Shirreffs S.M., Armstrong L.E., Chevront S.N. Fluid and electrolyte needs for preparation and recovery from training and competition. *Journal of Sports Sciences* 22(1):57-63, 2004.
- Maresh C.M., Gabaree-Boulant C.L., Armstrong L.E., Judelson D.A., Hoffman J.R., Castellani J.W., Kenefick R.W., Bergeron M.F., Casa D.J.. Effect of hydration status on thirst, drinking, and related hormonal responses during low-intensity exercise in the heat. *Journal of Applied Physiology* 97:39-44, 2004.
- Armstrong LE, Maresh CM, Keith NR, Elliott TA, VanHeest JL, Scheett TP, Stoppani J, Judelson DA, DeSouza MJ. Heat acclimation and physical training adaptations of young women using different contraceptive hormones. *American Journal of Physiology: Endocrinology and Metabolism* 288: E868-E875, 2005.
- Armstrong LE, Pumerantz AC, Roti MW, Judelson DA, Watson G, Dias JC, Sökmen B, Casa DJ, Maresh CM. Fluid, electrolyte, and renal indices of hydration during 11 days of controlled caffeine consumption. *International Journal of Sport Nutrition & Exercise Metabolism* 15:252-265, 2005.
- Armstrong L.E. Hydration assessment techniques. *Nutrition Reviews* 63(6 suppl, pt. 2):S40-S54, 2005.
- Watson G, Judelson DA, Armstrong LE, Yeargin SW, Casa DJ, Maresh CM. Influence of Diuretic-Induced Dehydration on Competitive Sprint and Power Performance. *Medicine and Science in Sports & Exercise* 37(7):1168-1174, 2005.
- Martin WF, Armstrong LE, Rodriguez NR. Dietary protein intake and renal function. *Nutrition and Metabolism* (online peer-reviewed scientific journal), <http://www.nutritionandmetabolism.com/>, 2:25, 20 September 2005
- Dias JC, Roti MW, Pumerantz AC, Watson G, Judelson DA, Casa DJ, Armstrong LE. Rehydration after exercise dehydration in heat: effects of caffeine intake. *Journal of Sport Rehabilitation* 14:294-300, 2005.
- Casa DJ, Armstrong LE, Ganio MS, Yeargin SW. Exertional heat stroke in competitive athletes. *Current Sports Medicine Reports* 4:309-317, 2005.
- Kavouras SA, Armstrong LE, Maresh CM, Casa DJ, Herrera-Soto JA, Scheett TP, Stoppani J, Mack GW, Kraemer WJ. Rehydration with glycerol: endocrine, cardiovascular and thermoregulatory responses during exercise in the heat. *Journal of Applied Physiology* 100(2):442-450, 2006.
- Roti MW, Casa DJ, Pumerantz AC, Watson G, Judelson DA, Dias JC, Ruffin K, Armstrong LE. Thermoregulatory responses to exercise in the heat: chronic caffeine intake has no effect. *Aviation Space Environ Medicine* 77(2):124-129, 2006.
- Watson G, Casa DJ, Fiala KA, Hile A, Roti MW, Healey JM, Armstrong LE, Maresh CM. Creatine Use and Exercise Heat Tolerance In Dehydrated Men. *Journal of Athletic Training* 41(1):18-29, 2006.
- Popkin BM, Armstrong LE, Bray GM, Cabalero B, Frei B, Willet WC. A new proposed guidance system for beverage consumption in the United States. *American Journal of Clinical Nutrition* 83:529-542, 2006.
- Martin WF, Cerundolo LH, Pikosky MA, Gaine PC, Maresh, CM, Armstrong LE, Bolster DR, Rodriguez NR. Effects of dietary protein on indexes of hydration. *Journal of the American Dietetics Association* 106:587-589, 2006.
- Armstrong LE. Nutritional strategies for soccer: Counteracting heat, cold, high altitude and jet lag. *Journal of Sport Sciences* 24(7):723-740, 2006.
- Maresh CM, Sökmen B, Kraemer WJ, Hoffman J, Watson G, Judelson D, Gabaree-Boulant C, Deschenes M, VanHeest JL, and Armstrong LE. Pituitary-adrenal responses to arm versus leg exercise in untrained man. *European Journal of Applied Physiology* 97(4):471-477, 2006.
- Armstrong LE, Whittlesey MJ, Casa DJ, Elliott TA, Keith NR, Kavouras SA, Maresh CM. No Effect of 5% Hypohydration on Running Economy of Competitive Runners at 23°C. *Medicine & Science in Sports & Exercise* 38(10):1762-1769, 2006.
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- Ganio MS, Casa DJ, Armstrong LE, Maresh CM. Evidence-based approach to lingering hydration questions. *Clinics in Sports Medicine* 26:1-16, 2007.
- Armstrong LE, Casa DJ, Maresh CM, and Ganio MS. Caffeine, Fluid-Electrolyte Balance, Temperature Regulation, and Exercise Performance. *Exercise and Sport Sciences Reviews* 35(3): 135-140, 2007.
- Casa DJ, McDermott BP, Lee EC, Yeargin SW, Armstrong LE, Maresh CM. Cold-Water Immersion: The Gold Standard For Exertional Heat Stroke Treatment. *Exercise and Sport Sciences Reviews* 35(3): 141-149, 2007.
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- McDermott BP, Casa DJ, Yeargin SW, Armstrong LE, Maresh, CM. Recovery and Return to Activity Following Exertional Heat Stroke: Considerations for the Sports Medicine Staff. *Journal of Sport Rehabilitation* 16(3):163-181, 2007.

- Judelson DA, Maresh CM, Anderson JM, Armstrong LE, Casa DJ, Kraemer WJ, Volek JS. Hydration and muscular performance. Does fluid balance affect strength, power and high-intensity endurance? *Sports Medicine (New Zealand)* 37:907-921, 2007.
- Casa DJ, Becker SM, Ganio MS, Brown CM, Yeargin SW, Roti MW, Siegler J, Blowers JA, Glaviano NR, Huggins RA, Armstrong LE, Maresh CM. Validity of devices that assess body temperature during outdoor exercise in the heat. *Journal of Athletic Training* 42:333-342, 2007.
- Judelson DA, Maresh CM, Farrell MJ, Yamamoto LM, Armstrong LE, Kraemer WJ, Volek JS, Spiering BA, Casa DJ, and Anderson JM. Effect of hydration state on strength, power, and the performance of resistance exercise. *Medicine & Science in Sports & Exercise* 39(10):1817-1824, 2007.
- Sökmen B, Armstrong LE. Caffeine use in sports: Considerations for the athlete. *Journal of Strength & Conditioning Research*, *in press*, 2007.
- Miller SL, Gaine PC, Maresh CM, Armstrong LE, Ebbeling CB, Lamont LS, Rodriguez NR. The effects of nutritional supplementation throughout an endurance run on leucine kinetics during recovery. *International Journal of Sport Nutrition & Exercise Metabolism* 17:456-467, 2007.
- Armstrong, L.E. Assessing hydration status: The elusive gold standard. *Journal of the American College of Nutrition* 26(5):575S-584S, 2007.
- Sökmen B, Armstrong LE, Kraemer WJ, Casa DJ, Dias JC, Judelson DA, Maresh CM. Caffeine use in sports: Considerations for the athlete. *Journal of Strength & Conditioning Research* 22(3): 978-986, 2008.
- Armstrong LE, Casa DJ, Roti MW, Lee EC, Craig SA, Sutherland JW, Fiala KA, Maresh CM. Influence of betaine consumption on strenuous running and sprinting in a hot environment. *Journal of Strength & Conditioning Research* 22(3): 851-860, 2008.
- Spiering BA, Kraemer WJ, Anderson JM, Armstrong LE, Nindl BC, Volek JS, Judelson DA, Joseph M, Vingren JL, Hatfield DL, Fragala MS, Ho J-Y, Maresh CM. Effects of elevated circulating hormones on resistance exercise-induced Akt signaling. *Medicine & Science in Sports & Exercise* 40(6): 1039-1048, 2008.
- Casa DJ, Ganio MS, Lopez RM, McDermott BP, Armstrong LE, Maresh CM. Intravenous vs oral rehydration: physiological, performance and legal considerations. *Medicine & Science in Sports & Exercise*, *in press*, 2008.
- Spiering BA, Kraemer WJ, Anderson JM, Armstrong LE, Nindl BC, Volek JS, Maresh CM. Resistance exercise biology: manipulation of resistance exercise program variables determines the responses of cellular and molecular signaling pathways. *Sports Medicine (New Zealand)* 38(7): 527-540, 2008.
- Yamamoto LM, Judelson DA, Farrell MJ, Lee EC, Armstrong LE, Casa DJ, Kraemer WJ, Volek JS, Maresh CM. Effects of hydration state and resistance exercise on markers of muscle damage. *Journal of Strength & Conditioning Research* 22(5):1387-1393, 2008.
- Ganio MS, Klau JF, Casa DJ, Armstrong LE, Maresh CM. Effect of caffeine on sport-specific endurance performance: a systematic review. *Journal of Strength & Conditioning Research* 23(1): 315-324, 2009.
- Ganio M, Brown C, Casa D, Becker S, Yeargin S, McDermott B, Boots L, Boyd P, Armstrong LE, Maresh CM. Validity and reliability of devices that assess body temperature during indoor exercise in the heat. *Journal of Athletic Training* 44(2):124-135, 2009.
- McDermott B, Casa DJ, Ganio M, Lopez R, Yeargin S, Armstrong LE, Maresh CM. Acute Whole-Body Cooling for Exercise-Induced Hyperthermia: A Systematic Review. *Journal of Athletic Training* 44: 84-93, 2009.
- Lopez R, Casa D, McDermott B, Ganio M, Armstrong LE, Maresh CM. Does Creatine Supplementation Hinder Exercise Heat Tolerance and/or Hydration Status? A Systematic Review. *Journal of Athletic Training* 44: 215-223, 2009.
- McDermott BP, Casa DJ, O'Connor FG, Adams WB, Armstrong LE, Brennan AH, Lopez RM, Stearns RL, Yeargin SW. Cold-Water Dousing With Ice Massage To Treat Exertional Heat Stroke: A Case Series. *Aviation Space Environmental Medicine* 80:720-722, 2009.
- Armstrong LE, Johnson EC, Casa DJ, Ganio MS, McDermott B, Yamamoto LM, Lopez RM, Emmanuel H. The American Football Uniform: Uncompensable Heat Stress and Hyperthermic Exhaustion. *Journal of Athletic Training*, *in press*, 2009.
- Armstrong LE, Pumerantz AC, Fiala KA, Roti MW, Kavouras SA, Casa DJ, Maresh CM. Human Hydration Indices: Acute and Longitudinal Reference Values. *International Journal of Sport Nutrition & Exercise Metabolism*, *in press*, 2009.

Published Books (2) and Selected Book Chapters (30 total)

- Armstrong L.E. *Performing in Extreme Environments*. Human Kinetics Publishers, 2000, 334 pages.
- Armstrong, L.E., editor. *Exertional Heat Illnesses*. Human Kinetics Publishers, April 2003, 275 pages.
- Armstrong, L.E. Environmental Considerations. *ACSM Guidelines for Exercise Testing and Prescription*, 7TH edition. Section V, Appendix E. Baltimore, MD: Lippincott, Williams & Wilkins, 2005, pp. 300-308.
- Armstrong, L.E., Boulant J.A. Neuroendocrine influences on temperature regulation in hot environments. In: *Encyclopaedia of Sports Medicine. Vol. XI. The Endocrine System in Sports and Exercise*, edited by W.J. Kraemer & A.D. Rogol. Blackwell Publishers, 2005, pp. 466-486.
- Armstrong, L.E., Castellani, J.W., et al. Special considerations: Exercise in hot environments. Chapter 8. In: *ACSM Graded Exercise Testing*, 8th edition. American College of Sports Medicine. 2008.

Position Statements of National Sports Medicine Organizations

1. Convertino V.A., Armstrong L.E., Coyle E.F., Mack G.W., Sawka M.N., Senay L.C., Sherman W.M. Exercise and Fluid Replacement. American College of Sports Medicine Position Stand. Med. Sci. Sports Exerc. 28: i-vii, 1996.
2. Armstrong L.E., Epstein Y., Greenleaf J.E., Haymes E.M., Hubbard R.W., et al. Heat and cold illnesses during distance running. American College of Sports Medicine Position Stand. Med. Sci. Sports Exerc. 28(12): i-x, 1996.
3. Casa D.J., Armstrong L.E., Hillman S.K., Montain S.J. et al. National Athletic Trainers' Association Position Statement: Fluid replacement for athletes. J. Athletic Training 35(2):212-224, 2000.
4. Armstrong LE, Roberts WO, Casa DJ, Millard-Stafford M, Moran D. American College of Sports Medicine Position Stand: Exertional Heat Illnesses During Training & Competition. Med. Sci. Sports Exerc. 39(3): 556-572, 2007.

Selected Presentations (163 total)

1. Armstrong, L.E. Assessing Hydration Status. Seminar, Lausanne Switzerland, Nestle' Research Center. Nov. 2004
2. Armstrong L.E. Exertional Hyponatremia: Eight Unresolved Questions. National ACSM Conference, Indianapolis IN, June 4, 2004.
3. Armstrong L.E. Research specific to Triathlon Training and Performance. U.S. Olympic Training Center, Colorado Springs, CO. Lecture at USA Triathlon Level III Coaches Course. November 2004.
4. Armstrong L.E. Controlling body temperature in hot and cold environments: neurotransmitters, neural plasticity, and hormones. Annual Conference of New England Chapter, ACSM. Providence, RI. November 2004.
5. Armstrong, L.E. Nutritional Strategies for Soccer: Counteracting Heat, Cold, High Altitude and Jet Lag. FIFA Consensus Conference on Sports Nutrition, Zurich Switzerland, September 2005
6. Armstrong L.E. Keynote Address: High and Dry: Tales from the edge of a Normal Distribution. Annual Conference of New England Chapter of ACSM. Providence, RI. November 2005.
7. Armstrong, L.E. Nutritional Interventions for Soccer: Counteracting Heat, Cold, High Altitude and Jet Lag. Zurich, Switzerland. Lecture at Fédération Internationale de Football Association (FIFA) Consensus Conference on Nutrition and Football. August 2005.
8. Armstrong, L.E. Hydration and Nutritional Needs of the Olympic Distance (ITU) and Long-Distance Elite Triathlete. USA Triathlon Conference, Colorado Springs, CO. February 2006
9. Armstrong, L.E. Sport Drink Considerations. USA Cycling Conference, Colorado Springs, CO. Oct. 2006.
10. Armstrong L.E. Hydration and Performance: Field and Event Studies. Featured Science Symposium presented at Annual ACSM Conference, Denver CO, June 2006.
11. Armstrong L.E. Does Caffeine Chronically Alter Fluid and Electrolyte Balance or Thermoregulation in Humans? Symposium presentation at Annual ACSM Conference, Denver CO, June 2006.
12. Armstrong L.E. ACSM Position Stand: Exertional Heat Illnesses During Training and Competition. Annual Conference of New England Chapter, ACSM. Providence, RI. November, 2006.
13. Armstrong, L.E. Assessing Hydration Status: Advising Sedentary & Active Adults. Nutrition Science Master's Student Seminar. Loughborough University, Leicestershire, U.K. March, 2007.
14. Armstrong, L.E. Hydration Assessment Techniques: Use, Misuse and The Elusive Gold Standard. Faculty, Graduate Student, and Undergraduate Student Seminar. University of Wales, Bangor, North Wales. March, 2007.
15. Armstrong L.E. Caffeine. Part of seminar titled Influence of Nutritional Supplements on Exercise-heat Tolerance and Hydration Status. Annual National ACSM Conference, New Orleans, LA. May, 2007.
16. Armstrong L.E. Review of the new ACSM Position Stand: Exertional Heat Illnesses During Training and Competition. Annual National ACSM Conference, New Orleans, LA. May, 2007.
17. Armstrong L.E. The Spectrum of Unusual Thermal and Hydration Extremes. Keynote Lecture. Annual Conference of Southeast Chapter of ACSM. Birmingham, AL. February 16, 2008.
18. Armstrong, L.E. Hydration Indices: The Elusive Gold Standard. Seminar at Danone Research, France. March, 2008.
19. Armstrong L.E. Timing and volume of fluid replacement following workouts and competition. Regional Conference of the National Strength and Conditioning Association ("Recovery & Restoration Symposium"), Storrs, CT. June, 2008.
20. Armstrong L.E. Prevention of exertional heatstroke: what factors compromise/enhance exercise heat tolerance? Annual Conference of the National Athletic Trainers' Association, St. Louis MO, June 2008.
21. Armstrong L.E. Influences of proper hydration on psychological, physiological, and health factors: Conference Summary. Hydration for Health Conference, Paris France. June, 2009.

Advisor at Mass Participation Events and Medical Tent Data Collection

1. Boston Marathon, Boston, MA, April of each year: 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995
2. Falmouth Road Race, Falmouth, MA, August of each year: 1992, 1993, 1994, 1999, 2000
3. Marine Corps Marathon, Washington, D.C., October of each year: 2005, 2006, 2007
4. Hotter 'n Hell Hundred [100-mile cycling event], Wichita Falls, TX. August 2007