

Curriculum Vita
RODGER KRAM

Department of Integrative Physiology
University of Colorado
Boulder, CO 80309-0354

Phone: (303) 492-7984
Fax: (303) 492-4009
E-mail: rodger.kram@colorado.edu

ACADEMIC APPOINTMENTS

Associate Professor *Emeritus*, University of Colorado Boulder 2017 - present
Associate Professor, University of Colorado Boulder 2000 - 2016
Assistant Professor, University of California Berkeley 1995 - 2000
Post-Doctoral Researcher, University of California Berkeley 1992 -1995
Lecturer, Harvard University 1991

EDUCATION

Harvard University, M.S., Ph.D. Organismic and Evolutionary Biology, 1991
The Pennsylvania State University, M.S. Biomechanics, 1985
Northwestern University, B.A. Biology, 1983

HONORS

Hay Award, American Society of Biomechanics, 2018
Marinus Smith Award, University of Colorado 2016
Borelli Award, American Society of Biomechanics, 2015
University of Colorado Outstanding Faculty Graduate Advising Award, 2014
Boulder Faculty Assembly Award for Excellence in Teaching, 2011
Fellow, American Society of Biomechanics, 2011
President, American Society of Biomechanics, 2008
University of Colorado Multicultural Engineering Program, Faculty Appreciation Award, 2006
University of Colorado, Boulder Inventor of the Year, 2006

MAJOR RESEARCH GRANTS

Optimizing the stiffness and height of running-specific leg prostheses
Principal Investigator: Alena Grabowski (Rodger Kram, Co-Investigator, 25% effort)
Department of Defense
BADER Consortium - Bridging Advanced Developments for Exceptional Rehabilitation
2013-2016
\$716,000 total costs

Biomechanical Basis for the Metabolic Cost of Locomotion
Principal Investigator: Rodger Kram.
National Institutes of Health, R-29, FIRST Award
1998-2004
\$499,829 total costs

PATENT

R. Kram, J.R. Modica and J.S. Gottschall. Force assistance device for walking rehabilitation therapy. US Patent 7,998,042, issued Aug. 16, 2011

AD HOC GRANT REVIEWER

National Institutes of Health, National Science Foundation, US Department of Veterans Affairs, NSERC (Canada), Netherlands Organization for Scientific Research (NWO).

JOURNAL REFEREE

American Journal of Primatology, American Journal Physical Anthropology, American Zoologist, Journal of Applied Physiology, Journal of Biomechanics, Journal of Comparative Biochemistry and Physiology, Journal of Experimental Biology, Journal of Morphology, Journal of Physiology, Journal of Theoretical Biology, Medicine and Science in Sports and Exercise, Exercise and Sports Science Reviews, Nature, Physiological Zoology, Proceedings of the National Academy of Science, Proceedings of the Royal Society, Science.

Editorial Board Member: *Journal of Applied Biomechanics*

PEER-REVIEWED PUBLICATIONS

104. T.J. Breiner, A.L.R. Ortiz, and **R. Kram**. Level, uphill and downhill running economy values are strongly inter-correlated. *European J. Applied Physiology*. (2018).
<https://doi.org/10.1007/s00421-018-4021-x>
103. W. Hoogkamer, S.Kipp, and **R. Kram**. The biomechanics of competitive male runners in three marathon racingshoes: a randomized crossover design. *Sports Med.* (2018), <https://doi.org/10.1007/s40279-018-1024-z>
102. S. Kipp, A.M. Grabowski and **R. Kram**. What determines the metabolic cost of human running across a wide range of velocities? *J. Experimental Biology* (2018) 221: jeb184218. doi:10.1242/jeb.184218 Published September 24, 2018.
101. E.M. Summerside, **R. Kram** and A.A. Ahmed. Contributions of metabolic and temporal costs to human gait selection. *J. Royal Society Interface*. 2018.
<http://doi.org/10.1098/rsif.2018.0197>
100. W. Swinnen, S. Kipp and R. Kram. Comparison of running and cycling economy in runners, cyclists, and triathletes *European J. Applied Physiology* 2018.
<https://doi.org/10.1007/s00421-018-3865-4>
99. S. Kipp, W.C. Byrnes and R. Kram. Calculating metabolic energy expenditure across a wide range of exercise intensities: the equation matters. *Appl. Physiol. Nutr. Metab.* 43:639-642, 2018. <dx.doi.org/10.1139/apnm-2017-0781>
98. O.N. Beck, S. Kipp, W.C. Byrnes and **R. Kram**. Viewpoint: Use aerobic energy expenditure instead of oxygen uptake to quantify exercise intensity and predict endurance performance. *J. Applied Physiology*. 2018. <https://doi.org/10.1152/jappphysiol.00940.2017>
97. W. Hoogkamer, S. Kipp, J.H. Frank, E.M. Farina, G. Luo, **R. Kram**. A comparison of the energetic cost of running in marathon racing shoes. *Sports Medicine*. 48:1009-1019, 2018. DOI 10.1007/s40279-017-0811-2
96. M.E. Batliner, S. Kipp, A.M. Grabowski, **R. Kram** and W.C. Byrnes. Does metabolic rate increase linearly with running speed in all distance runners? *Sports Medicine International Open*, 38: 2:1132-1138, 2018. DOI: 10.1055/s-0043-122068
95. A.L.R. Ortiz, N. Giovanelli and **R. Kram**. The metabolic costs of walking and running up a 30-degree incline: implications for vertical kilometer foot races. *European Journal of Applied Physiology*, 117:1869-1876, 2017. DOI: 10.1007/s00421-017-3677-y
94. A.H. Straw, W. Hoogkamer and **R. Kram**. Changing relative crank angle increases the metabolic cost of leg cycling. *European Journal of Applied Physiology*, 117:2021-2027, 2017. DOI: 10.1007/s00421-017-3691-0.

93. W. Hoogkamer, R. Kram and C.J. Arellano. How biomechanical improvements in running economy could break the 2-hour marathon barrier. *Sports Medicine*, 47:1739-1750, 2017. DOI:[10.1007/s40279-017-0708-0](https://doi.org/10.1007/s40279-017-0708-0).
92. S. Kipp, P. Taboga and **R. Kram**. Ground reaction forces during steeplechase hurdling and waterjumps. *Sports Biomechanics*. 2017. DOI: 10.1080/14763141.2016.1212917
91. A.H. Straw and **R. Kram**, Effects of shoe type and shoe–pedal interface on the metabolic cost of bicycling. *Footwear Science*. 8:19-22, 2016. <http://dx.doi.org/10.1080/19424280.2016.1140817>
90. W. Hoogkamer, S. Kipp, B.A. Spiering and **R. Kram**. Altered running economy directly translates to altered distance-running performance. *Medicine and Science in Sports and Exercise*. 48:2175-2180, 2016. DOI: 10.1249/MSS.0000000000001012
89. J.E. Peterman, K.L. Morris, **R. Kram** and W.C. Byrnes. Pedelects as a physically active transportation mode. *European J. of Applied Physiology*. 116:1565-1573, 2016. DOI: 10.1007/s00421-016-3408-9.
88. J.E. Peterman, K.P. Wright Jr., E.L. Melanson, **R. Kram** and W.C. Byrnes. Motor-driven (passive) cycling: a potential physical inactivity countermeasure? *Medicine and Science in Sports and Exercise*, 48:1821-1828, 2016. DOI: 10.1249/MSS.0000000000000947.
87. P. Taboga, **R. Kram** and A.M. Grabowski. Maximum-speed curve-running biomechanics of sprinters with and without unilateral leg amputations. *J. Experimental Biology*, 219:851-858, 2016. DOI: 10.1242/jeb.133488
86. N. Giovanelli, A.L.R. Ortiz, K. Henninger and **R. Kram**. Energetics of vertical kilometer foot races; is steeper cheaper? *J. Applied Physiology*, 120:370-375, 2016. DOI: 10.1152/jappphysiol.00546.2015
85. O.N. Beck, S. Kipp, J.M. Roby, A.M. Grabowski, **R. Kram** and J.D. Ortega. Older runners retain youthful running economy despite biomechanical differences. *Medicine and Science in Sports and Exercise*, 48:697-704, 2016. DOI: 10.1249/MSS.0000000000000820
84. C.J. Arellano, W.J. McDermott, **R. Kram**, and A.M. Grabowski. Effect of running speed and leg prostheses on mediolateral foot placement and its variability. *PLOS ONE*. 2015. DOI: 10.1371/journal.pone.0115637
83. J.D. Ortega, O.N. Beck, J.M. Roby, A.L. Turney and **R. Kram**. Running for exercise mitigates age-related deterioration of walking economy. *PLOS ONE*, 2014. DOI: 10.1371/journal.pone.011347
82. A.L. Kehler, E. Hajkova, H.-C. Holmberg and **R. Kram**. Forces and mechanical energy

fluctuations during diagonal stride roller skiing; running on wheels? *J. Experimental Biology*, 217: 3779-3785, 2014.

81. R.G. Ellis, B. Sumner and **R. Kram**. Muscle contributions to propulsion and braking during walking and running; insight from external force perturbations. *Gait & Posture*, 40:594–599, 2014.

80. P. Taboga, A.M. Grabowski, P.E. di Prampero and **R. Kram**. Optimal starting block configuration in sprint running; a comparison of biological and prosthetic legs. *J. Applied Biomechanics*, 30:381-389, 2014.

79. W. Hoogkamer, P. Taboga and **R. Kram**. Applying the cost of generating force hypothesis to uphill running. *PeerJ*. 2014. DOI 10.7717/peerj.482

78. S.M. O'Connor, T.J. Dawson, **R. Kram** and J.M. Donelan. The kangaroo's tail propels and powers pentapedal locomotion. *Biology Letters*. 10(7), 2014. doi:2014.0381

77. C.J. Arellano and **R. Kram**. Partitioning the metabolic cost of human running: a task-by-task approach. *Integrative Comparative Biology*. 2014. DOI: icu033

76. C.J. Arellano and **R. Kram**. The metabolic cost of human running: is swinging the arms worth it? *J. Experimental Biology*. 217:2456-2461, 2014.

75. J.L. Bartlett, B. Sumner, R.G. Ellis and **R. Kram**. Activity and functions of the human gluteal muscles in walking, running, sprinting and climbing. *American J. Physical Anthropology*. 153:124-131, 2014.

74. J.R. Franz, M. Maletis and **R. Kram**. Real-time feedback enhances forward propulsion during walking in old adults. *Clinical Biomechanics*. 29:68-74, 2014.

73. K.D. Tung, J.R. Franz and **R. Kram**. A test of the metabolic cost of cushioning hypothesis during unshod and shod running. *Medicine and Science in Sports and Exercise*. 46:324-329, 2014.

72. J.R. Franz and **R. Kram**. Advanced age and the mechanics of uphill walking: a joint-level, inverse dynamic analysis. *Gait & Posture*. 39:135-140, 2014.

71. M. Reger, J.E. Peterman, **R. Kram**, W.C. Byrnes. Exercise efficiency of low power output cycling. *Scandinavian J. Medicine and Science in Sports*. 23:713-721, 2013.

70. N. Look, C.J. Arellano, A.M. Grabowski, W.J. McDermott, **R. Kram** and E. Bradley. Dynamic stability of running: the effects of speed and leg amputations on the maximal Lyapunov exponent. *Chaos*. 23: 043131 <http://dx.doi.org/10.1063/1.4837095>, 2013.

69. R.G. Ellis, K.C. Howard and **R. Kram**. The metabolic and mechanical costs of step time asymmetry in walking. *Proceedings of the Royal Society B*. 280:(1756), 2013.

68. J.R. Franz and **R. Kram**. Advanced age affects the individual leg mechanics of level, uphill and downhill walking. *J. Biomechanics*, 46:535-540, 2013.
67. J.R. Franz and **R. Kram**. How does age affect leg muscle activity/coactivity during uphill and downhill walking? *Gait & Posture*. 37:378–384, 2013.
66. J.R. Franz, C.M. Wierzbinski and **R. Kram**. Metabolic cost of running barefoot versus shod: is lighter better? *Medicine and Science in Sports and Exercise*. 44:1519-1525, 2012.
65. K.L. Snyder, **R. Kram** and J.S. Gottschall. The role of elastic energy storage and recovery in downhill and uphill running. *J. Experimental Biology*. 215:2283-2287, 2012.
64. H.J. Huang, **R. Kram** and A.A. Ahmed. Reduction of metabolic cost during motor learning of arm reaching dynamics. *J. Neuroscience*. 32:2182-2190, 2012.
63. C.P. McGowan, A.M. Grabowski, W.J. McDermott, H.M. Herr and **R. Kram**. Leg stiffness of sprinters using running specific prostheses. *J. of the Royal Society Interface*. 9:1975-1982, 2012.
62. J.E. Peterman, **R. Kram** and W.C. Byrnes. Factors affecting the increased energy expenditure during passive cycling. *European J. Applied Physiology*. 112:3341-3348, 2012.
61. C.J. Arellano and **R. Kram**. The energetic cost of maintaining lateral balance during human running. *J. Applied Physiology*. 112:427-434, 2012.
60. J.R. Franz, N.E. Lyddon, **R. Kram**. Mechanical work performed by the individual legs during uphill and downhill walking. *J. Biomechanics*. 45:257-262, 2012.
59. J.R. Franz and **R. Kram**. The effects of grade and speed on leg muscle activations during walking. *Gait & Posture*. 35:143-147, 2012.
58. C.J. Arellano and **R. Kram**. The effects of step width and arm swing on energetic cost and lateral balance during running. *J. Biomechanics*. 44:1291-1295, 2011.
57. J. R. Priebe and **R. Kram**. Why is walker-assisted gait metabolically expensive? *Gait & Posture*. 34:265-269, 2011.
56. A.C. Lim, E.P. Homestead, A.G. Edwards, T.C. Carver, **R. Kram** and W.C. Byrnes. Measuring changes in aerodynamic/rolling resistances by cycle-mounted power meters. *Medicine & Science in Sports & Exercise*. 43:853-860, 2011.
55. A.M. Grabowski, J. Rifkin and **R. Kram**. K3 Promoter prosthetic foot reduces the metabolic cost of walking for unilateral transtibial amputees. *J. Prosthetics & Orthotics*. 22:106-112, 2010.

54. A.M. Grabowski, C.P. McGowan, W.J. McDermott, M.T. Beale, **R. Kram** and H.M. Herr. Running specific prostheses limit ground-force during sprinting. *Biology Letters*. 6:201-204, 2010.
53. R.C. Browning, C.P. McGowan and **R. Kram**. Obesity does not increase external work per kilogram body mass during walking. *J. Biomechanics*. 42:2273-2278, 2009.
52. P.G. Weyand, M.W. Bundle, C.P. McGowan, A. Grabowski, M.B. Brown, **R. Kram**, and H. Herr. The fastest runner on artificial legs: different limbs, similar function? *J. Applied Physiology*. 107:903-911, 2009.
51. McGowan, C.P., **R. Kram** and R.R. Neptune. Modulation of leg muscle function in response to altered demand for body support and forward propulsion during walking. *J. Biomechanics*. 42:850-856, 2009.
50. P.A. Zani and **R. Kram**. Low metabolic cost of locomotion in ornate box turtles, *Terrapene ornata*. *J. Experimental Biology*. 211:3671-3676, 2008.
49. A.M. Grabowski and **R. Kram**. Effects of velocity and weight support on ground reaction forces and metabolic power during running. *J. Applied Biomechanics*. 24:288-297, 2008.
48. A.M. Grabowski and **R. Kram**. Running with horizontal pulling forces: the benefits of towing. *European J. Applied Physiology*. 104:473-479, 2008.
47. C.P. McGowan, R.R. Neptune and **R. Kram**. Independent effects of weight and mass on plantar flexor activity during walking: implications for their contributions to body support and forward propulsion. *J. Applied Physiology*. 105:486-494, 2008.
46. J.L. Bartlett and **R. Kram**. Changing the demand on specific muscle groups affects the walk-run transition speed. *J. Experimental Biology*. 211:1281-1288, 2008.
45. L.P. J. Teunissen, A. Grabowski, and **R. Kram**. Effects of independently altering body weight and body mass on the metabolic cost of running. *J. Experimental Biology*. 210:4418-4427, 2007.
44. R.C. Browning and **R. Kram**. Effects of obesity on the biomechanics of walking at different speeds. *Medicine and Science in Sports and Exercise*. 39:1632-1641, 2007.
43. R.C. Browning, J.R. Modica, **R. Kram** and A. Goswami. The effect of adding mass to the legs on the energetics and biomechanics of walking. *Medicine and Science in Sports and Exercise*. 39:515-525, 2007.
42. Y.-H. Chang and **R. Kram**. Limitations to maximum running speed on flat curves. *J. Experimental Biology*. 210:971-982, 2007.

41. J.S. Gottschall and **R. Kram**. Mechanical energy fluctuations during hill walking: the effects of slope on inverted pendulum exchange. *Journal of Experimental Biology*. 209:4895-4900, 2006.
40. J.R. Hutchinson, D. Schwerda, D.J. Famini, R.H.I. Dale, M.S. Fischer, and **R. Kram**. The locomotor kinematics of Asian and African elephants: changes with speed and size. *J. Experimental Biology*. 209 3812-3827, 2006.
39. R.C. Browning, E.A. Baker, J.A. Herron and **R. Kram**. Effects of obesity and sex on the energetic cost and preferred speed of walking. *J. Applied Physiology*. 100:390-398, 2006.
38. J.S. Gottschall and **R. Kram**. Energy cost and muscular activity required for leg swing during walking. *J. Applied Physiology*. 99:23-30, 2005.
37. R.C. Browning and **R. Kram**. Energetic cost and preferred speed of walking in obese vs. normal weight women. *Obesity Research*. 13:891-899, 2005.
36. J.R. Modica and **R. Kram**. Metabolic energy and muscular effort required for leg swing in running. *J. Applied Physiology*. 98:2126-2131, 2005.
35. P.A. Zani, J.S. Gottschall and **R. Kram**. Giant Galápagos tortoises walk without inverted pendulum mechanical-energy exchange , *J. Experimental Biology*. 208:1489-1494, 2005.
34. J.S. Gottschall and **R. Kram**. Ground reaction forces during downhill and uphill running. *J. Biomechanics*. 38:445-452, 2005.
33. A. Grabowski, C.T. Farley, and **R. Kram**. Independent metabolic costs of supporting body weight and accelerating body mass during walking. *J. Applied Physiology*. 98:579-583, 2005.
32. T.M. Griffin, **R. Kram**, S.J. Wickler and D.F. Hoyt. Biomechanical and energetic determinants of the walk–trot transition in horses. *J. Experimental Biology*. 207:4215-4223, 2004.
31. J.M. Donelan, D.W. Shipman, **R. Kram** and A.D. Kuo. Mechanical and metabolic requirements for active lateral stabilization in human walking. *J. Biomechanics*. 37:827-835, 2004.
30. T.M. Griffin, T.J. Roberts and **R. Kram**. Metabolic cost of generating muscular force in human walking: insights from load-carrying and speed experiments. *J. Applied Physiology*. 95:172-183, 2003.
29. J.S. Gottschall and **R. Kram**. Energy cost and muscular activity required for propulsion during walking. *J. Applied Physiology*. 94:1766-1772, 2003.
28. J.R. Hutchinson, D. Famini, R. Lair, and **R. Kram**. Are fast-moving elephants really running?

Nature. 422 (6931): 493-494, 2003.

27. J.M. Donelan, **R. Kram**, and A.D. Kuo. Mechanical work for step-to-step transitions is a major determinant of the metabolic cost of walking. *J. Experimental Biology*. 205:3717-3727, 2002.

26. J.M. Donelan, **R. Kram**, and A.D. Kuo. Simultaneous positive and negative external mechanical work in human walking. *J. Biomechanics*. 35:117-124, 2002.

25. J.M. Donelan, **R. Kram** and A.D. Kuo. Mechanical and metabolic determinants of the preferred step width in human walking. *Proc. Royal Society London B*. 268:1985-1992, 2001.

24. Y.-H. Chang, C. M. Hamerski and **R. Kram**. Applied horizontal force increases impact loading in reduced gravity running. *J. Biomechanics*. 34:679-685, 2001.

23. T.M. Griffin and **R. Kram**. Penguin waddling is not wasteful. *Nature*. 408:929, 2000.

22. J.M. Donelan and **R. Kram**. Exploring dynamic similarity in human running using simulated reduced gravity. *J. Experimental Biology*. 203:2405-2415, 2000.

21. **R. Kram**. Muscular force or work: what determines the metabolic cost of running? *Exercise and Sports Science Reviews*. 28:138-143, 2000.

20. M.H. Dickinson, C.T. Farley, R.J. Full, M.A.R. Koehl, **R. Kram** and S. Lehman. How animals move: an integrative view. *Science*. 288:100-106, 2000.

19. Y.-H. Chang, H.W. C. Huang, C. M. Hamerski, and **R. Kram**. The independent effects of gravity and inertia on running mechanics. *J. Experimental Biology*. 203: 229-238, 2000.

18. Y.H. Chang and **R. Kram**. Metabolic cost of generating horizontal forces during human running. *J. Applied Physiology*. 86:1657-1662, 1999.

17. T.M. Griffin, N.A. Tolani and **R. Kram**. Walking in simulated reduced gravity: mechanical energy fluctuations and exchange. *J. Applied Physiology* 86: 383-390, 1999.

16. T.J. Roberts, **R. Kram**, P.G. Weyand and C.R. Taylor. Energetics of bipedal running I. Metabolic cost of generating force. *J. Experimental Biology*. 201: 2745-2751, 1998.

15. **R. Kram**, T.M. Griffin, J.M. Donelan, Y.H. Chang. Force-treadmill for measuring vertical and horizontal ground reaction forces. *J. Applied Physiology*. 85: 764-769, 1998.

14. **R. Kram** and T.J. Dawson. Energetics and biomechanics of locomotion by red kangaroos (*Macropus rufus*). *Comparative Biochemistry and Physiology Part B*. 120: 41-49, 1998.

13. J.M. Donelan and **R. Kram**. The effects of size, speed and gravity on the kinematics of human walking; a test of the dynamic similarity hypothesis. *J. Experimental Biology*. 200: 3193-3201, 1997.

12. **R. Kram**, R.J. Full and B. Wong. 3-d kinematics and internal mechanical energies of running cockroaches, (*Blaberus discoidalis*). *J. Experimental Biology*. 200: 1919-1929, 1997.

11. **R. Kram**, A. Domingo and D.P. Ferris. Effect of reduced gravity on the preferred walk-run transition speed. *J. Experimental Biology*. 200: 821-826, 1997.

10. **R. Kram**. Inexpensive load carrying by rhinoceros beetles. *J. Experimental Biology*. 199: 609-612, 1996.

9. V.A. Langman, T.J. Roberts, J. Black, G.M.O. Maloiy, N.C. Heglund, J.-M. Weber, **R. Kram** and C.R. Taylor. Moving cheaply: energetics of walking in the African elephant. *J. Experimental Biology*. 198: 629-632, 1995.

8. **R. Kram**. Carrying loads with springy poles. *J. Applied Physiology*. 72: 1119-1122, 1991.

7. J. He, **R. Kram** and T. A. McMahon. The mechanics of running under simulated low gravity. *J. Applied Physiology*. 71: 863-867, 1991.

6. **R. Kram** and C.R. Taylor. Energetics of running: a new perspective. *Nature*. 346: 265-267, 1990.

5. **R. Kram** and A.J. Powell. A treadmill-mounted force platform. *J. Applied Physiology*. 67: 1692-1698, 1989.

4. P.R. Cavanagh and **R. Kram**. Stride length in distance running: velocity, body dimensions, and added mass. *Medicine and Science in Sports and Exercise*. 21: 467-479, 1989.

3. P.R. Cavanagh, and **R. Kram**. The efficiency of human movement - a statement of the problem. *Medicine and Science in Sports and Exercise*. 17: 304-308, 1985.

2. P.R. Cavanagh and **R. Kram**. Mechanical and muscular factors affecting the efficiency of human movement. *Medicine and Science in Sports and Exercise*. 17: 326-331, 1985.

1. P.R. Cavanagh, G.C. Andrew, **R. Kram**, M.M. Rodgers, D.J. Sanderson, & E.M. Hennig. An approach to biomechanical profiling of elite distance runners. *International J. Sports Biomechanics*. 1: 36-62, 1985.

OTHER PUBLICATIONS (editorial, invited, book chapters etc.)

R. Kram and T.J. Roberts. A.V. Hill sticks out his neck. *J. Experimental Biology*. 219:468-469, 2016. DOI: 10.1242/jeb.123372

R. Kram and J.R. Franz. Is barefoot running more economical? *Int. J Sports Medicine* 33: 249, 2012.

R. Kram. Taylor's treadmill menagerie. *J. Experimental Biology*. 215:2349-2350, 2012.

R. Kram. Bouncing to conclusions: clear evidence for the metabolic cost of generating muscular force. *J. Applied Physiology*. 110:865-866, 2011.

R. Kram, C.J. Arellano, and J.R. Franz. The metabolic cost of locomotion; muscle by muscle. *Exercise & Sport Sciences Reviews*. 39:57-58, 2011.

R. Kram, A.M. Grabowski, C.P. McGowan, M.B. Brown and H.M. Herr. Counterpoint: artificial limbs do not make artificially fast running speeds possible. *J. Applied Physiology*. 108:1012-1014, 2010.

R.C. Browning and **R. Kram**. Pound for pound: working out how obesity influences the energetics of walking. *J. Applied Physiology*. 106:1755-1756, 2009.

R. Kram. Are efficiency and the cost of generating force both relevant concepts? *J. Applied Biomechanics*. 13: 460-463, 1997.

K.M. Baldwin, T.P. White, S.B. Arnaud, V.R. Edgerton, W.J. Kraemer, **R. Kram**, D. Raab-Cullen and C.M. Snow. Musculoskeletal adaptations to weightlessness and development of effective countermeasures. *Medicine and Science in Sports Exercise*. 28: 1247-1253, 1996.

S.L. Lehman, **R. Kram** and C.T. Farley. Locomotion and muscle biomechanics. In: *Introduction to Bioengineering*. Oxford Univ. Press, 1996.

P.R. Cavanagh and **R. Kram**. Stride length in distance running: velocity, body dimensions and added mass effects. In: *Biomechanics of distance running*. Human Kinetics Books, 1990.

R. Kram. Interaction of ventilatory movements with distance running biomechanics. M.S. Thesis, The Pennsylvania State University, 1986. Published by Microform Publications, Univ. of Oregon 1989 (microfiche).

R. Kram. Comment on 'on the relation between joint moments and pedaling rates'. *J. Biomechanics*. 20: 554, 1987.

INVITED LECTURES

Hay Award Lecture, American Society of Biomechanics, 2018
Nike Global Research Symposium, 2016.
Iowa State University, Annual Pease Family Lecture, Kinesiology Dept., 2016.
3rd Annual International Autumn School on Movement Science. Berlin, 2016
Brigham Young University, Exercise Science Department, 2015.
World Congress of Biomechanics, 2014.
University of Virginia Running Medicine Conference, 2013.
University of Calgary, 2012.
Nike Global Research Symposium, 2012.
American College of Sports Medicine, Rocky Mountain Chapter Meeting, Keynote, 2011
Pennsylvania State University, Kinesiology Department Seminar, 2011.
American College of Sports Medicine, Keynote Lecture, 2010.
Dynamic Walking Conference, MIT, 2010
American College of Sports Medicine, Northland Regional Meeting, Keynote Address, 2009.
American Society of Biomechanics, Pacific Northwest Regional Meet., Keynote Lecture, 2007.
Colorado State University, Health and Exercise Science Department Seminar, 2007.
University of Houston, Health and Human Performance Department Seminar, 2007.
Brown University, Biology Department Seminar, 2006.
Univ. of Michigan, Kinesiology Dept. Seminar, 2006.
Arizona State University, NSF IGERT Group on Neural & Musculoskeletal Adaptation, 2005.
Cornell University, NSF IGERT Group on Machines and Organisms, 2005.
Northeastern University, Biology Department, 2004.
Free University of Amsterdam, Faculty of Human Movement Sciences, 2003.
Harvard University, Organismic and Evolutionary Biology Dept. Seminar, 1999.
University of Massachusetts, Joint Biology and Exercise Science Depts. Seminar, 1999.
3rd IFKB Symposium. Institute for Fundamental and Clinical Human Movement Sciences. Free University of Amsterdam, 1998.
Allerton Conference on Control Theory. Symposium on the Control of Animal and Robotic Locomotion, "Energetics of Animal Locomotion", 1998.
California Polytechnic University - Pomona, Animal Locomotion Symposium, 1998.
University of California - Berkeley, Integrative Biology Department Seminar, 1998.
Stanford University, Hopkins Marine Lab Seminar Series, 1998.
Arizona State University, Exercise Science Department Seminar, 1997.
Santa Fe Institute Symposium on Scaling in Biology, "Scaling the metabolic cost of terrestrial locomotion", 1997.
NASA sponsored symposium at American College of Sports Medicine Annual Meeting, "A biomechanical perspective on exercise countermeasures for space flight", 1996.
University of California - Berkeley, Bioengineering Graduate Group Seminar, 1996.
Pennsylvania State University, Kinesiology Department Colloquium, 1996.
Harvard University, C. Richard Taylor Memorial Symposium, 1996.
Stanford University, Mechanical Engineering Department Seminar, 1995.
ACSM/NASA Roundtable Conference. "A biomechanical perspective on exercise countermeasures for space flight", Indianapolis, 1995.
University of California - Davis, Bioengineering Department Seminar, 1995.

University of California - Berkeley, Mechanical Engineering Department Seminar, 1995.
University of California - Riverside, Entomology Department Seminar, 1995.
World Congress of Biomechanics, Symposium on Locomotion Biomechanics,
“Comparative biomechanics: a tool for elucidating general principles of movement”, 1994.
University of California – Davis, Physiological Sciences Lecture Series, 1993.
Iowa State University Physiological Council, Keynote Lecture, 1993.
Northern Arizona University, Exercise Science Department Seminar, 1993.
Rank Prize Fund Symposium on Muscular Activity and Energy Expenditure.
Grasmere, England, 1990.
University of Milano, Italy, Physiology Department Seminar, 1989

RESEARCH STUDENTS

Former Post-Doctoral Fellows: Peter Zani, Ph.D., Craig McGowan, Ph.D.

Current Post-Doctoral Fellows: Wouter Hoogkamer, Ph.D.

Graduated Doctoral Students: Young-Hui Chang, Ph.D., J. Maxwell Donelan, Ph.D., Timothy M. Griffin, Ph.D., Jinger S. Gottschall, Ph.D., Ray Browning, Ph.D., Alena Grabowski, Ph.D., Jamie Bartlett, Ph.D., Kristine Snyder, Ph.D., Christopher Arellano, Ph.D., Jason Franz, Ph.D.

Graduated M.S. Students: J. Maxwell Donelan, Jesse Modica, Jamie Murray, Ryan Meardon, Chris Hurt, Jon Priebe, Erin Warddrip, Melissa Thompson, Michaela Reger, Richard Ellis, Kryztopher Tung, Alyse Kehler, Adam Carahalios, Bryant Pham, Shalaya Kipp, Jesse Frank, Asher Straw, Petra Hyncicova.

Former International Visiting Graduate Students:

Free University Amsterdam - Wouter Hoogkamer, Ellen Generaal, Lennart Teunissen, Bas Moed, Kirsten Bijker

University of Groningen, the Netherlands - Linda Generaal

University of Udine, Italy - Paolo Taboga, Nicola Giovanelli

University of Ste. Etienne, France - Christelle Chau

University of Queensland, Australia - Ross Wilkinson

University of Cologne, Germany - Wannes Swinnen

Universidade Federal do Rio Grande do Sul, Brazil – Edson Soares da silva