

Biomedical Engineering

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Core Faculty Profile

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Wendy M. Murray

Research Interests

Activities of daily living involve the coordinated control of multiple joints of the upper extremity. We use our arms and hands within an extensive functional workspace, and we complete tasks that require everything from intricate manipulation to raw strength. As a first example of the complexity of our arm movements, just the orientation of the limb with respect to gravity varies considerably during basic daily tasks (compare typing on a keyboard, putting on shoes, and reaching for an item on an overhead shelf). The human hand provides a remarkable interface with our environment, allowing self-care, grasp and release, communication, and the ability to connect with other people. The loss of hand and arm function presents a severe disability.

The aim of my research is to use biomechanics as a framework for investigating how we move and control our arms and hands. The foundation for my work is the development of biomechanical models that represent accurately the mechanical actions of the upper extremity muscles. Computer simulations are integrated with quantitative anatomy, in vivo laser diffraction, medical imaging, and dynamometry to better characterize the basic functional capabilities of individual muscles and to quantify how these capabilities are altered by physical impairments or surgical interventions. Given the intricate anatomy of the upper extremity, I am interested in understanding how musculoskeletal design contributes to limb mechanics. I am especially motivated to apply this research to help improve function following injuries and impairments that affect the upper limb.

Selected Publications

1. Elly S. LaRoque, Wendy M. Murray, Sarah Langley, Sanaz Hariri, Benjamin Parker Levine and Amy L. Ladd(2008) **Muscle Moment Arms in the First Dorsal Extensor Compartment After Radial Malunion. A Cadaver Study.** *J Bone Jt Surg*, 2008; 90:1979-1987. doi:10.2106/JBJS.G.01015. [pdf of published paper](#)
2. Towles, J. D., Hentz, V. R., and Murray, W. M. (2008) **Use of intrinsic thumb muscles may help to improve lateral pinch function restored by tendon transfer.** *Clin Biomech.(Briston, Avon)*, 23 (2008) 387-394 [pdf of published paper](#)
3. Holzbaur, K. R. S., Murray, W. M., Gold, G. E., and Delp, S. L. (2007) **Upper limb muscle volumes in adult subjects.** *J Biomech*, 40:742-9, 2007 [pdf of published paper](#)
4. Holzbaur, K. R. S., Delp, S. L., Gold, G. E., and Murray, W. M. (2007) **Moment-generating capacity of upper limb muscles.** *J Biomech*, 40:2442-2449, 2007. [pdf of published paper](#)
5. Johanson, M. E., Smaby, N., Hentz, V. R., and Murray, W. M. (2006) **Reduced activation in transferred brachioradialis muscles to restore lateral pinch in**

- tetraplegia. *J Hand Surg*, 31:747-53, 2006. [pdf of published paper](#)
6. Murray, W. M., Hentz, V. R., Fridén, J., Lieber, R.L. (2006) **Variability in surgical technique for brachioradialis tendon transfer. Evidence and implications.** *J Bone Jt Surg*, 88:2009-2016, 2006. [pdf of published paper](#)
 7. Lieber, R. L., Murray, W. M., Clark, D. L., Hentz, V. R., and Fridén, J.(2005) **Biomechanical properties of the brachioradialis muscle: Implications for surgical tendon transfer.** *J Hand Surg*, 30:273-82, 2005. [pdf of published paper](#)
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 10. Towles, J. D., Murray, W. M., Hentz, V. R. (2004) **How joint stabilization and pulley release affect the thumb-tip force produced by the long flexor during key pinch: A cadaver study.** *J Hand Surg*, 29:273-82, 2004. [pdf of published paper](#)
 11. Saul, K. R., Murray, W. M., Hentz, V. R., and Delp, S. L. (2003) **Biomechanics of the Steindler flexorplasty surgery: A computer simulation.** *J Hand Surg*, 28A:979-986, 2003. [pdf of published paper](#)
 12. Murray, W. M., Buchanan, T. S., and Delp, S. L. (2002) **Scaling of peak moment arms of elbow muscles with dimensions of the upper extremity.** *J Biomech*, 35:19-26, 2002. [pdf of published paper](#)
 13. Johanson, M. E. and Murray, W. M. (2002) **The unoperated hand: The role of passive forces in hand function after tetraplegia.** *Hand Clin*, 18:391-398, 2002. [pdf of published paper](#)
 14. Murray, W. M., Bryden, A. M., Kilgore, K. L., and Keith, M. W. (2002) **The influence of elbow position on wrist range of motion following the brachioradialis to extensor carpi radialis brevis tendon transfer.** *J Bone Jt Surg*, 84-A:2203-2210, 2002. [pdf of published paper](#)
 15. Delp, S. L., Suranarayanan, S., Murray, W. M., Uhler, J., Triolo, R. J. (2001) **Architecture of the rectus abdominis, quadratus lumborum, and erector spinae.** *J Biomech*, 34:371-375, 2001. [pdf of published paper](#)
 16. Memberg, W. D., Murray, W. M., Ringleb, S. I., and Kilgore, K. L., and Snyder, S. A. (2001) **A transducer to measure elbow extension moments.** *Clin Biomech*, 16:918-920, 2001. [pdf of published paper](#)
 17. Murray, W. M., Buchanan, T. S., and Delp, S. L. (2000) **The isometric functional capacity of muscles that cross the elbow.** *J Biomech*, 33:943-952, 2000. [pdf of published paper](#)



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