

# Daniel M Dudek

Assistant Professor

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## EDUCATION

**University of California at Berkeley** Ph.D. in Integrative Biology 5/06  
*Research Advisor:* Robert J. Full  
Dissertation: "Passive mechanical properties of the exoskeleton simplify the control of rapid running in the cockroach, *Blaberus discoidalis*"

**University of Chicago** B.A. in Biology with Honors, 6/98  
*Research Advisor:* Mark W. Westneat  
Thesis: "Kinematics of pectoral fin locomotion in *Halichoeres bivittatus*"

## RESEARCH

**Visiting Scholar** (host: Dr. Chris Elvin) 9/08 – 12/08  
Commonwealth Scientific and Industrial Research Organization – Brisbane, Australia

- *Cloning and Expressing Recombinant Insect Protein*
  - Cloned the dragonfly gene for the elastic protein, resilin
  - Expressed recombinant dragonfly resilin

**Postdoctoral Fellow** (advisor Prof. John M. Gosline): 9/06 – 8/09  
Biomaterials Lab, Department of Zoology, University of British Columbia

- *Dynamic Mechanical Properties of Resilin*
  - Experimental investigation of the effects of temperature, pH, and hydration level on the material properties of the arthropod elastic protein, resilin.
  - Experimental investigation of the fatigue lifetime of elastic proteins.
  - Comparison of properties of native and synthetic resilin from different species (with Chris Elvin of CSIRO – Brisbane).

**Doctoral Research** (advisor Prof. Robert J. Full): 8/98 – 5/06  
Poly-PEDAL Lab, Department of Integrative Biology, UC Berkeley

- *Biomechanics of Insect Locomotion*
  - Initiated and designed original research on how the material and structural properties of insects effects energy management, stability, and control of rapid locomotion.
  - Developed an inertial treadmill for cockroaches with perturbations controlled by a real-time computer in the loop.
  - First application in biology of a frequency independent model that allows for prediction of limb response to varying perturbations.
  - Applied mathematical models to show that there is no simple concept of natural frequency for a given spring-loaded inverted pendulum.
  - Teamed up with multidisciplinary biologists, mathematicians, and engineers on a research program to develop a new class of biologically inspired robots (Sprawl and RHex).
- *Dynamics of Climbing*
  - First experimental measurements of single limb forces generated by geckos and insects during rapid climbing showed surprising similarities.

- Developed a model for climbing that captures center of mass dynamics of insects and geckos during rapid climbs.
- Collaborated with a team of multidisciplinary biologists, mathematicians, and engineers on a research program to develop agile climbing robots (IS Robotics "Mecho-Gecko" and Boston Dynamics "RiSE").

**Undergraduate Research** (advisor: Prof. Mark W. Westneat)  
Fish Division, Field Museum of Natural History, Chicago, IL

4/95 - 05/98

- *Functional Morphology of Swimming*
  - Conducted experiments on the use of pectoral fins in high speed swimming in the wrasse family of fishes.
  - Used principles of hydrodynamics to discover a gait transition where pectoral fins shift from a drag-based to a lift-based method of propulsion.

## GRANTS, AWARDS, & HONORS

Journal "Zoology" sponsored talk (SICB – Boston, 2009)  
NSF International Research Fellowship (2006-2008)  
American Society of Biomechanics 2003 Travel Award  
Outstanding Graduate Student Instructor (2002-2003)  
Integrative Biology 2003 Summer Research Grant  
Aid Association for Lutherans Scholarship (1994-1998)  
National Merit Scholar (1994-1998)

## PUBLICATIONS

**Dudek, D.M.**, and Gosline, J.M. **Dynamic Mechanical Properties of the Elastic Protein, Resilin** (in prep)

**Dudek, D.M.**, Elvin, C.M., and Gosline, J.M. **Comparative Biomechanics of Native and Recombinant Resilin** (in prep)

**Dudek, D. M.**, Full, R. J. **Mechanical Properties of the Support Tripod in Running Insects** (in prep)

**Dudek, D. M.**, Full, R. J. **A Running Insect Leg's Rapid Recovery from Perturbations During Swing** (in prep)

**Dudek, D. M.**, Full, R. J. (2007) **An Isolated Insect Leg's Passive Recovery from Perturbation**. *J. Exp. Bio*, **210**: 3209-3217.

Goldman, D. I., **Dudek, D. M.**, Chen, T. S., and Full, R. J. (2006) **Dynamics of Rapid Vertical Climbing in Cockroaches Reveals a Template**. *J Exp Bio*, **209**: 2990-3000.

**Dudek, D. M.**, and Full, R. J. (2006) **Dynamic Mechanical Properties of Legs from Running Insects**. *J Exp Bio*, **209**: 1502-1515.

Autumn, K.; Hsieh, S. T.; **Dudek, D. M.**; Chen, J.; Chitaphan, C.; and Full, R. J. (2006) **Dynamics of geckos running vertically**. *J Exp Bio*, **209**:260-272.

Xu, X., Cheng, W., **Dudek, D.**, Cutkosky, M., Hatanaka, M., and Full, R.J. (2000) **Material modeling for shape deposition manufacturing of biomimetic components**. *Proceedings of DETC/DFM, DETC2000/DFM-14022*.

## PRESENTATIONS

Depew, T.A., Michal, C.A, **Dudek, D.M.**, Gosline, J.M., Elvin, C.M., Kim, M., Lyons, R.E., and Dumsday, G.J. **Recombinant Resilin: an Outstanding Synthetic Rubber.** Experimental Nuclear Magnetic Resonance Conference (Pacific Grove, CA 29 March – 03 April 2009).

**Dudek, D.M.**, Gosline, J.M., Michal, C.A., Depew, T.A., Elvin, C., Kim, M., Lyons, R, Dumsday, G. **Dynamic mechanical properties of synthetic resilin.** Society for Integrative and Comparative Biology (Boston, MA 3-7 January 2009).

**Dudek, D.M.**, and Gosline, J.M. **Dynamic Mechanical Properties of the Elastic Protein, Resilin.** Society for Integrative and Comparative Biology (San Antonio, TX 2-6 January 2008).

**Dudek, D.M.**, M. Srinivasan, K. Rogale, R. Kukillaya, P. Holmes, and R.J. Full. **The Relevance of Resonant Frequency in Running Cockroaches Modeled by a Spring-loaded, Inverted Pendulum.** Society for Integrative and Comparative Biology (Phoenix, AZ 3-7 January 2007).

**Dudek, D. M.**, Dastoor, S., and Full, R. J. **Rapid Recovery From An Impulse Perturbation To A Leg In Running Insects.** Society for Integrative and Comparative Biology (Orlando, FL 4-8 January 2006).

**Dudek, D. M.**, Goldman, D. I., and Full, R. J. **A Hysteretic Model Predicts a Biological Structure's Response to Perturbations: A Test Case Using Insect Legs.** IUPS 2005 Satellite Symposium: Biophysical and Biomechanical Adaptation and Bioinspired Engineering Symposium (Pasadena, CA 28-30 March 2005).

**Dudek, D. M.**, Goldman, D. I., and Full, R. J. **A Hysteretic Model Predicts a Biological Structure's Response to Perturbations: A Test Case Using Insect Legs.** Society for Integrative and Comparative Biology (San Diego, CA 4-8 January 2005). **In:** Integrative and Comparative Biology December, 2004. 44 (6): 547.

**Dudek, D. M.**, Full, R. J. **Mechanical Properties Of The Support Tripod In Running Insects.** Society for Integrative and Comparative Biology (New Orleans, LA 5-9 January 2004). **In:** Integrative and Comparative Biology December, 2003. 43 (6): 911.

**Dudek, D. M.**, Gilboa, D., MacLafferty, M., and Full, R.J. **Mechanical Properties Of The Support Tripod In Running Insects: The Role Of Reflexes In Dynamic Stabilization.** American Society of Biomechanics (Toledo, OH 25-27 September 2003).

**Dudek, D. M.**, Xu, X., Cheng, W., , Cutkosky, M., and Full, R. J. **Compliant damped legs of arthropods inspire the design of robot legs.** American Physiological Society (San Diego, CA 24-28 August 2002). **In:** The Physiologist August, 2002. 45(4): 348.

**Dudek, D. M.**, Full, R. J. **Leg function in running insects: Resilience and impedance of legs linked to a body.** Society for Integrative and Comparative Biology (Anaheim, CA 2-6 January 2002). **In:** American Zoologist December, 2001. 41 (6): 1432-1433.

**Dudek, D. M.**; Full, R. J. **Spring-like behavior of the legs of running insects.** Society for Integrative and Comparative Biology (Chicago, IL 3-7 January 2001). **In:** American Zoologist December, 2000. 40 (6): 1002-1003.

Autumn, K.; Hsieh, S. T.; **Dudek, D. M.**; Chen, J.; Chitaphan, C.; Full, R. J. **Dynamics of geckos running vertically.** Society for Integrative and Comparative Biology (Denver, CO 6-10 January 1999). **In:** American Zoologist 1998. 38 (5): 84A

Autumn, K.; Hsieh, S. T.; **Dudek, D. M.**; Chen, J.; Chitaphan, C.; Full, R. J. **Function of feet in ascending and descending geckos.** Society for Integrative and Comparative Biology (Denver, CO 6-10 January 1999). **In:** American Zoologist 1998. 38 (5): 84A.

## SERVICE

Invertebrate Biologist Search Committee (Fall, 2002)  
Graduate Student/Faculty Committee (Fall, 2002-2005)

## TEACHING EXPERIENCE

### PHYSIOLOGY

*Comparative Animal Physiology*  
*Organismal Physiology*  
*Mammalian Physiology Laboratory*

### BIOMECHANICS

*Mechanics of Organisms*  
*Motor Control*  
*Biomotion*  
*Physiology, Structure, and Biomechanics*

Upward Bound Math-Science, Biology and Physics Instructor

6/00 – 8/00