

DANIEL I. GOLDMAN  
CURRICULUM VITAE

GOLDMAN, DANIEL I. Associate Professor  
School of Physics  
Georgia Institute of Technology

Personal Data:

Born: 1/24/72, RICHMOND, VA

Educational Background:

S.B.	Physics	1994	M.I.T.
Ph.D.	Physics	2002	University of Texas Austin

Employment History:

Graduate Teaching Assistant, Physics Dept., UT Austin	1995-1996
Research Assistant, Physics Dept., UT Austin	1996-2002
Postdoctoral Researcher, Physics Dept., UT Austin	2002-2003
Postdoctoral Fellow, Dept. of Integrative Biology, UC Berkeley	2003-2006
Assistant Professor, School of Physics, Georgia Tech	2007-2013
Associate Professor, School of Physics, Georgia Tech	2013-
Courtesy Appointment, School of Biology, Georgia Tech	2007-
Member in the Bioengineering Graduate Program, Georgia Tech	2007-

Current Fields of Interest:

Nonlinear dynamics, biomechanics, locomotion, granular media, robotics

Teaching Experience: (last five years, reverse chronological order)

Quarter, year	Course number	Course title	Number of students
Fall 2014	4267/6268	Nonlinear Dynamics & Chaos	18
Spring 2014	2211	Classical Mechanics I	237
Spring 2013	unassigned	Physics in Modern Life	0 (prepped)
Fall 2012	4267/6268	Nonlinear Dynamics & Chaos	14
Spring 2012	3201-A	Classical Mechanics I	49
Fall 2011	4267/6268	Nonlinear Dynamics & Chaos	30

Spring 2011	3201-A	Classical Mechanics I	49
Fall 2010	3201-A	Classical Mechanics I	35
Spring 2010	4267/6268	Nonlinear Dynamics & Chaos	21
Fall 2009	2212P	Matter and Interactions II	181
Spring 2009	2212Q	Matter and Interactions II	171
Fall 2008	2212P	Matter and Interactions II	153
Spring 2008	2212Q	Matter and Interactions II	161
Fall 2007	2212P	Matter and Interactions II	149

Refereed Publications: (List all significant publications, in reverse chronological order. List co-authors and estimate percentage of individual contributions.)

List the following categories separately:

a) Already published

“Beneath our feet: strategies for locomotion in granular media”, A. E. Hosoi and Daniel I. Goldman, *Annual Reviews of Fluid Mechanics*, 47, 431 (2015).

“Locomotor benefits of being a slender and slick sand-swimmer”, Sarah S. Sharpe, Stephan Koehler, Miguel Serrano, Patricio Vela, and Daniel I. Goldman, *Journal of Experimental Biology*, 218, 440 (2015).

“The effectiveness of resistive force theory in granular locomotion”, Tingnan Zhang and Daniel I. Goldman, *Physics of Fluids*, 26, 101308 (2014).

“Sidewinding with minimal slip: snake and robot ascent of sandy slopes”, Hamidreza Marvi, Chaohui Gong, Nick Gravish, Henry Astley, Matthew Travers, Ross L. Hatton, Joseph R. Mendelson III, Howie Choset, David L. Hu, and Daniel I. Goldman, *Science*, 346, 224 (2014).

“Colloquium: Biophysical principles of undulatory self-propulsion in granular media”, Daniel I. Goldman, *Reviews of Modern Physics*, 86, 943 (2014).

“The effect of volume fraction on granular avalanche dynamics”, Nick Gravish, and Daniel I. Goldman, *Physical Review E*, 90, 032202 (2014).

“Force and flow at the onset of drag in plowed granular media”, Nick Gravish, Paul B. Umbanhowar, and Daniel I. Goldman, *Physical Review E*, 89, 042202 (2014).

“Conditioned basis array factorization: an approach to gait pattern extraction”, Chaohui Gong, Matthew Travers, Henry Astley, Lu Li, Joe Mendelson, David Hu, Daniel I. Goldman, Howie Choset, *Robotics: Science & Systems (RSS) conference* (2014).

“Swimming in the desert”, Yang Ding, Chen Li, and Daniel I. Goldman, *Physics Today*, November, pg. 68 (2013).

“Emergence of the advancing neuromechanical phase lag in a resistive force dominated medium”, Yang Ding, Sarah S. Sharpe, Kurt Wiesenfeld, and Daniel I. Goldman, *Proceedings of the National Academy of Science*, 110, 10123-10128 (2013)

“Climbing, falling and jamming during ant locomotion in confined environments”, Nick Gravish, Daria Monaenkova, Michael A. D. Goodisman, and Daniel I. Goldman, *Proceedings of the National Academy of Science*, 110, 9746-9751 (2013).

“A terradynamics of legged locomotion on granular media”, Chen Li, Tingnan Zhang, and Daniel I. Goldman, *Science*, 339, 1408 (2013).

“Flipper driven terrestrial locomotion of a sea turtle inspired robot”, Nicole Mazouchova, Paul B. Umbanhowar, and Daniel I. Goldman, *Bioinspiration & Biomimetics*, 8, 026007 (2013).

“Geometric visualization of self-propulsion in a complex medium”, Ross Hatton, Yang Ding, Howie Choset, and Daniel I. Goldman, *Physical Review Letters* 110, 078101 (2013).

“Ground fluidization promotes rapid running of a lightweight robot”, Tingnan Zhang, Feifei Qian, Chen Li, Pierangelo Masarati, Paul Birkmeyer, Andrew Pullin, Aaron Hoover, Ronald S. Fearing, and Daniel I. Goldman, *International Journal of Robotics Research*, 32, 859 (2013).

“An automated system for systematic testing of locomotion on heterogeneous granular media”, Feifei Qian, Tingnan Zhang, Kevin Daffon, and Daniel I. Goldman, *CLAWAR* (2013)

“Environmental interaction influences muscle activation strategy during sand-swimming in the sandfish lizard (*Scincus scincus*)”, Sarah S. Sharpe, Yang Ding, and Daniel I. Goldman, *Journal of Experimental Biology*, 216, 260 (2012).

“Mechanics of undulatory swimming in a frictional fluid”, Yang Ding, Sarah S. Sharpe, Andrew Masse, and Daniel I. Goldman, *PLoS Computational Biology*, 8(12): e1002810 (2012).

“Lift-off in a hopping robot”, Jeffrey Aguilar, Alex Lesov, Kurt Wiesenfeld and Daniel I. Goldman, *Physical Review Letters*, 109, 174301 (2012).

“Using computational and mechanical models to study animal locomotion”, Laura A. Miller, Daniel I. Goldman, Tyson L. Hedrick, Eric D. Tytell, Jane Wang, Jeannette Yen, and Silas Alben, *Integrative and Comparative Biology*, 52, 553 (2012).

“Multi-functional foot use during running of the zebra-tailed lizard (*Callisaurus draconoides*)”, Chen Li, S. Tonia Hsieh, and Daniel I. Goldman, *Journal of Experimental Biology*, 215, 3293 (2012).

“Effects of worker size on the dynamics of fire ant tunnel construction”, Nick Gravish, Mateo Garcia, Nicole Mazouchova, Laura Levy, Paul B. Umbanhowar, Michael A. D. Goodisman, and Daniel I. Goldman, *Journal of the Royal Society Interface*, (2012).

“Entangled granular media”, Nick Gravish, Scott V. Franklin, David L. Hu, and Daniel I. Goldman, *Physical Review Letters*, 108, 208001 (2012).

“Walking and running on yielding and fluidizing ground”, Feifei Qian, Tingnan Zhang, Chen Li, Pierangelo Masarati, Paul Birkmeyer, Andrew Pullin, Aaron Hoover, Ronald S. Fearing, and Daniel I. Goldman, *Robotics: Science and Systems (RSS) conference* (2012).

“Towards a terramechanics for bio-inspired locomotion in granular environments”, Chen Li, Yang Ding, Nick Gravish, Paul B. Umbanhowar, Haldun Komsuoglu, Daniel E. Koditschek, and Daniel I. Goldman, *ASCE, Earth and Space 2012 conference* (2012).

“Mechanical models of sandfish locomotion reveal principles of high performance subsurface sand-swimming”, Ryan D. Maladen, Yang Ding, Paul B. Umbanhowar, Adam Kamor, and Daniel I. Goldman, *Journal of the Royal Society Interface*, 8, 1332-1345 (2011).

“Drag induced lift in granular media”, Yang Ding, Nick Gravish and Daniel I. Goldman, *Physical Review Letters*, 106, 028001 (2011).

“Granular lift forces predict vertical motion of a sand-swimming robot”, Ryan D. Maladen, Paul B. Umbanhowar, Yang Ding, Andrew Masse and Daniel I. Goldman, *ICRA*, (2011).

“Undulatory swimming in sand: experimental and simulation studies of a robotic sandfish”, Ryan D. Maladen, Yang Ding, Paul B. Umbanhowar, and Daniel I. Goldman, *International Journal of Robotic Research*, 30, 793-805 (2011).

“Comparative studies reveal principles of movement on and within granular media”, Yang Ding, Nick Gravish, Chen Li, Ryan D. Maladen, Nicole Mazouchova, Sarah S. Sharpe, Paul B. Umbanhowar, and Daniel I. Goldman, *IMA Workshop on Locomotion* (2011).

“Force and flow transition in plowed granular media”, Nick Gravish, Paul B. Umbanhowar and Daniel I. Goldman, *Physical Review Letters*, 105, 128301 (2010).

“Granular impact and the critical packing state”, Paul B. Umbanhowar and Daniel I. Goldman, *PRE Rapid Communications*, 82, 010301R, (2010)

“Wiggling Through the World”, Daniel I. Goldman and David L. Hu, *American Scientist*, July/August 2010 (this is a popular article)

“The effect of limb kinematics on the speed of a legged robot on granular media”, Chen Li, Paul B. Umbanhowar, Haldun Komsuoglu, and Daniel I. Goldman, *Journal of Experimental Mechanics*, (2010)

“Biophysically inspired development of a sand-swimming robot”, Ryan D. Maladen, Yang Ding, Paul B. Umbanhowar, Adam Kamor and Daniel I. Goldman, *Proceedings of Robotics: Science & Systems 2010* (2010).

“Systematic study of the performance of small robots on controlled laboratory substrates, Chen Li, Aaron M. Hoover, Paul Birkmeyer, Paul B. Umbanhowar, Ronald S. Fearing, and Daniel I. Goldman, *Proceedings of SPIE*, Vol. 7679, 76790Z (2010)

“Utilization of granular solidification during terrestrial locomotion of hatchling sea turtles”, Nicole Mazouchova, Nick Gravish, Andrei Savu, and Daniel I. Goldman (*Biology Letters*, early edition, Feb 2010 (print version June).

Ryan D. Maladen, Yang Ding, Chen Li and Daniel I. Goldman, “Undulatory swimming in sand: subsurface locomotion of the sandfish lizard, *Science*, 325, 314, (2009)

“Sensitive Dependence of the motion of a legged robot on granular media”, Chen Li, Paul B. Umbanhowar, Haldun Komsuoglu, Daniel E. Koditschek, and Daniel I. Goldman, *Proceedings of the National Academy of Science*, 106, 2029 (2009).

“March of the SandBots”, Daniel I. Goldman, Haldun Komsuoglu, Daniel E. Koditschek, *IEEE Spectrum*, April 2009, pg. 30. (this is a popular article).

“Integrating a Hierarchy of Simulation Tools for Legged Robot Locomotion”, Andrew Slatton, Daniel Cohen, Yang Ding, Paul B. Umbanhowar, Daniel I. Goldman, G. Clark Haynes, Haldun Komsuoglu, and Daniel E. Koditschek, *IROS*, (2008)

“Scaling and dynamics of sphere and disk impact into granular media”, Daniel I. Goldman and Paul B. Umbanhowar, *Physical Review E*, **77**, 021308 (2008).

“Active tails enhance arboreal acrobatics in geckos”, Ardian Jusufi, Daniel I. Goldman, Shai Revzen, and Robert J. Full, *Proceedings of the National Academy of Science*, **105**, 4215 (2008).

“Design of a Bio-inspired Dynamical Vertical Climbing Robot”, Jonathan E. Clark, Daniel I. Goldman, Pei-Chun Lin, Goran Lynch, Tao S. Chen, Haldun Komsuoglu, Robert J. Full, and Daniel E. Koditschek, *Proceedings of Robotics: Science and Systems* (2007).

“Distributed mechanical feedback in arthropods and robots simplifies control of rapid running on challenging terrain”, Joseph C. Spagna, Daniel I. Goldman, Pei-Chun Lin, Daniel E. Koditschek, and Robert J. Full, *Bioinspiration and Biomimetics*, **2**, 9-18 (2007).

“Toward a dynamic climbing robot,” Jonathan E. Clark, Daniel I. Goldman, Tao S. Chen, Robert J. Full and Daniel E. Koditschek, *CLAWAR 2006*, 9th International Conference on Climbing and Walking Robots.

“Dynamics of rapid vertical climbing in a cockroach reveals a template”, Daniel I. Goldman, Tao S. Chen, Daniel M. Dudek, and Robert J. Full, *The Journal of Experimental Biology*, **209**, 2990-3000 (2006).

“The RiSE Climbing Robot: Body and Leg Design”, A. Saunders, D. I. Goldman, R. J. Full and M. Buehler, *Unmanned Systems Technology VIII*, SPIE, **6230**, 623017 (2006).

“Signatures of glass transition in a fluidized bed of hard spheres”, Daniel I. Goldman and Harry L. Swinney, *Physical Review Letters*, **96**, 145702 (2006).

“Low density fragile states in cohesive powders”, Paul B. Umbanhowar and Daniel I. Goldman, *American Journal of Physics*, **74**, 720-721 (2006).

“Robotics in Scansorial Environments”, Kellar Autumn, Martin Buehler, Mark Cutkosky, Ronald Fearing, Robert J. Full, Daniel Goldman, Richard Groff, William Provancher, Alfred E. Rizzi, Uluc Saranlı, Aaron Saunders and Daniel Koditschek, in *Unmanned Ground Vehicle Technology VII*, eds. Grant R. Gerhart, Charles M. Shoemaker, Douglas W. Gage, *Proceedings of SPIE*, **5804**, 291-302 (2005).

“Stationary state volume fluctuations in a granular medium”, Matthias Schroeter, Daniel I. Goldman and Harry L. Swinney, *Review E Rapid Communications* **71**, 030301 (2005).

“Mach cone in a shallow granular fluid”, Patrick Heil, E. C. Rericha, Daniel I. Goldman, and Harry L. Swinney, *Physical Review E Rapid Communications* **70**, 060301, (2004).

“Crucial role of sidewalls in velocity distributions in quasi-2D granular gases”, J. S. van Zon, J. Kreft, Daniel I. Goldman, D. Miracle, J. B. Swift, and Harry L. Swinney, *Physical Review E Rapid Communications* **70**, 040301 (2004).

“Noise, coherent fluctuations, and the onset of order in an oscillated granular fluid”, Daniel I. Goldman, J. B. Swift, and Harry L. Swinney, *Physical Review Letters* **92**, 174302 (2004).

“Persistent holes in a fluid”, Florian S. Merkt, Robert D. Deegan, Daniel I. Goldman, Erin C. Rericha, and Harry L. Swinney, *Physical Review Letters* **92**, 184501 (2004).

“Dynamics of drag and force distributions for projectile impact in a granular medium”, Massimo Pica Ciamarra, Antonio H. Lara, Andrew T. Lee, Daniel I. Goldman, Inna Vishik, and Harry L. Swinney, *Physical Review Letters* **92**, 194301 (2004).

“Stages of relaxation of patterns and the role of stochasticity on the final stage”, Shaowen Hu, Daniel I. Goldman, Donald J. Kouri, David K. Hoffman, Harry L. Swinney and Gemunu H. Gunaratne, *Nonlinearity* **17**, 1535 (2004).

“Kink-induced transport and segregation in oscillated granular layers”, Sung Joon Moon, Daniel I. Goldman, J. B. Swift, and Harry L. Swinney, *Physical Review Letters* **91**, 134301 (2003).

“Lattice dynamics and melting of a nonequilibrium pattern”, Daniel I. Goldman, M. D. Shattuck, J. B. Swift, and Harry L. Swinney, *Physical Review Letters* **90**, 104302 (2003).

“Emergence of order in an oscillated granular layer”, Daniel I. Goldman, M. D. Shattuck, Harry L. Swinney, and Gemunu H. Gunaratne, *Physica A* **306**, 180 (2002).

“Phase bubbles and spatiotemporal chaos in granular patterns”, Sung Joon Moon, M. D. Shattuck, C. Bizon, Daniel I. Goldman, J. B. Swift, and Harry L. Swinney, *Physical Review E* **65**, 011301 (2001).

“Continuum-type stability balloon in oscillated granular layers”, J. R. De Bruyn., C. Bizon., M. D. Shattuck, Daniel I. Goldman, J. B. Swift, and Harry L. Swinney, *Physical Review Letters* **81**, 1421 (1998).

“Absence of inelastic collapse in a realistic three ball model”, Daniel I. Goldman, M. D. Shattuck, C. Bizon, W. D. McCormick, J. B. Swift, and Harry L. Swinney, *Physical Review E* **57**, 4831 (1998).

b) Accepted for publication/in review

“Behavioral and mechanical determinants of robust collective subsurface nest excavation”, Daria Monaenkova, Nick Gravish, Gregory Rodriguez, Rachel Kutner, Michael A. D. Goodisman, and Daniel I. Goldman, *Journal of Experimental Biology*, in press (2015).

“Modulation of orthogonal body waves enables high maneuverability in sidewinding locomotion”, Henry Astley, Chaohui Gong, Matthew Travers, Miguel Serrano, Patricio Vela, Joseph R. Mendelson III, Howie Choset, David L. Hu, and Daniel I. Goldman, *Proceedings of the National Academy of Science*, in press (2015).

“Kinematic Gait Synthesis for Snake Robots”, Chaohui Gong, Matthew Travers, Henry Astley, Lu Li, Joseph R. Mendelson III, David L. Hu, Daniel I. Goldman and Howie Choset, *Proceedings of the National Academy of Science*, in press (2015).

“Controlled preparation of wet granular media reveals limits to lizard burial ability”, Sarah S. Sharpe, Robyn Kuckuk and Daniel I. Goldman, *Physical Biology*, in review (2015).

“Universality in legged locomotion on granular media”, Feifei Qian, Tingnan Zhang, Wyatt Korff, Paul B. Umbanhowar, Robert J. Full, and Daniel I. Goldman, *Bioinspiration & Biomimetics*, in review (2015).

“Robophysical study of jumping dynamics on granular media”, Jeffrey Aguilar, Daniel I. Goldman, *Nature Physics*, in review (2015).

“Obstacle independent scattering pattern enables anticipatory control in heterogeneous granular media through tail induced substrate solidification”, Feifei Qian and Daniel I. Goldman, *RSS*, in review 2015.

c) In preparation

“Glass-like dynamics in confined and congested ant traffic”, Nick Gravish, Gregory Gold, Andrew Zangwill, Michael A. D. Goodisman, and Daniel I. Goldman, to be submitted to *Physical Biology* 2015.

“Locomotion robophysics: physics at the intersection of self-deforming artificial moving systems, dynamical systems and soft materials”, Daniel I. Goldman, to be submitted to *Reports on Progress in Physics* 2015.

“Tracking in noisy environments”, Miguel Serrano, Sarah Sharpe, Robyn Kuckuk, Patricio Vela, and Daniel I. Goldman, to be submitted to *Journal of Experimental Biology*, 2015.

“Modeling of the interaction of rigid wheels with granular media using resistive force theory”, Carmine Senatore, Tingnan Zhang, Mark Kingsbury, Daniel I. Goldman, and Karl Iagnemma, to be submitted to *Journal of Terramechanics*, 2015.

“Animal and robot experiments reveal a minimal feature set for the invasion of land”, Benjamin McInroe, Henry Astley, Sandy Kawano, Chaohui Gong, Howie Choset, Richard Blob, and Daniel I. Goldman, to be submitted to *Science*, 2015.

Non-Refereed Publications: (Same order and categories as above)

(Numerous stemming from conference participation. For a complete list, see Google scholar under the journal *Integrative and Comparative Biology*)

Books: (Separate categories as above)

-----

Research Grants and Contracts: (Title, Agency, Dates, Amounts)

### **Current Support**

Title: *Principles Governing the Mechanics and Control of Snake Strikes*

Sponsoring Agency: Army, Research Triangle Park, NC

Period of Performance: 7/1/14-3/31/15



FTE Person-Month / Year: 0.12  
Total Budget: \$50,000

Title: *3D Printer Instrumentation to Create Varied Geometries of Robotic Limbs and Heterogeneous Granular Media: Topic 11.4*

Sponsoring Agency: Army, Research Triangle Park, NC  
Proposed Period of Performance: 5/12/14-5/11/15  
FTE Person-Month / Year: 0.00  
Total Budget: \$50,000

Title: *Towards a Terramechanics of Heterogeneous Granular Substrates*

Sponsoring Agency: DARPA, Washington, DC  
Proposed Period of Performance: 8/13/12-8/11/15  
FTE Person-Month / Year: 1.00  
Total Budget: \$300,000

Title: *Biological Locomotion Principles and Rheological Interaction Physics for Unprecedented Multimodal Mobility within Complex Granular Media*

Sponsoring Agency: Army, Research Triangle Park, NC  
Period of Performance: 9/22/11-10/21/15  
FTE Person-Month / Year: 1.00  
Total Budget: \$683,424

Title: *EAGER: Determining Interaction Parameters of Roots in Soils (Co-PI)*

Sponsoring Agency: Duke University (National Science Foundation, Washington, DC)  
Proposed Period of Performance: 4/15/14-3/31/16  
FTE Person-Month / Year: 0.12  
Total Budget: \$86,793 (GT portion)

Title: *1.3.2 Multi-Dimensional and Dissipative Dynamical Systems: Exploration of the Soft-Matter Phase Transitions of Fire Ant Aggregates (Co-PI)*

Sponsoring Agency: Army, Research Triangle Park, NC  
Proposed Period of Performance: 8/12/13-8/11/16  
FTE Person-Month / Year: 0.25  
Total Budget: \$415,000

Title: *CAREER: Discovery and Dissemination of Neuromechanical Principles of Swimming, Walking and Running in Granular Media*

Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 3/1/12-2/28/17  
FTE Person-Month / Year: 2.00  
Total Budget: \$776,024

Title: *Collaborative Research: Geometric Mechanics for Locomoting Systems*

Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 8/1/14-7/31/17  
FTE Person-Month / Year: 0.12  
Total Budget: \$150,000 (GT portion)

Title: *Student Research Network in the Physics of Living Systems: Georgia Tech Node*  
Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 9/1/12-8/31/17  
FTE Person-Month / Year: 0.12  
Total Budget: \$1,188,363 (with 5 Co-PIs)

Title: *NRI: Collaborative: Exploiting Granular Mechanics to Enable Robotic Locomotion*  
Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 8/15/14-7/31/17  
FTE Person-Month / Year: 0.5  
Total Budget: \$360,000 (Georgia Tech portion)

Title: *Science and MATH Research Training (SMART) Scholarships (Co-PI)*  
Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 8/15/14-8/14/18  
FTE Person-Month / Year: 0.00  
Total Budget: \$613,554

#### **Pending Support**

Title: *NRI: Collaborative Research: Integrating Physics Models and Control Methodologies for Enhanced Legged Locomotion on Yielding Terrain*  
Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 7/1/15-6/30/18  
FTE Person-Month / Year: 0.12  
Total Budget: \$303,215

Title: *Physical Aspects of Superorganism Physiology: Construction, Circulation, and Homeostasis in Fire Ant Colonies*  
Sponsoring Agency: National Science Foundation, Washington, DC  
Proposed Period of Performance: 6/1/14-5/31/17  
FTE Person-Month / Year: 0.12  
Total Budget: \$595,555

Title: *Modification to Proposal 60615-EG*  
Sponsoring Agency: Army, Research Triangle Park, NC  
Proposed Period of Performance: 9/1/14-8/31/15  
FTE Person-Month / Year: 0.12  
Total Budget: \$200,000

Title: *Towards a Terramechanics of Heterogeneous Granular Substrates (Supplement)*  
Sponsoring Agency: DARPA, Washington, DC  
Proposed Period of Performance: 8/13/12-8/11/15  
FTE Person-Month / Year: 0.50  
Total Budget: \$100,000

Title: *Robophysical approach to discovery of principles of effective interaction of ambulatory robots with multicomponent environments*

Sponsoring Agency: BAE Systems (Army Research Lab), Nashua, NH

Period of Performance: 11/1/14-10/31/18

FTE Person-Month / Year: 0.12

Total Budget: \$330,000

Title: *High throughput root phenotyping to understand drought adaption*

Sponsoring Agency: Colorado State (ARPA-E)

Proposed Period of Performance: 8/1/15-1/31/18

FTE Person-Month / Year: 0.50

Total Budget: \$445,861

Title *Engineering Research Center for Bio-Mediated and Bio-Inspired Geotechnics (CBBG) (Co-PI)*

Sponsoring Agency: Arizona State (NSF)

Period of Performance: 8/1/15-7/31/20

FTE Person-Month / Year: 0.12

Total Budget: \$18,500,000

Meetings and Symposia: (Indicate **Invited** or **Contributed** participation)

### **Invited**

University of Arizona Physics Colloquium, 02/15

University of Missouri St Louis Physics Colloquium, 10/14

University of North Carolina Physics Colloquium, 10/14

Burroughs Wellcome Fund Annual Meeting, 10/14

Rockefeller University, 05/14

Carnegie Mellon University, 05/14

DARPA M3 Review, 04/14

Brandeis University, 04/14

Robotics: Science & Systems AC Meeting workshop, 04/14

Brown University, 03/14

University of Maryland, 02/14

APS DFD Invited Speaker, 11/13

UPenn Physics seminar, 10/12

CLAWAR (two talks given by students), 07/12

Robotics: Science & Systems, invited talk (given by student), Sydney, Australia, 07/12

Hands-On Research School talk on locomotion, Shanghai, China, 06/12

Locomotion Systems Science workshop talk (co-organizer), Arlington, VA, 05/12

Johns Hopkins University, Mechanical Engineering, seminar, 05/12

Harvard University, Organismic and Evolutionary Biology seminar, Cambridge, MA, 04/12

iPoLS kickoff meeting, Montpellier, France, 04/12.

Atlanta Science Tavern, Atlanta, GA, 03/12

University of Georgia, Physics, colloquium, Athens, GA, 03/12  
Northwestern University, Mechanical Engineering colloquium, Evanston, IL, 03/12  
American Physical Society March meeting, invited talk, Boston, MA, 02/12  
Society for Integrative and Comparative Biology meeting, invited talk, Charleston, SC, 01/12  
IBB Breakfast Club seminar, Georgia Tech, Atlanta, GA, 12/11  
Stanford University, seminar, 11/11  
Princeton University, seminar, 10/11  
RSS 2011, workshop seminar, 06/11  
Cornell University, seminar, 05/11  
Los Alamos National Lab, seminar, 05/11  
MIT, Civil and Environmental Engineering, 04/11  
Emory University, Physics, colloquium, 04/11  
American Physical Society March meeting, invited talk (student), Dallas, TX, 03/11  
Hands-on Research School talk on locomotion, Cameroon, Africa, 08/10  
Robotics: Science & Systems, invited talk (given by student), Zaragoza, Spain, 07/10  
Gordon Conference on Granular Media, invited talk, Colby College, ME 06/10  
Institute for Mathematics and its Applications, workshop, invited talk, Minneapolis, MN, 06/10  
Drexel University, department colloquium, 04/10  
City College of New York, Levich Institute, 11/09  
Georgia Tech School of Physics, homecoming talk, 10/09  
Hands-On Research School talk on locomotion, Sao Paulo, Brazil, 07/09  
Stonybrook, Physics Department colloquium, 05/09  
University of Rochester/RIT seminar, 03/09  
Siemens Science Fair Regional Winners Award banquet, Georgia Tech, 11/08  
Gordon Conference on Granular Media, Colby College, ME 06/08  
College of Science Advisory Board, Georgia Tech, 04/08  
Cornell University, Machines and organisms seminar, 04/08  
American Physical Society March meeting, invited talk, 03/08  
Emory University, Physics department colloquium, 03/08  
University of Maryland, Nonlinear dynamics seminar, 02/08  
University of Toronto, Physics department colloquium, 01/08  
Aspen Workshop on Locomotion, Aspen, CO, 06/07  
Robotics, Systems & Science conference, accepted paper, Atlanta, GA 06/07  
Gordon Conference on Nonlinear Science, invited talk Colby College, ME, 06/07  
Emerging Themes in Physics Workshop, Austin, TX, 10/06  
Southern Workshop on Granular Materials 2006, Viña del Mar, Chile, 9/06  
Frontiers in Dynamics: Physical and Biological Systems, Tokyo, Japan 5/06  
Berkeley Mini Statistical Mechanics Meeting, Berkeley, CA, 1/06

### **Contributed**

American Physical Society, Division of Fluid Dynamics, 11/98 – 11/02, 11/04-11/05, 11/07-14  
Society for Integrative and Comparative Biology, 1/05-1/15  
Georgia Tech Soft Matter workshop, 05/13  
Southeast Regional SICB annual meeting (co-organizer), 09/13  
Robotics: Science and Systems, 06/10,12

CLAWAR, 07/12,13

Gordon Conference on Granular Materials, Davidson, NC, 07/12 (poster, student gave)

ASCE Earth and Space conference, Pasadena, CA, 04/12

ICRA, Shanghai, China, 05/11

International Sea Turtle Symposium, Myrtle Beach, SC, 03/07

IUPS Biophysical and Biomechanical Adaptation and Bioinspired Engineering, 3/05

Robots in Scansorial Environments Morphology Meeting, 11/05

American Physical Society March Meeting, 3/05,3/08-3/13

Director of Central Intelligence Postdoctoral Research Fellowship Colloquium, 4/04,4/05

Workshop on Predicting Ground Robot Performance, 9/04

American Physical Society, Glass Workshop Participant, 3/02

IUPAP 21<sup>st</sup> International Conference on Statistical Physics, 7/01

Conference in honor of Harry Swinney's 60<sup>th</sup> birthday, 6/00

Dynamics Days, 1/00, 1/04

#### Committees - Georgia Tech:

School of Physics web committee, 2013,2014

CoS Dean Search committee, 2012

Petit Scholars selection committee, 2012

Biophysics Search, School of Physics, 2007-2012 (co-chair 2012)

Graduate Admissions, School of Physics, 2007-2010.

Integrative BioSystems Institute Graduate Program planning, 2009-

School of Physics, Chair search, 2010

PhD/dissertation committees : Ken Desmond [Emory, Weeks, 05/08,09,10,12], Tai-de Lee

[Riedo,06/08], Jonathan Halcrow [Cvitanovic,05/08], Gina Cremona [Lu, Chem. E.,09/08],

Bummo Chung [qual exam, Bioengineering, 12/08], Bo Li [Flannery, 04/09], Abhinav Singh

[Weiss, Math, 04/09], Jan Krajniak [Lu, Chem. E., 08/09,04/13], Patrick Bradley

[Butera/Wiesenfeld, 11/09], Jay Bauman [Chang, Applied Physiology, 08/10-10/12], Alejandro

Garzon [Grigoriev, Physics, 08/10], Huseyin Kurtuldo [Schatz, Physics, 08/10], Se Il Lee

[Nguyen, Physics, 04/10], Ryan Maladen [Goldman, BioE, 06/09, 12/10], Huseyin Kurtuldo

[Schatz, Physics], Chen Li [Goldman, Physics, 10/11], Yang Ding [Goldman, Physics, 10/11],

Nick Gravish [Goldman, 03/13], Jay Bauman [Chang, Applied Physiology, 01/12,10/12],

Nicholas Parnell [Streelman, Biology, 08/11], Jeff Bingham [Ting, BME, 08/11,05/13], Nicole

Mazouchova [Goldman, Biology, 01/10, 06/10, 10/10, 5/12], Bo Li [Lin, MSE, 05/13].

#### Honors, Awards, and Recognitions:

Work recognized in popular press including New York Times, NPR, Discovery Channel, etc (for a complete list see <http://www.physics.gatech.edu/research/goldman/pages/press/index.htm>)

#### 2015

Tingnan Zhang is awarded a Bonnie B. and Charles K. Rice Jr. Fellowship from the School of Physics at Georgia Tech

## 2014

Prof. Goldman is elected as a Fellow of the American Physical Society (APS). His citation reads: "For contributions to biological physics and nonlinear dynamics at the interface of biomechanics, robotics, and granular physics".

Prof. Goldman is named a Georgia Power Professor of Excellence

Prof. Goldman joins the Editorial Board of the journal Bioinspiration & Biomimetics

John Parker is awarded the H. Fukuyo Memorial Scholarship Award in Physics from the Georgia Tech School of Physics.

Perrin Schiebel is awarded a National Defense Science & Engineering Graduate Fellowship (NDSEG)

Ben McInroe wins Best Oral Presentation for the College of Sciences at the Georgia Tech UROP Spring Symposium

Prof. Goldman receives Presidential Early Career Award for Scientists and Engineers (PECASE).

## 2013

Sarah Sharpe (PhD student) is awarded the Best Paper Award for the Georgia Tech Bioengineering Graduate Program 2013

Nicole Mazouchova (now a PhD student at Temple University) is awarded the Archie Carr Student Award in the Category of Field Biology Oral Presentation for her presentation at the 33rd Annual Symposium on Sea Turtle Biology and Conservation in Baltimore, USA.

Sarah Sharpe is awarded an Honorable Mention in the Best Student Presentation Program in the Division of Comparative Biomechanics at the Society for Integrative and Comparative Biology meeting in San Francisco, CA

## 2012

Goldman receives DARPA Young Faculty Award, 2012.

Goldman receives NSF CAREER Award, 2012.

Goldman receives GT Fire Award, 2012.

Best Student Paper award (Qian), Robotics: Science & Systems meeting, 2012

Nick Gravish is awarded a James McDonnell postdoctoral fellowship

PhD student (Gravish) is awarded a 2012 Georgia Tech Auxiliary Services IMPACT Scholarship, 2012

Chen Li is awarded the Sigma Xi Best PhD Thesis Award at Georgia Tech, 2012.

Nicole Mazouchova wins a Travel Award at the Georgia Tech Research and Innovation Conference, February 2012.

Nicole Mazouchova receives the Boyd Lyon Award for the best student poster at the Southeast Regional Sea Turtle Meeting, February 2012.

Nick Gravish wins a 2012 Amelio Award for excellence in research by a graduate student in Physics at Georgia Tech.

Undergraduates received PURA awards Fall 2007, Spring 2008, Summer 2011, Summer 2012.

## 2011

Yang Ding wins a 2011 Amelio Award for excellence in research by a graduate student in Physics at Georgia Tech.

Ryan Maladen is awarded the Sigma Xi Best PhD Thesis Award, 2011.

Sarah Steinmetz wins a Travel Award at the Georgia Tech Research and Innovation Conference, February 2011.

Ryan Maladen is awarded an Honorable Mention in the Best Student Presentation Program in the Division of Comparative Biomechanics at the Society for Integrative and Comparative Biology meeting in Salt Lake City, UT, 2011

Panelist for NSF PoLS, 11/09

#### 2010

Best Paper Award, Robotics: Science & Systems meeting, 2010.

Sigma Xi award, Georgia Tech, 2010.

Blanchard-Milliken Fellowship, Georgia Tech, 2010.

Invited to write popular article on undulatory locomotion for American Scientist (appeared July/August 2010).

Two PhD students (Mazouchova & Gravish) won \$5000 fellowship at the GTRIC poster conference, February 2010.

PhD student Ryan Maladen wins the IBB Suddath award, Georgia Tech, 2010

#### 2009

Advisor for CEISMIC NDF SLIDER grant, 12/09-

Thank a Teacher Award (2 awards) , CETL, Georgia Tech, 12/09

Invited to write popular article on robots on sand for IEEE Spectrum (appeared Fall 2009)

Panelist for NSF PoLS, 11/09

#### 2008

Thank a Teacher Award, CETL, Georgia Tech, 03/08

Best Student paper award, SICB (biology) meeting, 12/08 (PhD student Chen Li)

Reviewer for proposals for NSF Physics of Living Systems panel, Nov. 2008

Burroughs Wellcome Fund Career Award, 7/06-7/11

#### 2003-2004

First prize, poster competition at Dynamics Days conference, Chapel Hill, NC, 1/04

Outstanding dissertation award, Physics Department, UT Austin, 5/03

#### Membership in Professional and Honor Societies:

American Physical Society	1998-present
Society for Integrative and Comparative Biology	2004-present
International Sea Turtle Society	2007-present

Graduate and Undergraduate Students Supervised: (Please give current positions of Ph.D. students, if known)

#### Graduate

Jeff Aguilar, Mechanical Engineering PhD student

Yang Ding, Physics PhD 2011 (Beijing Computational Science Research Center as a research assistant professor)

Nick Gravish, Physics PhD 2013 (Harvard, postdoc)

Mark Kingsbury, Physics PhD student

Chen Li, Physics PhD 2011 (UC Berkeley, postdoc)

Ryan Maladen, Bioengineering PhD 2010 (Procter & Gamble)

Nicole Mazouchova, Biology MS 2012 (Temple University, PhD)

Feifei Qian, ECE PhD student  
Will Savoie, Physics PhD student  
Perrin Schiebel, Physics PhD student  
Sarah Steinmetz, Bioengineering PhD student  
Tingnan Zhang, Physics PhD student  
Vadim Linevich, ME MS student

Undergraduate

Azeem Bande-Ali (PHYS)  
Luke Buffardi (PHYS)  
Sandy Chen  
Jessica Chau (ME)  
Daniel Cohen (Princeton U, summer rotation student)  
Edward Coyle III (PHYS)  
Jeremiah Crane (ME)  
Kevin Daffon (ME)  
Elisabeth Deeb (ME)  
Dominique Everett (Morehouse College, SURE program)  
Mateo Garcia, (PHYS)  
Pegah Ghafourian (BME)  
Robbie Glenn (MATH)  
Elan Grossman (PHYS)  
Danny Guigo (ME)  
Duncan Hathaway (BME)  
Matt Jacobson (ECE)  
Nathan Jankovsky (PHYS)  
Adam Kamor (PHYS)  
Andras Karsai (PHYS)  
Katie Kelfer (ME)  
Nigel King (PHYS)  
Pushkar Kohle (ECE)  
Robyn Kuckuk (BME)  
Loretta Lau (ME)  
Yean Lee (PHYS)  
Vlad Levenfeld (PHYS)  
Laura Levy (BIO)  
Lionel London (PHYS)  
Andrew Masse (PHYS)  
Ben McInroe (PHYS)  
Daniel Mendel (PHYS)  
Graham Miller (PHYS)  
John Parker (PHYS)  
Greggory Rodriguez (PHYS)  
Max Roy (PHYS)



Luis Saldana (PHYS)  
Jeff Shen (BME)  
Romik Srinivastava (BIO, UGA)  
Zackary Stinnett (PHYS)  
Andrew Slatton (technician/researcher)  
George Tamunodiepriye, (Georgia Perimeter, SURE program)  
Humaira Taz (Wesleyan College, intern)  
Nicholas Ward (Augsberg College, SURE summer program)  
Baris Yildirim, (ISyE)  
Vanessa Yip, (BME)  
Kevin Daffon, high school intern, now GT  
Santosh Guin, high school intern, now GT  
James Farley, high school intern, GT in Fall 2014  
Aaron Kauffman, high school intern  
Anthony Stranko, high school intern, now GT  
Charles Xiao, high school intern  
Chad Weeks, high school intern

Postdoctoral Fellows Supervised: (Please give current positions, if known)

Dr. Henry Astley (Georgia Tech, postdoc)  
Dr. Darya Monaenkova (Georgia Tech, postdoc)  
Dr. Yang Ding, Physics, (now Beijing Computational Science Research Center as a  
research assistant professor)  
Dr. Hamid Marvi (now CMU, postdoc)

-----