SANGYOON JOSHUA HAN

Michigan Technological University
Department of Bioinformatics
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EDUCATION

2007 - 2012 **Ph.D., Mechanical Engineering, University of Washington**, Seattle, WA
Dissertation title: *Experimental and computational analysis of cell mechanics during spreading and migration*
Advisor: Nathan J. Sniadecki, Associate Professor in Mech. Engineering and Adjunct in Bioengineering
Dissertation committee: Tom Daniel (Biology), Garry Odell (Biology), Santosh Devasia (Mech. Eng.), Duane Storti (Mech. Eng.) and Alex Veress (Mech. Eng.)
Research experience: BioMEMS, Microfluidics, Micropatterning, Mammalian Cell Culture, Mathematical Modeling, Fluorescence Microscopy and Electron Microscopy

2002 - 2004 **M.S., Mechanical Engineering, Seoul National University**, Seoul, Korea (Advisor: Kunwoo Lee)
Thesis: *Biomechanical study of artificial disc replacement in lumbar spine using finite element analysis*

1998 - 2002 **B.S., Mechanical Engineering, Seoul National University**, Seoul, Korea
Senior project: *Development of Smart 2D Sketcher Using Dimensional Constraint Manager for Computer-Aided Design (CAD) Program*

CURRENT AND PAST EMPLOYMENT HISTORY

2017 - present **Michigan Technological University,** *Assistant Professor,* Biomedical Engineering
2014 - 2017 **University of Texas Southwestern Medical Center,** *Postdoctoral Scientist,* Bioinformatics
2012 - 2013 **Harvard Medical School,** *Postdoctoral Scientist,* Cell Biology
2007 - 2012 **University of Washington,** *Research Assistant,* Mechanical Engineering
2006 - 2007 **Korea Institute of Industrial Technology (KITECH),** *Project Manager*, Applied Robotics, Ansan, Korea
2004 - 2006 **Daewoo Electronics Corp,** *Research Engineer*, Digital Multimedia R&D Center, Gunpo, Korea

POSTDOCTORAL POSITIONS

Research Interests: Cell mechanics, Computational Cell Biology, Mechanobiology, Machine Learning and Cell Migration

2014 - present **University of Texas Southwestern Medical Center, Bioinformatics,** *Postdoctoral Scientist*
P.I.: Gaudenz Danuser, Professor and Chairman, Lyda Hill Department of Bioinformatics
- Developed high-resolution traction force microscopy (TFM) software package.
- Developed single-particle-tracking program for nascent and focal adhesions.
- Developed Machine-Learning-based classification of dynamic nascent adhesions.

2012 - 2013 **Harvard Medical School, Cell Biology,** *Postdoctoral Scientist*
P.I.: Gaudenz Danuser, Professor, Department of Cell Biology
- Developed high-performance particle image velocimetry (PIV) for TFM.
- Identified role of myosin II activity in actin's inward flow using quantitative fluorescence speckle microscopy (qFSM).

AWARDS AND GRANTS

Awards

2016 Best Poster Award, US-Korea Conference 2016
2015 American Society of Cell Biology Conference, Postdoctoral Scholar Travel Award
2011 University of Washington Travel Award
2011 NSF Student Travel Grants for the ASME IMECE 2011 Micro/Nano Forum
2009 Kobayashi Fellowship for outstanding graduate students

Grants (*Including current and previous trials*)

2017 NIH R01 (GM071868) Mechanochemical regulation of actin-mediated cell protrusion – Assisted P.I. with figures.
2016 NIH K99/R00 Career Development Grant: Science score: 3 in average (out of 6).
2015 Burroughs Wellcome Fund, Career Award in Scientific Interface: Finalist
2014 American Heart Association Postdoctoral Fellowship: Review score 2.12
2009 NIH R21 (HL097284) Subcellular Platelet Forces and Adhesions - Assisted P.I. with preliminary analysis
2008 NSF CAREER (#0846780) Mechanics of Smooth Muscle Cell Contraction - Assisted P.I. with preliminary analysis

SOFTWARE

1. Han, S.J., **TFM software**, written in Matlab and released in 2015, http://lccb.hms.harvard.edu/software.html

PATENTS

1. Sangyoon Han, Korea Patent 10-0643886-0000, *Remote Controlled Television by User's Motion Using Image Processing and the Method Thereof.* June, 2004
2. Sangyoon Han, Korea Patent 10-2004-0109944 Screen Angle Alternation Apparatus Through Viewer-position Detection And Method Thereof. December, 2004
3. Sangyoon Han, Korea Patent 10-0635144-0000, A Button Door Structure of Electronic Goods, June, 2004

SERVICE

Paper Referee

- *Biophysical Journal (2)*
- *Biomechanics and Modeling in Mechanobiology (2)*
- *Current Biology*
- *Journal of Cell Science*
- *Physical Chemistry Chemical Physics*
- *PLOS ONE*
- *RSC Advances*
- *Molecular Biosystems*
- *Computer Methods in Biomechanics and Biomedical Engineering*

Poster Judge:

2015 ASCB Conference undergraduate poster judge

TEACHING AND MENTORING EXPERIENCE

Teaching Experience

2016 October Teaching Assistant for Computational Image Analysis in Marine Biology Laboratory, Woods Hole, MA
2015 Summer Teaching Assistant for Matlab Boot Camp at UT Southwestern
2010 Spring Guest lectures for Biological Framework for Engineers (ME599) at University of Washington
2008 Spring Teaching Assistant for Mechanical Design and Analysis (ME356) at University of Washington

Mentoring Experience

Ning Zhang (Ph.D. student): 3D Sub-resolution Localization of Telomere and Gene in Chromosome (2014-2016)
Ariel Medina (Undergraduate): Live Cell Migration Force Analysis (2012)
Sean Chang (Undergraduate): Casting of Silicone Posts with Microbubbles (2009)
Max Walner (Undergraduate): Mechanical Testing of PDMS (2008)

INVITED TALKS

2016 Mechanical Engineering Graduate Student Seminar at University of North Texas, Denton, TX
2016 Mechanical Engineering Graduate Student Seminar at University of Texas Arlington, Arlington, TX
2015 Keynote speech at Korean Scientists and Engineers Association (KSEA) North Texas Meeting, Dallas, TX
2014 IEEE EMBC 2014, Cancer Nanotechnology Minisymposium, Chicago, IL
2013 Condensed Matter Seminar, Physics and Astronomy, Tufts University, Medford, MA
2012 World Class University seminar, Mechanical Engineering, Seoul National University, Seoul, Korea
2012 Undergraduate Seminar course, Mechanical Engineering, Myung-Ji University, Yongin, Korea
2012 Kristin Swanson Lab, Pathology, University of Washington Medical Center, Seattle, WA
2012 Tom Daniel Lab Seminar, Biology, University of Washington, Seattle, WA
2010 Graduate Student Seminar Series, Mechanical Engineering, University of Washington, Seattle, WA

PROFESSIONAL AFFILIATIONS

2009 - American Society of Mechanical Engineers (ASME)
2013 - American Society for Cell Biology (ASCB)
2013 - Biophysical Society
2014 - American Heart Association (AHA)
2014 - IEEE Engineering in Medicine and Biology Society (EMBS)

PEER REVIEWED PUBLICATIONS (in reverse chronological order)

1. Costigliola, N., Ding, L., Burckhardt, C.J., **Han, S.J.**, Gutierrez, E., Mota, A., Groisman, A., Mitchison, T.J., and Danuser, G. (2017) Vimentin directs traction stress. ***PNAS***. *2017 114 (20) 5195-5200.*

2. **Han, S.J**., Rodriguez M.L., Al-Rekabi, Z., Sniadecki, N.J. (2016) Spatial and Temporal Coordination of Traction Forces In One-Dimensional Cell Migration, *Cell Adhesion & Migration*. 10(5): 529-539.

3. Oudin, M.J., Barbier, L., Schäfer, C, Kosciuk, T., Miller, M.A., **Han, S.J.**, Jonas, O., Lauffenburger, D.A., Gertler, F.B. (2016) Mena confers resistance to Paclitaxel in triple-negative breast cancer. *Mol Cancer Ther*. DOI**:** 10.1158/1535-7163. MCT-16-0413.

4. Milan,J., Manifacier, I., Beussman, K.M., **Han, S.J.**, Sniadecki, N.J., About, I., Chabrand, P. (2016) In silico CDM model sheds light on force transmission in cell from focal adhesions to nucleus. *J Biomechanics*. 49(13):2625-2634.

5. Lomakin. A.J., Lee, K.C., **Han, S.J**., Bui, A., Davidson, M., Mogilner, A., Danuser G. (2015) Competition for molecular resources among two structurally distinct actin networks defines a bistable switch for cell polarization, ***Nature Cell Biology***. 17, 1435–1445

6. **Han, S.J.**, Oak, Y., Groisman, A., Danuser, G. (2015) Traction Microscopy to Identify Force Modulation in Sub-resolution Adhesions, ***Nature Methods***. 12(7): 653–656

7. Rodriguez, M.L., Graham, B.T., Pabon, L.M., **Han, S.J**., Murry, C.E., Sniadecki, N.J. (2014) Measuring the Contractile Forces of Human Induced Pluripotent Stem Cell-Derived Cardiomyocytes with Arrays of Microposts. *J Biomechanical Engineering*. 136(5), 051005

8. Sniadecki, N.J., **Han, S.J.**, Ting, L.H., Feghhi, S. (2013) Micropatterning on Micropost Arrays, *Methods in Cell Biology*. 121:61-73

9. Rodriguez, A.G., Rodriguez, M.L., **Han, S.J**. Sniadecki, N.J., Regnier, M. (2013) Enhanced Contractility with 2-deoxy-ATP and EMD 57033 is Correlated with Reduced Myofibril Structure and Twitch Power in Neonatal Cardiomyocytes. *Integr Biol*. 5(11):1366-73

10. **Han, S.J.**, Bielowski, K., Rodriguez, M, Ting, L., Sniadecki, N.J. (2012) Decoupling Spread Area, Substrate Stiffness, and Micropost Density: A Close Spatial Relationship Between Traction Forces and Focal Adhesions. ***Biophys J*.** 103(4):640-648

11. Ting, L., Jahn , J., Jung, J., Shuman, B., Feghhi, S., **Han, S.J.**, Sniadecki, N.J. (2012) Flow Mechanotransduction Regulates Traction Forces, Intercellular Forces, and Adherens Junctions. *Am J Physiol Heart and Cir Physiol*. 302(11):H2220-H2229

12. Ting, L.H., Feghhi, S., **Han, S.J**., Rodriguez, M.L., Sniadecki, N.J. (2011) Effect of Silanization Film Thickness in Soft Lithography of Nanoscale Features. *ASME J Nano Engr Medicine*. 2(4):041006

13. Rodriguez, A.G., **Han, S.J**., Regnier, M., Sniadecki, N.J. (2011) Substrate Stiffness Increases Twitch Power of Neonatal Cardiomyocytes in Correlation with Changes in Myofibril Structure and Intracellular Calcium. *Biophys J*. 101(10):2455-2464.

14. **Han, S.J.**, Sniadecki, N.J. (2011) Simulations of the Contractile Cycle in Cell Migration Using a Bio-Chemical-Mechanical Model. *Comp Meth Biomech Biomed Eng*. 14(5):459-468

15. Tooley, W.W., Feghhi, S., **Han, S.J.**, Wang, J., Sniadecki, N.J. (2011) Thermal Fracture of Oxidized Polydimethylsiloxane during Soft Lithography of Nanopost Arrays. *J Microeng Micromech*. 21(5):054013

16. Liang, X.M, **Han, S.J.**, Reems, J.A., Gao, D., Sniadecki, N.J. (2010) Platelet Retraction Force Measurements Using Flexible Post Force Sensors. *Lab on a Chip*. 10(8):991-998

BOOK CHAPTER

1. **Han, S.J.**, Sniadecki, N.J. (2011) Nanotechnology Usages for Cellular Adhesion and Traction Forces. *Cellular and Biomolecular Mechanics and Mechanobiology*. (ed. A. Gefen). Springer: New York. 7:177-200.

MANUSCRIPTS IN PREPARATION

1. **Han, S.J.**, Bachir, A., Dean, K., Guttierrez, E., Groisman, A., Horwitz, A.R. and Danuser, G. Emerging role of differential molecular association to nascent adhesions in force-assisted stabilization of adhesion complex. *In preparation*
2. Halidy, N., **Han, S.J.,** Vilela, M., Guttierrez, E., Groisman, A. and Danuser, G. Mechanical environment alters Rac1 and RhoA activity at the leading edge of a migrating cell. *In preparation*
3. Lakoduk, A.M., **Han, S.J.**, Kadlecova, Z., Schmid, S. The interaction of PIPKI gamma with AP2 regulates spatial and temporal focal adhesion dynamics in cells. *In preparation*
4. Schäfer, C., Ju, Y., Tak, Y., **Han, S.J.**, Tan, E., Shay, J.W., Danuser, G., Holmqvist, M., Bubley, G. Identification of circulating pluripotent cancer stem cells in the blood of prostate cancer patients for the diagnosis of metastatic cancer. *In preparation*

CONFERENCE PROCEEDINGS

15. **Han, S.J**., Biophysics Society Meeting, Single Cell Biophysics, Taipei, Taiwan (Podium and Poster) 2017

14. **Han, S.J**., Bachir, A.I., Dean, K., Guttierrez, E., Groisman, A., Horwitz, A.R., Danuser G., Horwitz A.R. Hierarchical molecular recruitment in force-transmitting nascent adhesions, US-Korea Conference (Poster) 2016

13. **Han, S.J**., Bachir, A.I., Dean, K., Guttierrez, E., Groisman, A., Horwitz, A.R., Danuser G., Horwitz A.R. Hierarchical molecular recruitment in force-transmitting nascent adhesions, Gordon Research Conference (Poster) 2016

12. **Han, S.J**., Bachir, A.I., Horwitz, A.R., Danuser G., Horwitz A.R. Mechano-sensitivity of nascent adhesions on soft substrates revealed by fluorescence fluctuation analysis and traction microscopy, ASCB (Podium and Poster) 2015

11. Bachir, A.I., **Han, S.J**., .., Danuser G., Horwitz A.R. Correlative Traction Force Microscopy and Fluorescence Fluctuation Analysis of Molecular Aggregation and Complex Formation in Cell Adhesions in Distinct Microenvironments, Biophysical Society Meeting (Podium) 2015

10. **Han, S.J**., Oak, Y., Danuser G. Feedback Interactions between Intracellular Contraction and Leading Edge Protrusion in Directed Cell Migration, Biophysical Society Meeting (Poster) 2015

9. **Han, S.J**., Oak, Y., Danuser G. Force Sensing at Adhesions Using Sparsity Regularization Schemes. 36th Annual International IEEE EMBS Conference (Podium) 2014

8. **Han, S.J**., Oak, Y., Danuser G. High-Resolution Traction Force Microscopy to Track Forces in Nascent Adhesions. American Society of Cell Biology (Poster) 2013

7. **Han, S.J**., Oak, Y., Danuser G. Novel High-Resolution Traction Force Microscopy to Track Forces in Nascent Adhesions. Gordon Research Conference Motile & Contractile Systems (Poster) 2013

6. **Han, S.J**., Sniadecki, N.J. Multiphysics Model About Traction Forces during Cell Migration. Multiscale Methods and Validation in Medicine and Biology (Podium) 2012

5. **Han, S.J**., Sniadecki, N.J. Traction Forces during Cell Migration Predicted By the Multiphysics Model. ASME International Mechanical Engineering Congress & Exposition (Podium and Poster) 2011

4. Rodriguez, A.G., **Han, S.J.**, Regnier, M., Sniadecki, N.J.. The Effect of Stiffness and beta-adrenergic stimulat on Neonatal Cardiomyocyte Ca++-mediated Contractile Force Dynamics. Biophysical Society Meeting (Poster) 2010

3. Rodriguez, A.G., **Han, S.J.**, Regnier, M., Sniadecki, N.J. Microfabricated Post Array Detectors to assess cardiomyocyte forces induced on their environment via focal adhesions. Biophysical Society Meeting (Poster) 2009

2. **Han, S.J.**, Wallner, M., Sniadecki, N.J. Flexible Force Sensors For Detecting The Biomechanical Signatures of Cancer vs. Normal Cells, MicroTAS 2009. Jeju Island, Korea, November 1st-5th, 2009, pp 1790-1792

1. **Han, S.J.**, Sniadecki, N.J. The Coupled Influences of Substrate Stiffness and Cell Spreading Area on Traction Forces. *Proc. of the ASME 2009 Summer Bioengineering Conference*. Squaw Creek, CA, June 17th-21st, 2009