

# SANGYOON J. HAN

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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  
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 - 2017 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).

## SOFTWARE

1. Han, S.J., **TFM software**, written in Matlab and released in 2015, <https://sites.google.com/mtu.edu/hanlab/software>

## 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

## AWARDS AND GRANTS

## **Awards**

2019 Best Poster Award, The 6<sup>th</sup> Zoo Meeting on Cell Adhesion and Migration in Inflammation and Cancer, 2019  
2017 Best Poster Award, US-Korea Conference 2017  
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

## **SERVICE**

### **Paper Referee**

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

### **Poster & Podium Judge:**

**2015** ASCB Conference undergraduate poster judge

**2018** Feb 28 Graduate Research Colloquium judge

### **Services to Local Community**

**2017** October Engineering Discovery Day

## **TEACHING AND MENTORING EXPERIENCE**

### **Teaching**

**2018** Spring Bio-Fluid Mechanics (BE4930), Michigan Tech University  
**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**

Nikhil Mittal (Ph.D. student): Nascent Adhesion Mechano-sensing (2017-present)  
Mehdi Abtahi (Ph.D. student): High-accuracy Traction Force Microscopy Development (2018-Present)  
Mohanish Chandurkar (M.S. student): Shear Flow Mechanotransduction (2018-Present)  
Shaina Rover (Undergrad): Silicone Gel Fabrication and Bead Conjugation (2018-Present)  
Sue Kim (Undergrad): Deformation Tracking Method (2018-Present)  
Elizabeth Kaechele (Undergrad): Actin Speckle Microscopy (2018-Present)  
Lucia Salinas (Undergrad): AFM measurement of silicone gel (2019 summer)  
Ning Zhang (Ph.D. student): 3D Sub-resolution Localization of Telomere and Gene in Chromosome (2014-2016)  
Ariel Medina (Undergrad): Live Cell Migration Force Analysis (2012)  
Sean Chang (Undergrad): Casting of Silicone Posts with Microbubbles (2009)  
Max Walner (Undergrad): Mechanical Testing of PDMS (2008)

## **INVITED TALKS**

2018 Materials Science and Engineering Department, Michigan Technological University, Houghton, MI  
2017 Chemistry Department, Michigan Technological University, Houghton, MI  
2017 Chicago Cytoskeleton Meeting, Northwestern University, Chicago, IL  
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 (BPS)
- 2014 - American Heart Association (AHA)
- 2014 - IEEE Engineering in Medicine and Biology Society (EMBS)
- 2017 - Biomedical Engineering Society (BMES)

## PEER REVIEWED PUBLICATIONS (in reverse chronological order)

1. Mohan, A.S., Dean, K.M., Isogai, T., Kasitinon, S.Y., Murali, V.S., Roudot, P., Groisman, A., Reed, D.K., Welf, E.S., **Han, S.J.**, Noh, J., and Danuser, G. (2019). Enhanced Dendritic Actin Network Formation in Extended Lamellipodia Drives Proliferation in Growth-Challenged Rac1P29S Melanoma Cells. *Developmental Cell*, 49(3), pp.444-460.
2. Schäfer, C., Ju, Y., Tak, Y., **Han, S.J.**, Tan, E., Shay, J.W., Danuser, G., Holmqvist, M., Buble, G. (2019) TRA-1-60-positive cells found in the peripheral blood of prostate cancer patients correlate with metastatic disease. *In revision, Heliyon*
3. Manificier I., Milan, J., Beussman, K., **Han, S.J.**, Sniadecki, N.J., About, I (2019) The consequence of large scale rigidity on actin network tension. *In press. Comp Meth Biomech Biomed Eng.*
4. Mohan A., Dean K., **Han S.J.**, Welf E.S., Danuser G. (2017) LB993 Focal adhesions mediate Rac1P29S-dependent drug resistance to MAPK inhibitors in melanoma. *J Investigative Dermatology*. 137 (10), B11
5. 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.
6. **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.
7. 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.
8. Milan, J., Manificier, 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.
9. 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
10. **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
11. 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
12. Sniadecki, N.J., **Han, S.J.**, Ting, L.H., Feghhi, S. (2013) Micropatterning on Micropost Arrays, *Methods in Cell Biology*. 121:61-73
13. 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

14. 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
15. 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
16. 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
17. 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.
18. 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
19. 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
20. 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. Isoguy, T., Dean, K., Han, S.J., ..., Danuser, G., Arp2/3 project
5. Buckhart, C., Han, S.J., ..., Danuser, G., TTP project.

#### CONFERENCE PROCEEDINGS

20. The 6<sup>th</sup> Zoo Meeting, Cell Adhesion and Migration in Inflammation and Cancer, Rotterdam, Netherlands 2019 (Poster)
19. Gordon Research Conference, Fibronectin, Integrin and Related Molecules, 2019 (Poster, Podium)
18. Biomedical Engineering Society (BMES) Meeting, Atlanta, GA 2018 (Podium)
17. Gordon Research Conference, Signaling by Adhesion Receptors 2018 (Poster)
16. ASME International Mechanical Engineering Conference and Exposition 2017 (Podium)
15. Biomedical Engineering Society (BMES) Meeting, Phoenix, AZ 2017 (Poster)
14. US-Korea Conference 2017 (Poster)– Best Poster Award
13. EMBO, Mechanical Forces in Biology, Heidelberg, Germany 2017 (Poster)
12. Biophysics Society Meeting, Single Cell Biophysics, Taipei, Taiwan 2017 (Podium and Poster)
11. US-Korea Conference 2016 (Poster)– Best Poster Award
10. Gordon Research Conference, Signaling by Adhesion Receptor 2016 (Poster)
9. ASCB Annual Meeting 2015 (Podium and Poster)
8. Biophysical Society Meeting 2015 (Poster)
7. Annual International IEEE EMBS Conference 2014 (Podium)
6. American Society of Cell Biology (ASCB) Annual Meeting 2013 (Poster)
5. Gordon Research Conference Motile & Contractile Systems 2013 (Poster)
4. Multiscale Methods and Validation in Medicine and Biology 2012 (Podium)

3. ASME International Mechanical Engineering Congress & Exposition 2011 (Podium and Poster)
2. Miniaturized Systems for Chemistry and Life Sciences (MicroTAS) 2009 (Poster)
1. ASME 2009 Summer Bioengineering Conference, 2009 (Poster)

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