

Heather Naomi Hayenga

Department of Bioengineering
Erik Jonsson School of Engineering and Computer Science
The University of Texas at Dallas

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EDUCATION

Doctor of Philosophy, May 2011

Biomedical Engineering, Texas A&M University, College Station, TX
Title: Mechanics of Atherosclerosis, Hypertension Induced Growth, and Arterial Remodeling
Advisor: Jay D. Humphrey, Ph.D.
GPA: 3.82

Bachelor of Science, June 2006

Biomedical Engineering, University of California - Davis, Davis, CA
Advisor: Scott I. Simon, Ph.D.
GPA: 3.7 with honors

RESEARCH INTERESTS

- Vascular mechanics and mechanobiology
- Computational models of cardiovascular disease progression and prevention
- Cell-based experimental systems to elucidate proteomic and genomic expression due to altered mechanical stimuli

EXPERIENCE

Assistant Professor (Aug. 2013 – Present)

The University of Texas at Dallas, Richardson, TX, Department of Bioengineering

Research Associate (Nov. 2011 – Jul. 2013)

Cell Biophysics Laboratory, University of Maryland

- Discovered the relationship between monocyte trans-endothelial migration and arterial stiffening using an established in vitro model of the vascular endothelium and immunofluorescence/ reflection interference / phase contrast microscopy.
- Investigated the mechanobiological response of macrophages.

Graduate Student Researcher (Aug. 2006 – May 2011)

Continuum Biomechanics Laboratory, Texas A&M University

- Analyzed structure and composition of multiple artery types in a porcine hypertensive model and mouse atherosclerotic model including: birefringence of collagen, cell density, elastin, macrophages, hematopoietic stem cells, endothelial cells, smooth muscle cells, and geometry
- Predicted mechanical stress and biochemical activity as an artery remodels due to pressure and flow perturbations using multi-scale modeling
- Designed and developed test methods to mechanically test heterogeneous plaques
- Collaborated with 5 labs/Investigators, and directed 3 undergraduate students

Research Assistant IV (*Sept. 2004 – Jun. 2006*)

Vascular Immunology Laboratory, University of California - Davis

- Detected receptor-ligand binding rates (KD) of cells using fluorescent flow cytometry

TEACHING

University of Texas at Dallas, Department of Bioengineering, Dallas, TX

- Lecture: Biomedical Applications of Electrical Engineering (EEBM6376 / BMEN6376)

University of Maryland, Department of Bioengineering, College Park, MD

- Research Assistantship: Lab training on cell engineering and biology

Texas A&M University, Department of Biomedical Engineering, College Station, TX

- Research Assistantship: Lab training on instrumentation and cardiovascular mechanics

PROFESSIONAL MEMBERSHIPS

- **Alpha Eta Mu Beta (AEMB)** (*2006 – Present*)
- **Biomedical Engineering Society (BMES)** (*2005 – Present*)
- **American Heart Association (AHA)** (*2013 – Present*)
- **Society of Women Engineers (SWE)** (*2013 – Present*)

HONORS AND OTHER RECOGNITIONS

BMEN Graduate Representative for Graduate Student Council (GSC) (*2009 – 2010*)

The GSC functions as the graduate student government

Academic Excellence Award at Texas A&M University (*2009 – 2010*)

Cash award given to selected student based on scholastic and research performance

President of Alpha Eta Mu Beta (AEMB) (*2007 – 2009*)

The Texas A&M Chapter of the Biomedical Engineering Honors Society

PROFESSIONAL ACTIVITIES AND SERVICE

- Served as an NIH Biomedical Instrumentation Special Emphasis Panel member and reviewed grant applications for Instrument and Development for Biomedical Applications (R21)

(March 4, 2014)

- Faculty Advisor for the UTD chapter of the Biomedical Engineering Society (BMES) (January 2014 – Present)
- Faculty Advisor for the UTD chapter of Society of Women Engineering (SWE) (September 2013 – Present)
- Chair of the Biomedical Engineering Seminar Series Committee at UTD (September 2013 – Present)
- Presented at Engineering Week at UTD (February 18-21, 2014)
- Speaker at IEEE research showcase (September 23, 2013)
- Discussant for Gemstone Senior Thesis Conference (April 2013)
- Volunteered at the Biomolecular Discovery Dome for Maryland Day (April 2013)
- Reviewer for Computer Methods in Biomechanics and Biomedical Engineering (2012 – Present)

PEER-REVIEWED PUBLICATIONS

1. **Hayenga HN**, Aranda-Espinoza H. “Substrate elasticity controls mechanotactic behavior of human monocyte derived macrophages.” (in preparation)
2. **Hayenga HN**, Aranda-Espinoza H. “Stiffness increases mononuclear cell transendothelial migration.” *Cell Mol Bioeng*. Sept 2013, 6(3):253-65.
3. Stroka KM, **Hayenga HN**, Aranda-Espinoza H. “Human neutrophil cytoskeletal dynamics and contractility actively contribute to trans-endothelial migration.” *PLOS ONE*. Apr 2013, 8(4):e61377.
4. **Hayenga HN**, Hu JJ, Meyer CA, Wilson E, Hein T, Kuo L, Humphrey JD. “Differential progressive remodeling of coronary and cerebral arteries and arterioles in an aortic coarctation model of hypertension.” *Frontiers Vasc Physiol*. Nov 2012, 3(420):1-16.
5. Munoz-Pinto DJ, Qu X, Bansal L, **Hayenga HN**, Hahn J, Hahn MS. Relative impact of form-induced stress vs. uniaxial alignment on multipotent stem cell myogenesis. *Acta Biomater*. Nov 2012, 8(11):3974-81.
6. Munoz-Pinto DJ, Jimenez-Vergara AC, Hou Y, **Hayenga HN**, Rivas A, Grunlan M, Hahn M. “Osteogenic potential of poly(ethylene glycol)-poly(dimethylsiloxane) hybrid hydrogels.” *Tissue Eng Part A*. Aug 2012, 18(15-16):1710-9.
7. **Hayenga HN**, Trache A, Trzeciakowski J, Humphrey JD. “Regional atherosclerotic plaque properties in ApoE^{-/-} mice quantified by atomic force, immunofluorescence, and light microscopy.” *J Vasc Res*. Aug 2011, 48(6):495-504.
8. **Hayenga HN**, Thorne BC, Peirce SM, Humphrey JD. “Ensuring congruency in multiscale modeling: towards linking agent based and continuum biomechanical models of arterial adaptation. *Ann Biomed Eng*. Nov 2011, 39(11):2669-82.

9. Thorne BC, **Hayenga HN**, Humphrey JD, Peirce SM. "Towards a multi-scale computational model of arterial adaptation in hypertension: verification of a multi-cell agent-based model." *Front Physio.* May 2011, 2(20):1-12.
10. Nemir S, **Hayenga HN**, West JL. "PEGDA hydrogels with patterned elasticity: Novel tools for the study of cell response to substrate rigidity." *Biotechnol Bioeng* Feb 2010, 105(3):636-11.
11. Sarantos MR, Zhang H, Schaff UY, Dixit N, **Hayenga HN**, Lowell CA, Simon SI. "Transmigration of neutrophils across inflamed endothelium is signaled through LFA-1 and Src family kinase." *J Immunology* Dec 2008, 181(12):8660-9.
12. Zhang Y, **Hayenga HN**, Sarantos MR, Simon SI, Neelamegham. "Differential regulation of neutrophil CD18 integrin function by di- and tri-valent cations: manganese vs. gadolinium." *Ann Biomed Eng.* Apr 2008, 36(4):647-60.
13. **Hayenga HN**, Sarantos MR, Simon SI. "Binding affinity of leukocyte function associated antigen-1 (LFA-1) towards Intracellular Adhesion Molecule-1 (ICAM-1) induced by Mg²⁺ and Gd³⁺ and abrogated with competitive and allosteric inhibitors." *J Explorations* 2006, 9:40-66.

PRESENTATIONS (* indicates presenting author)

1. Matthews ME*, **Hayenga HN**, Aranda-Espinoza JH. "ICAM-1 Ring Expression and Role in Transmigration of Leukocytes on Endothelial Cells." ASCB Conference, San Francisco, December 15-19, 2012.
2. **Hayenga HN***, Paraloglou A, Aranda-Espinoza H. "Differential Stiffness Effects Integrin-dependent Mononuclear Cell Transmigration." BMES Conference, Atlanta Georgia, October 24-27, 2012.
3. **Hayenga HN***, Helim Aranda-Espinoza, Stroka KM. "Dynamics of Neutrophil Cytoskeleton in Transmigration." BMES Conference, Atlanta Georgia, October 24-27, 2012.
4. **Hayenga H***, Hallmark B, Hu J-J, Meyer C, Miller M, Fossum T, Wilson E, Humphrey J. "Hypertension Induced Remodeling of Muscular and Elastic Arteries in a Mini-Pig Coarctation Model." BMES Conference October 12, 2011.
5. **Hayenga HN***, Trache A, Trzeciakowski J, Humphrey J. "Regional Atherosclerotic Plaque Properties as Measured by Atomic Force Microscopy." BMES Conference October 8, 2010.
6. **Hayenga H***, Thorne B, Peirce S, Humphrey J. "Predicted Arterial Changes during Hypertension using Multi-Scale Modeling." BMES Conference October 8, 2010.
7. Humphrey JD*, **Hayenga HN**, Thorne BC, Peirce SM. "Multiscale Modeling of Arterial

Adaptations: Integration of Agent Based and Constrained Mixture Models.” IMAG Multiscale Modeling Consortium Meeting October 28, 2010.

8. Thorne BC*, **Hayenga HN**, Humphrey JD, Peirce SM. “Development of an Agent-Based Model of Arterial Wall Remodeling in Response to Hypertension.” Swarmfest, New Mexico, June 20-22, 2010.
9. Simon SI*, Sarantos M, Schaff U, **Hayenga H**, Staunton D. “Beta 2-Integrin Affinity and Valence in Binding ICAM-1 Regulates Contact Mediated Emigration of PMN in Shear Flow.” FASEB, 21(6):A1226-A1226, April, 2007.
10. Neelamegham S*, Zhang Y, **Hayenga HN**, Sarantos MR, Simon SI. “Mn and Gadolinium Regulate Neutrophil CD18 Integrin Affinity via Distinct Mechanisms.” Annual Meeting, Engineering Fundamentals in Life Science November 17, 2006.
11. Sarantos MR*, Schaff UY, **Hayenga HN**, Davis BB, Stauton DE, Simon SI. “Outside-in Signaling of Neutrophil Adhesion and Cell Polarization Involves LFA-1/ICAM-1 Dimerization.” BMES Conference October 13, 2006.
12. Sarantos MR*, **Hayenga HN**, Lum AFH, Raychaudhuri S, Staunton DE, Simon SI. “LFA-1 bound to ICAM-1 homodimer regulates adhesion lifetime and outside-in signaling.” FASEB, 20(4):A116-A116, March 6, 2006.
13. **Hayenga HN***. “Leukocyte Function-associated Antigen-1 (LFA-1) Affinity for Intercellular Adhesion Molecule-1 (ICAM-1) is increased by Gadolinium.” 17th Annual Undergraduate Research Conference February 17, 2006.

BOOK CHAPTER

1. **Hayenga HN**, Thorne BC, Yen P, Papin JA, Peirce SM, Humphrey JD. (2013). Multiscale Computational Modeling in Vascular Biology: From Molecular Mechanisms to Tissue-Level Structure and Function. In *Studies in Mechanobiology, Tissue Engineering and Biomaterials* (pp. 209-240). New York: Springer.

INVITED TALKS

1. **Hayenga HN**. “Research and Graduate School Opportunities at UT Dallas.” SHPE meeting. University of Maryland, College Park, MD. March 4, 2014.
2. **Hayenga HN**. “Arterial Mechanobiology.” IEEE research showcase. University of Texas, Dallas, TX. September 23, 2013.
3. **Hayenga HN**. “Mechanobiology of Atherosclerosis and Hypertension.” George Washington University, Washington DC. April 30, 2013.

4. *Hayenga HN*. “Mechanobiological aspects of Atherosclerosis and Hypertension.” University of Texas at Dallas, Dallas, TX. March 26, 2013.
5. *Hayenga HN*. “Implications of Arterial Stiffening.” University of Maryland, College Park, MD. February 19, 2013.
6. *Hayenga HN*. “Mechanics of Atherosclerosis, Hypertension Induced Growth, and Arterial Remodeling.” University of Maryland, College Park, MD. October 27, 2011.
7. *Hayenga HN*. “Histological Examination of Arteries in Adult Mini-pigs.” Yale University, New Haven, CT. October 14, 2011.

CURRENT GRADUATE STUDENTS

1. Neil R. Dorsey, M.S. Student in Biomedical Engineering (2013 – present)
2. Rita Bhui, Ph.D. Student in Physics (2013 – present)

CURRENT UNDERGRADUATE STUDENTS

1. Stephanie Kubecka, B.S. Student in Biomedical Engineering (Fall 2013 – present)
2. Arri Morris, B.S. Student in Biomedical Engineering (Fall 2013 – present)
3. Joseph McFarland, B.S. Student in Electrical Engineering (Fall 2013 – present)
4. Yuvan Gupta, B.S. Student in Computer Science (Fall 2013 – present)
5. Sanyukta Bihari, B.S. Student in Biomedical Engineering (Fall 2013 – present)
6. Michael Kaldawi, B.S. Student in Computer Engineering (Spring 2013 – present)
7. Samantha Hartke, B.S. Student in Biomedical Engineering (Spring 2013 – present)
8. Lauren Oneal, B.S. Student in Biomedical Engineering (Spring 2013 – present)