Hoda Zarkoob

hoda.zarkoob@northwestern.edu , (319)-471-8338, Tarry Bldg 3-7345, 303 E. Chicago Ave, Chicago

RESEARCH INTERESTS

Mechanobiology of Heart, Cell-Cell and Cell-ECM Interactions, Mechanobiology of Wound Healing, Three Dimensional Skin Tissue Remodeling, Cellular Mechanotransduction

EDUCATION

Postdoctoral, Pathology, 2017-Present
Feinberg School of Medicine, Northwestern University, Chicago, Illinois, USA
Postdoctoral Advisor: Prof. Kathleen Green

Ph.D., Biomedical Engineering, 2012 – 2017
The University of Iowa, Iowa City, Iowa, USA
Thesis Advisor: Dr. Edward Sander
Thesis Title: *Mechanobiology of keratinocytes colony formation and its role in wound healing*

M.Sc., Mechanical Engineering, 2008 - 2011
Isfahan University of Technology, Isfahan, Iran
Thesis Advisor: Prof. Saeed Ziaei-Rad, Prof. Mohammadhossein Fathi
Thesis Title: *Manufactured, characterized and modeled (FEM) a new bone graft composite "Porous Barium Titanate with Nanostructured Hydroxyapatite Coating".*

B.Sc., Mechanical Engineering, 2004 - 2008
Isfahan University of Technology, Isfahan, Iran
Thesis Advisor: Prof. Saeed Ziaei-Rad
Thesis Title: *Design and manufacturing of a Magneto rheological Damper based on Magneto Rheological Fluid*

RESEARCH EXPERIENCE AND PROJECT MANAGEMENT

Postdoctoral Fellow: Northwestern University, 2017-Present

- Study mechanotransduction of cardiomyocytes through desmosomal junctions by investigating the potential pathways that translate mechanical cues from the adjacent cardiomyocyte into biological response.

Research Assistant: University of Iowa, 2012-2017

Multi-scale Mechanics, Mechanobiology, and Tissue Engineering Lab

- Performed a study on the effect of substrate stiffness on human keratinocyte colony formation, differentiation and force generation and quantified the elevated rates of colony formation on lower stiffness substrates.
- Quantified the alteration of Rho-ROCK pathway proteins (involved in the process of cells force generation) at RNA and protein level in the keratinocytes on varied stiffness substrates using qPCR, Western blot and proteomics iTRAQ analysis.
- Studied the effects of Y27632 and blebbistatin drugs on force generation, colony

formation and Rho/ROCK gene expression of keratinocytes on soft and stiff substrates.

- Conducted a study on the role of keratin intermediate filaments on keratinocytes force generation using keratin-muted keratinocyte and appraised their significant role.
- Built a biomimiced model of re-epithelialization in wound healing by injuring the reconstructed epithelial layer of the skin on collagen.

Research Assistant: Isfahan University of Technology, 2008-2011

Biomaterials Lab- FEA Lab

- Designed and manufactured a new piezoelectric bone graft composite "*Porous Barium Titanate with Nanostructured Hydroxyapatite Coating*".
- Characterized the structural properties and bioactivity of the hydroxyapatite using XRD, SEM, EDX and ICP analysis.
- Manufactured barium titanate nano-powder, hydroxyapatite nano-powder and nano-structured Hydroxyapatite coating with sol-gel method.
- Modeled the mechanical properties of porous Barium Titanate with Finite Element software using crushable foam material model.

COLLABORATIONS

- Prof. Janet Fairly, Dr. John Selby, and Dr. Kelly Messingham: Department of Dermatology, University of Iowa Carver College of Medicine, USA.
- Prof. Thomas Magin: TRM Leipzig & Institute of Biology, University of Leipzig, Germany.
- Prof. Joseph Reinhardt: Department of Biomedical Engineering, University of Iowa, USA.

TECHNICAL SKILLS

Tissue culture Techniques:

- Isolation of neonatal rat ventricular cardiomyocyte, Isolation of Primary keratinocyte and Fibroblast from Human Skin Tissue, Culturing Human Skin Keratinocyte, Human Skin Fibroblast, Prostate Epithelial Cancer Cell, Trabecular Meshwork Cells,

Microscopy Techniques:

- Differential Interference Contrast (DIC), Phase Contrast, Epi-Fluorescence, Laser Scanning Confocal Microscopy**,** Scanning Electron Microscopy (SEM)**,** Atomic Force Microscopy**,** Time-lapse Live Cell Imaging**,** Displacement Tracking Microscopy (DTM), and Traction Force Microscopy (TFM).

Molecular Biology Techniques:

- Immunofluorescence Staining**,** RT-PCR, qPCR**,** Western Blot, Immunoprecipitation, Coomassie Blue and Silver Staining

Mechanical Testing:

- Uniaxial Extension/Compression Test, Measuring the Stiffness of Polymer Using Glass Bead Indentation Technique with Hertzian Contact Model

Computer and Programming skills:

- Abaqus, Ansys, Catia, Visual Nastran software (Mechanical Design, Simulink, Analysis),

Matlab, ImagJ, C, Java, Pascal

LEADERSHIP AND COMMUNICATION

Training and Teaching:

- Lab manager and teaching assistance of cell-material interaction course
- Teaching assistance of mechanics of deformable bodies course
- Training undergraduate students for tissue culturing techniques, imaging with microscopes and casting polyacrylamide gels

Leadership and Communication:

- Head of departmental research group working on "Design and Manufacturing of a Smart Structure Builder".

PUBLICATIONS

Journal Publication:

- **Hoda Zarkoob**, Sandeep Bodduluri, Sailahari V. Ponnaluri, John C. Selby and Edward A. Sander, Substrate Stiffness Affects Human Keratinocyte Colony Formation, *Cellular and Molecular Bioengineering***,** Volume 8, Issue 1, pp 32-50, March 2015.
- **Hoda Zarkoob**, Saeed Ziaei-Rad, Mohammadhossein Fathi and Hossein Dadkhah, **"**The effect of piezoelectric properties in Calcium Phosphate mineralization in piezoelectric biomaterials**"**, *Advanced Science Letters*, Volume 19, Number 1, pp. 101-105(5), January 2013.
- **Hoda Zarkoob**, Saeed Ziaei-Rad, Mohammadhossein Fathi and Hossein Dadkhah, "Synthesis, Characterization and Bioactivity Evaluation of Porous Barium Titanate with Nanostructured Hydroxyapatite Coating for Biomedical Application", *Advanced Engineering Biomaterials*, Volume 14, Issue 6, pages B322–B329, June 2012.
- **Hoda Zarkoob**, Saeed Ziaei-Rad, Mohammadhossein Fathi and Hossein Dadkhah, **"**An Investigation on Mechanical Behavior of Barium Titanate Foam with Hydroxyapatite Coating **"**, *Ceramics International,* Volume 38, Issue 4, Pages 3445–3451, May 2012.

Journal Publication (in preparation):

- **Hoda Zarkoob**, John C. Selby, Sathivel Chinnathambi, Thomas M. Magin and Edward A. Sander, "Mouse Keratinocytes with Muted Keratin Intermediate Filaments Demonstrate Substrate Stiffness Dependent Colony Forming Capacity", under review in *Cellular and Molecular Bioengineering* Journal.
- **Hoda Zarkoob**, Sathivel Chinnathambi, John C. Selby and Edward A. Sander, **"**Substrate Displacements Induce Directed Keratinocyte Migration**"**, submitted in Biophysical Journal.
- **Hoda Zarkoob**, Sathivel Chinnathambi, Spencer Van Dorn, John C. Selby and Edward A. Sander**, "**Substrate Stiffness Modulate Protein Expression in Human Keratinocytes**"**, in preparation.

Conference Proceeding:

- **Hoda Zarkoob**, Sathivel Chinnathambi, John C. Selby, Edward A. Sander. "Substrate

Displacements Induce Directed Keratinocyte migration", *Summer Biomechanics, Bioengine*ering and Biotransport Conference, 2017, USA.

- **Hoda Zarkoob**, Sathivel Chinnathambi, Spencer Van Dorn, Jon Reed, John C. Selby, Edward A. Sander, "Substrate Stiffness Modulates Rho/ROCK Expression in Human Keratinocytes", *Biomedical Engineering Society Annual Meeting BMES*, 2016, USA.
- **Hoda Zarkoob**, Thomas M. Magin and Edward A. Sander, "The role of keratin intermediate filaments on mouse keratinocyte force generation on polyacrylamide substrates", *NanoEngineering for Medicine and Biology*, 2015, USA.
- **Hoda Zarkoob**, John C. Selby, Sailahari V. Ponnaluri, Kelley A.N. Messingham, Janet A. Fairley, and E. Sander, " Mechanical Signaling in Keratinocyte Colony Formation", *Biomedical Engineering Society Annual Meeting*, 2014, USA.
- **Hoda Zarkoob**, John C. Selby, Kelley A.N. Messingham, Janet A. Fairley, and Edward A. Sander, " Role of Substrate Stiffness on Keratinocyte Sheet Formation Assessed From Time-Lapse Imaging", *World Congress of Biomechanics*, 2014, USA.
- **Hoda Zarkoob**, John C. Selby, Kelley A.N. Messingham, Janet A. Fairley, and Edward A. Sander. "Differences in Keratinocyte Colony Formation in Response to Substrate Stiffness", *Society of Investigative Dermatology Annual Meeting*, 2014, USA.
- **Hoda Zarkoob**, Mohammadhossein Fathi, Saeed Ziaei-Rad and Hossein Dadkhah, **"**Biomimetic Approach for Simulating Deformation Mechanisms in Bone tissue**"**, proceeding of *Euro BioMat*, 2011, Germany.

PATENT

- Neda Latifi Alavijeh, **Hoda Zarkoob**, Saeid Ziaeirad, Saeid Mirian, **An intelligent damper using a magneto-rheological fluid**, (Patent Serial No.: A/85-012050 in Iran Invention Organization).

REFERENCE LIST

- Kathleen Green, Ph.D, Professor, Pathology
  kgreen@northwestern.edu
  Dept. of Pathology W127, Tarry Bldg, Room 3-735, 303 E. Chicago Ave, Chicago, IL 60611

- Edward Sander, PhD, Associate Professor, Biomedical Engineering
  edward-sander@uiowa.edu
  Office: (319) 384-2862
  1418 Seamans Center for the Engineering Arts and Sciences, Iowa city, IA 52242

- John Selby, MD, PhD, FAAD, Assistant Professor of Dermatology
  john-selby@uiowa.edu
  Office: (319) 356-2856
  40033 PFP, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA 5224.