

**MINKYU KIM PH.D.**◆ (520) 621-2767 ◆ 1235 James E. Rogers Way, 143 Mines, Tucson, AZ 85719 ◆ minkyukim@email.arizona.edu ◆

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**EDUCATION****Duke University – Durham, NC** 2011**Ph.D. in Mechanical Engineering and Materials Science**

- Dissertation: “Design and characterization of protein-based building blocks for constructing self-assembled nanostructured molecular networks and materials” Advisor: Prof. Piotr E. Marszalek
- Graduate Certificates (2010), Center for Biologically Inspired Materials and Material System (CBIMMS) and Center for Biomolecular & Tissue Engineering (CBTE)

**Duke University – Durham, NC** 2006**M.S. in Biomedical Engineering****Kyung Hee University – South Korea** 2004**B.S. in Mechanical Engineering****RESEARCH & WORK EXPERIENCE****University of Arizona – Tucson, AZ****Dept. of Materials Science and Engineering and Dept. of Biomedical Engineering** *Aug. 2016 - present***Assistant Professor – Biopolymer-Based Functional Materials for Biomedical and Environmental Applications**

- RBC mechanical property mimicking drug delivery vehicles for the treatment of small vessel disease
- Design of synthetic nuclear membrane from artificially engineered proteins for pharmaceutical applications

**Massachusetts Institute of Technology – Cambridge, MA****Lab of Prof. Brad Olsen, Dept. of Chemical Engineering** *Jul. 2012- Jun. 2016***Postdoctoral Scholar – Biopolymer-Based Functional Materials for Defense Applications**

- Conceptualized and developed a method to selectively sequester biological warfare agents
- Invented first artificial protein polymer hydrogel that acts as a selective biomolecule filter
- Developed simple and safe formulation for decontamination of chemical warfare agents on aircraft surfaces
- Determined the effect of electrostatics on the self-assembly of protein-polymer block copolymers for material design

**Duke University – Durham, NC****Lab of Prof. Piotr Marszalek, Dept. of Mechanical Engineering and Materials Science****Graduate Researcher & Postdoctoral Scholar – Biopolymer Design, Synthesis, Mechanics and Self-Assembly for Biomedical Polymeric Materials** *Aug. 2006 – Jun. 2012*

- Designed protein-based polymeric materials with advanced properties including muscle toughness and red blood cell reversible deformability
  - Discovered a new class of proteins with nanospring mechanical behavior using custom-built AFM-based single molecule force spectroscopy
  - Developed a route to controllably construct protein polymer architectures by utilizing self-assembled biopolymer complexes as material joints
  - Invented protein-based force probes to precisely measure the strength of self-assembled biopolymer complexes to identify strong crosslinkers for use in materials design

**Duke University – Durham, NC**

**Lab of Prof. George Truskey, Dept. of Biomedical Engineering****Graduate Researcher – Single Cell Mechanics**

Aug. 2004 – Jul. 2006

- Correlated single cell mechanical properties obtained from mathematical and theoretical modeling using finite element methods to those from experimental indentation measurements using AFM and total internal reflection fluorescence microscopy

**8<sup>th</sup> U.S. ARMY, 2<sup>nd</sup> Infantry Division, 44<sup>th</sup> Engineer Battalion, S4 (Logistics) – Camp Howze, S. Korea****Non-Commissioned Officer (Sergeant), KATUSA**

Aug. 1998 – Aug. 2000

- Coordinated military vehicle movements and managed logistics within the battalion as interim section leader
- Reduced the budget for the battalion (valued over \$50k) by searching out, negotiating, and coordinating vendors for all locally procured items
- Supervised U.S. and Korean soldiers

**FELLOWSHIPS, HONORS & AWARDS****Non-University**

- Travel Award, Reverse Engineering of Bioinspired Nanomaterials Symposium, Materials Research Society (2014)
- Best Presenter, Naturally-Derived and Sustainable Biomaterials Session, American Institute of Chemical Engineers (2014)
- Student Research Achievement Award, 54<sup>th</sup> Annual Meeting of the Biophysical Society (2010)
- Medtronic Pre-doctoral Fellowship, Medtronic Foundation (2009)
- Graduate Study Abroad Fellowship, Korea Science and Engineering Foundation (2004-2006)
- Silver Medal (2<sup>nd</sup> Prize) at the 14<sup>th</sup> National Undergraduate Student Competition in Transport Phenomena, Korean Institute of Chemical Engineers (2003)
- U.S. Army Commendation Medal, 2<sup>nd</sup> Infantry Division, United States Army (2000)

**Duke University**

- Conference Travel Fellowship, the Graduate School (2011)
- 2010 Kewaunee Student Award, Center for Biomolecular & Tissue Engineering (CBTE) Annual Meeting (2010)
- Conference Travel Award, CBTE (2010)
- Oral Presentation Award, MEMS Annual Meeting (2009)
- Poster Award, Center for Biologically Inspired Materials and Material System (CBIMMS) Annual Meeting (2009)
- Poster Award, MEMS Annual Meeting (2008)
- Poster Award, CBTE Annual Meeting (2008)
- Conference Travel Award, CBTE (2007)
- Engineering Pre-doctoral Fellowship, Pratt School of Engineering (2006-2007)

**Kyung Hee University**

- Graduated with Dean's Award for Distinguished Academic Achievement, College of Engineering (2004)
- Outstanding Undergraduate Award, Department of Mechanical Engineering (2001)
- Outstanding Undergraduate Scholarships (1997-2003)

**PEER REVIEWED PUBLICATIONS**

1. **Kim, M. W.** G. Chen, K. Ribbeck and B. D. Olsen. Selective Biomolecule Sequestration by Artificially Engineered Molecular Transporters and Nucleoporin-Like Polypeptide Hydrogel. (*Manuscript in preparation*)

2. **Kim, M.**, W. G. Chen, M. J. Glassman, J. W. Kang, K. Ribbeck and B. D. Olsen. Artificially Engineered Protein Hydrogels Adapted from the Nucleoporin Nsp1 for Selective Biomolecular Transport. *Advanced Materials* **2015** 27: 4207-4212.  
  - **Featured on the cover**
3. Lam, C. N.\* , **M. Kim\***, C. S. Thomas, D. Chang, G. E. Sanoja, C. U. Okwara, and B. D. Olsen. The Nature of Protein Interactions Governing Globular Protein–Polymer Block Copolymer Self-Assembly. *Biomacromolecules* **2014** 15 (4): 1248–1258. \***co-first authors**
4. **Kim, M.**, M. Gkikas, A. Huang, J. W. Kang, N. Suthiwangcharoen, R. Nagarajan and B. D. Olsen. Enhanced Activity and Stability of Organophosphorus Hydrolase via Interaction with an Amphiphilic Polymer. *Chemical Communication* **2014** 50: 5345-5348.
5. **Kim, M.**, S. Tang, and B. D. Olsen. Physics of Engineered Protein Hydrogels. *Journal of Polymer Science Part B: Polymer Physics* 2013 51: 587-601.  
  - **Featured review article**
6. Callahan, D. J., W. Liu, X. Li, M. R. Dreher, W. Hassouneh, **M. Kim**, P. E. Marszalek, A. Chilkoti. Triple Stimulus-Responsive Polypeptide Nanoparticles that Enhance Intratumoral Spatial Distribution. *Nano Letters* **2012** 12 (4), 2165-2170.
7. **Kim, M.**, C.-C. Wang, F. Benedetti, and P. E. Marszalek. A Nanoscale Molecular Force Probe for Gauging Molecular Interactions. *Angewandte Chemie International Edition* **2012** 51: 1903–1906.
8. **Kim, M.**, C.-C. Wang, F. Benedetti, M. Rabbi, V. Bennett, and P. E. Marszalek. Nanomechanics of Streptavidin Hubs for Molecular Materials. *Advanced Materials* **2011** 23: 5684-5688.
9. **Kim, M\***, K. Abdi\*, G. Lee, M. Rabbi, W. Lee, M. Yang, C. J. Schofield, V. Bennett, and P. E. Marszalek. Fast and Forceful Refolding of Stretched  $\alpha$ -Helical Solenoid Proteins. *Biophysical Journal* 2010 98:3086-3092. \***co-first authors**
10. Ke, C. H.\* , A. Loksztajn\*, Y. Jiang\*, **M. Kim\***, M. Humeniuk\*, M. Rabbi\*, and P. E. Marszalek\*. Detecting Solvent-Driven Transitions of poly(A) to Double-Stranded Conformations by Atomic Force Microscopy. *Biophysical Journal* 2009 96:2918-2925. \***authors contributed equally**
11. Jiang, Y., M. Rabbi, **M. Kim**, C. H. Ke, W. Lee, R. L. Clark, P. A. Mieczkowski, and P. E. Marszalek. UVA Generates Pyrimidine Dimers in DNA Directly. *Biophysical Journal* 2009 96:1151-1158.
12. Kim, D. H., M. T. Novak, J. Wilkins, **M. Kim**, A. Sawyer, and W. M. Reichert. Response of monocytes exposed to phagocytosable particles and discs of comparable surface roughness. *Biomaterials* 2007 28:4231-4239.

## PATENTS

1. **Kim, M.**; Olsen, B. D. “Biotoxin Sequestration by Engineered Nuclear Transporter and Nuclear Membrane Mimetic Hydrogel” U.S. Provisional Patent Application No. 62/254771. November 12, 2015
2. **Kim, M.**; Olsen, B. D. “Artificially Engineered Protein Hydrogels to Mimic Nucleoporin Selective Gating” U.S. Provisional Patent Application No. 62/015012. June 20, 2014
3. **Kim, M.**; Gkikas, M.; Huang, A.; Olsen, B. D. “Elevated Robustness of Organophosphorus Degrading Enzyme Via Hydrophobic Interaction with Amphiphilic Polymer” (*filed*)

## SELECTED ORAL & POSTER PRESENTATIONS

1. “Artificially Engineered Protein Hydrogels that Mimic Selective Gating by The Nuclear Pore Complex” *2014 Materials Research Society Fall Meeting*, Boston, MA, 12/01/2014
2. “Artificially Engineered Protein Gels Derived from Nucleoporins” *2014 AIChE Annual Meeting*, Atlanta, GA, 11/20/2014
3. “Enhanced Activity and Stability of Organophosphorus Hydrolase via Interaction with an Amphiphilic Polymer” *2014 AIChE Annual Meeting*, Atlanta, GA, 11/19/2014

4. "Design of Biopolymer Building Blocks for Novel Self-Assembled Materials" *2014 AIChE Annual Meeting*, Atlanta, GA, 11/16/2014
5. "Designing Biosynthetic Hydrogels as Selective Filters for Biological Agents" *2014 Defense Threat Reduction Agency program review*, Edgewood, MD, 07/28/2014
6. "Designed Block Copolypeptide Hydrogels to Mimic Nucleoporin Selective Gating" *Gordon Research Conference*, Newry, ME, 06/23/2014
7. "Enhanced Performance and Stability of OPH-Polymer Conjugate Micelle for the Decontamination of Organophosphate Agents" *Chemical and Biological Defense Program: Enzyme Colloquium & Program Review*, *Defense Threat Reduction Agency / Joint Science and Technology Office*, Falls Church, VA, 10/02/2013
8. "A Protein-Based Force Probe for Gauging Intermolecular Interactions with AFM" *56<sup>th</sup> Annual Meeting of the Biophysical Society*, San Diego, CA, 02/29/2012
9. "Nanomechanics of Streptavidin Hubs for Molecular Materials" *Korean-American Science, Engineering, and Medicine South-Atlantic Conference*, Research Triangle Park, NC, 10/22/2011
10. "Probing the Strength of a Bio-Nano Hub by Single-Molecule Force Spectroscopy" *55<sup>th</sup> Annual Meeting of the Biophysical Society*, Baltimore, MD, 03/08/2011
11. "Single-Molecule Atomic-Force Spectroscopy Captures a Novel Class of Molecular Nanosprings with Robust Stepwise Refolding Properties" *54<sup>th</sup> Annual Meeting of the Biophysical Society*, San Francisco, CA, 02/23/2010
12. "Extreme Protein Nanosprings", MEMS meeting, Duke University, Durham, NC, 11/20/2009 (**Award Talk**)
13. "The Mechanical Behavior of  $\beta$ -catenin captured by Atomic Force Microscopy" *51<sup>st</sup> Annual Meeting of the Biophysical Society*, Baltimore, MA, 03/07/2007

## MENTORING AND TEACHING EXPERIENCE

### Graduate Researchers

- |  |           |   |
|--|-----------|---|
| • Shuaili Li (Chemical Engineering, MIT)                     | 2015-2016 |   |
| • Chien-Chung Wang (National Chung-Hsing University, Taiwan) | 2009-2011 | - Currently postdoctoral scholar at Whitesides Group (Harvard)<br>- Contributed to several publications |

### Undergraduate Researchers

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|---|------|--|
| • Carley M. Allen (Biological Chemistry, Wellesley) | 2014 |  |
| • Chindimma Okwara (Biology, MIT)                   | 2013 | - Supervised the submission of a 2013 Summer Research Grant by MIT Energy Initiative (granted)<br>- Contributed to <i>Biomacromolecules</i> publication (2014) |

### Summer Undergraduate Internship

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| • Latha Uthaykumar (Bunker Hill Community College) | 2015 Summer | - Research Experience for Undergraduates - - Program run by MIT Center for Materials Science and Engineering |
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### Graduate Student Instructor, Duke University

*Thermodynamics* (Spring 2008)

- Laboratory Instructor and Teaching Assistant (Instructor: Dr. Teh Y. Tan)

*Thermodynamics* (Spring 2007)

- Teaching Assistant (Instructor: Dr. Piotr E. Marszalek)

*Transport Phenomena; Biological Systems* (Spring 2006)

- Teaching Assistant (Instructor: Dr. David F. Katz)

**PROFESSIONAL AFFILIATIONS**

Materials Research Society; American Institute of Chemical Engineers; Biophysical Society; Sigma XI, the Scientific Research Society; Korean-American Scientists and Engineers Association

**SERVICE ACTIVITIES**

Reviewers for *Angewandte Chemie International Edition*, *Biophysical Journal*, *Langmuir*, *International Journal of Biological Macromolecules* and *Material Research Society Proceeding*