

CURRICULUM VITAE

NANCY WANGECHI KARURI

A. DEMOGRAPHIC

Name: Nancy Wangechi Karuri
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B. EDUCATION

Ph.D. Chemical Engineering, University of Wisconsin-Madison, Madison, WI USA
May 2005
Dissertation: The Effect of Biological Length Scale Topography on Cell Substrate Adhesion in Human Corneal Epithelial Cells

Bachelor of Engineering (Chemical)-1st Class Honors, University of New South Wales, Sydney, Australia.
April 1999

C. PROFESSIONAL HISTORY

Registered Professional Engineer (Registration Number 25054), State Board of Registration for Professional Engineers, West Virginia, USA

Associate Professor and Chair, Chemical Engineering, Dedan Kimathi University of Technology (DeKUT), Nyeri, Kenya
April 2020 - Present

Associate Professor and Chair, Mechanical Engineering, Dedan Kimathi University of Technology (DeKUT), Nyeri, Kenya
October 2017-March 2020

Senior Lecturer, Mechanical Engineering, Dedan Kimathi University of Technology (DeKUT), Nyeri, Kenya
May 2016-October 2017

Assistant Professor, Chemical and Biological Engineering, IIT, Chicago, IL, USA
August 2009-May 2016

Visiting Senior Lecturer, Mechanical Engineering, DeKUT, Nyeri, Kenya
May-August 2014, May-August 2015

Visiting Professor, National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health, Bethesda, MD, USA
May-July 2013

Research Associate, Molecular Biology, Princeton University, Princeton, NJ, USA
Feb 2005-August 2009

Research Assistant, Chemical Engineering, University of Wisconsin-Madison, Madison WI, USA
2000-2004

Research Assistant, Chemical Engineering, University of New South Wales, Sydney, Australia.

1998-1999

D. CONTRIBUTIONS TO TEACHING

Classes Taught

Developed course material and taught the following undergraduate classes

1. CHE 311 Foundations of Biological Science for Engineering - *IIT*
2. CHE 302 Heat & Mass Transfer Operations - *IIT*
3. CHE 100 Introduction to the Profession I and CHE 101 Introduction to the Profession II - *IIT*
4. EMG2302 ThermodynamicsII- *DeKUT*
5. EMG2502 Heat Transfer – *DeKUT*
6. EMG2206 Thermodynamics I – *DeKUT*
7. ECH 3204 Reactor Design I– *DeKUT*
8. ECH 4102 Reactor Design II– *DeKUT*
9. ECH Chemical Process Optimization– *DeKUT*
10. ECH 3202 Chemical Process Design – *DeKUT*
11. SCH2363 Fluid flow, heat and mass transfer (Sep-Dec 2016)– *DeKUT*
12. ECH 4204, ECH 5101 – Process Design I, II - *DeKUT*

Developed course material and taught the following graduate class

1. CHE 584 Tissue Engineering -*IIT*
2. EMG 6201 Numerical Modeling –*DeKUT*
3. EME 7203 Doctoral Research Seminar – *DeKUT*

Graduate Students Mentored (Primary Advisor)

PhD – Josephat Tanui (DeKUT, 2020), Chen Zhang (IIT, 2013), Anand Ramanathan (IIT, 2014)
MSc – Job Momanyi (DeKUT, 2020), Nickson Rono (DeKUT, 2020), Patrick Kariuki (DeKUT, 2020), Sogol Hekmatfar (IIT, 2013), Pradnya Kshatriya (IIT, 2012), Chunyi Chiang (IIT, 2012)

E. ACADEMIC CONCENTRATIONS AND RESEARCH INTERESTS

Academic concentrations

1. Chemical and mechanical engineering – Chemical kinetics and reactor design, heat, mass and momentum transfer, thermodynamics
2. Biological engineering – Biology, bioengineering, biomolecular engineering, biomaterials

Research Interests

1. Engineering extracellular matrix mimics.
2. Characterizing kinetics of assembly and degradation of extracellular matrices and their components.
3. Creation and characterization of polymer-protein conjugates for protein stability.
4. Modeling heat, mass and momentum transfer
5. Surface chemistry modification for creation of biomimetics
6. Biosensors

F. PUBLICATIONS

Italic font represents students mentored students, * represents undergraduate.

Selected Refereed Journal Publications

1. Kaur, K, *Chelangat, W*, Druzhinin, SI, Karuri, NW, Müller, M, Schönherr, H, Quantitative E. coli Enzyme Detection in Reporter Hydrogel-Coated, Paper Using a Smartphone Camera, Submitted to Biosensors, December 2020.
2. *Tanui, JK*, Kioni, PN, Mirre, T, Nowitzki, M, Karuri NW, The influence of particle packing density on wood combustion in a fixed bed under oxy-fuel conditions. 2020, Energy, 194.

3. *Wanjiru, PK, Karuri, NW, Wanyeki, PM, Kioni, PN, Tanui, JK*, Numerical simulation of the effect of diluents on NO_x formation in methane and methyl formate fuels in counter flow diffusion flame, 2020, *AIMS Environmental Science*, 7(2):140.
4. *Ronoh KN, Karuri, NW, Mwema, FM, Ngetha, HT, Akinlabi, SA, Akinlabi, ET*, Evaluation of the Surface Roughness of Ti-6Al-4V for Surface Grinding under Different Cooling Methods Using Conventional and Vegetable Oil-based Cutting Fluids, 2019, *Tribology in Industry*, 41 (4): 634-647.
5. *Ramanathan A, Karuri N*, Proteolysis of decellularized extracellular matrices results in loss of fibronectin and cell binding activity, 2015, *Biochemical Biophysical Research Communication*, 459(2):246-251. *Times Cited: 1*
6. *Zhang, C, Ramanathan, A, Karuri, NW*, Proteolytically stabilizing fibronectin without compromising cell and gelatin binding activity, 2014, *Biotechnology Progress*, 31(1):277-288.
7. *Zhang, C, Desai*, R, Perez-Luna, V, Karuri, NW*, PEGylation of lysine residues improves the proteolytic stability of fibronectin while retaining biological activity, *Biotechnology Journal*, 2014, 9(8):1033-1043. *Times Cited: 2*
8. *Ramanathan, A, Karuri, NW*, Fibronectin increases the rate of fibrin clot polymerization and alters matrix morphology, *Biochemical and Biophysical Research Communications*, 2014, 443(2):395-399. *Times Cited: 11*
9. *Zhang, C, Hekmatfer, S, Karuri, NW*, A comparative study of polyethylene glycol hydrogels derivatized with the RGD peptide and the cell-binding domain of fibronectin, *Journal of Biomedical Materials Research Part A*, 2014, 102:170-179. *Times Cited: 10*
10. *Zhang, C, Hekmatfer, S, Ramanathan, A, Karuri, NW*, PEGylated human plasma fibronectin is proteolytically stable, supports cell adhesion, cell migration, focal adhesion formation and fibronectin fibrillogenesis, *Biotechnology Progress*, 2013, 29:493-504. *Times Cited: 8*
11. *Kshatriya, PP, Karuri, SW, Chiang, C, Karuri, NW*, A combinatorial approach for directing the amount of fibronectin fibrils assembled by cells that uses surfaces derivatized with mixtures of fibronectin and cell binding domains, *Biotechnology Progress*, 2012, 28:862-871.
12. *Chiang, C, Karuri, SW, Kshatriya, PP, Schwartz, J, Schwarzbauer, JE, Karuri, NW*, A new surface derivatization strategy for combinatorial analysis of cell response to mixtures of protein domains, *Langmuir*, 2012, 28:548-556. *Times Cited: 4*
13. *Karuri, NW, Lin, Z, Rye, H, Schwarzbauer, JE*, Probing the conformation of the fibronectin III1-2 domain by fluorescence resonance energy transfer, *Journal of Biological Chemistry*, 2009, 284:3445-3452. *Times Cited: 22*
14. *Karuri, NW, Porri, TJ, Albrecht, R, Murphy, CJ, Nealey, PF*, Structural organization of the cytoskeleton in SV40 human corneal epithelial cells cultured on nano- and microscale grooves, *Scanning*, 2008, 30:1-9. *Times Cited: 22*
15. *Karuri, NW, Albrecht, R, Murphy, CJ, Nealey, PF*, Nano- and microscale holes modulate cell-substrate adhesion, cytoskeletal organization and β 1 integrin localization in SV-40 Human Corneal Epithelial Cells, *IEEE Transactions on Nanobioscience*, 2006, 5:273-280. *Times Cited: 36*
16. *Karuri, NW, Nealey, PF, Murphy, CJ, Albrecht, RM*, Structural organization of the cytoskeleton in SV40 human corneal epithelial cells cultured on nano- and microscale topography, *Microscopy and Microanalysis*, 2005, 11:182-183. *Times Cited: 24*
17. *Karuri, NW, Liliensiek, S, Teixeira, AI, Abrams, G, Campbell, S, Nealey, PF, Murphy, CJ*, Biological length scale topography enhances cell substrate adhesion of human corneal epithelial cells, *Journal of Cell Science*, 2004, 117:3153-3164. *Times Cited: 189*

Selected Non-Refereed Proceeding Publications

1. *Ramanathan, A, Karuri, NW*, Fibronectin Increases the Rate of Fibrin Clot Polymerization and Alters Matrix Morphology, *Proceedings of the American Institute of Chemical Engineers*, 2013, San Francisco, 2013.
2. *Karuri, NW, Liliensiek, SJ, Diehl, KA, Foley, JD, Abrams, GA, Campbell, S, Nealey, PF, Murphy, CJ*, Biologic length scale topographic features modulate human corneal epithelial

cell adhesion and migration, 2004, Conference Paper, 7th World Biomaterials Congress, Sydney, Australia.

3. Pham, QT, Karuri, NW, A computational efficient technique for calculating simultaneous heat and mass transfer during food chilling, Proceedings of the 20th International Congress of Refrigeration, Sydney, 1999, vol IV, paper 52.

Selected Presentations at professional society meetings

Presenter is in bold.

1. **Ramanathan, A, Karuri, NW**, "Fibronectin, Fibrin, Hydrogels and Stability: Bioengineering as a Tool for Addressing the Problems in the Chronic Wound", 2014, American Institute of Chemical Engineers Midwestern Regional Conference, Chicago IL (Oral presentation)
2. **Ramanathan, A, Karuri, NW**, "Fibronectin Alters the Rate of Formation and Structure of the Fibrin Matrix", 2014, American Institute of Chemical Engineers Midwestern Regional Conference, Chicago IL (Poster presentation)
3. **Wang, Z, Karuri, NW**, "Testing the secondary structure for Pegulated-Fibronectin through Dichroism Spectra study", 2014, American Institute of Chemical Engineers Midwestern Regional Conference, Chicago IL (Poster presentation)
4. **Desai, R*, Zhang, C, Yamada, K, Karuri, N**, The effect of fibronectin PEGylation site on proteolytic stability, cell adhesion and cell migration, 2014, American Institute of Chemical Engineers Midwestern Regional Conference, Chicago IL (Poster presentation)
5. **Wang, Z, Karuri, NW**, "Testing the secondary structure for Pegulated-Fibronectin through Dichroism Spectra study", 2014, American Institute of Chemical Engineers Midwestern Regional Conference, Chicago IL (Poster presentation)
6. **Ramanathan, A, Karuri, NW**, "Fibronectin Increases the Rate of Fibrin Clot Polymerization and Alters Matrix Morphology", 2013, Annual Meeting of the American Institute of Chemical Engineers, San Francisco, CA (Oral Presentation and proceeding paper)
7. **Zhang, C, Hekmatfar, S, Ramanathan, A, Karuri, NW**, Formulation of a proteolytically stable and biologically active fibronectin - polyethylene glycol conjugate, 2012, Annual Meeting of the American Institute of Chemical Engineers, Pittsburgh, Pennsylvania (Oral Presentation)
8. **Hekmatfar, S, Schumer, C, Karuri, NW**, Development of an instructional module for fitting kinetic models to enzymatic degradation of proteins, 2012, American Society of Engineering Education, Summer School, Orono, ME (Poster presentation)
9. **Chiang, C, Kshatriya, P, Karuri, SW, Karuri, NW**, Variation in FN fibril formation and cell spreading to different ratios of immobilized cell and fibronectin binding domains on PEG hydrogels, 2011, American Society of Cell Biology Annual Meeting, Denver, CO (Poster presentation)
10. **Karuri, NW**, Karuri, SW, Schwartz, J, Schwarzbauer, JE, Directing fibronectin matrix assembly through surface immobilization of integrin and fibronectin binding domains, 2010, Gordon Research Conference – Signal Transduction by Engineered Extracellular Matrices, Biddeford, ME (Poster presentation)
11. **Karuri, NW**, Karuri, SW, Schwartz, J, Schwarzbauer, JE, Directing FN matrix assembly through surface immobilization of III1-2 and III9-10 domains, 2009, American Society for Cell Biologists Annual Meeting, San Diego, CA (Poster presentation)
12. **Schwarzbauer, JE, Karuri, NW**, Lin, Z, Rye, HS, Dissecting a fibronectin matrix assembly domain using FRET, 2008, American Society for Matrix Biology Biennial Meeting, San Diego, CA (Oral presentation)
13. **Karuri, NW**, Dennes, T, Schwartz, J, Schwarzbauer, JE, A robust and highly efficient method for functionalizing polyamides with adhesion ligands and its effect on matrix assembly, 2008, Gordon Research Conference, Lewiston, ME (Poster presentation)
14. **Karuri, NW**, Lin, Z, Rye, H, Schwarzbauer, JE, A FRET conformation sensor for fibronectin matrix assembly, 2007, Annual meeting of the American Institute of Chemical Engineers, Salt Lake City, UT (Oral presentation)

15. **Karuri, NW**, Lin, Z, Rye, H, Schwarzbauer, JE, FRET analysis of fibronectin binding site conformation and a model for matrix assembly, 2006, Gordon Research Conference: Signal Transduction by Engineered Extracellular Matrices, New London, CT (Poster presentation)
16. **Fraser, S**, Porri, T, Liliensiek, S, Foley, J, Kambampati, R, McKie, G, Teixeira, A, Karuri, N, Diehl, K, Campbell, S, Mallon, K, Murphy, CJ, Nealey, PF, Towards a synthetic basement membrane for the corneal epithelium, 2005, 38th Synchrotron Radiation Center Users' Meeting, Madison, Wisconsin.
17. **Karuri, NW, Liliensiek, SJ**, Diehl, KA, Foley, JD, Abrams, GA, Campbell, S, Nealey, PF, Murphy, CJ, Biologic length scale topographic features modulate human corneal epithelial cell adhesion and migration, 2004, 7th World Biomaterials Congress, Sydney, Australia (Oral Presentation and proceeding paper).
18. **Karuri, NW**, Liliensiek, S, Teixeira, AI, Abrams, G, Campbell, S, Nealey, PF, Murphy, CJ, The effect of biological length scale topography on cell substrate adhesion in human corneal epithelial cells, 2003, Oral Presentation, Annual meeting of the American Institute of Chemical Engineers, San Francisco, CA (Oral presentation)
19. **Karuri, NW**, Nealey, PF, Campbell, S, Abrams, GA, Teixeira, AI, Murphy, CJ, Fluid Shear induced detachment of SV-40 corneal epithelial cells from planar and nano-structured substrates, 2002, Poster Presentation, Annual meeting of the Association for Research in Vision and Ophthalmology, Fort Lauderdale, FL (Poster presentation)
20. **Pham, QT**, Karuri, NW, A computational efficient technique for calculating simultaneous heat and mass transfer during food chilling, 1999, 20th International Congress of Refrigeration, Sydney, Australia (Oral Presentation and proceeding paper)

G. PROFESSIONAL ACTIVITIES

Meeting Sessions Chaired/Co-Chaired

1. Co-Chair, Biomaterial-Cell Interactions in Tissue Engineering Session, 2012 Annual Meeting of the American Institute of Chemical Engineers, Pittsburgh, PA.
2. Chair, Engineering Extracellular Matrices Session, 2013 American Institute of Chemical Engineers, Midwest Regional Conference, Chicago, IL.

Invited Seminars

1. University of Illinois at Chicago, Cancer Center's Breast Cancer Working Group, Chicago, IL, Invited by Prof. Arkadiusz Z. Dudek, October 2015.
2. Department of Chemical Engineering, University of Iowa, Iowa City, IA, Invited by Prof. Eric Nuxoll, February 2015.
3. Department of Chemical and Process Engineering, Technical University of Kenya, Nairobi, Kenya, Invited by Dr. Benson Gathitu, December 2013.
4. Department of Chemical Engineering, City College of New York, New York, NY, Invited by Prof. Elizabeth Biddinger, March 2013.
5. Department of Chemistry, IIT, Chicago, IL, Invited by Prof. Hyun-soon Chong, September 2012.
6. Biotechnology Program, Northwestern University, Evanston, IL, Invited by Prof. Lonnie Shea, April 2012.
7. Department of Biology, IIT, Chicago, IL, Invited by Prof. Andrew Howard, September 2009.

Journal Reviewer

Reviewed manuscripts in Cell Communication and Adhesion, EMBO, PLoS One and Matrix Biology, Biotechnology Progress, Langmuir

Grant Reviewer

- National Institutes of Health, Musculoskeletal Tissue Engineering Study Section [MTE], Small Business Orthopedics Study Section (SBIR/STTR)
- DAAD In-Country/In-Region (ICIR) Scholarship Programme for Eastern Africa

Student Thesis Committees

Josephat Tanui, Ph.D. 2020 Mechanical Engineering
Aadil Benmayza, Ph.D. 2016 Chemical and Biological Engineering
Yunwei Chen, Ph.D. 2015 Chemistry
Yu Chieh Chiu, Ph.D. 2011, Biomedical Engineering
Pawel Drapala, Ph.D. 2010, Chemical and Biological Engineering
Chu-Yi Lee, Ph.D. 2012, Biomedical Engineering
Chenlin Lu, MSc. Biomedical Engineering
Hamidreza Mehdizadeh, 2013, Ph.D. Chemical and Biological Engineering
Rebecca Mick, Ph.D. Chemical and Biological Engineering
Venkateshkumar Prabhakaran, 2013, Ph.D. Chemical and Biological Engineering
Neha Sahni, Ph.D. 2011, Biology
Chi Soo Kang, Ph.D. Biology
Xiang Sun, Ph.D. 2012, Chemistry

H. CONTRIBUTIONS TO ADMINISTRATION AND UNIVERSITY SERVICE

DeKUT Committees Served

Coordinator for the Center for Material Science and Nanotechnology

IIT University Committees Served

1. Undergraduate studies committee, (member)
2. Research Council, (member)

IIT Department Committees Served

1. Academic studies committee (member)
2. Undergraduate studies (member)

Other IIT Service Rendered

1. Academic advisor for incoming class of 2012 in Chemical and Biological Engineering, IIT, approximately 33 students. Advised students until graduation in May 2015
2. Academic advisor for Professional Masters Students in Biological Engineering, approximately 16 students.
3. Discovery Day presenter for Chemical and Biological Engineering Department.
4. National Society for Black Engineers, IIT Chapter, Faculty Advisor.

I. PROFESSIONAL HONORS, AWARDS AND RESEARCH SUPPORT

Awards and Honors

1. ERASMUS exchange award with University of Siegen, Department of Chemistry - 2018
2. Minorities Affairs Committee Travel Awards, American Society for Cell Biology - 2011
3. Minorities Affairs Committee Travel Awards, American Society for Cell Biology - 2009
4. Carl Storm Underrepresented Minority Fellowship, Gordon Research Conferences - 2006
5. T32 National Institutes of Health Training Grant - 2006
6. Roland Ragatz Teaching Assistant Award, University of Wisconsin-Madison - 2002, 2003
7. Graduate Engineering Research Scholars Fellowship, University of Wisconsin-Madison - 2000
8. Australian Research Council Scholarship, University of New South Wales, Australia – 1999

Completed Research Support

1. Pritzker award, Illinois Institute of Technology, Fibronectin PEGylation as a non-surgical intervention to breast cancer, September 1, 2014 – August 31, 2016, \$25,000 – Principal Investigator.
2. National Science Foundation Award #1446008, NUE: Development of a minor in Nanotechnologies for Surface Engineering (Nano-SurfEng) – A Cross-Departmental Effort at Illinois Institute of Technology, September 15, 2014 – August 31, 2016, \$200,000 – Co-Principal Investigator.
3. American Society of Cell Biology, Cell Migration on PEGylated fibronectin, May 28, 2013-April 31, 2014, \$17,700, Principal Investigator.
4. Education Research Initiative Fund, Illinois Institute of Technology, Surface Modifications for Promoting Tissue Repair, January 1, 2011-December 31, 2012, \$28,690-Principal Investigator.

Professional Development

Participated the following workshops

1. Grant Writers' Seminars and Workshop sponsored by the NIH (June 19, 2013) in Bethesda, MD.
2. National Science Foundation Regional Grants Conference (October 17-18, 2011) in Nashville, TN.
3. Grant writing workshop by the Office of Sponsored Research (November 5, 2010) in IIT, Chicago, IL.
4. Effective Teaching Workshop by Richard Felder and Rebecca Brent, American Society for Engineering Education - Chemical Engineering (July 21-27, 2012), University of Maine, Orono, ME

J. MEMBERSHIP IN PROFESSIONAL SOCIETIES

American Chemical Society, National Society of Black Engineers, Engineering Board of Kenya (Graduate Engineer), National Council of Examiners for Engineering and Surveying (Registered Professional Engineer, WV, #25054)

K. CIVIC AND COMMUNITY ACTIVITIES

Fundraising for American Cancer Society, 2014 Chicago Marathon

Course volunteer, 2012 Chicago Marathon

Fundraised for Organization for Autism Research, 2010 Chicago Marathon

Volunteer – Saint James Food Pantry, Chicago

Volunteer – New Life Home Trust, Nyeri, Kenya