

# JACQUELINE CALLIHAN LINNES, PH.D.

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## EDUCATION

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- 2012 - 2014     **Postdoctoral Research Associate**  
PI: Catherine Klapperich, PhD  
Biomedical Engineering Department, Boston University, Boston, MA
- 2011 - 2012     **Postdoctoral Research Fellow**  
PI: Edward Nardell, MD  
Division of Global Health Equity, Brigham and Women's Hospital, Boston, MA  
Harvard School of Medicine / Harvard School of Public Health, Boston, MA  
Innovations in International Health, Massachusetts Institute of Technology, Cambridge, MA
- 2010            **PhD: Bioengineering**  
Research Advisor: James Bryers, PhD  
University of Washington, Seattle, WA  
Graduate Certificate: Global Health
- 2004            **BS: Engineering**  
Purdue University, West Lafayette, IN  
Minor: French

## FUNDING

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- 2015            I<sup>2</sup>D Lab Seed Grant, College of Engineering, Purdue University
- 2014            Ruth Kirchstein National Research Service Award (F32), National Institute of Health, NIAID
- 2012 - 2013     Design for Dissemination Fellowship, Massachusetts Institute of Technology D-Lab Scale-Ups
- 2011 - 2012     Pilot Project Grant, Harvard Education and Research Center
- 2006 - 2009     Graduate Research Fellowship, National Science Foundation
- 2004 - 2005     Top Scholar Research Appointment, University of Washington

## AWARDS

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- 2013            Travel Award, Northeastern University Future Faculty Fellows Workshop, Boston, MA

- 2012 Travel Award, Bringing Diagnostics to the Point of Care, Nairobi, Kenya
- 2009 International Service Scholarship, University of Washington Rotaract
- 2006 Student Travel Award, Biomedical Engineering Society Annual Meeting, Austin, TX
- 2003 Interdisciplinary Engineering Outstanding Senior Academic Achievement Award, Purdue University, 2003
- 2003 Women in Engineering Alumni Academic Achievement Award, Purdue University
- 2002 Elected Tau Beta Pi Engineering National Honors Society

## RESEARCH EXPERIENCE

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### Current Position:

Weldon School of Biomedical Engineering, Purdue University, West Lafayette, IN 2015 – present

- Research focus: Point-of-care diagnostics for global health

### Postdoctoral Research:

Biomedical Engineering Department, Boston University, Boston, MA, 2012 – 2014

PI: Catherine Klapperich, PhD

- Research focus: Sample-to-answer rapid molecular diagnostics for pathogen detection at the point-of-care

Division of Global Health Equity, Brigham and Women's Hospital, Boston, MA 2011 – 2012

Harvard School of Medicine / Harvard School of Public Health, Boston, MA

Innovations in International Health, Massachusetts Institute of Technology, Cambridge, MA

PI: Edward Nardell, MD

- Research focus: Ultraviolet germicidal irradiation technologies to prevent airborne disease transmission

### Doctoral Research:

Department of Bioengineering, University of Washington, Seattle, WA 2004 – 2010

Research Advisor: James Bryers, PhD

- Dissertation: Staphylococcus epidermidis extracellular matrix binding protein and its role in adhesion and biofilm formation

### Global Health Practicum:

University of Washington Chapter of Engineers Without Borders, Northern Potosi, Bolivia 2009

Project Mentor: Susan Bolton, PhD, PE

- Project: Quantitative assessment of women's health related-quality of life in rural Andean Bolivia

### First Year Graduate Rotation:

Department of Bioengineering, University of Washington, Seattle WA 2004

Rotation Advisor: Albert Folch, PhD

- Project: Development of primary smooth muscle and mouse embryonic fibroblast co-cultures

### Undergraduate Research:

Department of Biomedical Engineering, Purdue University, West Lafayette, IN 2003 – 2004

Research Advisor: Leslie A. Geddes, PhD

- Project: *In vivo* ventricular fibrillation frequencies and electromechanical dissociation in swine hearts

Pharmacy Department, Purdue University, West Lafayette, IN 2002 – 2003

Research Advisor: Kinam Park, PhD

- Project: Fast melting oral tablet formulations for pharmaceutical drug delivery

## PEER REVIEWED PUBLICATIONS

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1. NM Rodriguez, JC Linnes, A Fan, CM Klapperich, CE Ellenson, NR Pollock, "Paper-based RNA extraction, in situ isothermal amplification, and lateral flow detection for low-cost, rapid diagnosis of Influenza A (H1N1) from clinical specimens," *Submitted*, 2015
2. JC Linnes, NM Rodriguez, L Liu, CM Klapperich, "Polyethersulfone improves the efficiency of nucleic acid amplification compared to current paper-based diagnostic materials," *Submitted*, 2015
3. R Derda, J Gitaka, TM Kariuki, CM Klapperich, CR Mace, AA Kumar, M Lieberman **JC Linnes**, J Nasimolo, J Ndung'u, E Taracha, A Weaver, DB Weibel, P Yager. "Enabling the development and deployment of next generation point of care diagnostics," *PLOS Neglected Tropical Diseases*, 2015, *in press*
4. **JC Linnes**, A Fan, NM Rodriguez, B Lemieux, H Kong, CM Klapperich. "Paper-based molecular diagnostic for *Chlamydia trachomatis*," *RSC Adv.*, 2014, 4 (80), 42245 - 51
5. P Vacas-Jacques, **JC Linnes**, A Young, V Gerrard, J Gomez-Marquez. "Portable digital lock-in instrument to determine chemical constituents with single-color absorption measurements for Global Health Initiatives," *Review of Scientific Instruments*, 2014. 85 (3), 033103
6. **JC Linnes**, SN Rudnick, GM Hunt, JJ McDevitt, EA Nardell. "Eggcrate UV: A whole ceiling upper-room ultraviolet germicidal irradiation system for air disinfection in occupied rooms," *Indoor Air*. 2013. 24 (2) 116-24
7. S Miller, **JC Linnes**, J Luongo. "Ultraviolet germicidal irradiation: Future directions for air disinfection and building applications," *Photochemistry and Photobiology*, 2013. 89(4) 777-81
8. **JC Linnes**, H Ma, JD Bryers. "Giant extracellular matrix binding protein gene and protein expression in *Staphylococcus epidermidis* is regulated by biofilm formation and osmotic pressure," *Current Microbiology*, 2013. 66(6) 627-33
9. **JC Linnes**, K Mikhova, JD Bryers. "Adhesion of *Staphylococcus epidermidis* to biomaterials is inhibited by fibronectin and albumin," *Journal of Biomaterials Research Part A*. 2013. 100(8) 1990-7
10. \*D Alexander, \***JC Linnes**, S Bolton, T Larson. "Ventilated cookstoves improve respiratory health-related quality of life in rural Bolivia," *Journal of Public Health*. 2013. (\*equal authorship) doi: 10.1093/pubmed/fdt086
11. C Matlack, H Chizeck, T Davis, **JC Linnes**. "A low-cost solar disinfection indicator for safe water," *2011 IEEE Global Humanitarian Technology Conference*, GHTC 283-286
12. RS Stowers, **J Callihan**, JD Bryers. "Optimal conditions for F(ab')<sub>2</sub> antibody fragment production from mouse IgG2a," *Journal of Undergraduate Research in Bioengineering*. 8 16-20 (2008)

13. T Pinon, K Katzenmeyer, **J Callihan**, JD Bryers. "Expression, purification, and characterization of a recombinant *Staphylococcus epidermidis* fibronectin-binding protein," *Journal of Undergraduate Research in Bioengineering*. 7 80-84 (2007)
14. **J Callihan**, R Roeder, LA Geddes, M Otlewski, A Kemeny. "Ventricular fibrillation frequency," *Pacing and Clinical Electrophysiology*. 28(7) 610-612 (2005)

## PATENTS

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1. "Multiplexed Diagnostic Systems" US Patent. US2014/0246334.  
I Bosch, L Gherke, J Gomez-Marquez, K Hamad-Schifferli, NC Hanoumara, **JC Linnes**, DK Wood
2. "Multiplexed Diagnostic Systems" International Patent Application. WO2012119128 A1.  
I Bosch, L Gherke, J Gomez-Marquez, K Hamad-Schifferli, NC Hanoumara, **JC Linnes**, DK Wood
3. "System and Method for Monitoring A Solar Disinfection Process" Patent Application 13/165312  
CB Matlack, **JC Linnes**
4. "Mannose Based Fast Dissolving Tablets" US Patent. US2006/0134195  
Y Fu, SH Jeong, J Kim, **J Callihan**, CM Pai CM, SY Park, G Seomoon, K Park
5. "Mannose Based Fast Dissolving Tablets" International Patent. WO 2004/047810  
Y Fu, SH Jeong, J Kim, **J Callihan**, CM Pai CM, SY Park, G Seomoon, K Park

## REFEREED CONFERENCE PRESENTATIONS

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1. **JC Linnes**, C Ellenson, CM Klapperich, "Bacterial Cell Filtration, Amplification, and Detection in Paper Matrices for Molecular Diagnostics at the Point of Care" Biomedical Engineering Society Annual Meeting, San Antonio Texas, October 22 – 25, 2014. Oral Presentation
2. **JC Linnes**, CM Klapperich. "Minimally Instrumented Paper-Based Molecular Diagnostic For Sexually Transmitted Infections." MicroTAS 2014. 2014. San Antonio, TX, October 26 – 29, 2014. Poster 783.
3. CM Klapperich, **JC Linnes**. "Minimally-instrumented diagnostics and paper-based nucleic acid extractions at the point-of-care" NanoBioTech, Montreux, Switzerland, November 18-20, 2013. Oral Presentation
4. **JC Linnes**, CM Klapperich. "Paper-based extraction for molecular diagnostics at the point-of-care" Biomedical Engineering Society Annual Meeting, Seattle, WA, September 25-28, 2013. Oral Presentation
5. A Lai, C Ellenson, **JC Linnes**, C Klapperich. "Extraction of Neisseria gonorrhoeae DNA in a Microfluidic Chip for Point-of-Care Molecular Diagnostics" Biomedical Engineering Society Annual Meeting , September 25-28, 2013, Seattle, WA. Poster presentation
6. **JC Linnes**, J Gomez-Marquez, CM Klapperich. "AherioTB: A paper based diagnostic for tuberculosis drug adherence monitoring" Bringing Diagnostics to the Point of Care, Nairobi, Kenya. June 25-29, 2012. Oral Presentation

7. **JC Linnes**, CM Klapperich. "Optimization of *Neisseria gonorrhoeae* lysis for on-chip isothermal amplification and detection" Bringing Diagnostics to the Point of Care, Nairobi, Kenya. June 25-29, 2012. Poster Presentation
8. C Ellenson, A Lai, **JC Linnes**, C Klapperich. "Optimizing Lysis of *Neisseria gonorrhoea* for Point-of-Care Diagnostics" Biomedical Engineering Society Annual Meeting, Atlanta, GA, October 24 – 27, 2012. Poster Presentation
9. **JC Linnes**, TB Davis, CB Matlack. "A Solar Disinfection Monitor for Safe Water" Unite for Sight, New Haven, CT. April 21-22, 2012. Oral Presentation
10. **J Callihan**. "Engineering outside of the classroom: lessons from Engineers Without Borders at University of Washington" Biomedical Engineering Society Annual Meeting, Austin, TX. October 6-9, 2010 Poster Presentation
11. **J Callihan**, K Mikhova, JD Bryers. "Extracellular matrix binding protein (Embp) and Its Role in Bacterial Adhesion to Catheter Materials" BioMedical Engineering Society Annual Meeting, Austin, TX. October 6-9, 2010 Poster Presentation
12. **J Callihan**, JD Bryers. "Comparison of *staphylococcal* specific and non-specific adhesion to adsorbed fibronectin" Society for Biomaterials Annual Meeting, Seattle, WA. April 21-24, 2010 Poster Presentation
13. **J Callihan**, JD Bryers. "Shear Stress Effects on Specific Adhesion of *Staphylococcus epidermidis*" 5<sup>th</sup> American Society of Microbiology Conference on Biofilms. Cancun, Mexico. November 15-19, 2009 Poster Presentation
14. **J Callihan**, JD Bryers. "SPR Analysis of *Staphylococcus epidermidis* Fibronectin (FN) Receptor Interactions with FN" 8th World Biomaterials Congress. Amsterdam, Netherlands. May 28 – June 1, 2008 Poster Presentation
15. **J Callihan**, JD Bryers. "Cross-Link-Release Isolation of a Bacterial Receptor" Biomedical Engineering Society Annual Meeting. Chicago, IL. October 11-14, 2006 Poster Presentation

## TEACHING EXPERIENCE

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Co-Instructor, Professional Development and Design in Biomedical Engineering (BME 390), Purdue University, West Lafayette, IN, 2015

- A studio-style course to develop user-centered needs identification and evaluation, ethical responsibilities and technical writing aspects of design for third year biomedical engineering undergraduate students

Instructor, Device and Diagnostics Design (BE 428), Boston University, Boston, MA 2013, 2014

- A project-based course developing fundamentals of the design aspects of biomedical devices and diagnostics for undergraduate biomedical engineering students

Instructor, D-Lab Health (EC.710), Massachusetts Institute of Technology, Cambridge, MA 2012

- Project based course developing technologies for low-resource settings

Faculty Member, Building Design and Engineering for Airborne Infection Control, Harvard School of Public Health, Boston, MA 2011

- Seminar: “Radiometers and ultraviolet Germicidal Irradiation Measurement”
- Laboratory session: “Hands on measurement of UVGI at Brigham and Women’s Hospital”

Global Leadership Curriculum Intern, Global Visionaries, 2009

- Developed and implemented project based curriculum in Global Health and Education for a new Global Leadership class at Seattle area high schools

Teaching Assistant, Sustainable Design for Developing Countries (Engr 380), University of Washington, Seattle, WA, 2008 – 2009

- Engineers Without Borders design course for students to apply engineering skills to practical problems in developing countries

Teaching Assistant, Initiative for Maximizing Student Diversity, University of Washington, Seattle, WA, 2008

- Intensive molecular and cell biology Summer Research Teaching Laboratory course

Teaching Assistant, Molecular Bioengineering (Bioen 501), University of Washington, Seattle, WA, 2006

- First year graduate course covering mass transport, diffusion, and chemical reaction processes

## INVITED TALKS

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Invited Speaker, Medicinal Chemistry and Molecular Pharmacology Seminar, Purdue University, West Lafayette, IN, 2015

- “Democratizing Molecular Diagnostics – Bringing Point-of-Care Diagnostic to Everyone”

Invited Speaker, Biomedical Engineering Seminar, Purdue University, West Lafayette, IN, 2015

- “Tools to Enable Molecular Diagnostics at the Point of Care”

Invited Guest Lecture, Engineering Health: Towards the Tricorder, Massachusetts Institute of Technology, Cambridge, MA 2013

- “Paper diagnostics and lateral flow assays”

Invited Speaker, Tech Talk, the MITRE Corporation, Burlington, MA 2013

- “State of the art technologies for low-resource settings”

Invited Speaker, New York Academy of Sciences, New York, NY 2011

- “Innovating on a Shoestring: Medical Technologies for the Developing World”

Invited Guest Lecturer, D-Lab Discovery, Massachusetts Institute of Technology, Cambridge, MA 2011

- Prototyping session: “Paper Diagnostics”

Invited Guest Lecturer, D-Lab Health, Massachusetts Institute of Technology, Cambridge, MA 2011

- “Diagnostics in the Developing World”

Invited Guest Lecturer, Science in Society Series at Roosevelt High School, Seattle, WA 2010

- “Bioengineering, Biomaterials and Beyond”

Invited Guest Lecturer, Introduction to Engineering in the Developing World, University of Washington, Seattle, WA, 2010

- “Monitoring and Evaluation of Project Impacts”

Invited Guest Lecturer, Molecular Bioengineering, University of Washington, Seattle, WA, 2007

- “Receptor-Ligand Binding Kinetics”

## LEADERSHIP EXPERIENCE

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Co-Founder, Little Devices, Cambridge, MA 2012

- Developing medical design innovation kits (MEDIKit) to enable local medical device innovation among medical professionals

Co-Founder and Vice-President, PotaVida Inc., Seattle, WA 2010 – Present

- Developing low cost, solar powered water purifier that provides feedback regarding microbiological contamination of drinking water

Bolivia Project Team Member, University of Washington Chapter of Engineers Without Borders, 2009

- Worked in rural Andean Bolivia to build and educate community members for improved cooking stoves and chimneys

Board Member, Two Wheeled Foundation, Inc., 2007 – 2012

- 501(c)(3), non-profit empowering youth to enact social change in Africa

BMES Bulletin Student Editor, Biomedical Engineering Society, 2006 – 2008

- Writer and Editor for student article contributions to the national BMES Bulletin

Industry Committee Co-Chair, Biomedical Engineering Society, University of Washington, 2005-2006

- Coordinated talks by local industry speakers at the Career Discovery Week Alumni Panel

## MENTORING

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Mentor, Biomedical Engineering Senior Project Research, Boston University, 2014-Present

- Courtney Ellenson, Nelson Boland, Danielle Conneely, Gil Couvarrubias  
Research Project: A novel point of care diagnostic for sexually transmitted infections  
\* Rice 360, 2014 Undergraduate Global Health Design Competition Participants

Mentor, Biomedical Engineering Senior Project Research, Boston University, 2013-2014

- Angela Lai, Tim Mon, Yash Adhikari, Leslie Nordstrom  
Research Project: An integrated microfluidic device for diagnosing *Neisseria gonorrhoeae*  
\* Boston University College of Engineering Societal Impact Capstone Project Award  
\* National Instruments, 2014 LabView myRIO Student Design Competition Participants  
\* Rice 360, 2014 Undergraduate Global Health Design Competition Participants

Mentor, Undergraduate Research Program, Boston University

- Angela Lai, Biomedical Engineering, (Lutchen Fellow and UROP) 2012, (UROP) 2013  
Research Project: Improved limits of detection in low-cost paper diagnostics for drug adherence

- Courtney Ellenson, Biomedical Engineering, (STARS Program) 2012, (Engineering Scholar and UROP) 2013, (Lutchen Fellow) 2013  
Research Project: Optimization of *Neisseria gonorrhoeae* genomic DNA extraction for point-of-care tests

Supervisor, Northeastern University Co-op Program, 2011

- Douce Hunt, Biology, 2011  
Research Project: Evaluation of germicidal efficacy of ultraviolet LEDs for air disinfection
- Ross Dworet, Chemical Engineering, 2011  
Research Project: Open-cell air-mixing system for ultraviolet germicidal irradiation of upper-room air

Mentor, Northwest Association for Biomedical Research Student Biotech Expo, 2007-2009

- Larissa Hurd, Sumner High School, 2007, 2008, 2009  
Research Project: Bacterial viability on contact lens surfaces in relation to protein preconditioning
- Tyler Roberts, Eastside Catholic High School, 2008  
Teaching Lecture: Age related memory loss and prevention strategies
- Alex Hamasaki, Garfield High School, 2007  
Research Project: E.coli uptake of quantum dots via chemical transduction
- Kelsey Oliver, Sumner High School, 2007  
Research Project: Minimum time required for non-specific adhesion to model foods
- Travis Butler, Shorecrest High School, 2006  
Teaching Lecture: Molecular action of antidepressants in the brain

Mentor, Research Experience for Undergraduates Program, University of Washington

- Ryan Stowers, Clemson University, 2008  
Research Project: Optimization of antibody fragmentation of monoclonal antibodies against *Pseudomonas aeruginosa*
- Tessa Pinon, St. Mary's University, 2006  
Research Project: Expression and characterization of a recombinant *Staphylococcus epidermidis* fibronectin-binding protein

Mentor, Women in Engineering Program, Purdue University, 2002-2004

- Advised underclassmen on engineering courses and learning skills, and attended Women in Engineering leadership workshops and training

## SERVICE

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Session Leader, Innovation to Discovery (I2R), Women in Engineering Program, Purdue University, 2015

- Developed and led a 2 hour workshop and lab tour for 6<sup>th</sup> grade students to learn about biomedical engineering through hands-on projects to build electricity-free nebulizers that deliver asthma medication

Participant, Workshop on the Future of Drinking Water, Institute for the Future, Palo Alto, CA, July 12<sup>th</sup> 2011

- Expert panel forecasting strategies for access and quality of global drinking water in the next ten years

Student Advisory Board Representative, University of Washington Bioengineering Department, 2007 – 2010

- Coordinated with department chair to develop and communicate department policies
- Established student priorities for funding, undergraduate curriculum, and graduate student mentoring
- Solicited student input and participated in the search for the department's Senior Academic Counselor



Community Service Chair, University of Washington Health Sciences Rotaract, 2008 – 2009

- Coordinated volunteer opportunities for Rotaract members at local charities and non-profit events.
- Projects included trail restoration with the Washington Trails Association, nutrition outreach at the South King County Latina Health Fairs, homeless youth luncheons at the University Family YMCA

Advisory Board Representative, University of Washington Global Health Resource Center, 2008 – 2009

- Provided student perspectives for the Resource Center and the Department of Global Health

Overnight Supervisor, Rising Out of the Shadows Youth Shelter, 2007 – 2009

- Weekly volunteer supervisor fostering a safe and protective environment for 25 homeless, street-involved, and low income youth
- Provided support through personal relationships and referral to career, housing, and counseling services
- Attended bi-weekly team meetings and trainings to develop leadership and diversity expertise