

## Kaoru Ikuma, Ph.D.

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### EDUCATION

Ph.D., Civil and Environmental Engineering, December 2011

Duke University, Durham, NC

Advisor: Claudia K. Gunsch

Dissertation: The effect of select biological and environmental factors on the horizontal gene transfer and functionality of the TOL plasmid: A case study for genetic bioaugmentation.

M.S., Environmental Sciences and Engineering, August 2007

Virginia Polytechnic Institute and State University, Blacksburg, VA

Advisor: Nancy G. Love

Thesis: The development of a bacterial biosensor designed to detect oxidative chemicals in water: Correlating sensor relevance to mammalian brain cells and assessing bacterial cell immobilization strategies.

B.S., Biological Sciences (Microbiology concentration), May 2005

B.S., Biochemistry (Biotechnology concentration), May 2005

Virginia Polytechnic Institute and State University, Blacksburg, VA

### RESEARCH EXPERIENCE

Postdoctoral research associate/Research Administrator (September 2014 – present)

The Water Innovation Network for Sustainable Small Systems (WINSSS)

Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Amherst, MA

Advisor: David A. Reckhow

Postdoctoral research associate (October 2011 – September 2014)

Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Amherst, MA (October 2013-present)

Department of Geology, Baylor University, Waco, TX (October 2011-September 2013)

Advisor: Boris L. T. Lau

Project: Interactions of metallic nanoparticles with biofilms at the biofilm-water interface

Graduate research assistant (August 2007 – September 2011)

Department of Civil and Environmental Engineering, Duke University

Project: Beneficial plasmid mediated genetic adaptation resulting from microbial exposure to anthropogenic contaminants

Graduate research assistant (May 2005 – July 2007)

Department of Civil and Environmental Engineering, Virginia Tech

Project: Microfluidic sensors for environmental monitoring

Project: Evaluating the extent of pollution-induced antibiotic resistance in environmental bacteria

## AWARDS AND NOTABLE RECOGNITIONS

Young Investigator Award, Fundamentals & Biological, Energy and Environmental Applications of Quartz Crystal Microbalance Focus Topic, American Vacuum Society (AVS) 61<sup>st</sup> International Symposium & Exhibition (2014)  
Selected to attend the NSF ADVANCE Future Faculty Workshop at Northeastern University (2012)  
Attendee of the US-EC Course in Environmental Biotechnology (2011)  
Selected as one of twelve Ph.D. students and postdoctoral researchers to attend from the USA.  
Dean's Award for Excellence in Mentoring, Duke University (2011)  
Paul. E. Torgersen M.S. Graduate Student Research Excellence Award, Virginia Tech (2007)

## PUBLICATIONS AND PRESENTATIONS

### Peer-Reviewed Journal Articles

Ikuma K., Shi Z., Walker A. V., Lau B. L. T. Effects of protein orientation and surface physicochemical features on the deposition of nanoparticles onto protein-coated planar surfaces. In review.  
Chae S.-R., Hunt D. E., Ikuma K., Yang S., Cho J., Gunsch C. K., Liu J., Wiesner M. R. Aging of fullerene C<sub>60</sub> nanoparticle suspensions in the presence of microbes. *Water Research* 2014, 65: 282-289. [doi:10.1016/j.watres.2014.07.038]  
Huang R., Carney R. P., Ikuma K., Stellacci F., Lau B. L. T. Effects of surface compositional and structural heterogeneity on nanoparticle-protein interactions: Different protein configurations. *ACS Nano* 2014, 8 (6): 5402-5412. [doi:10.1021/nn501203k]  
Ikuma K., Madden A. S., Decho A. W., Lau B. L. T. Deposition of nanoparticles onto polysaccharide-coated surfaces: Implications for nanoparticle-biofilm interactions. *Environmental Science: Nano* 2014, 1 (2): 117-122. [doi:10.1039/C3EN00075C]  
Lau B. L. T., Hockaday W. C., Ikuma K., Furman O., Decho A. W. A preliminary assessment of the interactions between capping agents of silver nanoparticles and environmental organics. *Colloids and Surfaces A: Physicochemical and Engineering Aspects* 2013, 435: 22-27. [doi:10.1016/j.colsurfa.2012.11.065]  
Ikuma K., Decho A. W., Lau B. L. T. The extracellular bastions of bacteria – A biofilm way of life. *Nature Education Knowledge* 2013, 4 (2): 2. [http://www.nature.com/scitable/knowledge/library/the-extracellular-bastions-of-bacteria-nbsp-a-100450088]  
Ikuma K. and Gunsch C. K. Successful genetic bioaugmentation with *Pseudomonas putida* for toluene degradation in soil columns. *Environmental Chemistry Letters* 2013, 11: 365-370. [doi:10.1007/s10311-013-0416-4]  
Ikuma K. and Gunsch C. K. Functionality of the TOL plasmid under varying environmental conditions following conjugal transfer. *Applied Microbiology and Biotechnology* 2013, 97 (1): 395-408. [doi:10.1007/s00253-012-3949-8]  
Ikuma K., Holzem R. M., Gunsch C. K. Impacts of organic carbon availability and recipient bacteria characteristics on the potential for TOL plasmid genetic bioaugmentation in soil slurries. *Chemosphere* 2012, 89 (2): 158-163. [doi:10.1016/j.chemosphere.2012.05.086]  
Ikuma K. and Gunsch C. K. Genetic bioaugmentation as an effective method for in situ bioremediation: Functionality of catabolic plasmids following conjugal transfers. *Bioengineered* 2012, 3 (4): 234-239 (invited addendum to Ikuma and Gunsch (2013) *Applied Microbiology and Biotechnology* article). [doi:10.4161/bbug.20551]  
Ikuma K. and Gunsch C. K. Effect of carbon source addition on toluene biodegradation by an *Escherichia coli* DH5 $\alpha$  transconjugant harboring the TOL plasmid. *Biotechnology and Bioengineering* 2010, 107 (2): 269-277. [doi:10.1002/bit.22808]

## Book Chapters

Ikuma K. and Lau B. L. T. Water constituents that affect the performance of nanomaterials. In Van der Bruggen B. (Ed), Applications of nanomaterials for water quality. Future Science Group, London, UK. [doi: 10.4415/EBO.13.532]

## Conference Oral Presentations (presenter name underlined)

Ikuma K., Shi Z., Walker A. V., Lau B. L. T. Probing nanoparticle-biofilm interactions using quartz crystal microgravimetry and complementary surface-sensitive methods. AVS 61<sup>st</sup> International Symposium and Exhibition (2014), Baltimore, MD.

Ikuma K., Madden A. S., Decho A. W., Lau B. L. T. Nanoparticle-biofilm interactions at the interface: Importance of surface physicochemical characteristics. International Water Association (IWA) Specialty Conference - Advances in particle science and separation: from mm to nm scale and beyond (2014), Sapporo, Japan.

Nguyen M. L., Ikuma K., Hockaday W. C., Lau B. L. T. Examining changing in adsorption and desorption dynamics of soil organic matter on Al- and Fe-oxide substrates: The effects of temperature. American Chemical Society (ACS) 247<sup>th</sup> National Meeting and Exhibition (2014), Dallas, TX.

Ikuma K., Madden A. S., Decho A. W., Lau B. L. T. Impact of chemical composition of extracellular polymeric substances on nanoparticle-biofilm interactions. Association of Environmental Engineering and Science Professors (AEESP) Conference (2013), Golden, CO.

Lau B. L. T., Huang R., Carney R. P., Stellacci F., Ikuma K. The effects of surface compositional and structural heterogeneity of nanoparticles on their self-aggregation and adsorption onto bacterial cells. 8<sup>th</sup> International Conference of the Environmental Effects of Nanoparticles and Nanomaterials (2013), Aix-en-Provence, France.

Decho A. W., Ikuma K., Lau B. L. T. When nanoparticles enter the house of microbes – the importance of biofilms in the fate and transport of nanoparticles. 1<sup>st</sup> Sustainable Nanotechnology Organization Conference (2012), Arlington, VA.

Ikuma K., Madden A. S., Lau B. L. T. The role of extracellular polymeric substances in nanoparticle-biofilm interactions. 22<sup>nd</sup> V. M. Goldschmidt Conference (2012), Montreal, Canada.

Lau B. L. T., Ikuma K., Bovet N., Furman O., Usenko S., Stipp S. L. S. Adsorption of metal-based nanoparticles: The importance of surface modification with organics. Interfaces Against Pollution (2012), Nancy, France.

Ikuma K. and Gunsch C. K. Genetic bioaugmentation: Utilizing horizontal gene transfer to enhance in situ bioremediation. AEESP Conference (2011), Tampa, FL.

Lau B. L. T., Huang R., Guo J., Ikuma K., Bruce E. Surface interactions of nanoparticles with model lipid membrane. Society of Environmental Toxicology and Chemistry (SETAC) North America 31st Annual Meeting (2010), Portland, OR.

Ikuma K., Pei R., Gunsch C. K. Effect of substrate type on toluene biodegradation following a horizontal gene transfer event in Escherichia coli DH5 $\alpha$ . Institute of Biological Engineering 13<sup>th</sup> Annual Conference (2008), Chapel Hill, NC.

Ikuma K., Henriques I. D. S., Love B. J., Love N. G. Immobilization of Pseudomonas aeruginosa in alginate microbeads for use in a biosensor designed to detect oxidative toxins. 85<sup>th</sup> Annual Water Environment Foundation Technical Exhibition and Conference (WEFTEC) (2007), San Diego, CA (paper published in conference proceedings).

## Curriculum Vitae

Ikuma K., Fraga-Muller J., Stevens A.M., Hagedorn C., Love N.G. Evaluating the extent of pollution-induced antibiotic resistance in environmental bacterial strains. AWRA Summer Specialty Conference – Emerging Contaminants of Concern in the Environment: Issues, Investigations, and Solutions (2007), Vail, CO.

Ikuma K., Rzigalinski B. A., Love N. G. Predicting the public health impact of oxidative toxins using a bacterial glutathione-gated potassium efflux stress response biosensor. American Chemical Society (ACS) 233<sup>rd</sup> National Meeting and Exposition (2007), Chicago, IL.

### Poster Presentations (presenter name underlined)

Ikuma K., Decho A. W., Lau B. L. T. Impact of physicochemical characteristics of biofilm extracellular polymeric substances on the fate and transport of metal nanoparticles. American Society of Microbiology (ASM) 114<sup>th</sup> General Meeting (2014), Boston, MA.

Ikuma K., Madden A. S. E., Decho A. W., Lau B. L. T. Nanoparticle-biofilm interactions: The importance of chemical composition of extracellular polymeric substances. ASM 113<sup>th</sup> General Meeting (2013), Denver, CO.

Ikuma K., Holzem R. M., Gunsch C. K. Stimulating genetic bioaugmentation in soil: Impact on TOL plasmid transfer rates and toluene biodegradation. AEESP Conference (2011), Tampa, FL.

Ikuma K. and Gunsch C. K. Effect of changes in environmental conditions on the horizontal gene transfer and functionality of the TOL plasmid. 13<sup>th</sup> International Symposium on Microbial Ecology (ISME) (2010), Seattle, WA.

Hunt D. E., Chae S.-R., Ikuma K., Yang S., Cho J., Gunsch C. K., Liu J., and Wiesner M. R. Complex bacterial interactions with nanomaterials. 7<sup>th</sup> Annual US Korea Nanoforum (2010), Pasadena, CA.

Ikuma K. and Gunsch C. K. Characterization of toluene biodegradation following a horizontal gene transfer event in Escherichia coli DH5 $\alpha$  and environmental bacteria. AEESP Conference (2009), Iowa City, IA.

Ikuma K. and Gunsch C. K. Characterization of toluene biodegradation following a horizontal gene transfer event in Escherichia coli DH5 $\alpha$  and environmental bacteria. 10<sup>th</sup> International Symposium on Bacterial Genetics and Ecology (2009), Uppsala, Sweden.

Ikuma K., Pei R., Gunsch C. K. Characterization of toluene biodegradation following a horizontal gene transfer event in Escherichia coli DH5 $\alpha$ . ASM 108<sup>th</sup> General Meeting (2008), Boston, MA.

### PAST AND CURRENT FUNDING

#### Pending Proposal Contributions

U.S. Geological Survey Annual Water Resources Institute Program through the Massachusetts Water Resources Research Center. “Microbial attenuation of non-point source pharmaceutical and personal care products pollution from antiquated septic systems in coastal communities”, \$30,000. Co-PI [PI: Caitlyn Butler].

#### Funded Proposal Contributions

National Science Foundation. “Collaborative Research: Natural Organic Matter, Capping Agents, and Nanoparticle Transport in Granular Media Filtration”, \$385,537 (9/15/2013-8/31/2016). Contributor of preliminary data and proposal editing [PIs: Desmond Lawler, Boris Lau, William Hockaday].

## Curriculum Vitae

C. Gus Glasscock, Jr. Endowed Fund for Excellence in Environmental Studies in the College of Arts and Sciences, Baylor University. “Probing the physicochemical interactions at the nanoparticle-biofilm interface by scanning transmission X-ray microscopy”, \$9,000 (PI; 6/01/2013-5/31/2014).

C. Gus Glasscock, Jr. Endowed Fund for Excellence in Environmental Studies in the College of Arts and Sciences, Baylor University. “Probing the role of surface chemical features in nanoparticle-biofilm interactions”, \$5,000 (PI; 6/01/2012-5/31/2013).

University Research Committee, Office of the Vice Provost for Research, Baylor University. “Probing the role of surface chemical features in nanoparticles-biofilm interactions”, \$7,500 (6/01/2012-5/31/2013). Main contributor of proposal writing [PI: Boris Lau].

University Research Committee, Office of the Vice Provost for Research, Baylor University. “Evaluating the microbial communities and performance of different on-site residential wastewater treatment systems”, \$7,336 (6/01/2012-5/31/2013). Main contributor of proposal writing [PI: Joe Yelderman].

## TEACHING EXPERIENCE

Instructor, Department of Civil and Environmental Engineering, University of Massachusetts Amherst (2014)

Course: CEE 697x Advanced Topics on Environmental Engineering (Spring 2014). Led course on current literature review and discussion offered to graduate students.

Guest lecturer, Department of Geology, Baylor University (2012-2013)

Course: GEO 1403 Environmental Geology (Instructor: Boris Lau, Spring 2012, Spring 2013). Developed and delivered lectures on geomicrobiology and wastewater treatment.

Instructor, Workshop on Essential Research Techniques, Department of Civil and Environmental Engineering, Duke University (2011)

Designed and instructed a workshop geared towards providing new graduate students with basic training in environmental engineering research.

Teaching assistant, Department of Civil and Environmental Engineering, Duke University (2009, 2010)

Courses: CE124L/244 Biological Processes in Environmental Engineering (Instructor: Marc Deshusses; Spring 2009). CE239L Environmental Molecular Biotechnology (Instructor: Claudia Gunsch; Spring 2010). Designed and lead laboratory sessions for both courses.

Guest lecturer, Virginia Tech (2006)

Course: Environmental Engineering Microbiology/Applied Microbiology for Life Sciences (Instructor: Nancy Love; Fall 2006).

## Curriculum Vitae

### SERVICES

#### Journal Reviewer

Environmental Science & Technology, Applied Microbiology and Biotechnology, Biodegradation

#### Outreach Activities

Volunteer for Girls STEM Explorers summer camp hosted by the Flying Cloud Institute at Bard College at Simon's Rock in Great Barrington, MA (2014)

Student mentor for a summer Howard Hughes high school student researcher at Duke University, Durham, NC (2010)

Student volunteer for "Scientists and Engineers for the Future", outreach activity for 7<sup>th</sup> grade students at Neal Middle School, Durham, NC (2010)

Student volunteer for FEMMES, Outreach program for local female students in 4-6<sup>th</sup> grades at Duke University, Durham, NC (2008-2010)