Courtney M. Gardner

Duke University • Nicholas School of the Environment • Pratt School of Engineering
(813) 966-7938 • Courtney.Gardner@duke.edu

EDUCATION

Doctor of Philosophy, Civil and Environmental Engineering May 2017
Duke University, Durham, NC
Dissertation: "Microbial Communities and Transgenic Crops: Understanding the Role Transgenic Crops May Play in the Rise of Antibiotic Resistance."
Committee: Claudia Gunsch (Chair), Chantal Reid, Lee Ferguson, Fred Boadu

Master of Science, Civil and Environmental Engineering 2015
Duke University, Durham, NC

Bachelor of Science, Biology 2011
Stetson University, DeLand, FL
Thesis: "Determination of Seed Paternity to Evaluate Reproductive Fitness in *Passiflora incarnata* Using DNA Microsatellites"
Advisor: Alicia Slater
Cum Laude, Honors Program Graduate with Distinction

RESEARCH INTERESTS

I am interested in understanding the interactions and dynamics between crop systems and soil microbiomes in both natural and engineered systems. My overarching goal is to bridge the gap between biotechnology, agriculture, and engineering in order to understand how rhizospheres are affected by both soil chemistry and exposure to emerging contaminants of concern, with the ultimate goal of manipulating these communities to improve crop yield, resilience to environmental stressors, and phytoremediation potential.

RESEARCH EXPERIENCE

Postdoctoral Associate June 2017
Pratt School of Engineering, Duke University
Addressing Co-Amplification of Chloroplast DNA in the Characterization of Endophyte Microbiomes

- Designed series of blocking primers to combat non-targeted amplification of chloroplast DNA when targeting endophyte communities for Illumina sequencing
- Employed three model plant systems: *Zea mays, Spartina* spp.*, and Pinus* spp.

Nicholas School of the Environment, Duke University
Evaluating the Impacts of Exposure to Dust-Bound Semi-Volatile Organic Compounds on the Gut Microbiome Composition of Children

- Characterized the gut microbiomes of children across a gradient of exposures to SVOCs bound to dust particles in homes using Illumina Miseq and Hiseq sequencing

- Prepared libraries for amplicon-based and deep metagenomic sequencing of gut samples and analyzed samples for associations with demographic metadata and chemical exposure

Graduate Research Assistant 2012-2017
Pratt School of Engineering, Duke University
Environmental Fate and Impact of Genetically Modified Crop Derived Antibiotic Resistance Genes

- Investigated how antibiotic resistance genes derived from genetically modified (GM) maize impact antibiotic resistance trends in wastewater treatment systems and agricultural soils
- Assessed microbial community shifts in bulk soils, rhizospheres, and maize endophytes with Illumina Miseq
- Quantified uptake and expression of free DNA released from decomposed transgenic maize in soil bacteria using qRT-PCR
- Identified transgene fragments in WWTPs and observed significant differences in transgene abundance in domestic WWTPs relative to control WWTPs

Effect of Chlorpyrifos Remediation Utilizing UV-Illuminated nano-TiO_2 on Microbial Communities

- Tested viability of using titanium dioxide nanoparticles to treat pesticide contaminated groundwater by investigating toxicity to *P. aeruginosa, B. subtilis,* and *A. baumannii*

Impact of Contaminant of Concern on Viability and Function of Environmental Soil Bacteria

- Quantified the concentration of triclosan on WWTP-generated biosolids
- Assessed the effect of triclosan on transcription of *Nir* genes in soil nitrogen-cycling bacteria
- Designed lab-scale reactors to monitor the biodegradation of tetrabromobisphenol A in natural and engineered systems

Research Assistant 2011-2012
Pratt School of Engineering, Duke University
Impact of Emerging Contaminants on Microbial Communities in Aquatic Environments

- Monitored degradation of benzo[a]pyrene and brominated flame retardants in wastewater sludge batch reactors
- Identified potential communities of microbial degraders

Undergraduate Research Assistant 2010-2011
Stetson University, DeLand, FL
Determination of Seed Paternity to Evaluate Reproductive Fitness in Passiflora incarnata Using DNA Microsatellites

- Examined the effect of phenotypic plasticity on reproductive fitness of *P. incarnata* plants
- Gained extensive experience with PCR, capillary sequencing, and bioinformatic analysis

TEACHING EXPERIENCE

Teaching Assistant, Integrative Bioinformatics for Investigating and Engineering Microbiomes (IBIEM) 2016
Pratt School of Engineering, Duke University

- Developed lectures and bioinformatics assignments regarding the characterization of endophyte microbiomes within corn tissues
- Described relevant sample preparation, Illumina library preparation workflow, taxa table generation, and biostatistical analyses

Teaching Assistant, Bioprocesses in Environmental Engineering 2015-2016
Pratt School of Engineering, Duke University

- Delivered lectures on microbial growth kinetics for wastewater treatment and biological reactor applications
- Taught laboratory sections focused on selective plating, fermentation, bioethanol production, microbial fuel cells, and algal biofuel production
- Graded assignments and laboratory reports, held office hours and exam reviews

Teaching Assistant, Environmental Biotechnology 2015-2016
Pratt School of Engineering, Duke University

- Delivered lectures describing the use of molecular biology tools in environmental science and engineering research
- Taught laboratory sections focused on selective plating, *E. coli* transformation, qPCR, and T-RFLP techniques
- Graded assignments and laboratory reports, held office hours and exam reviews

Teaching Assistant, Environmental Microbiology 2014-2015
Pratt School of Engineering, Duke University

- Delivered lectures describing fundamentals of microorganisms, soil microbiology, and applications to environmental science and engineering
- Taught laboratory sections focused on selective plating, DNA isolation, gel electrophoresis, and PCR techniques
- Graded assignments and laboratory reports, held office hours and exam reviews

Teaching Assistant, Self and Society 2010-2011
Honors Program, Stetson University

- Guided discussions concerning the role of an individual in society
- Graded essay assignments and mentored students during the formation of capstone projects

Teaching Assistant, Foundations of Knowledge and Understanding 2009-2010
Honors Program, Stetson University

- Explained challenging concepts regarding how the human mind process information, hold biases, and forms opinions to honors program freshmen

OUTREACH AND LEADERSHIP

Short Course Instructor 2017
Duke Talent Identification Program Scholar Weekends, Durham, NC

- Taught short course "Man Made Disasters: Environmental Explorations" to local middle and high school students
- Lead lectures and discussions about how human activities impact the surrounding environment
- Helped students think critically about developing clean-up plans for environmental disasters

Instructor and Research Communicator 2017
Science Day, North Carolina School of Science and Math, Durham, NC

- Engaged local high school students in current research topics and STEM opportunities at Duke through brief research talks, lessons, and demonstration activities

Lead Counselor 2017
BioScience and Engineering Summer Camp, Duke University, Durham, NC

- Responsible for planning and delivering interdisciplinary lectures on environmental microbiology, biotechnology, and scientific ethics to high school students
- Lead lessons with demonstrations, and collaborative activities and oversaw completion of student capstone projects
- Mentored students in basic microbiological lab techniques

Diversity and Inclusion Representative 2016-2017
Duke University Diversity and Inclusion Committee

- Nominated to serve as graduate student representative on the committee to strategize Duke's commitment to diversity and inclusion in education
- Planned STEM outreach events to attract local students to environmental science and engineering fields
- Organized a magnet program to attract minority and underrepresented students across the country interested in pursuing STEM education at Duke

Research Translator 2015
Superfund Research Program, Duke University, Durham, NC

- Communicated the importance, goals, and impacts of the Superfund Research Program to local community organizers
- Involved local community garden owners in research efforts to characterize PAH deposition from passing motor vehicles onto crops and soils

Research Translator 2012-2014
CEINT Research Center, NanoDays at Marbles Kids Museum, Raleigh, NC

- Interacted with young children in informal setting using accessible activities to describe unique properties of nanoparticles and their interactions with bacteria

AWARDS AND HONORS

2017	Jeffrey B. Taub Environmental Engineering Graduate Student Award, Duke University
2013-2016	Graduate Research Fellow, National Science Foundation
2011	Graduate with Distinction, Stetson University Honors Program
2011	Mays Award for Undergraduate Research Runner Up, Stetson University
2007-2011	Dean's List, Stetson University
2009-2011	SMART Grant, Stetson University

GRANT SUPPORT

2017 **Duke University GeMS Grants-In-Aid for Microbiome Bioinformatic Analysis**. Impacts of exposures to semi-volatile organic compounds (SVOCs) in indoor environments on the gut microbiomes of toddlers. Co-PI with Heather Stapleton ($20,000)

2010-2011 **Stetson Undergraduate Research Experience (SURE) grant**. Determination of Seed Paternity to Evaluate Reproductive fitness in *Passiflora incarnata*. Undergraduate Research Fellow ($2,000)

PUBLICATIONS

xx. **Gardner, C. M.,** Volkoff, S.J., and Gunsch, C. K. Examining the Behavior of GMO-Derived Free DNA in Model WWTP Anaerobic Digesters. *Environmental Science & Technology*. In preparation (Research: 100% complete, Writing: 70% complete).

xx. L.K. Redfern, **Gardner, C.M**., Hsu-Kim, H., Stapleton, H.M., Ferguson, P.L., Cooper, E., and Gunsch, C.K. Evaluating Bacterial and Archaeal Community Structure Along a Polycyclic Aromatic Hydrocarbon and Metal Gradient at a Hazardous Waste Site. *Journal of Hazardous Materials*. In preparation (Research: 100% complete, Writing: 70% complete).

xx. R.M. Holzem, **Gardner, C.M.**, Stapleton, H.M., and Gunsch, C.K. Using Laboratory Generated Biosolids to Evaluate the Microbial Toxicity of Triclosan in a Simulated Land Application Scenario. *Environmental Science and Pollution Research*. In Review.

xx. **Gardner, C. M.**, Redfern, L.K., and Gunsch, C. K. GMOs and ARGs: Characterizing the GM Maize Microbiome and Assessing the Risk of GMO-Derived ARG Uptake in Soil Bacteria. *Science of the Total Environment*. In Review.

xx. **Gardner, C. M.**, Gwin, C.A., and Gunsch, C. K. Evidence of Transgenic Crop Derived Transgenes in Activated Sludge and Digester Sludge in Wastewater Treatment Plants Across the United States. *Water Science & Technology*. In Review.

1. Farner-Budarz, J., Cooper, E.M., **Gardner, C.M**., Hodzic, E., Stapleton, H.M., Ferguson, P.L., Gunsch, C.K., Wiesner, M. R. Chlorpyrifos Degradation via Photoreactive TiO_2 Nanoparticles: Assessing the Impact of a Multi-Component Degradation Scenario. *Journal of Hazardous Materials*. Accepted with Minor Revisions.

2. R.M. Holzem, **Gardner, C.M.**, and Gunsch, C.K. Evaluating the Impacts of Triclosan on Wastewater Treatment Performance During Startup and Acclimation. *Water Science & Technology*. Accepted.

3. E. Lefèvre, Bossa, N., **Gardner, C.M**. Gehrke, G.E., Cooper, E., Stapleton, H.M., Hsu-Kim, H., and Gunsch, C.K. Biochar and activated carbon act as promising amendments for promoting the complete microbial debromination of tetrabromobisphenol A. *Water Research*. Accepted.

4. **Gardner, C.M.**, and C.K. Gunsch. Adsorption capacity of multiple DNA sources to clay minerals and environmental soil matrices less than previously estimated. *Chemosphere* 175 (2017): 45-51.

5. Thomson, A.D., **Gardner, C.M.**, Gwin, C.A., and Gunsch, C.K. Cocopeat for wastewater treatment in the developing world: comparison to traditional packing media in lab scale biofiltration columns. *ASCE Journal of Environmental Engineering* 142.2 (2015): 04015069.

PRESENTATIONS

Gardner, C.M., and C.K. Gunsch. 2017. Characterizing and Manipulating the Environmental Microbiome. North Carolina A&T State University Biology Department Seminar Series (October 25, 2017), Invited Speaker.

Gardner, C.M., and C.K. Gunsch. 2017. Characterizing the Maize Microbiome and Assessing the Risk of GMO-Derived ARGs in Soil Bacteria. International Symposium on Environmental Biogeochemistry Conference, Palm Cove, Australia (September 25-29, 2017), Oral.

Gardner, C.M., Redfern, L.K., and C.K. Gunsch. 2016. Estimating the contribution of Non-Traditional ARG Sources to Environmental Antibiotic Resistance. IBIEM Symposium, Duke University, Durham, NC (March 10, 2017), Poster.

Gardner, C.M. and C.K. Gunsch. 2015. Assessing the Role of GM Crops in the Rise of Antibiotic Resistance. Duke University Graduate Research Elevator Talks, Durham, NC (October 31, 2016), Oral.

Gardner, C.M. and C.K. Gunsch. 2016. Using Next Generation Sequencing to Assess the Changes in Soil and Endophytic Microbiomes Associated with Transgenic Maize. International Society for Microbial Ecology Meeting, Montreal, Canada (August 21-26, 2016), Poster.

Holzem, R., **Gardner, C.M.,** and Gunsch, C.K. Effect of Triclosan on the Nitrification Rates of Soil Bacteria. *Proceedings of the Residuals and Biosolids Conference 2016,* Oral.

Gardner, C.M. and C.K. Gunsch. 2015. Assessing the Role of GM Crops in the Rise of Antibiotic Resistance. BioMicroWorld Meeting, Barcelona, Spain (October 28-30, 2015), Oral.

Gardner, C.M. and C.K. Gunsch. 2015. Microbial Communities and BT Maize: Understanding the Role Genetically Modified Crops May Play in the Rise of Antibiotic Resistance. Association of Environmental Engineering and Science Professors Meeting, New Haven, CT (June 13-16, 2015), Poster.

Farner-Budarz, J., Rhoads, K., **Gardner, C.M.,** and Gunsch, C.K. 2012. Effect of Chlorpyrifos Remediation Utilizing UV-Illuminated nano-TiO_2 on Microbial Communities. Superfund Research Program Meeting, Raleigh, NC (October 21-24, 2012), Poster.

Gardner, C.M. and A. Slater. Determination of Seed Paternity to Evaluate Reproductive Fitness in *Passiflora incarnata* Using DNA Microsatellites. Association of Southeastern Biologists Conference, Huntsville, AL (March 12-14, 2011), Oral.

PROFESSIONAL POSITIONS

- *Biodegradation*, Reviewer 2016-Present
- *Journal of Environmental Engineering,* Reviewer 2015-Present

PROFESSIONAL MEMBERSHIPS

- International Society for Environmental Biogeochemistry
- International Society for Microbial Ecology
- American Society of Microbiology
- Association of Environmental Engineering and Science Professors

R E F E R E N C E S

Claudia K. Gunsch, PhD
Theodore Kennedy Associate Professor of Civil and Environmental Engineering
PhD Adviser
Duke University Box 90287, Durham, NC 27708
(919) 660-5208
Ckgunsch@duke.edu

Chantal Reid, PhD
Assistant Professor of the Practice of Environmental Science & Policy
Committee Member
Duke University Box 90328, Durham, NC 27708
Chantal@duke.edu
(919) 660-7378

Lee Ferguson, PhD
Associate Professor of Civil and Environmental Engineering
Committee Member
Duke University Box 90287, Durham, NC 27708
Lee.Ferguson@duke.edu
(919) 660-5460

Kurt Rhoads, PhD
Assistant Professor of Civil Engineering
Postdoctoral Mentor
Case Western Reserve University, Bingham 208, Cleveland OH, 44106
Krr38@case.edu
(216) 368-2952