

the goal

“...working together to reduce viral food borne illness”

NoroCORE, the USDA-NIFA Food Virology Collaborative, is a food safety initiative that focuses on outreach, research, and education in the field of food virology.

NoroCORE's ultimate goal is to reduce the burden of food borne disease associated with viruses, particularly noroviruses.

The Next Generation of Food Virologists

The “E” at the end of “NoroCORE” stands for “Education”- one of the three areas of focus for the Collaborative, alongside research and extension. The education and training of the next generation of food virologists is a central goal of NoroCORE.

In the last issue of *Capsid*, we discussed NoroCORE's efforts towards developing a properly trained and equipped professional community to tackle foodborne viral disease. NoroCORE teams include post-docs, graduate students, and undergraduate students who, thanks to their involvement with the program and its members, are receiving unique and cutting-edge training in this emerging discipline. This special edition of the *Capsid* is dedicated to featuring our graduate students.

NoroCORE supports graduate students in two ways: indirectly through the research teams it funds, and directly by means of the competitive NoroCORE Graduate Fellowship awards. The vast majority of graduate students are supported through the first means, as members of the research teams and laboratories receiving NoroCORE support. NoroCORE Graduate Fellowships are also available, which students acquire after being selected through a competitive application process. The Fellowships are awarded annually and are open to any graduate student- Master's, Ph.D., or M.P.H- working with a NoroCORE investigator, who has completed at least one year of graduate study and research at the time of application. Applicants must be in good academic standing with a high GPA and have excellent letters of recommendation. Awardees receive

a stipend of \$25,000 as well as \$35,000 towards the cost of education. NoroCORE awarded four fellowships in 2013 (Year 2/3 group), and recently awarded another four in 2014 (Year 3/4 group).

All of the graduate students supported by the NoroCORE program gain the opportunity to work in highly collaborative, multi-disciplinary teams. They have access to the network of experts that make up the Collaborative, as well as to specialized reagents and protocols that might otherwise be difficult to obtain. Students have the opportunity to attend NoroCORE Collaborative meetings, where they are exposed to the latest research across all of the disciplines involved in the project, and have the opportunity to connect and share ideas with experts from academia, industry, and government. They also gain experience presenting posters and, for the first time this year, oral presentations to the team.

In the next few pages we feature two groups of our students: the eight NoroCORE Graduate Fellows, and five of our NoroCORE-supported graduates who have completed their degrees and moved into the next step of their careers. Please keep in mind that this is only a sampling of over 30 graduate students who have been involved with the Collaborative, and is by no means an exhaustive picture of what our students are up to! Make sure to check out our website, where we will soon feature our Fellowship awardees, and more stories about what NoroCORE graduates “do next” in their careers.

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NoroCORE Graduate Fellows



Hannah Bolinger

Year 2/3 Fellow

MS Nutritional Science

Rutgers University

Advisor: Dr. Don Schaffner

Hannah recently received her M.S. in Nutritional Science from Rutgers and is now working on her Ph.D. in Food Science at North Carolina State University. While at Rutgers, Hannah participated in a NoroCORE-supported, multi-institutional prevalence study spearheaded by Clemson University. Hannah managed the logistics of identifying and communicating with an extensive list of New Jersey restaurants, as well as carried out the actual swabbing of restroom surfaces at each location. Her other project examined the survival of *Bacteroides* and *Enterococcus* bacteria on different surfaces, which may serve as alternative norovirus diagnostic tools.

Hannah said her research experience gave her new laboratory skills and refined others, as well as allowed her to delve into the intricacies of norovirus. She found noroviruses very interesting and the larger picture of norovirus transmission routes, host susceptibility, food handler activities, and other epidemiological aspects were what prompted her to pursue a Ph.D. She also really enjoyed working with her mentor, Dr. Don Schaffner. As for being part of the NoroCORE Collaborative, Hannah shared that it allowed her to understand the scope and impact of foodborne illness, and she enjoyed the opportunity to meet NoroCORE team members at the 2012 Atlanta conference.

“I have worked on smaller projects before and being part of such a large project really opened my eyes to its scope. I’d never heard of norovirus before. Sometimes with the smaller projects you are too focused on only the one thing you’re doing.”

She also had very positive things to say about the Fellowship award, which allowed her to overcome a challenging funding situation and focus on her studies and research. *“I cannot say enough how much that award meant to me. My first year I didn’t have funding, I had to take out a huge loan and look for jobs [which affected my studies]...This is the best thing that ever happened to me...I am really thankful to have the opportunity to work with NoroCORE.”*

Hannah is currently working on her Ph.D., assessing the prevalence of *Campylobacter* and antibiotic resistance in turkey flocks. Following graduation, she hopes to go into industry, and then transition into a regulatory or other government position.



Rita Czako

Year 2/3 Fellow

PhD Translational Biology and Molecular Medicine

Baylor College of Medicine

Advisors: Drs. Mary Estes and Robert Atmar

Rita finished her Ph.D. this past July, and her research dealt with the production of human monoclonal antibodies for norovirus, which was an uncharted area when she started. The Baylor group did this by immortalizing immune cells that produce antibodies from people previously infected with norovirus. They then isolated and checked the antibodies for binding to the norovirus capsid.

These antibodies show a lot of promise as reagents for detecting noroviruses in clinical, food, and environmental samples. Rita helped get the project off the ground, and the NoroCORE funding helped support the cost of materials needed to do so, as well as allow her to collaborate extensively with other groups developing novel techniques. Rita shared that this allowed her to have and independently manage

her own project for the first time.

“It is unique to be in a field that has a group like this. This is an interesting community where you really get to communicate with people who are working on other pieces of the same puzzle; you get cross-fertilization within the field.” Rita also felt that NoroCORE has given her a great avenue for networking.

Dr. Czako will be starting a post-doc with the National Institute of Allergy and Infectious Diseases (NIAID) arm of the NIH in December, working on influenza and coronaviruses. The laboratory she is entering focuses on the development of live attenuated vaccine candidates for avian and pandemic influenza strains. She would ultimately like to become an independent investigator, preferably with the government, and hopes to work at the CDC. She has an overarching interest in science policy and the “big picture” state of scientific research in this country.

“I want you guys to know that I am very grateful for this opportunity and it has definitely been a wonderful experience.”

NoroCORE Graduate Fellows



Erin DiCaprio

Year 2/3 Fellow

PhD Comparative & Preventative Veterinary Medicine

The Ohio State University

Advisor: Dr. Jianrong Li

Erin is in the final year of her Ph.D., and her project is researching the interaction of noroviruses with fresh produce, and how noroviruses come to contaminate produce, to determine effective control measures. She has looked at the internalization of the virus in growing produce, as well as virus attachment to the surfaces of plants such as leafy greens and strawberries. She has also worked on a project testing the inactivation of norovirus with ionizing radiation and high pressure processing, which has involved collaboration with an engineer versed in electronic beam treatments at Kent State University.

Erin learned useful skills being in the Li lab, including how to better communicate what she does through presentations and written manuscripts. The NoroCORE fellowship also gave her the ability to collaborate with Kent State and gave her more flexibility, creativity, and independence in how she carried out her experiments. *“It’s been a really great benefit to be involved with NoroCORE. Being a PhD student who had gone to the meeting two years ago, I’d read all these manuscripts and put names to faces. Meeting others in the field is really beneficial.”*

Following graduation, Erin hopes to enter a post-doctoral program, such as in academia, at USDA diagnostic labs, or in public health. She also really enjoys teaching in addition to research. Erin was confident that her research experience has prepared her for her future career path:

“I’ve gotten a lot of different experiences in the laboratory and I feel like I have a good skill set now in basic virology techniques. I have a broad perspective of virology. I also have my Masters in Food Science so I have a lot of knowledge about the Food Industry, as well as experience giving presentations and lectures in class and mentoring undergrads. I have gotten a taste of all the aspects of what would be expected of me to be a faculty member in the future.”

As for receiving the Fellowship, *“It’s been a huge honor. I feel proud when I get to tell people I’m a NoroCORE fellow. For me, it’s a point of pride... Getting the fellowship has made me feel more empowered.”*



Kelly Wahl

Year 2/3 Fellow

MPH Epidemiology

Emory University

Advisors: Drs. Christine Moe and Amy Kirby

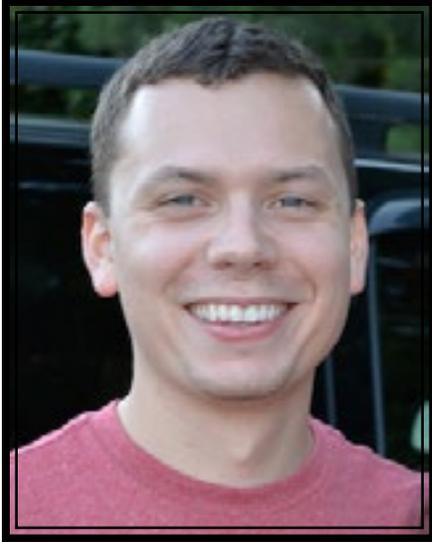
Kelly graduated this past May, and her project at Emory focused on the course of norovirus and rotavirus infections in children with underlying gastrointestinal dysfunctions, such as congenital malformations, Crohn’s disease, and ulcerative colitis. This is a vulnerable population that may have longer or more severe illness once infected with norovirus, but they have not been studied in detail before.

Kelly’s research experience improved her problem solving, scientific writing, editing, and presentation skills. As for being part of the NoroCORE Collaborative, she said the conference in Atlanta was a great way to meet all of the researchers and access the network of experts in the field. Receiving NoroCORE support allowed Kelly to not only work with a great group of collaborators, but also let her focus on her project and not on sourcing support.

Kelly will soon be entering a position with the Regulatory Science Team at Booz Allen Hamilton, where she will work to improve the review process and standardization of clinical information between different research studies. She feels that her graduate experience of going through the whole research process, writing papers, and honing her problem solving skills has helped prepare her for this position. Down the road, Kelly is looking toward going into government consulting to bring about positive change. When we asked her if she had additional comments about her experience, Kelly shared:

“I can’t thank my advisors enough, especially Dr. Kirby and Dr. Moe. It was such a pleasure working with them and getting to learn from them, and a big thanks to all the collaborators I got to work with on my project. I can’t say enough good things about Amy. I loved working with her while I was at Emory and she has been a phenomenal mentor. I didn’t plan on continuing research in a lab after college but [after] working with Amy and Dr. Moe, and learning more about the fascinating epidemiology and biology of norovirus, I was hooked.”

NoroCORE Graduate Fellows



David Buckley

Year 3/4 Fellow

MS Microbiology

Clemson University

Advisors: Drs. Xiuping Jiang and Angela Fraser

David's project focuses on investigating the recovery of noroviruses from soft surfaces such as carpets, as well as the efficacy of disinfection methods. He has been using the surrogate viruses, FCV and MNV, with cell line plaque assays and RT-PCR for detection. He is currently working towards transitioning from an M.S. to a Ph.D. degree program.

David explained that before coming to Clemson a year ago, all of his experiences were with bacteria. He has since learned how to perform RT-PCR, plaque assays, cell culture, and how to concentrate viruses in a sample. A neat offshoot of the project has had him learning about electrokinetic potentials, which measure a surface and provide information about the isoelectric point of that material. This knowledge can then be used in the design of elution

buffers to increase yields.

"Before I came to Clemson my knowledge of norovirus was very limited, and I wanted to do virology. I also got norovirus from my girlfriend not long into coming to Clemson, and it gave me firsthand experience of what we are dealing with. Working on a national project is really nice, and knowing that I get to work with and collaborate with a lot of people, so that in the future, I will have more contacts. Working alongside other scientists and collaborating is always better."

According to David, receiving NoroCORE support has given him more knowledge of working with noroviruses and viruses in general, which will give him more ideas for future research projects, and the NoroCORE funding will let him complete his project more quickly. David is currently a medical service officer in the NC National Guard, and after graduation, he is thinking of joining the military's microbiology program, or possibly going into industry, as his project has ties with Proctor and Gamble.

"The grant has been a real blessing. I was urged to apply, and it was a real honor, and I hope to do more research in the field."



Rasheena Edmondson

Year 3/4 Fellow

PhD Integrated Biosciences

North Carolina Central University

Advisor: Dr. Liju Yang

Rasheena is one of our new batch of Year 3/4 fellows, and her project at North Carolina Central University focuses on developing biosensors to detect norovirus, as well as the inactivation of the virus using nanoparticles. Prior to becoming a fellow, her background was in cancer biology, and working with viruses was novel for her. Rasheena has now embraced the field, and says she wants to learn as much about virology as she can.

Rasheena has also learned several new skills as part of this switch into a new discipline, such as Western blotting, 3D cell culture, and immunofluorescence-based imaging.

When it comes to working in a virology lab and what she has gotten out of her experience, she had the following to say:

"I have found that people in the lab are very helpful if you have questions on techniques or needing materials. I am also learning how to work with different people, and how science requires collaboration."

Looking ahead to post-graduation, Rasheena had originally planned on academia as a career path because she enjoys teaching. However, she has also recently become interested in a career in industry, after attending a conference where she heard from people talking about their unique, industry-based careers.

NoroCORE Graduate Fellows



Sarah Markland

Year 3/4 Fellow

PhD Animal and Food Sciences

University of Delaware

Advisor: Dr. Kali Kniel

Sarah will be graduating with her Ph.D. this coming May, and her research has been focused on understanding the plant-microbe interactions of norovirus and leafy greens to better design control and prevention strategies. She has been pursuing several research questions, such as the nature of plant immune responses to noroviruses (NoVs), how NoVs react to biofilms on leaf surfaces, and the inactivation of human NoV and its surrogate viruses by chlorine, calcium hypochlorite, and ozone. In broad terms, the research group wants to know how plants serve as vectors for the virus, as this can be important to detection and control measures.

According to Sarah, being part of the NoroCORE Collaborative has been awesome because she has been able to collaborate with a lot of people, and her group gets to do cutting-edge research surrounding norovirus persistence in the pre-harvest environment, which not many people outside of the Collaborative study. Receiving NoroCORE support has also allowed her to do a lot more research, which has let her expand her current thesis proposal, and enabled her to pick up microscopy and bio-imaging as new technical skills.

Sarah said her research experience and working with viruses and plants has allowed her to become a more well-rounded scientist and microbiologist with multidisciplinary experience. Additionally, she has also learned new molecular techniques and infectivity assays in the lab, all of which she believes will be useful in her future career path in virology and/or clinical research. Sarah is looking at government-based post-doctoral opportunities, such as at the CDC and USDA, as well as programs in clinical microbiology and public health. Sarah also shared:

“Thank you to NoroCORE for this amazing opportunity!”



Molly Steele

Year 3/4 Fellow

MPH Epidemiology

Emory University

Advisors: Drs. Christine Moe (Emory), Ben Lopman (CDC) and Justin Remais (Emory)

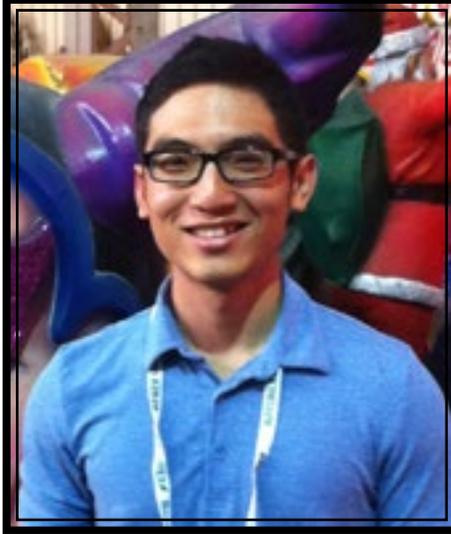
Molly is also one of our new fellows, and her project involves the mathematical modeling of different vaccine strategies, such as by age group and targeted vs. mass vaccination, to see how these variables would impact the transmission of foodborne viruses. She plans on incorporating food handlers into the study as they are a particular risk group in the population, to model what would happen to the risk dynamics if these people were vaccinated.

Molly said this is the first time she has done a lot of computer-based modeling, and she has also been gaining experience writing grants and presenting her work, which is technically complex, to a variety of audiences. She had the following to say about being part of the Collaborative:

“Being able to connect with professionals in the field, and being able to communicate with people who have been doing this for many years is a great opportunity.”

According to Molly, her NoroCORE support has also allowed her to go to conferences and given her opportunities to network, which she probably wouldn't have been able to do otherwise. The funding has also allowed her to focus on her research. Down the road, Molly hopes to work with a federal, state, or local health agency and be involved in public health education and epidemiological practice. She sees her research project as directly relating to her career goals and real-world applications, since epidemiologists seek to know how vaccines will affect a population.

NoroCORE Graduates



Ben Yeap, MS
Food Technologist
Coalescence, LLC
Columbus, OH
The Ohio State University
Graduate
Advisors: Drs. Richard
Linton and Jianrong Li

Ben Yeap received his M.S. in Food Science and Technology in May 2013 under the guidance of Drs. Richard Linton and Jianrong Li at The

Ohio State University, making him one of the first NoroCORE-supported graduate students to finish his degree. Ben worked on several projects while at OSU, including assessing the effectiveness of chlorine dioxide gas against norovirus surrogates on stainless steel, and investigating a novel indicator system for the detection of the virus in stool samples.

Ben was also a key member of the OSU arm of a multi-institutional collaboration with Dr. Angela Fraser at Clemson University and Dr. Don Schaffner at Rutgers University that performed environmental sampling at food service establishments. Ben said he acquired a number of molecular skills, such as PCR, qPCR, Western Blotting, SDS-PAGE, as well as cell culture techniques while he was in the lab.

Ben is now a Food Technologist at Coalescence, LLC, which is based in Columbus, Ohio. In addition to managing some sales accounts, he is primarily responsible for product development of their seasoning blends, dry and liquid flavor systems, and dry and liquid nutritional products.

When asked what he gained by being part of the NoroCORE Collaborative, Ben replied that he felt his participation in NoroCORE broadened his view of norovirus, giving him the understanding that there are many relevant aspects to a single infectious agent like norovirus.



Dove Cormier, PhD
Research Engineer
Institute of Gustave Roussy,
France
Louisiana State University
Graduate
Advisor: Dr. Marlene Janes

Dr. Dove Cormier was also one of NoroCORE's first graduates, under the guidance of Dr. Marlene Janes at Louisiana State University. She received her Ph.D. in Food Science in December 2013,

specializing in Food Microbiology. Dove explored microbiological techniques, specifically the rapid detection of viral contamination in shellfish harvesting waters and oysters. She also investigated new methods for detecting hepatitis A virus and its indicator MS2 in seawater.

Dr. Cormier is now a research engineer at the Institute of Gustave Roussy in France, where she investigates the role a DNA-repair protein plays in the prognosis of cancer patients. Dove learned a number of important technical skills at LSU, such as performing cell culture, RNA extraction, real-time PCR, bacterial enumeration, and plaque assays.

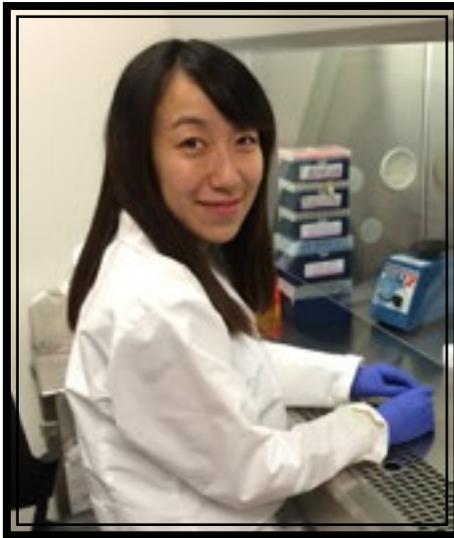
When asked to share her thoughts about working in a lab with NoroCORE support, Dr. Cormier had very positive and insightful things to say about her experience and how it prepared her for her new position:

"I gained confidence [and] independence...I was trusted with handling the project on my own, and my ideas were readily accepted by my advisor. The experience of working in a lab, dedicating my full potential to a project, dealing with the stress of negative results, [and] facing the challenge of independent research, all better prepared me for a job."

When asked if she had anything else she wanted to say about her experience, she added:

"I owe all my success to my colleagues and especially, my advisor. She gave a 22 year-old college graduate her full trust and support to do independent research, and has never doubted my potential."

NoroCORE Graduates



Fangfei Lou, PhD
Technical Support
Manager
JES Foods, Inc., Celina, OH
The Ohio State University
Graduate
Advisor: Dr. Jianrong Li

Dr. Fangfei Lou graduated in August 2014 with a Ph.D. in Food Science and Technology, under the guidance of Dr. Jianrong Li at The Ohio State University. Dr. Lou

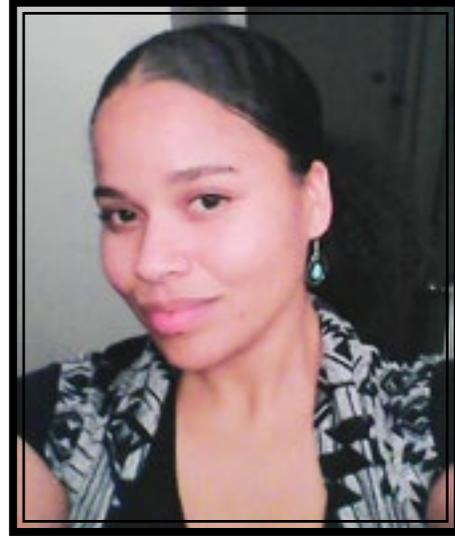
completed her dissertation on the inactivation of norovirus by high pressure processing methods. Her investigations focused on foods at higher risk of being contaminated with norovirus, such as produce and seafood, and high pressure processing shows promise as a way of inactivating viruses in foods without the use of heat.

Dr. Lou is now Technical Support Manager at JES Foods, Inc. in Celina, Ohio. She plays a key role in maintaining food safety at her company, and is responsible for managing HACCP documentation and development. She also oversees the sanitation department, the staff laboratory technician, and their quality control technologist. To top it off, she leads the development and implementation of their SQF 2000 system, which is an international food safety and quality assurance certification program for food suppliers.

We asked Dr. Lou to share her thoughts about working on a research team with NoroCORE support, and she had only good things to say about her experience and how it prepared her for her new position.

Dr. Lou explained that she learned an array of skills essential to performing food safety research, including bacterial and mammalian cell culture, aseptic technique, and several of the important rapid pathogen detection methods, including RT-PCR, real time PCR, and ELISA. Being in the lab helped her gain a comprehensive understanding of food disinfection and pathogen detection. As part of the research team, she was able to hone her skills in troubleshooting and analyzing test results, which directly relate to her current position.

The added benefits of being part of the NoroCORE Collaborative were that it gave her a comprehensive understanding of food safety, sanitation methods, and food processing, and most importantly, it helped her build a wide network with other food safety professionals.



Decima Washington, MS
Consumer Safety Officer
Food and Drug
Administration,
Portsmouth, VA
North Carolina A&T State
University Graduate
Advisor: Dr. Leonard
Williams

Decima graduated in August 2014 with a M.S. in Food and Nutritional Sciences, under the

guidance of Dr. Leonard Williams of N.C. A&T State University. During her research, she used traditional and molecular-based methods to isolate and understand the prevalence of specific food borne pathogens, including norovirus, from locally grown produce sold at farmers' markets in North Carolina.

Decima learned a number of important skills during her time in the lab, such as how to isolate and characterize microorganisms from foods, as well as from human and animal samples. She learned both conventional detection methods, as well as the newer molecular and immunology-based methods. Working with NoroCORE gave her a broader understanding of NoroCORE's mission and the importance of norovirus and its effect on the public.

Decima is now a Consumer Safety Officer with the Food and Drug Administration for the Baltimore District, and works out of the Resident Post in Portsmouth, VA. This division deals with imported and domestic consumer products. They conduct inspections of products regulated under the Federal Food, Drug, and Cosmetic Act, as well as the manufacturers, warehouses, and retail shops that support these products.

When asked to share her thoughts about working in a lab with NoroCORE support, Decima had very positive things to say about her experience and how it prepared her for her new position:

"Although my actual work is not laboratory based, my duties often include collecting samples to be analyzed by our labs. [I use] the same techniques I used when collecting samples for the project. I feel that I am more aware of the laboratory process by having been on the other side during my studies at the university."

"I would just like to thank my advisor and all the people that created this program to give students like me an opportunity to learn and collaborate with other scientists and institutions for a common goal."

NoroCORE Graduates (...continued)



Ben Raymond, MS

Associate Innovation
Scientist

DD Williamson, Louisville,
KY

North Carolina State
University Graduate

Advisor: Dr. Benjamin
Chapman

Ben Raymond is one of NoroCORE's most recent students to enter the food industry. He recently completed his

defense and will graduate this December with an M.S. in Food Science, under the guidance of Dr. Benjamin Chapman at North Carolina State University. Ben Raymond studied food safety and risk communication in social media, conducting online surveys of blogging mothers, "mommy bloggers," aimed at learning more about the group's level of knowledge and attitudes around norovirus.

Ben is now an Associate Innovation Scientist at DD Williamson in Louisville, Kentucky, where he develops new natural colors for foods. He is involved in the entire process, from idea generation to proof of concept, to design of experiments and refinement for scale up and production. In Ben's own words, he makes food look as great as it tastes!

We asked Ben to share his thoughts about working on a research team that is part of NoroCORE, and he explained that he gained problem solving skills, better critical thinking abilities, and a knowledge of risk communication and social media that was far greater than he would have had otherwise:

"The most important gain for me was and is learning how to solve problems on my own, how to look for help, and when to ask for help. The research and thesis writing [itself] has made me a better scientist in the lab and at my desk, even if most of my research was under the umbrella of social research and primarily utilized a MacBook as my workstation rather than a lab bench."

Ben also added his thanks to Dr. Ben Chapman and Dr. Lee-Ann Jaykus for their invaluable guidance.

To the NoroCORE Graduate Students...

NoroCORE is proud of all of our students and their successes. We plan to continue featuring our graduate students in future issues of the newsletter, and our Fellows on the NoroCORE website.

The NoroCORE Graduate Fellowship is open to all graduate students working with a NoroCORE collaborator who have finished at least one year of graduate study and research. You must have a high GPA and excellent letters of recommendation. Scholars from traditionally underrepresented backgrounds (African American or Black; American Indian or Alaska Native; Hispanic and/or Latino) are encouraged to apply. Please note we cannot award more than one fellowship per given institution per year, though multiple applicants may apply. Current NoroCORE fellows are not eligible to compete for this award.

The next call for applications will likely take place in Spring 2015. Here's a little more about the award and application process:

Funding: 1 year

Stipend: \$25,000/year

Cost of education: \$35,000/year

Available to: M.S. and Ph.D. students (& MPH students having a significant research component to their project)

Requirements

*You must be a U.S. Citizen or Permanent Resident.

*You must be currently working with a NoroCORE investigator and have completed at least 1 year of graduate studies.

*You must be in good academic standing with a high GPA and excellent letters of recommendation.

Application Materials

*Online Graduate Fellowship Information Form

*CV

*Official Transcripts (undergraduate and graduate)

*2 letters of recommendation, including a letter of nomination from your advisor and one additional letter

*1-2 page statement of your current research project, progress to date, and its relevance to food safety/public health as it pertains to viral illness

To learn more or apply next Spring, please visit our website!



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NoroCORE
Food Virology

Collaborative for Outreach, Research & Education