

STEC CAP News

CONTROLLING SHIGA TOXIN-PRODUCING *E. coli* TO IMPROVE BEEF SAFETY

Director's Update

Dear STEC CAP Nation,

It is hard to believe we are now in Year 4 of the STEC CAP; where did the time go? To begin with, I have some very good news to share; on February 4 I received official notification of our award approval for this year from the USDA-NIFA. As in previous years, it takes some time for subawards to be fully executed; so, for the relatively few of you who don't have remaining funds from previous years from which to operate, I ask for your patience as the necessary paperwork and agreements get completed.

I must say it is very gratifying to see projects come to fruition. This is especially manifested when manuscripts to refereed journals have been submitted, accepted, and published. Along this line, I ask for collaborators to put their efforts and expertise into overdrive, and not only that, but to prioritize and do your very best to focus and complete projects through to the manuscript submission and publication stage. Most of us have several STEC CAP projects in different stages of completion; however, we should be putting those projects that have expected deliverables as stated in your Statements of Work at the highest priority. Objective Teams should be in frequent communication and working together



Rod Moxley

to complete experiments and publish the results. We need to follow through on what was stated in our grant proposal to the USDA-NIFA, who trusted us with the funds

to get the work done. As a reminder, the highest priority for all of us is to provide the Objective 4 team with data to "feed the QMRA." Our Team 4 leaders, Dan Gallagher and Mike Sanderson, cannot wait until the end of Year 5 to receive your data sets, as they, too have deliverables to meet. I also suggest that you contact Dan and Mike and revisit why your data are important and how it fills the voids in our QMRA. Together, you can also discuss the timing and preferred format for sharing your data sets.

At the risk of sounding like a "broken record", I continue to ask everyone to be diligent in documenting and submitting their "points on the board" to OEIE. As your Project Director, I am required to submit four reports per year to the USDA, culminating with the REEport in the fall, and it is very hard to know what

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Developing as a Scientist and a Scholar

A student's perspective working on the STEC-CAP Grant

Two-and-a-half years ago, I began my graduate education at the University of Nebraska-Lincoln. I often recall how "green" I was back then - unaware of the challenges and rigor that accompanies graduate research experience. Fortunately, I was able to work with a tremendous mentor in Dr. Harshavardhan Thippareddi and under the purview of the STEC-CAP grant. Being part of such an ambitious study exposed me not only to a wide range of STEC-related research issues but also connected me with other graduate students, regulators, and scientists that have served as invaluable colleagues and sources of inspiration.

My masters-level work at UNL was focused on thermal destruction of STEC in ground beef as well as the efficacy of high pressure processing to eliminate STEC in salami. Compiling data, learning how to work new instruments, and designing protocols was challenging, was challenging, but also helped me to develop as a scientist and a scholar.

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USDA ERRC co-laborators Drs. John Luchansky and Anna Porto-Fett spent quality time on April 9, 2014 with 60 students from Souderton Area High School (SAHS) in Pennsylvania who visited ERRC. The group toured the ERCC facility as part of "Career Day" and learned about our STEC CAP beef safety research.



USDA's National Institute for Food and Agriculture (NIFA) Funded Beef Safety Grant STEC-STEP Externship Program Opportunities for High School and Undergraduate College Students

High school and college undergraduate students from across the country are invited to apply for Student Training and Education (STEP) externships with the USDA STEC Coordinated Agricultural Project (CAP) grant. This USDA National Institute for Food and Agriculture (NIFA) funded grant is focused on understanding and controlling Shiga toxin-producing *E. coli* (STEC) throughout the entire beef system. These human pathogens, carried by cattle and other ruminant animals, can enter the food chain during pre-harvest production, beef processing, and/or food preparation and cause significant foodborne illness consequences. Seven types of STEC bacteria are regulated as adulterants in raw beef products prompting scientists, beef processors, regulators and public health officials to exert a vast effort to eliminate them from the food system.

Externs can shadow (typically one day in length) project collaborators conducting laboratory research or spend time with the education and outreach specialists to gain a better understanding of STEC's as foodborne disease agents, how they affect the food system and approaches for their control, and types of methods used to detect STEC bacteria. Additionally, externs learn how educational and outreach programs are used to distribute information to beef system stakeholders (farm to final consumer) to communicate and reduce the risks associated with foodborne disease. The goal of the STEC-STEP externship program is to increase awareness of food safety and beef production as exciting college majors that prepare graduates for excellent careers in the beef/food industry, academia or tech-based companies, or regulatory agencies.

STEC-STEP externships are non-paid opportunities to briefly visit our collaborators' laboratories (12 institutions and 50 collaborators involved), discuss research activities and opportunities, ask questions regarding beef/food safety or how research is conducted, and make professional contacts.



2013 STEC-STEP extern Anteeleh Phebus explores microbial culturing procedures with STEC CAP research technician Donka Milke at K-State. Anteeleh now is a food science student and works part-time in the K-State Food Safety & Defense laboratory.

These externships can occur at any time of the year and require advance notice to arrange at the STEC CAP institution of your choice (participating institutions highlighted at www.stecbeefsafety.org).

Additionally, when collaborators convey STEC CAP related content to other individuals or groups (teachers, community associations, high schools, 4-H clubs, FFA chapters, etc.), it should be included as externship experiences in monthly OEIE reporting. We encourage every collaborator to seek out these opportunities to meet with young people, and after participating in such externship experiences, please complete the Externship Summary Report found at the website (<http://www.stecbeefsafety.org/externship-program>) and submit to Sarah Reasoner, Externship Coordinator at externship@stecbeefsafety.org. Note that we have a significant number of STEC CAP overview presentations and other workplan materials and educational activity examples available to assist you in making effective STEC CAP presentations to these groups.

Induction of Non-O157 STEC Fimbrial Gene Transcription by Ethanolamine

One component of Objective 2 of the STEC CAP involves experiments aimed at identifying mechanisms by which STEC adhere to and colonize the bovine intestinal mucosa. The long-term goal of this work is that through identification of mechanisms of adherence and colonization, effective pre-harvest interventions may be identified, developed, and ultimately implemented. Fernanda Morcatti Coura, a veterinarian and visiting Ph.D. student at the Federal University of Minas Gerais in Belo Horizonte, completed a one-year collaborative project in the Moxley laboratory on January 30, and has returned to Brazil to finish other studies. Fernanda came to Dr. Moxley's laboratory at the University of Nebraska-

Lincoln as a part of the Ph.D. "Sandwich Program" with Brazil, sponsored by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES; Higher Education Personnel Training Coordination) Foundation. Fernanda's studies represent a significant accomplishment for the STEC CAP, because of the potential impact of the work, and the funds leveraged to accomplish STEC CAP objectives. Fernanda's experiments addressed the hypothesis that ethanolamine promotes the transcription of specific non-O157 STEC fimbrial genes as has been shown previously for STEC O157:H7, and also induces transcription of other fimbrial loci that have not been tested for this effect. Fernanda tested this hypothesis on strains

representative of the different non-O157 STEC serogroups that are the subject of the STEC CAP, and ones that had been found previously by STEC CAP-funded Ph.D. student Zach Stromberg in the Moxley Laboratory to adhere to intestinal mucosal epithelium in bovine explants and also to human intestinal epithelial cells in culture. Ethanolamine is a breakdown product of mammalian and bacterial cell membranes. The gastrointestinal tract is rich in ethanolamine, with its content contributed to by host diet and decomposing cells. Working with Stromberg, Fernanda conducted experiments on strains at different stages of growth in M9 minimal medium containing 0 or 2 nM ethanolamine, and quantified transcription of 18 different

fimbrial loci by real-time PCR. Although the data is currently being statistically analyzed, it was evident that the transcription of several fimbrial loci on different strains and at specific stages of growth was induced. The Moxley Laboratory is confirming that these effects are meaningful at the level of expressed proteins and surface adhesins. This is being done through analysis of proteins and bacterial surface structures, antigen and sequence identification of surface-expressed proteins, and further tests of their role in adherence. This work may lead to novel non-O157 STEC pre-harvest interventions for use in cattle through the development of new vaccines directed against and diets adjusted to minimize STEC fimbrial expression.

...Developing as a Scientist and a Scholar ...continued from page 1

Dr. Thippareddi can attest to an increase in my ability to "write scientifically"; his edits to my thesis were extensive, and I'm certain my initial drafts tried his patience! We made it through, however, and I graduated from UNL (#GBR) in August 2014.

By being a part of the STEC-CAP grant I was afforded the opportunity to explore, to design, to re-do, and to succeed. Along the way I gained insight, confidence, and other intrinsic values that I utilize daily. I returned to my undergraduate alma mater this past fall as a Ph.D. student at K-State's Olathe campus (#EMAW). The skills I developed during my time on the STEC-CAP grant have continued to serve me well.

I am very happy to continue to collaborate on the STEC-CAP objectives. Our lab (directed by Dr. Sara Gragg) partners with Dr. Randy Phebus's lab in Manhattan, collaborating on small-scale projects as well as major endeavors at K-State's Biosecurity Research Institute (BRI). This affirms another important lesson I have learned as a STEC-CAP graduate student: the importance of collaboration and working alongside colleagues to attain a clearer vision and new understanding. I look forward to continue researching on STEC-related issues with fellow researchers at K-State, colleagues from UNL, and other STEC-CAP grant universities!



The K-State Olathe Food Safety Research Team
Jacob Jenott (M.S. Student), Jennifer Page, M.S. (Lab Technician),
Danny Unruh, M.S. (Ph.D. Student), and Sara Gragg, Ph.D.
(Principal Investigator)

For graduate students reading this, I encourage you to contact other graduate students on the grant so we can continue to develop our relationships. Many of us will be working on these sorts of issues for the foreseeable future, and beginning to network now will only help us in our careers.

I wish everyone the best of luck with their research programs, and I look forward to seeing collaborators at STEC-CAP meeting in June or IAFFP in July.

Danny Unruh | K-State Olathe
Ph.D. Student and STEC-CAP Researcher
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Consumer Willingness to Pay for Food Safety Interventions

The Role of Message Framing and Involvement Elicitation

A primary focus of objective 3 of the STEP CAP grant is to assess the economic impact of select interventions that mitigate the risk of STEC-7 contamination. Cattle vaccines against *E. coli* O157:H7 and the inclusion of direct-fed microbials (DFMs) in cattle feed are two pre-harvest food safety interventions that have been approved for use and are shown to be effective in reducing *E. coli* O157:H7 contamination. The recommended application of these interventions is, however, costly to producers, suggesting that a widespread adoption may hinge on consumer acceptance and willingness to pay for them.

Kofi Britwum, a PhD student, and Emie Yiannaka, an Associate Professor, both in the Department of Agricultural Economics at the University of Nebraska-Lincoln (UNL), are working to determine the factors that influence consumer perceptions and willingness to pay (WTP) for beef products from cattle treated with vaccines and fed DFMs. As is often the case with new technologies in the food industry, consumer perceptions regarding their safety and health implications can be divergent and influenced by multiple factors, including the type, source and framing of information available to them. Motivated by prospect theory which suggest that people are more sensitive to losses than they are to gains, this study investigates the impact of gain-framed and loss-framed information on consumer preferences and WTP. In the study, both information frames have the same preamble narrating the efficacy of vaccinations and DFMs in potentially reducing human *E. coli* O157 infections by as much as 80%. While the gain-framed information highlights the benefits associated with the choice to consume beef from cattle treated with the two interventions, the loss-framed information emphasizes the opportunity the consumer forgoes in reducing the risk of an *E. coli* O157 infection, by choosing not to consume beef from cattle treated with these technologies. In this context, one of the key questions explored by the study is whether, in an effort to be impactful, certain information frames could be viewed as 'excessively' persuasive and may thus backfire. Another goal of the study is to explore perceptions and purchase intentions when consumer involvement on food safety issues is elicited. In the study this is done by highlighting a story published in the New York Times in its October 3, 2009 edition that reports



Translation of STEC: Mitigation to Field Implementation," is a series of comprehensive modules, available in both English and Spanish.

the case of Stephanie Smith, 22, who suffered a severe form of foodborne illness that left her paralyzed after consuming an *E. coli* O157 contaminated hamburger. Finally, the study examines the effect of information provision on consumers' perceived risks of foodborne illnesses that results from beef consumption as well as the potential effects of the source of information, trust and familiarity on consumer preferences.

An experimental survey (choice experiment) was developed to achieve the above study objectives. The survey targets a representative, random sample of 1,800 residents across the U.S recruited by Knowledge Networks, a leading on-line survey firm. The experimental design involves six information treatments, with each treatment group consisting of 300 respondents. The surveys have been piloted among graduate and undergraduate students at UNL and will be fielded in the Spring of 2015. In addition to assessing the market potential of the two pre-harvest food safety interventions, vaccines and DFMs, study findings will shed light on effective ways of communicating the benefits of new food safety interventions to the public and should be of interest to cattle producers who consider adopting these interventions and policy makers who may regulate their use.

- Emie Yiannaka and Kofi Britwum

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collaborators are doing or getting accomplished if nothing is reported to OEIE. At this point, I sincerely thank Dr. Jeanette Thurston, USDA-NIFA National Program Leader for Food Safety and our point of contact for the STEC CAP for all her support and advocacy for our work.

On other matters, I wish to welcome two new members and our new Chair of the Stakeholder Advisory Board (SAB), and extend my thanks to those whom they are replacing. First, I welcome Mr. Darin Detwiler and Dr. Phil Bronstein to the SAB! Darin is the Senior Policy Coordinator for STOP Foodborne Illness, and replaces Ms. Vanessa Coffman. Phil is a Senior Microbiologist and Science Staff member in the Office of Public Health Science, USDA-FSIS and replaces Dr. Nora Pikhala. Nora and Vanessa stepped off the SAB due to reassignment of duties and pursuit of a Ph.D. in Public Health, respectively. We sincerely thank them for their great commitment and service, and wish them well in their future endeavors. Second, I welcome Dr. Peter Taormina, Director of Food Safety, Quality, and Regulatory Affairs at John Morrell Food Group, as the new SAB Chair! Peter, as Chair, is replacing Dr. Peggy Cook, Research and Development Leader at Safe Foods Corporation. Peggy will stay on as an SAB Member. We give special thanks and recognition to Peggy for her continued service and great leadership as SAB Chair in 2014.

In the last two newsletters we made you aware of three upcoming meetings, and as they are still four to seven months away and you may not yet have registered, I will call them to your attention again. The first is our next Annual STEC CAP meeting, June 3-5 in Manhattan, Kansas.

As a reminder, attendance by STEC CAP collaborators is mandatory; the registration site is open on our website at <http://www.stecbeefsafety.org/>. Feel free to contact Jill Hochstein (jhochstein2@unl.edu; 402-472-8564), our Project Manager, with questions or for more details. The next meeting which is important for many of us is the Annual Meeting of the International Association for Food Protection (IAFP) in Portland, Oregon, on July 25-28. We will have a STEC CAP breakfast there as done in the last couple of years. Jill Hochstein is working out the details on this and will send out a communication in the near future. Lastly, VTEC 2015 is September 13-16 in Boston, Massachusetts. Hopefully, the snow will be melted there by then. I encourage all of you to seriously consider submitting abstracts to this meeting, which may be submitted anytime between now and May 15. Let's do our very best to have representation from STEC CAP Nation at these meetings.

Please take a look at the news and announcements in this issue of this newsletter and, as always, feel free to contact me or other members of the Executive Management Team or Jill Hochstein, Project Manager, with any questions or concerns you might have about the STEC CAP. Also, please be on the lookout and let us know about items you would like to see included in future newsletters. We are especially seeking stories that highlight your work.

Thanks for all you do for the STEC CAP.

- Rod Moxley

Induction of Non-O157 STEC Fimbrial Gene Transcription by Ethanolamine



SAVE THE DATE 2015 STEC CAP CONFERENCE



JUNE 3-5, 2015
MANHATTAN
CONFERENCE CENTER
MANHATTAN, KS



This project was supported by Agriculture and Food Research Initiative Competitive Grant no. 2012-68003-30155 from the USDA National Institute of Food and Agriculture.

Check us out on the Web! Visit us at: www.stecbeefsafety.org

Subscribe to the listserv. Send an email to: listserv@unl.edu In the message field: [subscribe stecbeefsafety](#)

Registration is now open for the 2015 STEC CAP Conference to be held June 3-5, 2015 in Manhattan, KS. Hosted by Kansas State University, this year's conference is open to all STEC CAP collaborators. To register, [click here](#), and to find more information hotels, flights, and agenda, [click here](#).

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This project was supported by Agriculture and Food Research Initiative Grant No. 2012-68003-30155 from the USDA National Institute of Food and Agriculture, Prevention, Detection and Control of Shiga Toxin Producing *Escherichia coli* (STEC) from Pre-Harvest Through Consumption of Beef Products Program -A4101.