

# STEC CAP



United States Department of Agriculture National Institute of Food and Agriculture



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stecbeefsafety.org

Illustration of *E. coli* in calf intestine by Joel Brehm.

## About STEC CAP

The goal of the STEC CAP grant is to reduce the occurrence and public health risks from eight targeted serogroups/serotypes of Shiga toxin-producing *Escherichia coli* (STEC-8) in beef using a quantitative microbial risk assessment (QMRA) platform.

This U.S. Department of Agriculture-National Institute of Food and Agriculture (USDA-NIFA) Coordinated Agricultural Project (CAP) grant, titled Shiga-toxigenic *Escherichia coli* (STEC) in the Beef Chain: Assessing and Mitigating the Risk by Translational Science, Education and Outreach, seeks to significantly advance evidence- and action-based beef food safety knowledge to protect public health.

This project is targeting the seven most important STEC serotypes that cause human illness in the U.S., as well as the O104:H4 strain from the German outbreak of 2011.

The three Core Pillars of this project are pre-harvest, post-harvest and consumer research, and all three of these initiatives feed directly into the framework of our project, that being a QMRA across the beef chain continuum.

The QMRA is the STEC CAP's centerpiece and is what drives all research, education and extension activities. This USDA-NIFA grant focusing on STEC in beef was awarded to the University of Nebraska-Lincoln (UNL) and includes 11 participating institutions and 51 collaborators. There is also wide representation from the beef production and processing industry, beef industry technology providers, wholesale/retail/food service sector, academic and regulatory experts, and consumer advocacy organizations as research and education contributors or technical advisers and as members of our Scientific Advisory Panel (SAP) and/or Stakeholder Advisory Board (SAB).

This grand effort to understand and control STEC throughout the beef system is a public-private partnership designed to generate advanced scientific understanding of STEC and to utilize this knowledge throughout the entire beef production to consumption continuum.

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



## What are STEC?

**S**TEC is an acronym for Shiga toxin-producing *Escherichia coli*. Most *E. coli* bacteria are normal inhabitants of the intestinal tracts of humans and animals, and are non-pathogenic (do not cause disease).

However, some *E. coli* are pathogenic (i.e., disease-producing). STEC is a type of pathogenic *E. coli* that, as the name implies, produces a potent toxin called Shiga toxin (Stx), also known as verotoxin or verocytotoxin. Stx causes blood vessel damage and plays a key role in other events that result in hemorrhagic colitis (bloody diarrhea), and a type of kidney failure called hemolytic uremic syndrome (HUS) in human patients. STEC, including *E. coli* O157:H7, is the number one cause of acute kidney failure in children.

Human outbreaks of STEC-related disease occur through consumption of contaminated food or water, through direct contact with infected animals or environments contaminated by their feces, or by direct human-to-human contact with infected persons (i.e. secondary infections). Cattle and other ruminant animals such as deer are natural reservoirs of STEC, which can lead to contamination of meat and milk during harvest and processing.

Other foods such as fresh produce can become contaminated with STEC from both livestock and

feral animals due to water contamination, run-off from animal production units, or dust and insects from animal production facilities. Due to a low infectious dose and the severity of disease manifestations for most STEC, their presence in raw and processed foods poses an important human health risk.

Thus, the food industry and its regulators have focused substantial resources and efforts towards elimination of STEC from the food supply. More detailed information on STEC can be found in the following reference:



Centers for Disease Control and Prevention (CDC). National Shiga toxin-producing *Escherichia coli* (STEC) Surveillance Overview. Atlanta, Georgia: U.S. Department of

Health and Human Services, CDC, 2012  
<http://www.cdc.gov/ecoli/general/index.html/>

## Tackling STEC across the beef chain continuum

**O**ur holistic approach to reduce risk from STEC in beef is based on ground truthing our quantitative microbial risk assessment (QMRA). To populate this QMRA we will: i) develop and validate rapid, high throughput screening methods for STEC-8 detection, ii) identify factors associated with STEC-8 frequency and concentration in cattle, cattle production environments, beef plants and products, iii) develop and validate commercial beef production/processing technologies for raw and processed beef, and iv) develop messages on safe food handling, preparation, and serving for several audiences and various media. Our research will inform and support scientifically sound policy decisions and practical control efforts.

## Training the next generation of food safety professionals

**T**he STEC CAP grant provides competitive internships for undergraduate, graduate, and veterinary students. These competitive internships, awarded through our Student Training and Education Program (STEP), will provide students with real-world experiences while helping our various partners address the milestones of our grant. While receiving a \$4,500 stipend, interns work directly in the field or laboratories of STEC scientists, and present their scholarly achievements at our annual STEC CAP conference. As a compliment to the STEC-STEP internship program, a related STEC-STEP externship program will bring 4-H, high school, junior college, and undergraduate students to the campuses of collaborating institutions to observe how science is being used to address significant food safety and public health challenges. A defined number of internships and externships are reserved for applicants from minority-serving institutions. STEC-STEP interns will also have an opportunity to apply for an additional Frontier Program internship in which they can travel to see firsthand various aspects of agriculture, food safety and defense, and trade/regulatory systems in action. Learn more about these student opportunities at <http://www.stecbeefsafety.org/resources>.



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Department of  
Agriculture

National Institute  
of Food and  
Agriculture

## STEC CAP Team

126D VBS, Lincoln, NE  
68588-0905

PHONE: 402-472-8564  
FAX: 402-472-9690

[stecbeefsafety.org](http://stecbeefsafety.org)