Natick scientists use mathematics to battle Listeria

U.S. Army

NATICK, Mass. (Oct. 11, 2012) -- Every so often, a story comes up in the news media that directly links to the laboratory work being done at Natick Soldier Research, Development and Engineering Center.

It happened recently with the recall of bagged spinach over contamination with Listeria monocytogenes bacteria. This recall comes on the heels of a Listeria outbreak in cantaloupes from a Colorado farm that killed 16 and made scores of others ill. Listeriosis illnesses cost up to $1.8 billion annually and can be particularly severe for the elderly, pregnant women, and people with weakened immune systems.

Christopher Doona, a civilian senior research chemist with NSRDEC's Materials and Defense Sciences Division, has done plenty of research on Listeria and understands just how dangerous this pathogen can be. For the past decade, Doona has been Natick's leading research expert in Predictive Modeling for Food Safety and in Nonthermal Processing technologies for foods. He also carries out research in novel decontamination technologies.

In the August 2012 edition of the Journal of Food Science, Doona and his co-authors published a unique mathematical "Enhanced Quasi-chemical Kinetics" model. JFS is published by the Institute of Food Technologists, the world's leading professional organization of food scientists and food technologists.

The model is used to predict high pressure processing conditions to kill baro-resistant Listeria strains in foods. High pressure processing is already used commercially to eliminate Listeria from ready-to-eat deli meats.

"This model is so unique we submitted a patent for it," Doona said. "It has tremendous potential to benefit military and civilian consumers."

Although successful for food safety, the model is so versatile it can be used in many other military applications.

"Mathematical models are needed in decontamination," Doona said. "We'd like to apply it to the decontamination of Bacillus anthracis (causative agent of 'Anthrax')."

"It would be great to use nonthermal technologies such as chlorine dioxide and high pressure processing for bio-decontamination, because they can kill spores and aren't just limited to food safety applications," Doona said.

Since joining Natick, Doona has been a part of approximately a dozen patents and

has edited three books, including the landmark book High Pressure Processing of Foods (IFT Press/Wiley-Blackwell) that has achieved international acclaim and contains many examples of killing pathogens, spores, and processing actual foodstuffs. For 2012, Doona was elected by other scientific leaders in the field to serve as chair of IFT's Nonthermal Processing Division.

"That's really a great part of working at Natick," Doona said. "There are so many opportunities to get involved in critical, forefront research areas at the basic and applied levels.

"There is tremendous satisfaction knowing that one day our laboratory advances will benefit Soldiers in the field."