



Listeria (in green) is one tough little critter. Here shown in a photomicrograph of an animal cell, Listeria is a harmful pathogen occasionally found in ready-to-eat foods such as soft cheeses and smoked fish. Photo courtesy of Martin Wiedmann, Cornell University.

On the Forefront of *Listeria* Control

What do savory smoked salmon in New York, spicy Cajun popcorn in New Orleans or

succulent Dungeness crab cocktail in Seattle have in common? All may be purchased as ready-to-eat seafood delicacies that are prepared in seafood processing plants under strict regulation. The quality of ready-to-eat (RTE) food – food that won't be cooked before it is consumed – is safeguarded by the U.S. government's current regulatory policy of not allowing any *Listeria monocytogenes* in such food. *Listeria monocytogenes* is a bacterial pathogen that is widespread in the environment; it can cause severe illness and death in high-risk consumers. Processing plants that produce RTE foods face significant challenges in preventing product contamination because bacteria is constantly being brought into the plant environment and can be difficult to eliminate. Smoked seafood and other ready-to-eat processors have experienced numerous and costly product recalls when contamination is found.

Ken Gall, New York Sea Grant's seafood specialist, and **Martin Wiedmann**, food science professor from Cornell University, served as co-investigators for a three-year integrated research and outreach project designed to help processors of RTE seafood products control *Listeria*. The project team included seafood specialists from several Sea Grant programs, students and faculty at Cornell University, the National Fisheries Institute (NFI), the National Food Processors Association (NFPA) and from ten seafood processing plants from around the country.

Delivering Results of Two Concurrent Projects

This coordinated research and outreach effort involved several parts. One research project involved using molecular DNA fingerprinting procedures available at Cornell to characterize specific *Listeria* contamination profiles for each of the ten participating processing plants. These research results were then used to help each plant develop, implement, and evaluate specific control strategies to reduce the potential for *Listeria* contamination of finished ready-to-eat products.

A concurrent effort undertaken by some of the project collaborators was the development of a 60-page handbook, ***Listeria monocytogenes Control Manual for Smoked Seafood Processors***. The book describes in detail the elements and procedures needed to minimize the potential for finished product contamination. In 2003, this manual was adopted as a reference for the *Model Code for Cured, Salted and Smoked Fish Good Manufacturing Practices* produced by the National Association of Food and Drug Officials. This model code is designed to provide guidance to state regulatory agencies to help them develop appropriate regulations for the production of smoked and cured seafood products.

In 2003, the results and experiences learned from these two concurrent projects were delivered to processors of RTE seafood products in the U.S. in a series of five workshops held in Louisiana, Virginia, New York City, Seattle and Chicago. Of the 175 individuals who attended these workshops, almost

Smoked salmon on the assembly line. Photos courtesy of Ken Gall





Salmon coming out of the smoking room (left) and getting sliced by hand (below) at a smoked fish processing plant. Photo courtesy of Barbara Branca

60% were from seafood businesses, one third were from regulatory or other agencies, and 7% were from trade associations or academia. All of the firms who had implemented some *Listeria* controls in their plants reported that they were planning to modify or enhance these controls after attending the workshop. Of those who had not implemented any *Listeria* controls, 18 of 20 indicated that they were planning to start implementing some or all of the controls presented in the workshops.

And just how much impact have the workshops had in getting controls implemented? The results from the industry show unequivocally the importance of the workshops. In a follow-up evaluation sent to workshop participants who mainly process smoked fish, crab, crawfish and shrimp, 80% reported that they had implemented new *Listeria* controls or enhanced their existing controls. Employee training is considered an essential part of a complete *Listeria* control program, and the follow-up evaluation revealed that a total of 33 in-plant employee training programs were conducted by plant management since the *Listeria* workshops and half of these programs used the training materials developed for the Cornell/USDA project. Over 80% of the firms reported that they had changed or implemented new sanitation procedures critical to *Listeria* control, and half of the firms had modified their process, upgraded equipment or processing areas, and initiated a new *Listeria* testing program or modified their existing testing program.

Investing in Control Prevents Costly Recalls

Eleven firms provided information on the amount of time and money devoted to *Listeria* controls since attending the workshops. The average expenditure on *Listeria* controls was almost \$20,000 with reported expenditures ranging from \$1,200 to \$75,000. Follow-up evaluation respondents also reported that their estimated monthly cost for *Listeria* controls was

approximately \$2,100 per month or almost \$25,000 per year with a range from \$6,000 to \$84,000 per year depending on the size of the plant and the volume of products produced. But with better controls in place, such RTE seafood processing businesses are better ensured against the sting of costly recalls.

This research and outreach effort to help processors of RTE seafood and other food products implement effective *Listeria* controls will continue. Dr. Wiedmann, Ken Gall, and collaborators from Cornell, Penn State University and the University of Vermont received a second \$500K grant from the USDA in 2003 to develop a mathematical model to help firms interpret plant environmental testing results for *Listeria* and take appropriate actions to prevent finished product contamination. This effort will include smoked seafood processors as well as processors of RTE meat and dairy products. Thus techniques of control developed for the RTE smoked seafood industry will be spread to other segments of the multibillion dollar RTE industries, providing an ever-widening circle of protection against *Listeria* contamination and diminishing the potential for expensive recalls.

— **Barbara A. Branca and Ken Gall**



Spreading the Word About *Listeria* Control

Results of these far-reaching projects are being shared through numerous publications including peer-reviewed scientific journals. Four research papers (2 published, 1 in press, and 1 submitted) are or will be published in the *Journal of Food Protection*. Four additional papers summarizing the elements of the *Listeria Control Manual for Smoked Seafood Processors* are in preparation for submission to the other journal of the International Association for Food Protection, *Food Protection Trends*. The first paper in this series entitled "Implementing Targeted Good Manufacturing Practices (GMPs) and Sanitation Procedures to Minimize *Listeria* Contamination of Smoked Seafood Products," written by NYSG's Ken Gall in collaboration with Dr. Martin Wiedmann, Jenny Scott from the National Food Processors Association, Bob Collette from the National Fisheries Institute, Doris Hicks from Delaware Sea Grant and Mike Jahncke of Virginia Tech, has been accepted for publication and will appear in the May 2004 issue of *Food Protection Trends*.

—Ken Gall, NYSG Seafood Specialist