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Keeping Pennsylvania's Food Products Safe

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Ground Zero, page 14

Keeping Pennsylvania's Food Products Safe

"One in five samples of supermarket ground meat and poultry bought for study was contaminated with Salmonella, and most of the strains were resistant to antibiotics."

(A report on a scientific paper in the *New England Journal of Medicine*, in *The Philadelphia Inquirer*, 10/18/01)

Food safety is very much on everyone's mind. Stories about unsafe foods, food poisonings, and rising antibiotic resistance of organisms, have alarmed the general public. Food is no longer locally produced — the marketplace is stocked with fruits and vegetables from far-away states and countries. Cheeses come from across the continent and Europe. Meat products and fish originate in Europe. Fish and particularly seafood is farm-raised in South America and Asia. The raising, selling and distributing of food is global and this makes it easier for harmful or resistant bacteria to travel from one country to another.

In response to the recent hoarding of antibiotics by the public, there have been many stories about the ability of Salmonella and other organisms to develop into more and more drug resistant varieties. There is an ongoing discussion about drug use in the food animal industry worldwide and about allowing new, powerful antibiotics to be used in the raising of food animals.

Each year, millions of Americans suffer from food borne illnesses. Most cause mild discomfort, but they can be dangerous for immunosuppressed individuals and the elderly. The culprits often are bacteria; *Campylobacter* causes the highest incidence of illness, followed by Salmonella, *Shigella*, and *Escheria coli* H0157. Most *Campylobacter* infections are associated with poultry, large numbers of which carry the microbe. Fortunately this microbe rarely causes outbreaks with sporadic or familial cases accounting for the greatest number of infections.

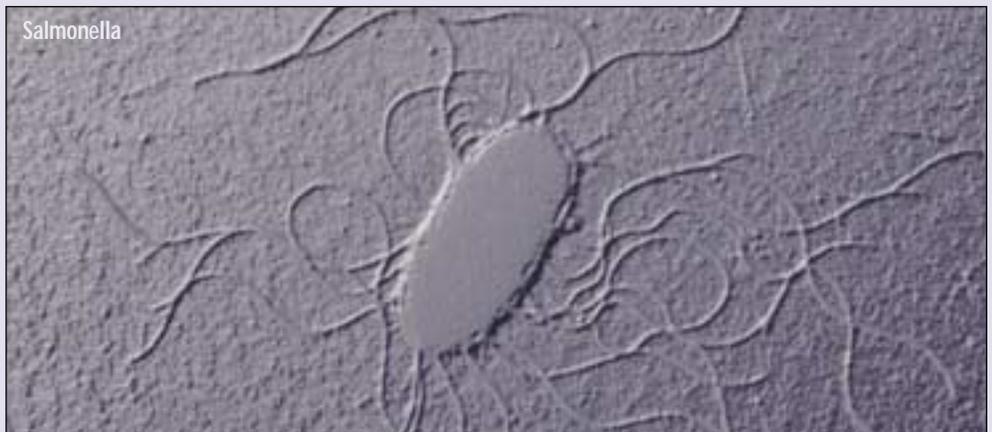
Is there reason to be worried? "Yes," says **Dr. Charles Benson**, professor of microbiology at the School. "These organisms are all around us. Even if you are a vegetarian, you can get infected by Salmonella as the bacteria can be on the skin of fruit or vegetables grown in a field fertilized with manure compost. Bacteria and other harmful organisms have been in the environment for millions of years and they have survived because they can adapt to changed circumstances rather rapidly."

There are more than 30 antibiotics approved for use in food animals, some of these drugs are also approved for use in humans. Bacteria are exposed to these drugs and develop resistance to them. This resistance may be transferred in bits of DNA from one bacterium to another and between different species of bacteria. Such resistance is then passed on to the next generation and becomes established in the bacteria population.

Salmonella is the focus of the Salmonella Reference Center (SRC) which was established five years ago at New Bolton Center under the direction of Dr. Benson. Actually, the work on Salmonella at the School began many years earlier when it was realized that table eggs could act as a vehicle for the transmission of *Salmonella enteritidis*. **Dr. Robert Eckroade**, associate professor of avian medicine and

background and training in reference and international disease surveillance. **Dr. Donald S. Munro** retired from the Scottish Salmonella Reference Laboratory (SSRL) in Glasgow and joined Dr. Benson's group at New Bolton. He is an authority on the epidemiology of Salmonellae. Dr. Shelley Rankin, also from the SSRL, is experienced in molecular epidemiology.

The Center provides diagnostic and reference service to the PADLS laboratories and serves the needs of individual practitioners within Pennsylvania. The Salmonella isolates samples are typed through a wide variety of techniques, including serotyping, phage typing, and antimicrobial resistance monitoring. In addition, molecular techniques such as plasmid profiling, restriction enzyme analysis of the bacterial genome and other tests are used to understand the dynamics of salmonellae trans-



pathology, and Dr. Benson, conducted many studies to determine how the bacteria could enter the egg prior to being produced by the chicken. They also developed a series of preventive measures that farmers employ to reduce the incidence of Salmonella infection in chicken houses. These measures have greatly reduced the number of infected eggs.

The Salmonella monitoring program that was developed and put in place at New Bolton Center led to the establishment of the SRC which has become a valuable resource, not only for Pennsylvania farmers, but for other agricultural laboratories in the nation. The Center is part of the Pennsylvania Animal Diagnostic Laboratory System (PADLS); funding is received from the Pennsylvania Department of Agriculture, along with grants from USDA, the American Egg Board, and with revenue generated through client services.

The Center is staffed by specialists with

mission. SRC is one of only three laboratories in the United States which has the capability and expertise to provide such a detailed analysis of the samples. "Using this approach, we have been able to achieve a degree of discrimination which has been previously impossible to achieve," says Dr. Benson. "We can not only relate a strain to a given farm, but in some cases we can even identify which barn." The Center also performs services for clients out of state. This yields an enormous amount of research material and generates a healthy income.

Each sample, once it has been completely typed, is deposited in the reference laboratory culture collection together with a complete record of the test data and available descriptive epidemiology. The collection is available to permit retrospective studies to be undertaken at such times as new serotypes appear in Pennsylvania. It represents a unique resource to the

state. "The services provided by the SRC provide an added dimension to the diagnosis and management control of animal associated human infectious disease and economically important animal diseases within the Commonwealth," says Dr. Benson.

One of the important tasks of the SRC is the monitoring of development of antimicrobial drug resistance which poses a major threat to human and animal health. Generally it is perceived that such resistance developed because of the addition of antibiotics to animal feeds, often at low levels, to enhance health and growth of food animals. "Not all antibiotic resistance develops in animals," says Dr. Benson. "This has been clearly established as a result of the work carried out at the SRC. Every isolate submitted to us is tested for resistance to a range of 13 antibiotics of human and veterinary importance. This monitoring allows us to track the development and spread of antibiotic resistance throughout the state." A key conclusion from this surveillance activity is that resistance is not predicated on a simple cause and effect basis. These developments are multifaceted in nature involving a range of complex interacting factors which include indigenous flora/dose/time/feed and the innate ability of the pathogen to change. The effects of these factors only begin to become obvious when large numbers of bacteria are monitored over time. This work has attracted considerable interest, not only within the veterinary microbiology community, but also within human medicine and the pharmaceutical industry because of the implications raised.

The SRC laboratory has a quick turnaround time for samples submitted. Serotype and phage type resistance profile can be provided in 24 hours, core molecular data are available in an additional 24 hours. This becomes important if an outbreak occurs — measures then can be taken quickly to contain it and to begin preventive steps to protect the other animals on the farm.

The SRC researchers also have the skill to take techniques developed for one genus and

adapt them to other genera. This is quite important because there are many organisms that threaten the health of food animals and humans such as *Listeria* and *Leptospira*.

The SRC works closely with the School's Center for Animal Health and Productivity (CAHP) and its field investigators to monitor infectious diseases on farms in the region.

The Commonwealth has in excess of 600,000 dairy cattle and this is one of the state's main, if not the largest, agricultural industries. In a collaborative study of the incidence of Salmonella infection on Pennsylvania dairy farms

the SRC surveyed 100 randomly chosen farms and found that 14% were positive. Mortality in cattle covered by this survey ranged from 1-5%. This indicates that losses due to Salmonella in the Pennsylvania dairy industry could exceed \$6,000,000.

Pennsylvania is unique in that it supports a large number of dual enterprise farms. The SRC recently completed a study to determine the prevalence of *Salmonella typhimurium* DT 104, a particular drug resistant strain, in the environment of a naturally infected dual enterprise farm. The real-time study allowed for quick development of recommendations to reduce the incidence and eventually eliminate the organism from the farm.

In most cases, further outbreaks of Salmonella or other bacterial infections can be prevented by changes in husbandry on the farm. Clinicians from the CAHP make recommendations about disinfection of areas where the animals are housed, about feed handling and rodent control, to help the farmer overcome the problem. Often it takes just a few changes in practices to eliminate the problem.

The SRC collaborates with researchers at other universities and laboratories, the Centers for Disease Control, the National Veterinary Services Laboratory, the National Antimicrobial Monitoring Service and the FDA as well as institutions abroad. The latter is particularly relevant because of the global nature of food production. SRC is working to become a part of the international surveillance network in the



Dr. Charles Benson

field of human enteric diseases. Its collection of more than 17,000 strains of Salmonella from across the United States is a unique asset and enables the laboratory to conduct retrospective studies and monitor the development of resistance to an enormous range of antimicrobial agents.

SRC will be one of the founding members of Vet-Net, a veterinary monitoring service funded by the European Economic Commission, to be established within two years. Dr. Benson and his group are a vital part of PADLS and they are doing their part of keeping the Commonwealth's food supplies safe. One piece of advice from Dr. Benson: "Wash the fruits and vegetables before eating them. Cook meat and eggs thoroughly. Always wash utensils and cutting boards between usage for raw and cooked ingredients. And enjoy your meal!"

Scholarships

The Dr. Ginnie Leiblein Memorial Scholarship and the Westminster Kennel Foundation Scholarship were awarded to **Patty Lathan, V'02**. **Amy Balcerzak, V'05** received a scholarship from the NCAA. **Darah Resh, V'03** received a scholarship from The Lalitta Nash McKaig Foundation. The Barnstable County Agricultural Society, Inc. and The Coondog Scholarship Fund awarded scholarships to **Kate Johnson, V'03**. **Emily Kuprion, V'03** received a scholarship from the Rotary District 7450 Gundaker Foundation. The Armour/Lewis Family Foundation provided scholarships to **Micah Brodsky, V'02**, **Annette LePere, V'02**, **Colleen Kane, V'02**, **Karena Joung, V'03** and **Kimberly Johnston, V'03**. The William Goldman Foundation has provided scholarships to **Gina Cairone, V'03**, **Edward Cooper, V'02**, **Melissa Geedey, V'02**, **Erin Mairs, V'03** and **Karen Oberthaler, V'02**. **Christine Bohn, V'02** is the recipient of the Clifford R. Wright, Jr. Scholarship. **Marcilyn Duman, V'02** was awarded the Iris M. McGee Scholarship. **Danielle Springer, V'03** and **Kathy Heim, V'04** have been awarded Anne Linn White Dean's Scholarships. **Frieda Rest, V'02** is the recipient of the Richard A. Dorr, Jr. Memorial Scholarship.