In the two previous Milk Quality columns, we discussed the diagnosis and treatment of the various causes of clinical mastitis. In certain situations, mastitis due to coliform bacteria such as E. coli may become distressingly common, and in 20-50% of cases the signs of severe toxemia are present: fever, depression, rapid heart rate, weakness, recumbency, or death. With prompt and aggressive fluid and anti-inflammatory therapy, some of these sad cows can be saved; however, future milk production is often lost and the cow must be culled. Coliform mastitis is better prevented than treated!

It is well known that coliforms are abundant in the cow's environment and that excessive contamination of the teats and udder with manure and mud are strongly associated with excessive levels of coliform mastitis. We can reduce its incidence using clean dry bedding and careful premilking teat and udder preparation, but even the cleanest cows can sicken and die of coliform mastitis. The ubiquitous nature of coliform bacteria, and the inevitable constraints on cow cleanliness so prevalent in today's enlarging dairy farms, lead to a fact of life on the modern dairy farm: coliform mastitis is here to stay in spite of our best efforts. What has been needed and lacking until recently was a means of increasing the cow's resistance to the effects of the toxins produced by coliform bacteria.

Making a coliform mastitis vaccine has been difficult. Coliform bacteria are coated with a complex lipopolysaccharide (LPS) capsule (Figure 1). Release of the LPS when the bacterium die accounts for the toxemia typical of severe coliform mastitis. Due to small but significant variations in this LPS capsule, there are hundreds of strains of E. coli that can infect the mammary gland; to afford reasonable cross-protection, the vaccine would need to incorporate all possible E. coli strains.

In the early 1980's, researchers at the University of California at Davis began working with a mutant strain of E. coli (the J-5 strain) that lacked many of the strain-specific bacterial LPS coatings. What remained on the surface of J-5 bacteria were some cell wall components called common core antigens common to virtually the entire family of coliform bacteria (Figure 2). A vaccine was formulated using a killed preparation of J-5 E. coli which was found to induce the production of antibodies to the common core antigens. UC Davis researchers received funding from the California dairy industry (California Milk Advisory Board) to conduct a field trial of this vaccine in commercial dairies. The results were very encouraging: only 6 of 246 vaccinated cattle, vs 29 of 240 unvaccinated cattle, developed clinical coliform mastitis. Similar results have since been repeated in many locations around the country.

Commercial development and USDA licensure followed quickly. Two different companies market similar products--J-Vac (Sanofi) and Escherichia Coli Bacterin (UpJohn). A third company, Immvac, markets a product called Endovac-Bovi. This vaccine is made from a core antigen strain of Salmonella and has also been shown to protect cattle against coliform mastitis with a slightly lower efficacy than the J-5 products.