Salmonella spp.  
A Serious Threat to Calves

Salmonella Overview

*Salmonella* is an important human and animal pathogen worldwide. There are more than 2,300 serotypes of *Salmonella* that have been identified; however, only ten serotypes are responsible for most disease in cattle. *Salmonella* serotypes Newport, Typhimurium, Dublin, Anatum, and often times Montevideo, are associated with the majority of infections in cattle. Serotypes Newport and Montevideo tend to become endemic in dairy herds following prolonged herd illness.

Animal and human infections can be acquired through contact with animals shedding *Salmonella* or through contaminated environments. *Salmonella* spreads primarily via the fecal-oral route. In cattle, *Salmonella* infection results in both asymptomatic carrier state and clinical salmonellosis. Cattle of all ages can be infected with *Salmonella*; serious infections and high mortality can occur in adult dairy animals. However, it most often occurs in calves younger than ten weeks of age.

*Salmonella* outbreaks in calves are serious economic and welfare concerns due to losses from mortality, treatment costs, and poor performance. *Salmonella* outbreaks are also a source of antimicrobial resistance, as numerous prevalent serotypes are resistant to many antibiotics and commonly used disinfectants.

Calf growers or calf-raisers are at a high risk of animals suffering from salmonellosis. In these operations, continual admission of new calves from various sources and high-density confinement of a large number of potentially susceptible animals enhance the transmission of *Salmonella*. As a result, a small number of infected animals can serve as a source that spreads the organism rapidly through the confined calves. Direct transmission can occur when infected calves are housed with susceptible animals in conditions that favor transmission from animal to animal. *Salmonella* also survives very well in the environment, which can result in indirect transmission through fomites and mechanical vectors. These are the primary means of spreading *Salmonella* in individually penned animals.

Acute salmonellosis appears to be more common in dairy calves than beef calves, and it usually does not occur in animals under two weeks of age. However, exceptions do occur, so animals should be monitored closely for clinical signs of disease. A primary sign is a high incidence of brownish, watery diarrhea containing shreds of sloughed mucosa. There may be some deaths, with the disease developing in animals over a period of time. Infected animals may have a fever, which decreases with the onset of diarrhea.

Intervention strategies are critical in controlling *Salmonella* infection in calves. Along with isolation of sick animals, the use of autogenous bacterins and good sanitation measures may be helpful in controlling this disease.

Newport Laboratories’ Salmonella Bacterin – The Logical Choice

*Salmonella* bacteria possess several different virulence factors that enable it to thrive in the host and cause disease. Antibodies to these various virulence factors, also referred to as anti-virulence factors, will help to reduce the degree of infectiveness and severity of disease. A goal of vaccination would be to stimulate the calf’s immune system to produce as many anti-virulence factors as possible. This would assist in repelling and eliminating the
Salmonella organism. A bacterin with multiple virulence factors could reasonably be expected to limit clinical disease more effectively than a bacterin with a single virulence factor.

In addition, some virulence factors may be serotype specific. An autogenous bacterin offers the inherent advantage of homologous antigens, with virulence factors identical to the serotype causing disease.

**Important Salmonella Virulence Factors:**

**IROMPs (Iron Regulated Outer Membrane Proteins):**
- Allow organism to “steal” required iron from the host resulting in logarithmic growth of the pathogen
- Immune responses to IROMPs will help kill the pathogen

**Fimbriae or pili:**
- Important virulence factor of Salmonella that allows the bacterium to adhere to host tissues, i.e. intestine, nose and mouth facilitating entry of the bacterium into the host and colonization of the intestine
- Immune response against this structure will prevent attachment and entry into the host
- Other adherence proteins found on the surface of Salmonella
- These proteins are involved in attachment of Salmonella to specific host tissue receptors, which facilitate intestinal colonization
- The immune response directed against these structures prevents attachment, colonization, and persistence in the host’s intestine

**Exotoxins (enterotoxins):**
- Secreted by Salmonella growing in the host, causing host cells to die as well as inducing fluid loss from the intestinal cells
- Antibody against these factors help prevent cell death and fluid loss (scours) in the immune calf

**Surface polysaccharides:**
- These molecules stick up from the surface of the bacterium and prevent killing of the Salmonella host cells
- Immunity against these helps the host clear this bacterium from the host
- Major antigen involved in serotyping or the characterization of strains

Newport’s proprietary manufacturing techniques maximize production of IROMPs:
- Growth media is low in iron – promoting growth of IROMPs by organism, and thus antibodies against them
- Unique IROMP growth promotant added to culture

Newport’s proprietary growth media mimics very closely the environment the Salmonella would see in the calf.

**Endotoxins:**
- Important antigen contained in the cell wall of Salmonella
- Dead or dying bacteria release endotoxins
- Can cause adverse reactions in host animal when released
- Newport includes special steps in the production process to control the endotoxin level in Salmonella bacterins:
  - Timely harvest of production cultures for inactivation prior to release of high endotoxin levels (lag phase of growth)
  - Use of proprietary additives to reduce presence
  - Finished product is tested to monitor endotoxin levels

Newport offers you flexibility and peace of mind:
- Product is built to address specific serotype(s) affecting the herd(s) in question
- Ability to build combination products for more efficient processing, fewer injections, and less stress
- Multiple adjuvant choices, all with 21-day pre-slaughter withdrawal
- Multiple product formats to best fit your need:
  - Traditional liquid
  - SoliDose® dual-dose implants
  - Lyophilized
  - Super concentrate, reduced dose volume
- Unique production processes allow for multiple gram-negative products to be administered simultaneously with less concern about adverse reactions
- FACS™ (Food Animal Care Specialists) team provides experienced, professional, reliable technical service