Respiratory disease continues to be a major cause of economic loss in the cattle industry, with annual losses from treatment, deaths and lost production estimated at over $1 billion U.S. per year. Although vaccines against respiratory disease are used extensively, antibiotics also continue to be used to prevent and treat pneumonia in feedlots. With increasing pressure from society to reduce the use of antibiotics, and the desire to produce market-ready, human-safe calves, which would also help reduce economic losses, are needed. There is also a need to develop vaccines that can be given to newborn calves to make vaccination more convenient for the farmer. Antibiotics from the mother cow that are present in the newborn calf prevent traditional vaccines from being effective.

One way to improve vaccines is to develop more effective adjuvants. Adjuvants are "helper" ingredients—substances that are added to a vaccine or medication to boost its effectiveness. C3d is a naturally occurring protein in animals that plays a role in immune response. When a virus or bacteria enters the body, C3d binds to the virus or bacteria, labeling it as a foreign invader. White blood cells then go after, or attack, the invading virus or bacteria. Research in human and animal medicine has focused on the use of C3d as a vaccine adjuvant. This could boost the potency of vaccines and increase their effectiveness. C3d can be used to stimulate a more rapid and effective immune response. The DNA sequence for sheep, pig, mouse and human C3d had been isolated but the DNA sequence for bovine C3d had not. This study successfully isolated the DNA sequence for bovine C3d for the first time, leading to its replication and potential use as a vaccine adjuvant.

M. haemolytica is the most prevalent bacteria causing pneumonia in calves and shipping fever in recently weaned feeder cattle. After a year of effort, bovine C3d was successfully fused with an antigen (a substance that stimulates production of antibodies) against M. haemolytica. The fusion of C3d with the M. haemolytica antigen permitted development of a C3d-adjuvant vaccine against M. haemolytica. Trials comparing the potency of the C3d vaccine to the potency of a traditional vaccine are now underway. This research has already contributed a great deal to the understanding of the C3d protein and its role in stimulating an effective immune response. The knowledge that this research has advanced may also lead to further breakthroughs in livestock vaccine therapy.

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