Vaccine improvement could decrease agricultural use of antibiotics

Project Code: 1.86
Completed: *August 2004*

Project Title:

Adjuvant Activity of Complement Component C3d in

Researchers:

Dr. Douglas C. Hodgins dhodgins@uoguelph.ca

Dr. Patricia E. Shewen and
Dr. Dongwan Yoo

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 in food-producing animals, better vaccines, 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. Antibodies 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. Whe 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 into action, creating antibodies to destroy 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 because concentrations of C3d are normally low in young calves, a C3d-adjuvant vaccine might permit vaccination at an earlier age. Prior to this research study, 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 feedlot cattle. After a great deal 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 was instrumental in identifying bovine C3d DNA for the first time. Further research may eventually result in improved commercially available vaccines against shipping fever and other respiratory illnesses. The knowledge that this research has advanced may also lead to further breakthroughs in livestock vaccine therapy.

Proudly Funded By:

The Beef Cattle Research Council, a division of the Canadian Cattlemen's Association, sponsors research and technology development and adoption in support of the Canadian beef industry's vision to be recognized as a preferred supplier of healthy, high quality beef, cattle and genetics.

For More Information Contact:
Beef Cattle Research Council
#180, 6815 - 8th St. NE
Calgary, AB T2E 7H7
Tel: (403) 275-8558 Fax: (403) 274-5686
info@beefresearch.ca

For More Information Visit:
www.beefresearch.ca