

**Discover Conference 15
Biology of the Calf
Conference Summary
Hotel Roanoke and Conference Center
Roanoke, VA
November 16 – 19, 2008**

General comments: This was the largest attendance for a Discover Conference with 153 registrants coming from 11 different countries and 30 states in the U.S. Ninety-five attendees were from industry with 40 from academia and the remainder from government positions or private consultants to the dairy industry. Evaluations indicated that the attendees were very complimentary of program content, speaker selection and especially the program format which promoted discussion and interaction.

There were three work groups which met during a working lunch on Tuesday and an extended break on Wednesday morning. The three workgroups and their moderators were: Immunity – Dr. Jim Quigley, Growth – Dr. Mike Van Amburgh and Welfare Considerations – Dr. Dan Weary.

A synopsis of each work group's deliberations follows:

Immunity

- Colostrum
 - Contamination of colostrum between harvest and feeding represents a significant risk to passive immunity transfer to the neonate. There is a need to better understand mechanisms whereby microbes interfere with Ig absorption. Preliminary results indicate that pasteurization at 60°C for 60 minutes reduces bacterial growth without impairing Ig content or absorption. There is a need to better understand ALL factors associated with apparent efficiency of absorption (AEA).
 - What is influence of processing / storage on AEA?
 - Comparative studies are needed on colostrum replacers vs. maternal colostrum vs. frozen colostrum.
 - The role of growth factors, hormones, proteins and leukocytes contained in first milking colostrum is poorly understood. What role do they play in:
 - Systemic immunity
 - Local intestinal immunity
 - Intestinal and hepatic metabolism
 - Mammary development
 - What are the long term effects of Colostrum Ig and other bioactive compounds on calf growth and later performance?
 - How can we better assess colostrum quality on the farm?
 - How do we define colostrum quality?
 - What are the influences of nutrition, the environment, genetics etc. on colostrum quality?
- Neonatal immunity
 - How do we better or more uniformly define morbidity/mortality? Should morbidity /mortality be a better indicator of immunity than an arbitrary IgG number? What are acceptable goals?
 - Is 10g of IgG/L at 24 h satisfactory? Measuring IgG ignores other factors of immunity.
 - Is there an optimal plane of nutrition for immune development? What nutrients are most important for immune function? (Protein, energy, minerals, vitamins.....)

- What are the negative effects of excessive / poorly timed vaccinations?
- Incorporate animal welfare considerations into development of immunity.
- What are the effects of genetics, cross breeding on immune development?
- Development of active immunity
 - How do we develop immunity in colostrum compromised calves?
 - What is the “right” measure to indicate efficacy of vaccines? (titer, memory, morbidity?)
 - What is the optimal route of delivery of vaccines in calves in face of maternal antibodies?
 - How does the feeding program (“limit fed” vs. “intensive”) influence response to vaccination?
 - What is the energy cost to the calf to respond to vaccination?

Growth

- Colostrum status is critical for growth and development of the immune system in the calf. What ingredients in colostrum have an impact on nutrient partitioning?
- What is normal rumen development from a pH and long term health perspective? Is currently observed low pH during onset of dry feed intake detrimental or normal? How does the nutrient intensity of the liquid feeding program influence rumen development?
- There is a need for quantitative data to describe nutrient transfer in calves during weaning and the transition period.
- What factors promote lifetime health and productivity beyond colostrum?
- How much body fat is required for optimum calf development and immune system competency during early life and during a disease challenge?
- What is the nutrient cost of an immune response? (Note the similar comment in the immunity section.)
- Need to refine the composition of milk replacers to reflect further understanding of calf development needs. Do we need to consider staged nutrition of the calf to provide higher quality/digestibility ingredients during the first 2 – 4 weeks of life?
- What is the role of fatty acid and amino acid composition of liquid diets and other nutrients or growth factors on imprinting during very early life as well as long term productivity?
- There is a need for management research evaluating liquid diet feeding frequency, automated feed systems on starter intake and weaning efficiency. How do animal welfare considerations influence animal performance, health and later productivity?
- Growth objectives for an “ideal” calf program
 - 4 liters of colostrum within 4 hours of birth
 - Target growth of 500 g/day from day 2 to 14 for large breed calves.
 - Target growth of 750 – 1,000 g/day from day 15 to 45 for large breed calves.
 - Reduce liquid feeding by 50% from days 46 to 53 with no liquid diet after 54 days.
 - Enable calves 6 to 10 days to fully adjust to weaning before moving to group pens if applicable.

Welfare

- Need to define welfare from the context of the consumer as well as the dairy producer.
- Animal welfare includes considerations of “natural” living conditions, affective states and basic health and functioning. Interpretation of these states is strongly influenced by cultural roots of society.
- Measures of animal welfare must be linked to a concept which includes freedom from pain.

- Measures of animal welfare need to be validated by scientific research. Many respectable techniques exist to evaluate emotional states of animals and importance of natural behavior to welfare, animal health and performance.
- Automated feeding systems enable producers to achieve excellent growth performance in group housing systems while minimizing cross sucking, competition for milk and enabling health surveillance.
- Pre-emptive pain management for procedures such as dehorning or during disease result in more “natural” behavior and more rapid resumption of starter intake following diarrhea.

Overall conference summary.

This conference provided a unique opportunity for scientists, consultants and technical service professionals to share the current state of knowledge in the biology of the calf. Historically there has been little opportunity for those interested in the immunology, growth and welfare of the calf to gather in a professional setting. Each attendee of this conference arrived with different experiences and professional training, but shared a common interest in improving our knowledge of the biology of the calf.

After reading summaries of the work groups it is evident that there were a greater number of questions posed than solutions to existing problems. There was considerable agreement that failure of passive transfer of immunity to the calf represents an area where not much progress has been made in the past 30 years. We are only beginning to understand the biological factors influencing passive transfer and the role that non-immune globulin factors play in immunity development in the neonatal calf. In addition, the lack of management systems impairs the timely administration of high quality colostrum to the neonate.

What is the ideal calf program? This will be subject to continuing debate. However, research suggests that improved nutrition of the young calf (less than one month of age) through nutrient intake sufficient for acceptable growth (500 – 1,000g/day) during the first month of life appears to foster improvements in mammary development and possibly immune response as well as promotes more efficient growth. Challenges exist in identifying the feeding and management program which optimizes growth rates while encouraging rumen development and transition to a ruminant state in a timely fashion.

Welfare considerations for calf management have received less attention in the U.S. However, workers in Canada and Europe have active research programs to study the impact of management practices on defined measures of animal welfare. It is becoming increasingly obvious that improvements in animal welfare supported by research are important to consumers of dairy products. Ultimately, systems must be developed which are cost effective and promote the health, well being and performance of dairy calves.

In a more general sense, this conference affirmed that:

- Collaboration among scientists and educators with interests in immunology, nutrition, welfare is essential.
- It is challenging to stay current with the new information available. A more efficient means of coordinating transmission of new information is needed.

- There is substantial room for improvement in the education of producers in the use of technologies and management systems that have proven to be biologically and cost effective.