Discussion

Dr. Ben Norman (moderator): For the first time in meetings that I have been to, we have looked beyond the rumen in the cow in our physiopathological appraoch. Nutritionists are now busy devising rumen bypass mechanisms with their feeding regimes. Several patented products on the market are claimed to move on through the rumen to the lower G.I. tract. Our speakers have killed some of the old wives' tales regarding the digestive tract. I am interested in the role of the ecology of the gut flora, on down, as it influences the nutritional uptake of some of these things. We have talked primarily about the wall and the organism but we have not had much research on the interface of the organism and how it lives against the wall and how it influences the physiopathology, particularly as we mass-medicate.

Phylogenetically, any time a ruminant animal gets away from a roughage diet, it is under stress. In California, we can produce alfalfa hay which is more than 20% protein and less than 20% fiber which in most states could be sold as a protein concentrate. Even some of our normal roughage is now out of balance.

Questions and Answers

Question: My question is directed to our immunologist. I noticed there is some work in pigs, with killed *E. coli* antigens in the neonate, where they have been given massive doses of dead antigen or killed *E. coli* and shown some rather good protection in the young animal. How do we stand in the bovine animal as far as this type of killed vaccine for *E. coli* protection, for example?

Answer (Dr. Smith): I am not aware of any work that is being done in the calf. As I have pointed out, it depends, I think, in terms of what we are trying to prevent in terms of immunological responsiveness of the calf when that disease occurs. I am saying, if we are dealing with a disease in the first week of life, our success will probably be much less unless we go back into the fetus, which people are doing now, of course. With the pig situation we are dealing with a pig at least three weeks of age. We have an opportunity for the development of an acquired immune response and therefore we should expect more success here than dealing with a situation where we are talking about the first week of life.

Question: Dr. Whitlock, I'm concerned about the lack of research and I was surprised there was not more comment concerning winter dysentery. It is a big problem for practitioners in the northern tier of states.

Answer (Dr. Whitlock): I guess I share your concern and probably you are aware that Drs. Gordon Campbell and Bob Kahrs are continuing the research on winter dysentery. To my knowledge they do not have a definitive agent. They have several possibilities and they feel they are able to transmit it. As everyone in this room who has dealt with that disease knows, it is a very transmissible disease. They have been able to do it to experimental animals, that is, heifers that presumably have not been exposed to it before. It does look to be an infectious organism. Above and beyond that, I don't know. They have been frustrated with their attempts at working on the disease for the last several years but they are continuing to work on it. That's about all I can say. Perhaps Dr. Duncan would comment.

Dr. Duncan: I want to get back to the subject that was raised a little bit earlier about giving killed *E. coli* antigens to calves. There was some work done with this in England and they did show that the number of days that the group that received the killed *E. coli* were scouring, as compared to the controlled group, was reduced. So, they felt that there was some benefit and also in weight gain of these calves for the first three weeks. It is an area that needs a lot more work. I think one reason I brought up the fact that we have these factors in *E. coli*–such as K-99, the ability to stick, and the enterotoxin production–is to illustrate that we have a lot of different strains of *E. coli* and if we can find some common genetic factor in these, then this would give us a greater ability to produce vaccines. For example, there is one factor common to 200 different strains of *E. coli* that produce diarrhea, and that is that they have this K-99 antigen and the enterotoxin production antigen. Perhaps we can find a vaccine that is common to all of these. We may never find this but I think that is really where the research is aiming now. The same when we are giving killed *E. coli* orally, we have to think of these things. There has been some work done manipulating these *E. coli* where you can give *E. coli* that have the ability to stick this K-99 antigen, but that do not have the ability to produce enterotoxin. You can give these first to an animal and then challenge him and follow that with pathogenic *E. coli* which do produce enterotoxin and you can protect these animals. This was done in baby pigs at Davis recently. With that kind of work, perhaps we will be able to develop oral vaccines. The passive immunity which seems to be the way we go now with salmonella, vaccinating dry cows with vaccines twice and then allowing the cow to pass the immunity to the calf through the colostrum, does not seem to have worked out very well with *E. coli*, although it has been looked at. It may be in the future we will find some breakthrough there, also, but that does not seem very promising at the moment.

I would like to comment on some work that was done in Guelph in regard to intramammary immunization in the cow where they looked at the local immune response to *E. coli* and the subsequent beneficial effect of this in the therapy of colibacillosis in pigs. I think the same principle could apply to the calf instead of saying that parenteral immunization didn't help. Possibly what we are forgetting here is the continuous effect of the antibacterial activity of the antibody in the milk (and this is present in normal milk). We could enhance this by an intramammary infusion that would persist in very significant levels to at least 80 days, post-parturient. So, we are not looking at the immediate effect of the antibody that is absorbed, but the continuous oral ingestion of it, and so, our produce in this way may be quite useful.

One big problem with any passive immunity in the bovine is that most of the diarrhea and neonatal problems are in dairy calves and they are on artificial diets. We can immunize the cow all we want but really all that calf is going to get is the colostrum for the first day or two and then he is going to be most likely on an artificial diet. We have to think about some of these local antibodies and the effects of IgA in milk. Perhaps it is better to feed whole milk to calves and spend that extra $5 on whole milk for the first three weeks and not go to artificial products, synthetic milk products and so on, because we lost that benefit of local immunity in the milk.

Question: I would like to ask Dr. Whitlock if he would comment on the etiology of vagal paralysis. Any suggestions on treatment?

Answer (Dr. Whitlock): Well, I could spend a little time on that question. I am quite interested in that area and I have spent quite a lot of time on it during my spare time. Basically, I feel that we are talking about vagal indigestion and it is my impression, based on clinical experience and discussions with people like Habel and Bjork who worked with Hoflund (who first described the syndrome), that the vagal nerve may not be as important in vagal diseases or vagal indigestion as we believed. There are probably four basic types of vagal indigestion: (1) failure of eructation; (2) failure of omasal transport; (3) abomasum impaction, which some people call pyloric stenosis, but primarily is the loss of abomasal motility; and (4) partial pyloric stenosis. I think that there is not any good treatment for abomasal impaction, that is, lack of motility of that organ. That animal usually has sufficient adhesions and loss of motility that nothing can be done. For the cows that have failure of eructation or are chronic bloaters, establishment of rumen fistulas is the way to go and you can probably save 90%+ of those. The ones that have failure of omasal transport, and this is where the abomasum has no motility (the omasum is not transporting the ingesta from the rumen into the abomasum), I think you can probably save between 50 and 75% of those cases by doing one of two things: Do a rumenotomy and drain the pressure, that is, the abscess that is usually present in these cows between the diaphram and the omasum. You can also treat them supportively by putting a tube down the esophagus and directly into the abomasum and feed them that way for several days while the omasum tends to regain function after the pressures have been released.

Question: Some of the commercial calf scours preparations include not just electrolytes and glucose but proteins or protein hydrolysates. Do these affect the osmotic balance in the gut and are they really necessary?

Answer (Dr. Whitlock): I'll let Dr. Smith comment also. I am sure he feels as strongly as I do. Basically, it is my feeling and impression that when you look at these protein hydrolysates, the amount of protein in there necessary for the nutrition of the calf is miniscule. It is costing a fair amount of money to put it there, but it represents very little as far as the total nutrient needs of that animal are concerned and often what happens is you are providing these nutrients in the form of amino acids, which are expensive. But, if he's not given glucose at the same time, and most of these do contain glucose, the glucose may run out and then they have to utilize these amino acids for energy. So, I think it is basically a waste of money.

Dr. Smith: Yes, I agree. There has really been no research to show that they are beneficial and there have been indications that they are possibly even harmful, especially if given intravenously. They may worsen the acidosis. In human medicine they feel strongly that the short-term use of parenteral amino acids is detrimental, and I don't see that animals are different.

Dr. Norman: I would like to make one comment, Dr. Whitlock. On a set of calves that we reported on yesterday, in Texas, we put part of these calves on an electrolyte solution (one of these magic elixirs), for a period of 24 hours before we loaded them on the truck, and this is a glycine-hydrolysate-glucose type situation as the exclusive water source for them, 50 pounds per 500 gallons. Then we kept them on this for a period of three days after they came into the lot. Five out of the six animals that died were in the electrolyte group. They used water to replace feed and it took them about five or six days longer to get up to the consumption rates of their pen mates and it took them five or six days longer to get on the feed. So, our experience was that as a preventative or as a prophylactic measure, we did not have very positive results.

Dr. Smith: Dr. Norman, you raised that question earlier about gut flora, and we did pretty well ignore the role of normal gut flora. I think it is important and we probably should not ignore it. One reason we probably did not talk about it a lot is because we don't know enough about it. What we are doing with gut flora as clinicians is, generally, if we culture a lot of *E. coli* or a lot of salmonella out of something, we say that is the cause of disease and we do not go much farther. It is pretty hard to quantitate how many bacteria are in the normal bowel of the animal unless you autopsy it. So, how much is coming out in the feces does not seem to mean a lot. But, definitely, the normal gut flow is important. I think people have over the years tried to work to improve the normal gut flora by giving, for example, a neonatal lactobacillus. There have been many remedies given to newborn calves such as cultured milk and different lactobacillus preparations. Basically, over the years people have tried them and given up on them. They do not seem in most cases to really solve the problem. In the adult animal, I think we have a good example in when we put an animal on tetracycline therapy, diarrhea may develop. This could also be with IV tetracycline therapy. This is very common in horses with something like tetracycline that is excreted in the active form in the bile; we are definitely altering the gut flora. We have seen in horses at Davis a number of cases of salmonellosis following the use of tetracyclines, even given parenterally; so that altering the gut flora is definitely a factor and it is something we probably need to consider more than we do. It may be a factor in secondary disease in animals that have metritis, mastitis or are off feed. Their gut flora alterations may be a factor in that, also.

Well, the comment that I did make before on that was that it has definitely been demonstrated that normal gut flora in the interaction with humoral response is antibacterial. The antibody was much more effective in the presence of a normal gut flora than without it.

Question: Do you consider the use of the reovirus calf scour vaccine practical in the absence of laboratory confirmation?

Answer: That's a tough question to answer. First of all, we know it can cause disease, and you saw the lesions there. Most of this work was done by Mebus, Tweihaus and Newman and their group in the Midwest. One of the problems, first of all, is that we can only see this disease in gnotobiotic calves, that is, calves that are disease-free and are challenged at birth. How much of a problem it is in the field, I think, is very debatable. In some areas it probably contributes to the disease, but I have doubts as to the exact role of these viruses and how significant they are. Just the fact that we can only cause the disease in gnotobiotic calves does not necessarily mean that it is not a problem in normal calves. We can take a really hot strain of *E. coli* and only cause disease in newborn calves that are, say, 24 hours old, and if I would give the same to healthy calves at 48 hours old, I cannot cause disease in them. So, I still believe that *E. coli* cause disease. What are these other factors that go along? Why can't we reproduce all these diseases experimentally as easily as we would like to? We don't know. But to try to get back to answering your question, do I think the vaccine is worthwhile? I think you really have to make an effort to see if you have a reovirus present. Look for viral particles with fluorescent antibodies and many labs have that facility. If you don't do that, then you are left with the question of whether to vaccinate half the calves or two-thirds of the calves and leave some controls, and see if you are doing anything for this farm in the way of protection. The problem with that is that some people feel that you need to vaccinate all calves in order to get protection. That is, if you leave some calves open you get enough viral transmission in maintaining virility that you don't get protection. So, I really don't know. The best study I saw done in the last few years was in Canada by Radostits and some other people and they looked at some beef calves that were having scours problems. Even when the virus was present they did not find that vaccinating made any difference in the incidence of diarrhea. So, seeing as that is the best study that is around, I would say it is questionable whether or not the vaccine has efficacy in the field.

Dr. Norman: Do you have any idea as to the mechanism of the diarrhea that we see here in California and the Northwest related to selenium-responsive disease? You gave a category there of several possible etiologies. I wonder if we also see some in copper deficiency, but here we see a lot of dirty tails that dry up rather rapidly.

Answer: I don't have any idea on the mechanism of diarrhea in selenium deficiency. Since you brought the subject up, I for one, and perhaps some of the audience, would be interested to hear more about the diarrhea associated with it.

If Dr. Norman can tell us how these things tie into "tying-up syndrome" in the horse, we'll tell him how they work in diarrhea.

Dr. Norman: We do see in northern California and some of the ranches where we have selenium-responsive disease, white muscle disease in baby calves. Most of those places now treat but we have run scour indexes, similar to what you have talked about there as a 0-to-3 type of scale, on some places where we have marked improvement in weight gains, in injected versus uninjected weaning calves. An example would be an uninjected animal gaining 16 pounds in 30 days, and an injected control gaining 46 pounds over the same period of time, fed in the same pen and the same source. These are young calves, weaning calves. But in four or five days after you give the selenium-E product, you get a radical change in your scours score, the tails clean up and they change. About the mechanism I have no idea.

Thank you very much. It has been a pleasure having you in California. We will see you all in St. Louis next year.