



# THE CUTTING EDGE OF NUTRITION

## The Bulletin for Alumni of the Beef Cattle Nutrition School

July 1996

### Nutrition & Immunity

“The immune system is one of the most complex and intricate cellular and molecular interactions known in all of biology.” This is a direct quote from Larry L. Berger, Ph.D., writing in *Salt & Trace Minerals*<sup>1</sup>. Berger goes on to say that “trace minerals act as keys which unlock the ability of the immune system to ward off invaders.” We thought some of the highlights from Berger’s review would be of interest to you. Plagiarism is not intended but we may come close.

### Immune Function

The immune system exists to protect the body from foreign invaders such as bacteria and viruses. These foreign agents are called antigens. The immune system employs different methods to detoxify these foreign antigens. One system is the lymphoid organ developing immune system. It has a memory for an antigen which is expressed in the formation of different antibodies for each antigen. When the animal is exposed to sub-lethal doses of an antigen, naturally or by vaccination, the lymphoid tissue memory mechanism is encoded. Upon subsequent exposure to the antigen, certain lymphocytes (B-cells and/or T-cells) will produce specific antibodies that will destroy the antigen. It appears that certain nutrients, particularly the trace minerals, are essential to one or both of these two biological processes:

1. Encoding the memory for eventual recognition of the foreign antigen (*response to vaccination*).
2. The formation of the antibody upon exposure to a foreign antigen.

Failure of either process will cause your Veterinarian to abort or at least start the graying process. It is not uncommon for vaccinated cattle to break with the infection for which they were immunized. When this occurs, the Vet pulls blood samples, looking for blood titers of anti-

bodies that should have formed in response to the vaccination. Serum trace mineral (particularly copper) levels are likely to be part of the analyses. Was immunity established originally or was there a lack of antibody formation when exposure occurred? **With a proper nutrition program, nutrient deficiencies should never impede the animal’s immune capability.**

### Copper

Copper adequacy is known to be essential for proper response to vaccinations associated with the shipping fever complex. It also is implicated in resistance to internal parasites. The copper situation is confounded further because its availability/utilization can be impeded by molybdenum, sulfur and iron. One precautionary note is the overreaction to the importance of copper. There have been reports that some commercial cattle supplements are causing copper poisoning in sheep.

### Iron

If you have been sampling forage on a regular basis, you probably have observed that the vast majority of the forage contains ample iron to meet requirements. Further, it is not uncommon to find the iron content in excess of requirement. Often it is sufficiently high to raise concerns about copper utilization. With our clients, there has not been an occasion to incorporate iron into the supplement. If you are using a commercial supplement, you most likely are supplementing with iron whether it is beneficial or detrimental. Either a deficiency or an excess of iron can compromise the immune system. Circulating iron levels fall early in response to bacterial and viral infections and rebound quickly with recovery. With *Pasteurella haemolytic*, the iron-regulated cell wall proteins are important vaccine components. If iron is in excess, the key proteins required to initiate recognition and antibody production may be masked.

### Selenium

As Dr. Berger noted, selenium is an immunostimulant. It commonly is supple-

mented along with Vitamin E. The two appear to have similar physiological roles but their effects are additive. Forages contain sufficient Vitamin E but are often low or entirely devoid of selenium. Because selenium is very toxic at low levels, forage analysis must be performed prior to formulating selenium-containing supplements.

### Chromium

At times of stress (weaning, shipping, sudden cold, etc.), circulating cortisol levels increase. Cortisol is known to suppress the immune system. Dietary chromium has been shown to reduce the level of circulating cortisol. Current information, however, is not sufficient to determine chromium requirements. This one deserves close surveillance of the literature.

### Cobalt

Dietary cobalt is essential for rumen microorganisms to form Vitamin B<sub>12</sub> for microbial and animal use and analogues of B<sub>12</sub> for microbial use. An animal deficient in B<sub>12</sub> soon will become ill and will have difficulty fighting any and all infections. There is some indication, however, that the immune response is reduced before B<sub>12</sub> status is below normal in cobalt deficient situations.

### Zinc

Zinc is critical in building proteins. Antibodies are proteins; their formation is dependent upon the presence of adequate zinc at the cellular level.

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<sup>1</sup> Berger, L. L. 1996. Trace Minerals: Keys to Immunity. Salt and Trace Minerals. Salt Institute. 700 N. Fairfax St, Fairfax Plaza, Ste 600, Alexandria, VA 22314-2040.