IMMUNITY

We spend our time and money immunizing and treating our livestock with antibiotics in an effort to preserve/increase the overall well being of the animal. In order to achieve this, the animal's immune system has to be in good condition. The health of the immune system is reliant on many factors, particularly the animal's nutrition.

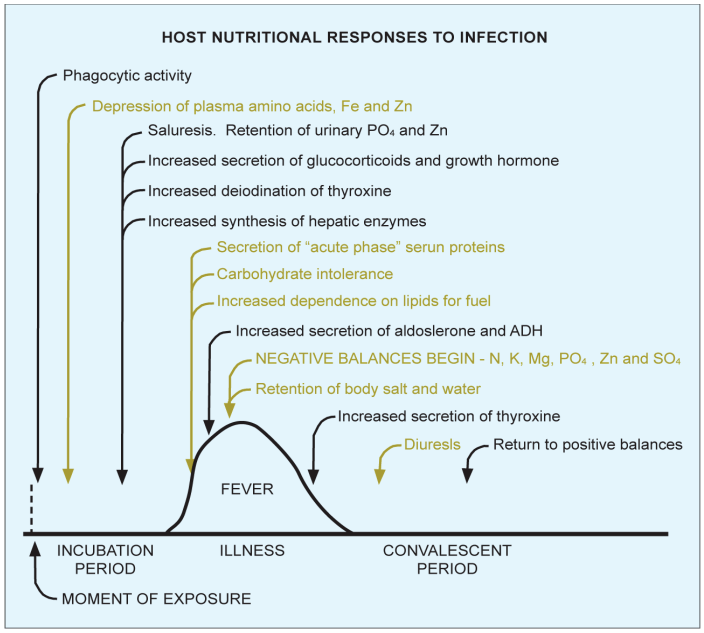
The immune response of the animal is regulated by antibody producing enzyme systems. The main contributors to the enzyme systems are trace minerals such as zinc, manganese, copper, iron, magnesium. When absorption of these critical minerals are increased, enzyme system production also increases. This results in overall improvement of the immune system.

The immune system has three types of responses to defend against disease. The three types are: species, innate (non-specific) and adaptive (specific). Species immunity means that the animal (ie, Bovine species) is not susceptible to that particular disease.

The innate (non-specific) defense is comprised of phagocytes, neutrophils and natural killer cells. They are indiscriminate (non-specific) in their defenses and are not linked to a specific antigen. They are the first line of defense against a disease. The formation and production of these cells are dependent upon trace minerals (mainly zinc and copper).

Adaptive (specific) or acquired immunity (from vaccinations) comes from the exposure to specific antigens. When an animal is exposed to specific diseases, antibodies called lymphocytes (primarily B and T cells) are produced to combat that disease.

Short-term immunity comes from antibodies in colostrum, whereas long-term immunity comes from actual exposure to disease or vaccinations (artificial exposure). When an antigen is introduced into the system, immunoglobulin's (mainly IgG1, IgG2, and IgM) are produced by B cells to directly respond to that specific antigen. This reaction is controlled by enzyme systems that require trace minerals (mainly zinc and copper) to function. In a normal situation IgM is first produced followed by IgG1 and IgG2. Due to the large molecular size of IgM (900,000 daltons) it is mainly found in the blood stream, it cannot pass through cell membranes. Even though IgM is the first reaction of an animal's adaptive immune response, it has very little to do with intercellular immune function. IgG antibodies have a smaller structure (of 180,000 daltons) and can pass through cell membranes and yet can still function in the circulatory system. The IgM:IgG ratio can be used to determine if the immune system is functioning correctly or not. The ratio should be between 1:1 to 1:15 (Figure 1) if the system is performing as it should. The ratio gap will widen if not. A wide ratio is most often caused by deficient IgM production meaning lower levels of IgM in the blood.



This causes problems with the animal's initial specific immune response. Decreased immunoglobulin function is a result of zinc and copper deficiency. Decreased IgG production is linked to a magnesium deficiency.

T-Cells are the location for cell-mediated immune activity, activating macrophages, natural killer cells and cytokines. The T-cells are produced in the thymus and

becomes sensitized when exposed to a specific antigen. This results in the formation of a memory cell that will respond quickly to an antigen if or when it is reintroduced. T-cells rely on zinc, copper and iron to function properly. Trace minerals influence processes such as T-cell maturation, neutrophic response time to infections and formation of lymphocytes.

Table 1.
Function of minerals in the immune system

Mineral	Deficiency Symptoms
Zinc	Lowered Immunoglobulin production Abnormal proportions of immunoglobulin classes Decreased T-cell levels Decreased T-cell function Reduced SOD function resulting in oxidation damages Ineffective response to bacterial, viral, and parasitic pathogens Decreased control of E. Coli
Copper	Decreased T-cell function Abnormal proportions of immunoglobulin classes Reduced SOD function resulting in oxidation damages
Manganese	Abnormal proportions of immunoglobulin classes Reduced SOD function resulting in oxidation damages
Iron	Reduction of circulating T-cells Reduced antigen specific antibody titers Reduced catalase function resulting in oxidation damages Impairment of humoral immunity
Selenium	Reduced GPx function resulting in oxidation damages Reduction in energy available to phagocytic cells
Magnesium	Reduced humoral and cell mediated immunity Abnormal proportions of immunoglobulin classes

Within mitochondria, the Electron Transport System is used to make ATP (energy). A byproduct of this is a superoxide radical (O2-) which damages the cell making it more susceptible to disease. This will occur unless the body is able to produce enough antioxidants (mineral dependent enzymes) to neutralize it. (Free radicals are also released by phagocytic activities). Antioxidants reduce the superoxide radicals to water and O2. The enzymes and minerals required are copper/zinc, and manganese superoxide dismutatse, catalase, and glutathionc peroxidase (GPA). Necessary minerals are; copper, zinc, manganese, iron and selenium (Table 1).

Cells detoxify free radicals first by using superoxide dismutase enzyme. The superoxide dismutase converts O2- to hydrogen peroxide. Then H2O2 is broken down either by catalase or glutathione peroxidase (depending on the environment) into H2O and O2.

When O2 radicals build up, the immune system increases activity and stress hormones (adrenaline and cortisone) are released increasing the amount of oxygen. One cause of this initial buildup could be a deficiency of the vitamin and minerals that cause a reduction of the antioxidant enzyme levels. Another could be high intake of fermentable carbohydrates with increase metabolism and digestion. With more readily absorbed minerals, Tracer Amino Acid Chelate improves the ani-mal's ability to detoxify free oxygen radicals.

When an animal is dealing with illness and the accompanying stress, the duodenum's ability to absorb inorganic minerals is reduced. If the duodenum cannot absorb minerals just adding more will not solve the problem, changing the location of mineral absorbtion however can. Amino acid chelated minerals are absorbed in the jejunum of the small intestine avoiding the obstacles of the duodenum.

Many minerals rely on one another to perform so a well rounded mineral program is a must. Animals that are deprived early in life may never achieve maximum immunity protection even if presented with a mineral regimen later. Good mineral levels for the animal are required throughout life to maintain a full functioning immune system (Figure 2).

Figure 1

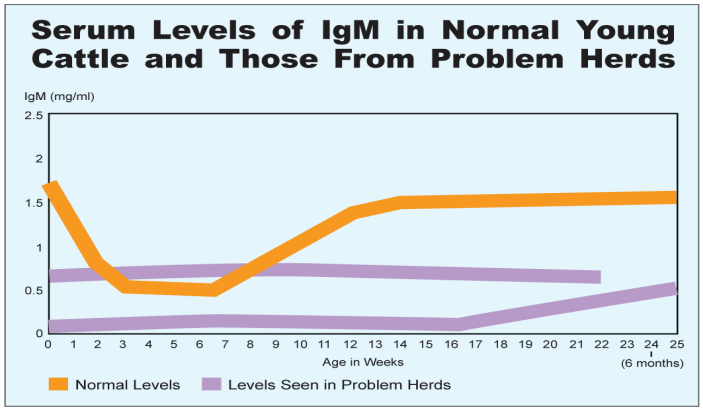
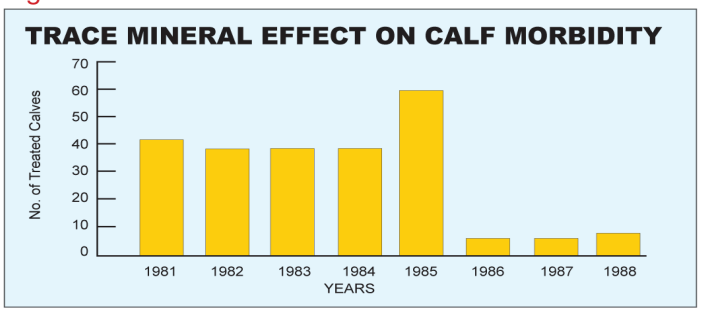


Figure 2



Montana Ranch

Amino Acid Chelated Minerals used beginning in 1986.