This is the fifth in a series of articles designed to acquaint Angus breeders with genetics defects, problems which occur in every breed of every species.

MANNOSIDOSIS

by Marilyn Barr
Assistant Director, Communications & Public Relations
American Angus Assn.

Mannosidosis recently has been discovered in U.S. Angus cattle. It's very rare in our country. Only four cases have been confirmed here, and that's only a minute fraction of a percent of the total U.S. Angus population. Although it's of minor economic importance here, this lethal nervous disease has occurred in higher frequencies in Angus and Murray Greys (a breed developed from Angus) in other countries, including New Zealand.

Although it's a new or newly discovered disease here (the first case was confirmed in 1978), more is known about it than many other defects because of research with similar human diseases and New Zealand cattle.

Because of this research, mannosidosis has one big advantage over most other genetic defects, an advantage that lends assurance that it should never become a problem here. It's one of the few cattle diseases that has been defined biochemically, which has allowed researchers to develop an accurate test to spot carriers (normal-appearing animals that carry a defective gene and can pass it to future generations) so they can be eliminated before the disease is spread. With other defects, carriers usually can't be identified until they've produced a defective calf, and by then they may have produced several carrier calves.

Storage Disease

Mannosidosis is a lysosomal storage disease that's inherited as a simple autosomal recessive trait. Presence of two defective (recessive) genes causes the absence of an enzyme the body needs to function properly, and this in turn causes an unwanted substance to build up and be stored in nerve cells in the brain and other organs, including the liver, pancreas, lymph nodes and kidneys.

Enzymes are proteins secreted by body cells that act as catalysts to induce changes in other substances.

Here's an example of how enzymes work: The body needs substance D to function properly. D isn't available in the body, so it must be built out of simpler substances that are available but can't be used in their present form. In a normal animal, D is built in a series of steps. The simple substance A is converted to B, B is converted to C, and C is changed into D. Each of these steps is controlled by a specific enzyme.

In an abnormal animal, one of those enzymes is defective or absent. Let's say the enzyme that should induce the change from C to D is absent. The body can't use C, so it's stored in body cells.

The enzyme alpha mannosidase is absent in mannosidosis cases, which prevents the production of a substance a calf must have to survive. Alpha mannosidase normally is involved in the metabolism and recycling of some parts of cells. When it's absent, unusable oligosaccharides (an intermediary product comparable to C in the foregoing example) accumulate and are stored.

Die Within Year

Mannosidosis calves usually are born alive and function normally at birth. But during the next few months when metabolic pathways should be working, oligosaccharides slowly accumulate and start causing problems. Most affected calves die within a year, ususally at six to eight months of age. Some die shortly after birth.

Since brain cells are most sensitive to this disruption of normal cellular activity, the most striking clinical signs are nervous reactions. The animal actually goes crazy.

Affected calves quit growing, develop progressive incoordination and have little sense of balance. They don't follow their mothers, don't seem to know where they're going and may become aggressive if crowded or worked.

Other signs may include fine head tremor, head nodding, intention tremor, humped backs and enlarged tongues. Moderate internal hydrocephalus (accumulation of fluid in the brain) is always present, and mannosidosis calves may be incorrectly diagnosed as hydrocephalic cases.

Test Spots Carriers

Blood samples from cattle with two normal genes have a normal amount of alpha mannosidase activity. Affected cattle with two defective genes have little or no activity of the enzyme. Carriers, with one normal and one defective gene, have an alpha mannosidase level halfway between that of normal and affected animals. This is called the gene dosage effect. (Carriers can function normally with this reduced level of the enzyme.)

This knowledge of enzyme activity led New Zealand researchers to develop a blood sample test that spots carriers. This type of test, used for many human diseases, has proven effective in mannosidosis control in New Zealand; and research at Kansas State University in Manhattan indicates that the test is accurate. Current research at Kansas State involves studying the feasibility of using the test for a control program in the U.S. if such a program is ever needed.

Additional mannosidosis cases may be confirmed in the future, but there's no cause for alarm. First, the finding of so few cases in the U.S. indicates that the defective gene is very rare here. And second, the blood sample test places a different emphasis on finding the disease. Even if future cases are reported, veterinarians should be able to initiate effective control programs that will detect carriers and prevent spread of the disease.