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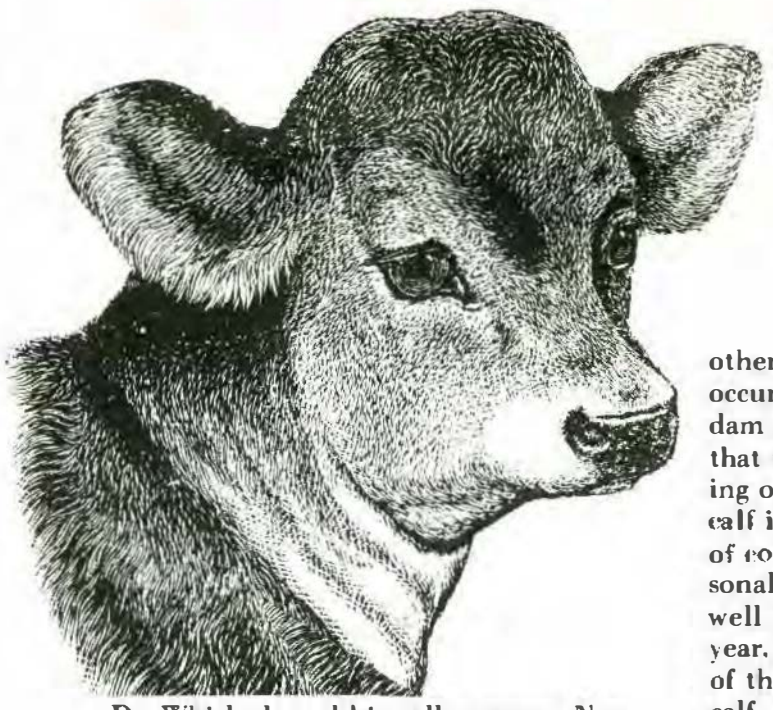
Each year the agriculture industry suffers heavy losses from calf diarrhea, a common disease of young calves. "It is a major loss to the cattle industry during the first year of life of cattle," explained Robert H. Whitlock, D.V.M., Ph.D., Chief of Medical Services at the Large Animal Hospital of the School of Veterinary Medicine, University of Pennsylvania, at New Bolton Center. "Approximately forty-eight to fifty million calves are born each year, according to USDA statistics. The average mortality per year is 3.5 million calves and the average annual loss exceeds $100 million."

Researchers found that calves are born with little maternal antibody protection. In order to obtain protection, calves must nurse within a few hours of birth to receive colostrum from the dam. It was found that calves can only absorb antibodies during this brief time span (first twenty-four hours of life), and that absorption is at its optimum during the first two hours of life. Thereafter the percentage of antibody absorption steadily declines. Between 15 and 40 percent of the calves born fail to absorb sufficient antibodies. Some animals are unable to absorb the antibodies; others are rejected by their dams. This often occurs with first calf heifers. In other cases the dam may have mastitis, or its udder is so full that the dairyman has to milk the cow, drawing out the colostrum, and in some cases the calf is too weak to suckle properly. Efficiency of colostrum absorption was found to be seasonal. During the winter months it is not as well absorbed as during other times of the year. It was also found that maternal behavior of the dam, such as licking and nudging her calf, increases absorption of colostrum.

Calves without sufficient antibody protection are prime candidates for calf diarrhea. Dr. Whitlock's research evaluated the treatment of calves with the disease. "We produced the diarrhea in groups of calves," he said. "Some were fed an electrolyte solution only; others were given a mixture of milk and electrolyte solution." It was found that the mixture of milk and electrolyte solution was more beneficial to the calves than electrolytes alone. "We recommend feeding about 50 to 75 percent of the normal milk ration and complementing it with an electrolyte solution. More research is needed to determine the best proportions of milk and electrolytes to give to calves with diarrhea." Dr. Whitlock explained that milk contains electrolytes in addition to protein and other nutrients. "The milk helps fullfill the caloric needs of the calf," he said. "A newborn calf is in a very delicate nutritional balance; it needs calories and protein to survive. It has very poor energy storage when it is born and has very few reserves. Its body protein is rapidly depleted when it is fed only electrolyte solution for more than thirty-six to forty-eight hours. If the regimen of feeding only electrolytes or diluted milk is continued, the calf loses sufficient muscle mass to become recumbent, i.e. a bright and alert downer calf. Such calves rarely survive even if given milk after they are down. It is very important to continue to feed milk, even more than normal, particularly in the winter months when the young animal needs additional energy to keep warm."

E. coli... K99



Dr. Whitlock and his colleagues at New Bolton Center are conducting research about the causes of calf diarrhea. "It can be caused by a number of different agents, though the most common one is E. coli, *a bacteria which is abundant in the environment." The* E. coli *strain causing the disease in calves produces K 99, an antigen that allows the bacteria to adhere to the intestinal lining.*

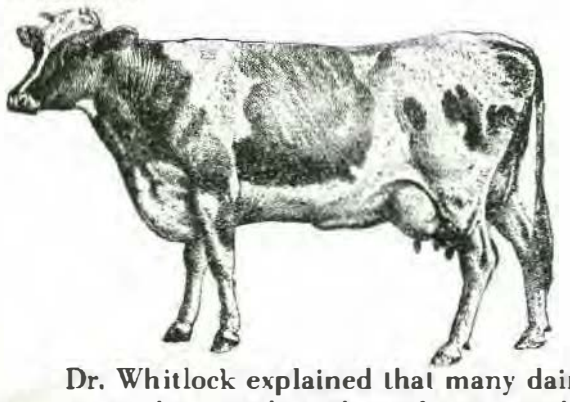
Dr. Whitlock and his colleagues at New Bolton Center are conducting research about the causes of calf diarrhea. "It can be caused by a number of different agents, though the most common one is *E. coli*, a bacteria which is abundant in the environment." The *E. coli* strain causing the disease in calves produces K 99, an antigen that allows the bacteria to adhere to the intestinal lining. Once adhered, the organism produces an enterotoxin that causes some intestinal cells to alter their normal absorptive function to secrete fluid and electrolytes. Such lining cells normally absorb fluids and secrete only small amounts. The excessive secretion dehydrates the calf as fluids and electrolytes are flushed from the body as diarrhea. As the severity of the diarrhea continues the animal becomes more ill, its blood thickens and its heartbeat becomes irregular. If prompt veterinary attention is not given, the calf may die.

Dr. Whitlock noted that a calf with diarrhea can lose between three and five pounds of body weight per day and that this can be life threatening in a very short time. The average birth weight of a newborn calf is between ninety and 120 pounds. Dr. Whitlock emphasized the importance of continuing to feed calves milk after they have been taken from the dam. "We found that whole milk rather than milk replacer is better and more economical," he said. "Milk may contain antibodies against *E. coli* and these prevent adherence of the bacteria to the intestine. They may provide a protective antibody coating K 99 cannot penetrate. Milk also provides antibodies against other disease causing agents." Calf raising practices have undergone significant changes during the last few years. "Calves are now left with the dam only for the first twenty-four to forty-eight hours and then are placed in individual hutches rather than being raised in an inside calf pen. This is the most important advance made in recent years. The hutch isolation effectively prevents the spread of calf diarrhea to other neonatal calves and cuts down on the economic losses to the farmer."

E. coli is not the only diarrhea-causing agent in young calves. A host of other bacteria and viruses are ready to invade an animal unprotected by maternal antibodies. Among them are the rotavirus, coronavirus, clostrid-

Medical Records, A Supportive Service

ium, cryptosporidia, campylobacter, salmonella and others. In order to determine which organism is implicated in the disease, the veterinarian needs to do laboratory examinations and sometimes more sophisticated tests are necessary to determine the course of treatment for the individual calf. While *E. coli* alters the function of the intestinal cells, a virus like the coronavirus destroys a portion of the lining. In both cases the calf improves only after the altered or damaged cells have been replaced by healthy ones. During the course of the disease all that can be done is to offer supportive treatment.



Dr. Whitlock explained that many dairymen treat their cattle with antibiotics at the first sign of trouble. "Antibiotics are of no value in viral diarrhea and of questionable value in bacterial diarrhea," he said. "They are given primarily to prevent septicemia." He explained that antibiotics kill certain bacteria in the calf but do not affect those fluid secreting cells which are the reason the calf has diarrhea. Antibiotics may prevent the adherence of additional bacteria as new cell growth takes place and contaminated cells are eliminated from the body. "But we see resistance to antibiotics due to indiscriminate and improper use of these drugs and we find many organisms which are resistant to commonly used antibiotics." To reverse such a trend in a herd can be very costly. "We restrict the use of antibiotics and the resistant strains, after a while, will revert back to an ordinary strain," he said. "But in the meantime the dairyman may lose some animals. However, this can be minimized by improving the management, i.e., ensuring colostrum, keeping the calves dry and in hutches, etc."

There are vaccines to protect cattle against infection by *E. coli*, rotavirus and coronavirus, though it was found that vaccination against coronavirus produces very few antibodies in the colostrum. Dr. Whitlock and his colleagues cooperate with scientists at the Wistar Institute. "Rotavirus is a big problem, young infants and the elderly are very susceptible to infection, and it is responsible for outbreaks of disease in nurseries and homes for the elderly," he said. "It is a different strain than the bovine strain, yet research about the bovine rotavirus may ultimately benefit humans and help in the development of an effective vaccine."

More research needs to be done to discover effective ways to prevent the losses from calf diarrhea suffered each year by the agriculture industry. According to Dr. Whitlock, "We don't have all the answers yet."

A student working on a research project about malnutrition needs to know whether such cases were seen at VHUP during the last year. This may appear to be a task involving a lot of record searching, and in previous years this would have been true. Then all diagnoses were recorded on Termatrex cards, a coding system punched on cards. To obtain information the researcher had to examine many cards to find the relevant patient files.

Now the researcher contacts Rosanne Hinrichs, director of medical records at VHUP, who, together with her staff of three, instituted a computerized medical records system at the hospital. All it takes is to pose the question to the computer and in minutes a printout listing all the cases, the specie, and the discharge status appears. It shows that the cases of malnutrition seen at VHUP during the last year occurred primarily in exotic animals. Armed with the case numbers the investigator can do further research and examine each patient file.

Four years ago, when Mrs. Hinrichs, an Accredited Records Technician, came to VHUP from the Department of Ontpatient Medicine at HUP, medical records was a complicated system where records and cross references were kept in different places. "We found that the old system, where a new case number was assigned to the patient each time it was admitted, could not handle the growing case load," she explained.

The new system is patterned after the medical records system used in human hospitals. Each animal is assigned a six-digit number which is used for all subsequent visits and the records are kept together under this number. "This provides continuity of care, it considers the animal as an entity and makes it easier for faculty and researchers to obtain information," Mrs. Hinrichs said.

The computer program which replaced the key punching and much of the manual record keeping was developed and written by George C. Farnbach, V.M.D., Ph.D., assistant professor of neurology. It was designed to meet not only the record keeping needs of the hospital but also the research and teaching requirements. The program, which is not a particularly large one, allows for storage of information on 800 diseases and disorders, each coded with a number.

It is not in its final form. "We get input from the staff," Mrs. Hinrichs said. "We continually ask what is needed in terms of information, and we upgrade the system as the needs are discovered."

The system permits many uses, such as determining the number of cases of fracture, infection, viral diseases, and the like. It can be helpful in determining whether an outbreak of a disease is occurring in an area, or in a particular specie.

To ensure that all the required data reach the computer, a two-step procedure has been instituted. When an animal is admitted, information such as species, sex, age, owner's name, and so on, is recorded on the admission form and a plastic imprint card with the patient number is prepared. This initial information is fed into the computer when the record comes to medical records after the visit. The record, which also contains information about the illness, general condition of the animal, treatment, laboratory tests, and other findings, is not filed until it is completed by the clinician in charge who records the diagnosis and the discharge status. Then the record is coded, the diagnosis and discharge information are added to the computer records, and the file is placed in storage. Under this system files can be located quickly. Currently there are 60,000 files in the medical records office on the second floor and each year about 18,000 are added. Mrs. Hinrichs explained that the computer records are up-to-date, enabling researchers at the school to obtain current information on the nature of cases seen.

Medical records is responsible for having available the records of animals that come in for repeat visits. Such records are pulled the day prior to the visit when the medical records office receives the appointment schedule. In emergency cases, when an animal comes in during the night, records can be pulled because the emergency service has access to them. Incomplete records, where the final diagnosis has not been recorded, are kept track of through a card system. Clinicians are reminded periodically to complete a record so it can be coded and filed. "We get good cooperation from the staff. They know that records can be located quickly and that they are available to them," Mrs. Hinrichs said. "Under the old system they often kept the records in their offices and it was very difficult to locate specific files."

"Medical records is a supportive service. The hospital is here to heal. We make it easier by having the data available when needed. We are a clearing house for information."