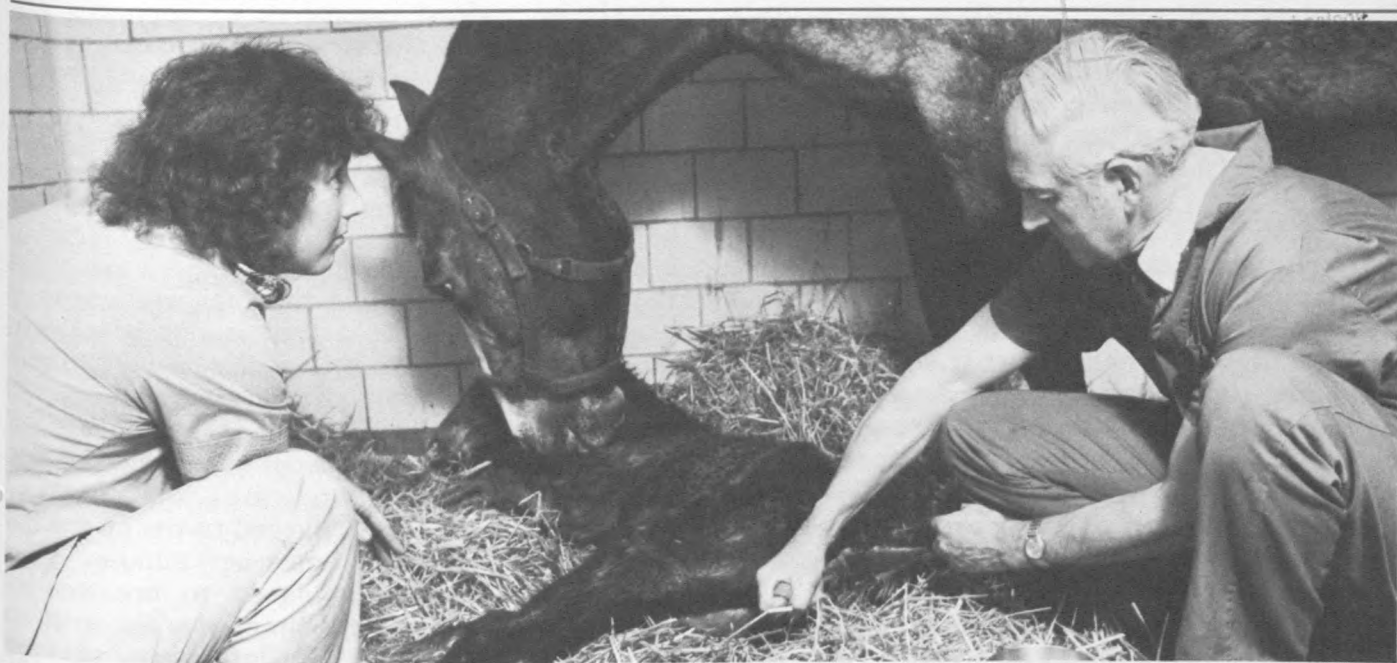




# EQUINE ROUNDS

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Dr. Robert Hillman cares for a newborn with assistance from Judy Chapman.

## DO YOU HAVE A 'PREEMIE'?

By Pamela Livesay-Wilkins '86  
With Special Thanks to Dr. Diane Craig

There are times when the mother and the fetus are prepared for birth at different stages of gestation. When it happens that the mother is ready first, the foal may be born premature. Approximately 1% of all Thoroughbreds are born prematurely, and the incidence approaches this value in most other breeds, so it isn't surprising that most active horse breeders have to deal with the problem of a premature foal at some point. In the last decade the value of horses, particularly Thoroughbreds, has increased tremendously, reflected by an increased interest on the part of both the veterinarian and the client in neonatal critical care and management techniques. While the field of neonatal equine medicine is still considered to be, itself, in infancy, progress has been made in the areas of diagnosis and management of these foals.

The perinatal period for the equine has been defined as the period from Day 300 of gestation, generally considered to be the lowest limit of viability, to 96 hours post-partum, when the foal is considered to have reached a steady state of body functions, recovering from the stresses of birth. Events in the fetus and in the mother need to be closely coordinated so that the mother will give birth to a full-term, mature foal that is capable of survival outside the uterus. However, there are a variety of conditions that can occur and indicate that the mother and fetus were not equally prepared for birth. Most forms of prematurity have a common cause with abortion and the distinction between them is rather arbitrary, based primarily on the prospect for fetal survival and gestational age of the fetus. Chronic placental insufficiency due to twinning, body pregnancy (pregnancy located in the body of the uterus rather than in one of the uterine horns), umbilical cord abnormalities, hydrops of the allantois (excessive accumulation of fluid in the fetal membranes), or fungal or bacterial infections can deprive the fetus of the oxygen it requires and precipitate a premature birth.



Premature placental separation can acutely deprive the fetus of oxygen, again resulting in a premature birth. Other causes of prematurity include fetal deformity, maternal malnutrition, induction of parturition and the Equine Herpes Type I virus (the rhino virus).

Diagnosing prematurity in a foal is not a difficult undertaking if the foal is obviously premature. The foal will be small and its coat will be short and silky. Its fetlocks will be dropped (hyper-extended) and it will be slow to stand and suck. If it is very premature it may have decreased or absent suck and righting reflexes. If a Thoroughbred foal is born at less than 320 days of gestation, prematurity can be diagnosed even in the absence of other signs of prematurity. If the foal is not obviously premature it may or may not show any or all of the above signs. In these cases, a veterinarian can make the diagnosis based on such parameters as venous blood pH, total red blood cell count, white blood cell differential count and the neutrophil to lymphocyte ratio. In cases that are still in doubt, further tests such as measurement of circulating plasma cortisol levels and performing an ACTH challenge test will help clarify things. The primary differential diagnosis when considering prematurity is infection of the foal, either in utero or following birth. The septicemic foal will eventually have an elevated rectal temperature and cells called band cells will be seen on the differential white blood cell count. Infected foals may present with a diminishing suck reflex and will develop some localizing sign of infection such as pneumonia, diarrhea, lameness or peritonitis. It should be kept in mind, however, that premature foals have a diminished ability to fend off infection and may become septic. It is possible that the premature foal may be born alive and found dead if the birth was unattended. In these cases the diagnosis can be made at autopsy.

Whether you attend the birth yourself or the birth is attended by a veterinarian, it becomes important to recognize the premature condition of a foal as early as possible. It is critical that the abnormal neonate be observed

closely by trained personnel, as neonates are quite capable of changing their condition very rapidly, with only subtle clues indicating that a change for the worse is about to occur!

The first step in managing the premature foal is to determine if there is a need for immediate intervention. Apnea, or lack of breathing effort, can occur and there are steps that can be taken to aid the foal while help is being summoned. If a foal is not breathing, mouth-to-nose resuscitation can be performed. Any obstruction of the airway, such as amniotic remnants, should be removed. The foal's neck is extended, the down nostril is held closed and a breath large enough to cause the chest to visibly rise and fall is delivered to the up nostril at a rate of 20 to 30 times per minute. The foal may also be stimulated to breathe by slapping its chest several times sharply with an open palm. Artificial ventilation may also be provided by endotracheal intubation and use of a ventilator or a specialized breathing bag that delivers oxygenated air if a veterinarian is present. All ventilation supports should be suspended for a short time periodically to determine if the foal is making an effort to breathe on its own. Evaluation of cardiovascular status and administration of appropriate support for this system should only be done by a veterinarian and one should be summoned for any critically ill or non-responsive foal.

Once the premature foal is over any immediate crisis, the decision should be made to either send the foal to a neonatal critical care unit or to nurse it at home. Distance, availability and financial considerations may preclude sending the foal to a critical care unit, so many of these foals are nursed at home. This can be successful, but it should be remembered that this is a time-consuming arduous route to take. Stalls are dirty and can serve as a source of contamination to the foal. Additionally, the lighting is generally poor and the mother may be uncooperative. Although for bonding purposes it may be desirable for the foal to stay with its mother, these other considerations generally require that the foal be removed to a cleaner, more efficient



environment with clean, warm, dry, soft bedding and a thermally neutral temperature. Heat sources can be in the form of heating pads or lamps and a twin sized water-bed with a heater is ideal for maintaining a critically ill foal.

Normally hydrated critically ill foals produce large amounts of very dilute urine, so provision should be made for mopping this up and keeping the foal clean and dry. Also, foals breathe best, and receive more oxygen if they are in sternal recumbance (resting on their sternum) rather than on their sides. Large wedge shaped pieces of sturdy foam can be used to support a foal in this position and the foal should be turned a minimum of every two hours both to aid its breathing efforts and to prevent bedsores.

Some provision will also need to be made for feeding the foal. The intestinal tract of many premature foals will be insufficiently developed to allow feeding with milk. In these cases, feeding of glucose and electrolyte solutions may be considered or parenteral feeding (feeding through a vein) may be required. Parenteral feeding should only be done with the direct supervision of a veterinarian.

Mare's milk is, of course, the fluid of choice for feeding the premature foal and it may be bottle fed if the foal has a suck reflex. If the foal is very weak or unwilling to suck, then milk may be administered through a nasogastric tube. Some common complications of tube feeding, such as gas distention, colic, diarrhea, nasal and pharyngeal irritation and aspiration pneumonia, can be avoided if the position of the tube is verified before each feeding. Your veterinarian can teach you the proper techniques for tube feeding if you are nursing the foal at home. It is best if the end of the tube is left in the foal's stomach. If it is in the distal esophagus, regurgitation around the tube can occur during feeding. The foal should be fed 100 ml of mare's milk every hour around the clock, initially, and gradually increased to at least 200 ml of mare's milk per

hour. However the foal is fed, its body weight should be monitored daily and if it is seen to decrease the method of feeding should be reevaluated.

Infection is the most common downfall of the premature foal and failure of passive transfer due to insufficient colostrum ingestion is commonly implicated. The immunoglobulin level of every foal should be determined and treatment with either colostrum orally (if the foal is less than 18 hours old) or administration of plasma intravenously should be done if the immunoglobulin level is less than 800 mg/dl. Any foal that is presenting signs of possible infection should be placed on a broad-spectrum bacteriocidal antibiotic combination such as penicillin and an aminoglycoside immediately. A veterinarian should be consulted when decisions concerning route, dosage and choice of antibiotic are made, as the foal's renal and liver function, hydration status, age and maturity will affect these decisions, as will the type of bacteria involved. The veterinarian may also want to consider the foal's adrenal status, as this affects immunocompetency, and may suggest treatment for adrenal insufficiency. Nursing care, of course, becomes paramount in preventing infection.

Premature foals are now surviving in greater numbers than ever before, and the advent of neonatal critical care units and research groups are increasing the knowledge and ability of veterinarians in the field to treat this condition. Not every abnormal neonatal foal can be saved, but many are going on to lead normal and productive lives. Early diagnosis and excellent nursing care on the part of many owners is certainly contributing to this!

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**Pamela Livesay-Wilkins** is a 4th year DVM student who bred and raised Thoroughbreds before entering veterinary college. Her senior seminar discussed prematurity in foals.



## HEMOLYTIC DISEASE OF THE NEWBORN

By Mary Dyroff, '87  
With Thanks to Dr. Steven Dill

Hemolytic disease of the newborn, or neonatal isoerythrolysis, is a disease of newborn animals characterized by an immune-mediated destruction of red blood cells. Although it is not seen frequently in horses, awareness of its causes, signs, treatments and preventions is important for several reasons. First, when it does occur, it can be fatal, especially if not recognized early. Also, sometimes foals which are icteric (having yellow mucous membranes) are misdiagnosed as having this disease and may needlessly be given a blood transfusion which is not an innocuous procedure. And lastly, it is a disease which can be prevented by taking proper precautions.

The destruction, or hemolysis, of the foal's red blood cells occurs following ingestion of the mare's colostrum which contains antibodies directed against the foal's red cells. A sequence of events causes the mare's immune system to make these antibodies, beginning with a fetus that has a different blood type from the mare. The fetal red blood cells have antigens (proteins) on them inherited from the sire, which are not present on the mare's red blood cells. If these fetal cells come in contact with the mare's circulation her immune system sees them as "foreign" and makes antibodies against them. The fetal cells may gain access to the maternal circulation to a small extent by leakage across the placenta during late pregnancy, but to a greater extent during birth itself. Therefore, a small amount of sensitization may occur during pregnancy but the major immune response occurs at birth. Then when the mare is pregnant with another foal of the same blood type as the first (usually from mating her with the same sire) there may be more leakage, more exposure to foreign cells, and a secondary immune response with more antibodies produced. So by the second foal there can be enough antibodies to cause



neonatal isoerythrolysis. These antibodies concentrate in the mare's colostrum. When ingested by the foal they are absorbed across the intestine, enter the bloodstream, and cause red cell hemolysis. This secondary immune response is why this disease is usually seen in second or subsequent foals and rarely in a first foal. A mare can also be sensitized to a different blood type by previous incompatible blood transfusions or previous incompatible tissue vaccines.

A foal with this disease is born normal and becomes ill after ingestion of the colostrum. The signs of the disease are usually seen within 24 hours after birth, but onset of symptoms can occur from 8 hours to 3 days after birth. The earliest signs are weakness and depression, and the foal usually lies down more, and nurses less frequently than normal. As the condition progresses mucous membranes will be pale from anemia and later may become icteric. The foal usually has an increased respiratory and heart rate. Red tinged urine (hemoglobinuria) may be seen in the later stages. The diagnosis of neonatal isoerythrolysis is made mostly by these clinical signs but the veterinarian can run tests to help support the diagnosis. A urinalysis can check



for hemoglobin in the urine and a blood test can detect the presence of anemia and check for bilirubin (a product of red cell destruction) in the blood. Also serological tests can be done. A positive direct Coombs test, which tests the foal's red blood cells for the presence of antibodies on them is strongly suggestive of this disease. A positive indirect Coombs test, which tests the mare's blood for antibodies directed against the foal's red cells can confirm the diagnosis definitively. This indirect Coombs test is sometimes done on the mare's colostrum instead of her blood. This can be misleading because if colostrum is used, the antibodies that are detected most strongly are "agglutinating" type antibodies. "Hemolysing" type antibodies may be detected less well in colostrum; it is these hemolysing antibodies that cause the trouble in this disease.

The treatment for neonatal isoerythrolysis depends on the severity, which in turn depends on the quantity of antibodies ingested and how long the disease has been progressing. If caught early, within the first 24 hours, the prognosis is good with the following treatment. The foal should be stopped from nursing, which can be done by muzzling the foal, and milk replacer should be fed every two hours until thirty-six hours of age. The intestine can absorb antibodies for up to thirty-six hours. After this time "closure" of the gut to antibodies occurs and the foal can be allowed to nurse again with no further absorption of antibodies occurring. The mare should be milked every two hours to stimulate milk production and to decrease the antibodies in the milk. The veterinarian may want to administer fluids and antibiotics to the foal. The antibiotics are used to prevent a secondary infection by opportunistic pathogens. The foal should be kept in a warm, dry stall and stress should be minimized. If the disease is not caught early enough, or if anemia is severe (PCV of less than 12%), a blood transfusion is necessary. The ideal blood to use is the mare's blood which has been washed of the antibodies. However this is not always practical in terms of facilities and/or time. The next best source of blood is

from a previously cross-matched blood donor. Again, this is not always feasible, as not all farms have a blood donor. The next choice is to use blood from a gelding which has never had a transfusion. Lastly, there has been some suggestion from genetic studies that Shetland pony gelding blood has a low chance of incompatibility, and may be used as an alternative. Once the transfusion has been given treatment is the same as that for the less acute cases previously discussed.

If the possibility of neonatal isoerythrolysis is suspected, measures can be taken to prevent it. Any mare that has had hemolytic foals before should be suspect. Also, this disease is seen with greatest incidence in Thoroughbreds and mules, which should be kept in mind. Suspected mares should be blood tested in the last 2-3 weeks of gestation. The blood can be tested for anti-red blood cell antibodies against a panel of known red blood cell antigens. But only certain labs perform this test, and an alternative test can be done after the foal is born but before colostrum is ingested. This alternative test, an indirect Coombs test, can be done on the mare's blood. If either of these tests is positive, then prevention consists of the following. The foal should not be allowed to nurse, but another source of colostrum must be provided for the first 12 hrs (2-4 quarts should be given). This may be difficult as there are no commercial preparations of colostrum. Therefore another mare that has recently foaled and still has colostrum can be used if one is available. Another source is frozen colostrum which some breeding farms maintain in a colostrum bank. If neither of these sources can be located, 2-3 liters of plasma from a blood-typed donor can be administered intravenously to provide antibodies as a last resort. Again, a cross-match would be needed. If a colostrum source was available and given to the foal, a zinc sulfate turbidity test should follow. This determines if the foal has received an adequate amount of colostrum. The test is done on the foal's serum, and works on the principle that zinc precipitates antibodies, producing a



turbidity. The mare's serum can be tested as well, to compare the degree of turbidity in the samples. They should be similar if the foal has received adequate colostrum. If it has not, then it may be necessary for the foal to receive a plasma transfusion to protect it from infectious disease. The mare should be milked every 2 hours, and milk replacer should be fed to the foal until after 36 hours when nursing can be permitted again.

It can be seen that the key to management of neonatal isoerythrolysis is prevention. When this disease is suspected, confirmation of your suspicions, preparation and proper treatment will usually result in a successful outcome.

**Mary Dyroff** is a junior veterinary student who hopes to join a mixed practice upon graduation.

## THE DUMMY FOAL

### (NEONATAL MALADJUSTMENT SYNDROME)

By Susan Coggins, '87

You have bred your mare and waited patiently for eleven long months, taking every precaution to ensure that nothing goes wrong. In all likelihood, everything will go smoothly and after an uneventful birth you will have a healthy, bouncy foal. However, in an estimated 0.75% of full term foals, a condition known as neonatal maladjustment syndrome arises, in which foals are descriptively classified as barkers, wanderers, dummies, or convulsives.

The exact cause of this noninfectious condition is not known, but it is thought to result from a lack of oxygen to the brain in the period shortly before or after birth of the foal. One theory is that the lungs of the neonate are not able to function adequately, either because of a deficiency in surfactant (a phospholipid which helps the alveoli of the lungs to resist collapsing) or because the chest wall of the foal is not as rigid as that of an adult and may therefore have an increased tendency to collapse. The muscles of respiration of the foal may also fatigue more easily, thus contributing to insufficient respiration. Another possible cause of anoxia is premature separation of the placenta from the uterus of the mare. Before the foal is able to draw its first breath, it relies on diffusion of oxygen from the blood of the mare in order to survive. If the placenta separates prematurely, the foal is deprived of this oxygen and brain injury may result. Premature severing of the umbilical cord, either accidentally during birth or by well-meaning attendants, may also be a factor, since almost three pints of fetal blood may remain in the umbilical cord and placenta following birth. (This amount constitutes 25% to 35% of the foal's normal blood volume.) If the cord is cut before this blood has been pumped into the foal, it is unavailable to carry oxygen to the brain and other tissues. Other factors which may be



involved are fractured ribs and bruised hearts sustained during a difficult birth.

Often foals afflicted with NMS are the product of a rapid and seemingly uncomplicated delivery and will suckle the dam and ambulate normally. For the first 12 hours or so of life, everything may appear to be normal. Difficulty rising in a foal previously capable of standing unaided may be one of the first signs of NMS. Characteristically, the suck reflex is lost suddenly and the foal may show abnormal behavior such as incessant chewing and aimless wandering during which it may collide with objects, appear to be blind, and seem not to recognize the mare. Jerking movements of the head or limbs may occur; the animal becomes unable to remain standing and may adopt a dog sitting position before becoming completely recumbent. If unable to regain its feet, the foal will make frantic galloping movements. The tail may be held erect and the animal may appear to be hyperexcitable. The limbs and neck may be held in a rigid position of extension. The nostrils may collapse with inspiration and the foal may make deep inspiratory efforts with its mouth open, as if hungry for air. Convulsions are common; the foal may then pass into a comatose state from which it may recover only to start more convulsions which lead to further coma. During convulsive episodes the foal will paddle wildly, champ the jaws and may bruise itself extensively about the head while banging it on the floor. Sweating may be profuse. Expiratory sound of "barking", grunting or high pitched whinnying occur during convulsive episodes. Foals may die during this stage or remain in a coma for hours or days and then begin to show signs of recovery.

It is important to note that with supportive treatment approximately 50% of the affected foals will recover and show no residual effects. The severity of signs does not seem to relate to survival, so there is hope for complete recovery even in the more severely affected animals. Treatment emphasizes good nursing care and requires dedicated commitment from the owner and the veterinarian.

The foal must be supervised to prevent exhaustion due to repeated attempts to rise and should be manually restrained in sternal recumbency if at all possible. Physical restraint during convulsions is necessary to prevent the foal from injuring itself. The stall should be bedded deeply to avoid pressure sores from long periods of recumbency. If lying on its side for extended periods, the foal should be turned from one side to the other every two hours. Urine scald can be minimized by keeping the foal dry and using petroleum jelly as needed. These foals need assistance to maintain their body temperature and can be dressed in a woolen pullover or sweatshirt. Severely affected foals may require that the ambient temperature be raised to 80-90°F. To this end, electric blankets or heat lamps may be used, but great caution is necessary in order to prevent burning the animal. It will be necessary to feed the foal through a nasogastric tube until the suck reflex returns. It is important to be certain that the foal has received adequate colostrum. The mare can be milked and the foal given colostrum equivalent to 1% of its body weight at 2 hour intervals for the first 24 hours of life. Following this, mare's milk or reconstituted dry milk may be fed; the foal should receive 80 ml/kg of body weight per day divided into ten equal feedings. Dried milk preparations should be reconstituted to contain 45 calories in 8-12 ml of water/kg of body weight/day. For example, a 50 kg (110 lb) foal should receive 2250 calories in 4-5 liters of fluid/day. Milk should be given at 100°F.

It is obvious that intensive medical and nursing care is required in these cases. These foals must be given every reasonable opportunity to survive. What is "reasonable" must be determined in each case by the severity of signs, the value of the foal and the willingness and ability of the owner and veterinarian to provide intensive care for a period of days to weeks.

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Susan Coggins, a third year student, is considering equine practice after graduation.



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## EQUINE ROUNDS

### A Newsletter for Horsepeople

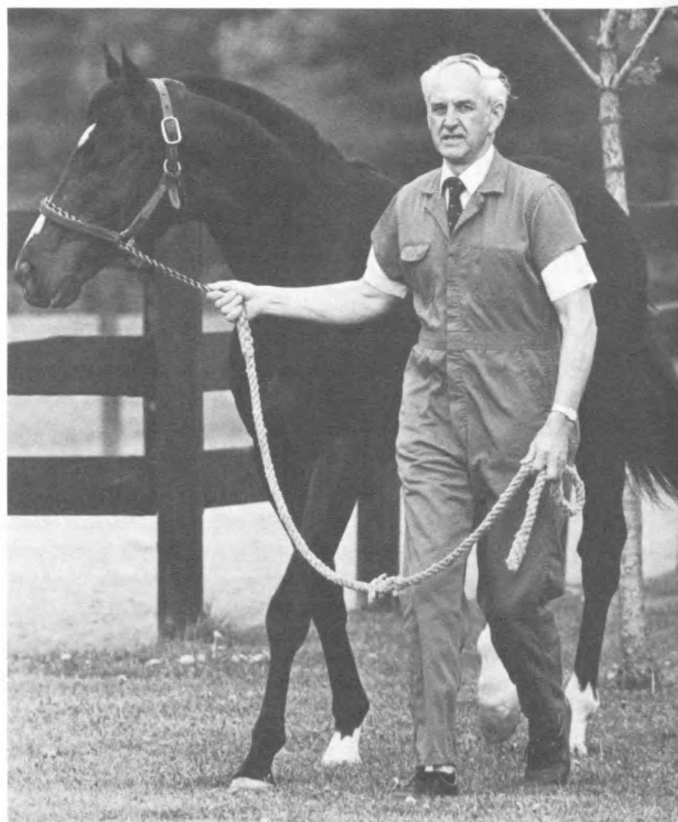
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**OUR GUEST EDITOR: Robert Hillman, DVM** is senior clinician in the Section of Reproductive Studies, Department of Clinical Sciences. He is a diplomate in the American College of Theriogenology, a member of the New York State Breeders Conference Planning Committee, the American Association of Equine Practitioners, the AVMA, and the American Association of Veterinary Clinicians in addition to many other professional organizations. He has served as the chairman

of the American Association of Equine Practitioners Equine Reproductive Committee and is a frequent instructor for courses on foal disease, horse care and equine reproduction offered by Cornell's Adult University. Dr. Hillman's teaching responsibilities in the area of reproduction include obstetrics and reproductive diseases, poisonous plants, and horse health management of the D.V.M. program.

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