

13th Annual Feline Fanciers Symposium

The Thirteenth Annual Feline Fanciers Symposium was held on March 31 at VHUP. Following are summaries of the four presentations.

The Clinical Importance of Feline Blood Groups

Dr. Urs Giger, associate professor of medicine and medical genetics, discussed feline blood groups and their clinical importance when treating ill cats. Blood group incompatibility can lead to neonatal isoerythrolysis and transfusion reactions, two life-threatening conditions. But, he pointed out, blood groups are not a disease, rather they are genetically determined differences in antigens on red blood cells.

Until recently it was believed that the great majority of cats had type A blood. Now studies at the University of Pennsylvania have shown that this is not so. Dr. Giger said that 99.7% of the DSH/DLH cats typed across the United States had type A blood. Siamese and related breeds (Oriental shorthairs, Burmese) tested also have predominantly type A blood. However, Dr. Giger and his colleagues discovered that other cat breeds have a significantly higher percentage of animals with type B blood. Breeds with about 10 - 25% type B cats are Abyssinian, Birman, Himalayan, Persian, Scottish fold, and Somali. In the British shorthair and the Devon Rex breeds approximately 50% of the cats have type B blood. Thus, there is a great variation in the frequency of blood type A and B between breeds.

Dr. Giger said that his studies of numerous purebred cat families have shown that type A and B are simply inherited with type A being dominant over type B. This means that a cat with blood type B is homozygous for B, and type A cats can either be homozygous for A or heterozygous, thereby hiding the B gene. Offspring of two type B parents have type B blood, whereas matings of type A and B cats may produce both type A and B kittens. Also, two type A cats that carry the B gene (heterozygotes) can have type A and rarely type B kittens. There are no type O cats. Recently the researchers identified a cat with type AB blood, but it appears that this is an extremely rare and separately inherited blood type.

Knowing the blood type of a feline patient can be of great clinical importance, particularly if the animal requires a transfusion. Similar to humans, cats have naturally-occurring antibodies against the other blood type; particularly type B cats have strong antibodies against type A blood cells. These antibodies cause two major incompatibility reactions:



neonatal isoerythrolysis (NI) and blood transfusion reaction.

Kittens with type A blood born to type B queen may develop a fatal NI reaction which is caused by maternal antibodies that destroy the kitten's red blood cells. Maternal antibodies do not pass through the placenta in cats, but are transferred via colostrum to the kitten during the first few days of life. These kittens are born healthy but show clinical signs within hours to days after colostrum intake. They cease to nurse, fade and most often die within the first few days of life. Specific signs may not be seen, but include dark red-brown urine and jaundice. NI has been recognized as a major cause of fading kitten syndrome in all breeds having more than 10% type B cats, and likely occurs in other breeds too.

Dr. Giger recommends that purebred cats be blood typed prior to breeding to assure compatible blood types in the breeding pair. If this is not possible, measures can be taken to save kittens from litters of incompatible parents. Using a foster mother and removing the kittens from the queen for the first couple of days while she is producing colostrum can prevent NI.

Knowing the blood type is also important in case of serious illness which may require a blood transfusion. There are many diseases which cause anemia and may require treatment with a blood transfusion, such as internal hemorrhage, trauma, FeLV infection, and others. If an anemic cat receives a

mismatched transfusion it will not benefit from it and may experience a life-threatening transfusion reaction. Since the common blood donors have blood type A, it is desirable to know the blood type of any purebred cat in case it needs a blood transfusion. In an emergency, when blood typing is not available, a crossmatch test can be performed. A crossmatch test will detect incompatibilities between donor and recipient blood, but does not specify the blood type. The common feline donor at the Veterinary Hospital has type A blood. If type B blood is needed, donors are available at VHUP.

Blood typing is a simple laboratory procedure that involve staking a small blood sample and incubating it with a reagent that reacts with either the type A or type B antigen. The transfusion procedure itself involves taking some blood from a peripheral blood vessel of the donor cat. The usual amount is roughly 1 1/2 ounces of blood from a 10-pound cat. This blood is anticoagulated, placed into a bag, and infused into the recipient cat.

Studies have shown that the transfused red blood cells have a half-life of about 35 days in the recipient cat. This is approximately the same as the half-life of the cat's own red blood cells. Transfusion of mismatched blood, however, leads to lysis (red blood cell destruction), followed by heart beat irregularities, transient cessation of breathing, and possibly death. Mismatched transfusions are particularly dangerous in type B cats.



As part of a Transfusion Medicine Academic Award, the University of Pennsylvania, School of Veterinary Medicine, offers a feline blood typing service to all veterinarians and cat breeders. Approximately 1 ml of blood in a labelled EDTA tube along with breed, age, pertinent history, (NI or transfusion reaction, blood donor) and address of correspondent should be shipped by overnight mail to: Dr. Urs Giger - Blood typing, Department of Clinical Studies - VHUP, 3850 Spruce Street, Philadelphia, PA 19104-6010. Results will usually be reported within two weeks of sending blood sample(s), but can be phoned immediately, if medically required.

Congenital Neurologic Diseases in Cats

Observation and indirect examination, along with clinical judgment, play an important role in the diagnosis of congenital neurologic disease in cats. The veterinarian—as Dr. Betsy Dayrell-Hart, lecturer in neurology, explained—must observe the animal's behavior and response to stimuli and then decide if these are appropriate or an indication of some deficit or (in rare cases) excess of nerve stimulation.

Veterinarians have developed lists which help them determine the probable cause of a given symptom, after due consideration of the animal's age, medical history, onset of condition, and response to various treatments. Quite often, an apparently neurological symptom may have other causes. In addition, neurological conditions can lead to symptoms that may be mistakenly attributed to some other disease. Illnesses can also give rise to neurological symptoms, as in the case of a diabetic cat that suffers from a neurologic disease secondarily.

A number of laboratory tests can be useful in helping to confirm a diagnosis (and in eliminating some conditions from the suspect list). These include blood tests; serum antigen and antibody tests; cultures for bacteria, fungi, and parasites; urinalysis; radiography; electrocardiography; and ultrasonography. After these, the veterinarian may decide to confirm (or eliminate) a suspected cause by further tests. These include cerebrospinal fluid analysis; brain or nerve biopsy; myelography (a technique for taking x-ray photographs of the spinal cord by injecting a contrast medium); nerve conduction velocity measurements; and serum tests for various neurotoxins, heavy metals, and specific pathogens. Many of these specific tests require general anesthesia, not only because they are painful, but because it is important to keep the animal absolutely still.

Few of the congenital neurological diseases are curable, but their diagnosis is still important because some apparently neurological defects are in fact due to viral disease, tumors, or dietary deficiencies that can be treated. In other cases, the owner may want to use the cat for breeding and genetic defects have to be ruled out.

Some neurological diseases are due to defects in the closure of the neural tube during fetal neurological development. One of these conditions is spina bifida in domestic shorthairs; another is sacroccygeal dysgenesis in the Manx cat. These conditions, which are difficult if not impossible to treat, are present at birth and may progress in the first weeks of life. Both are marked by signs of weakness in the hind legs, and sometimes incontinence or loss of sensation. Some of these kittens may also have meningocele, a condition in which part of the nervous system protrudes through the skull or spinal column, resulting in constant drainage of cere-

brospinal fluid. The outward signs of this condition are a "soft mushy backbone" or a wet spot at the base of the spinal column, just above the tail.

Spongiform degeneration of spinal cord cells, which has been reported in the Egyptian Mau, is manifested by weakness of the hind legs. The symptoms appear around the age of seven weeks and sometimes improve.

Both mixed breed and purebred kittens are sometimes born with hydrocephalus, lissencephaly (undeveloped cerebral cortex), or anencephaly (lack of cerebral cortex). Hydrocephalus, which can be either congenital or acquired, literally "fluid on the brain," has as one of the outward signs a domed skull. Hydrocephalus can lead to very abnormal behavior in kittens, some of whom may gradually improve or respond to drug therapy. The condition can sometimes be treated by a fairly complicated surgical procedure.

Himalayans are known to suffer from megaesophagus, a condition marked by a dilated, weak esophageal muscle sheath. The condition becomes manifest at the age of a few months and can have a variety of causes, including faulty innervation and myasthenia gravis (which can be treated). These animals have trouble swallowing their food and keeping it down. They sometimes recover spontaneously.

A number of storage diseases have neurological symptoms. These diseases are ultimately due to deficiency of some enzyme, one of the chemicals that facilitates chemical reactions in the body's cells. Enzymatic deficiencies can lead to the accumulation of wastes and other metabolic byproducts in cells. Some storage diseases can be diagnosed from their symptoms, while others require analysis of blood, urine, or cerebrospinal fluid, or other tissues. Some breeds are particularly susceptible to certain storage diseases. Siameses can have cerebral sphingolipidosis, beta galactose deficiency, and mucopolysaccharidosis. Gangliosidosis affects Korats, while Persians suffer from mannosidosis. Among the conditions that can afflict domestic shorthairs are ceroid lipofuscinosis, hyperchylomicronemia, globoid cell leukodystrophy, and GM-1 and GM-2 gangliosidosis.

Even though each of these diseases has a different origin, they have many common features. Kittens usually look normal at birth, but grow slower than their litter-mates. Signs of disease begin to appear after a few weeks or months, and may include peripheral or central nervous system symptoms—such as tremors, spasms, and difficulty in moving. These signs tend to be progressive.

Panleukopenia virus infection can lead to the birth of kittens without a part of the brain (the cerebellum). This condition is not always fatal, and may even be asymptomatic. The kittens usually have normal strength, but they are very clumsy, likely to reach toward their food and miss it. Even so, many of these cats will adjust and live, making good pets. Since this condition is not inherited, they can be bred—although they will make clumsy mothers.



Feline Clinical Nutrition as Related to Cardiomyopathy, Feline Urological Syndrome, and Obesity

Obesity in humans and felines is defined the same way: cats whose weight is more than 15% above the ideal are classified as "overweight," while those whose weight is more than 25% above the ideal are classified as "obese." "Nutrition and obesity play an important role in such clinical conditions as feline central retinal degeneration, feline dilated cardiomyopathy, and feline urinary syndrome," explained Dr. John Burr, Animal Care Center Veterinarian, Technical Services, The IAMS Company.

Feline urinary syndrome (FUS) is the term for a rather vaguely defined group of clinical signs and symptoms associated with obstructions of the lower urinary tract, more specifically the bladder and urethra. FUS can occur at any age and male cats are particularly susceptible because of the anatomy of their urinary system. The clinical signs include polyuria (unusually frequent urination), obviously painful urination, straining, and blood in the urine (hematuria). When these signs are not due to injury, infection, or outside pressure on the urethra (for example from a tumor), they are often a result of ureterolithiasis: the presence of calculi (or stones) in the urethra.

Most of these stones consist of struvite, a mineral that is also known as ammoniomagnesium phosphate. A study at the University of Minnesota showed that 82% of urethral stones in cats consist of struvite.

The main predisposing factor for struvite crystal formation is a high degree of urinary alkalinity, meaning a pH well above 7.0. Other predisposing factors are the presence of microbes that produce an enzyme called urease, and an area in the urethra that is suitable for the accretion of crystals. Suggestions that viral infections, particularly herpesvirus infection, may play a role in crystal formation have not been proven.

What does seem to have been proven is that the stones are not caused primarily by diet, or more specifically the magnesium content of diet. Some earlier investigators suggested the stones were due to high dietary levels of magnesium oxide and magnesium chloride. More recent studies have shown that the amount of magnesium oxide is less important than urinary pH because crystal formation does not begin unless the urine is very alkaline. The metabolism of magnesium chloride, meanwhile, causes urine to become more acidic.

The simplest way to measure the alkalinity of urine is by means of the litmus paper test. It is important to keep a cat's urinary pH under 7.0. A pH of 6.7 or less is even better.

Trying to reduce urinary alkalinity by giving the cat vitamin C (ascorbic acid) is not advisable, because the metabolism of this compound actually causes urine to become more alkaline. Some temporary increase in urinary alkalinity is a natural result of the digestive process. One way to reduce this is by allowing cats to eat ad lib instead of providing them with a few substantial meals a day.

Protein from animal sources causes urine to become acidic and FUS is rarely a problem in cats who get most of their protein from meat and animal

by-products. Animal proteins are rich in sulfur-containing amino acids, which are lacking in plant-derived proteins. Animal protein also contains taurine, an aminosulfonic acid necessary for the digestion of fats and fat-soluble vitamins. Humans and some animals, including dogs, can manufacture all or most of the taurine they need but this is not true of cats. Cats are true carnivores which must depend on their diet for the taurine they require. In cats taurine deficiency causes feline dilated cardiomyopathy (FDC) and feline central retinal degeneration. Since the relationship between taurine deficiency and FDC was established about three years ago, taurine supplementation has become the rule in the cat food industry; all commercial cat foods now contain adequate amounts of this compound.

FDC is a condition marked by enlargement of the heart and consequent decrease in blood pressure. Its incidence is not yet known; its symptoms include overall weakness and obstruction of blood flow to the back legs. Fortunately this condition in cats can be treated successfully with taurine dietary supplements, as has been demonstrated by dramatic series of chest radiographs showing how a previously enlarged heart returns to normal size. A laboratory test for blood levels of taurine is available. Taurine deficiency has also been implicated in feline central retinal degeneration, which leads to irreversible blindness. This condition develops gradually, owing to the variable taurine content of different foods and the long serum half-life of taurine (from 30 to 88 days). Retinal degeneration is seldom diagnosed until the cat has lost its eyesight. Fortunately its progression can be halted—although not reversed—by a change in diet.

The National Research Council has recommended a daily allowance of at least 400 units of taurine a day to prevent feline retinal degeneration, with a minimum of 500 units for pregnant queens. The amount needed for prevention of FDC is substantially larger, in the neighborhood of 2,500 units a day.

Medical Approaches to Feline Respiratory and Hepatic Problems

Medical approaches to hepatic and respiratory problems in cats formed the subject discussed by Dr. Joan C. Hendricks, assistant professor of medicine. She noted that taking a good medical history from the owners is a key element in the accurate diagnosis of both conditions.

Cats can suffer from a number of liver conditions. At present, there is no cure for liver cancer. The situation is more hopeful in regard to the metabolic liver diseases whose symptoms include jaundice (also known as icterus). This is usually manifested by "yellowness," or discoloration of the cat's gums, eyes, and mucous membranes.

The liver can be characterized as a metabolic factory that processes many different substances, making some of them and breaking down others. It is the major organ for degrading poisons and drugs, as well as many of the waste products resulting from normal metabolism.

Jaundice is a major sign of liver disease. It is caused by the tissue build-up of bile, one of the liver products that plays an important role in digestion.

The build-up of waste products that are normally processed by the liver can lead to other symptoms, such as dementia and seizures. The neurological changes associated with liver disease are usually

global in nature. The cat may stand and stare into a corner—or refuse to play or respond. Lack of appetite, nausea, and vomiting are other possible symptoms of liver disease. Finally, liver disease can lead to abnormal bleeding because the liver is not producing sufficient amounts of a variety of clotting factors. Another consequence may be leakage of serum through the walls of blood vessels, causing edema because the liver is not making albumin, a protein that makes blood thicker. Edema and abnormal bleeding are usually signs of advanced disease.

There are a number of laboratory tests that can establish the presence of metabolic liver disease before it has reached this stage. Many of these are similar to the tests used in human patients. Nonetheless, liver biopsy—removal of a bit of tissue—is the most definitive means to establish the diagnosis of many conditions. This is usually done by means of a needle, under general anesthesia, and often under ultrasonographic guidance.

In some cases it may be necessary to give the cat a blood transfusion, as well as nutritional support, before subjecting it to such a procedure. Nutritional support is most effectively provided by means of a nasogastric tube. This method has many advantages: it does not require an incision and can be used at home if the cat learns to tolerate it (as many cats do).

The respiratory system can be characterized as a mechanism that provides the body cells with oxygen and removes carbon dioxide, the major waste product of normal metabolism. The same system is also used for other purposes, such as vocalization and regulation of body temperature.

The system begins with the windpipe, which is really a conducting tube. The windpipe leads to the lungs, where the main tubes branch off into bronchi, small-diameter tubes that lead to lung cells where gas exchange takes place. The entire system is controlled by a muscular pump, the diaphragm, which is under very close neurological control and cannot function automatically like the heart.

When the lungs or the pumping mechanism begins to fail, the consequences are likely to be sudden, acute, and life-threatening. In many cases, it may be possible to provide mechanical compensation, but usually there is little that can be done about the underlying condition. Many of these animals die before anyone can help them.

Veterinarians are more likely to be able to help in the case of diseases that affect the airway. These conditions are rather common and tend to be marked by all sorts of "funny noises" that are really coughs and sneezes. Cats make coughing sounds that are

distinguishable from gagging, retching, and vomiting.

Coughing is usually due to local irritation or inflammation of the airway—in a way, not unlike the bronchitis seen in chronic smokers. The onset is often gradual and the condition may be longterm, ranging in severity from a minor irritation to an affliction that is virtually disabling, although generally not life-threatening. (Incidentally, it remains unclear if animals suffer as a result of their owners' smoking.)

Diagnosis of a respiratory condition starts with a very thorough physical examination and history. The important questions are: Is he fibbing or turning blue? Is he making whistling noises, or coughing, or gagging? Measuring the levels of oxygen and carbon dioxide in the animal's blood can provide useful information. There are methods of doing this without drawing any blood, by means of a clip attached to the cat's ear that analyzes blood gas concentrations from the color of the blood.

After that, radiography can be very useful, because it actually provides a look at the cat's airways and lungs; it may also be useful to take a sample of fluid from the airway to culture and examine the cells.

Endoscopy is another useful diagnostic method. This involves passing a thin tube, with a camera and light source on its tip, down the airway for an actual look.

Jan Kangilaski

Feline Symposium

The Fourteenth Annual Feline Fanciers Symposium will be held April 13, 1991 at the Veterinary Hospital of the University of Pennsylvania in Philadelphia.

The day-long program begins 9:30 a.m. Ms. Kathleen Dunn, the social worker at VHUP, will discuss "Attachment and Bonding — Breaking the Attachment - Pet Loss." Dr. Karen Kuhl, a dermatologist, will speak on "Feline Reaction Patterns."

The final presentation of the morning will be a "Parade of Breeds" and Mr. Richard Gebhardt will illustrate breed characteristics with the help of cats from different breeds.

In the afternoon Dr. Mark Saunders will speak on "Ultrasound Imaging of Abdominal Disorders." This will be followed by a tour of VHUP and a wine and cheese reception hosted by Mrs. R.V. Clark, Jr., and Mrs. Edith Young.

The cost of the program is \$45. This includes lunch and parking. Reservations are required and can be made by contacting Dr. M. Josephine Deubler, VHUP, 3850 Spruce Street, Phila., PA 19104, Tel.: (215) 898-8800.

